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MULTIMARKET CONTACT AND MARKET POWER: A CASE OF THE U.S. AIRLINE INDUSTRY

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Abstract

Many researchers have empirically shown that multimarket contact has had a collusive effect in the U.S. airline industry. This paper empirically analyzes the effect of multimarket contact on air carriers' pricing behaviors and the impact of market power on multimarket contact. We estimated the simultaneous demand and price (pseudo-supply) equations to derive the impacts of multimarket contact by using cross-sectional data of the year 2006 (top 30 U.S. air markets with 4484 sample observations). We found that multimarket contact increases airfare and that if there are only full-service carriers (FSCs) in a market, the effect of multimarket contact among FSCs is enforced by their preferrence for collusion. However, if there are low-cost carriers (LCCs) in a market, the effect of multimarket contact is not enforced. We also found that in a market where LCCs have dominant market shares, multimarket contact does not necessarily result in carriers' collusive behavior. These results suggest that multimarket contact affects market performances differently depending on whether an LCC exists.

I. *Introduction*

The situation in which there are many inter-firm rivalries between a limited number of firms in multiple markets is called "multimarket contact." Some researchers believe that multimarket contact blunts the edge of the firms' competition (see, for example, Edwards 1955 and Bernheim and Whinston 1990). Many researchers have empirically studied the effect of multimarket contact and suggest that it has a collusive effect (see, for example, Heggestad and Rhoades 1978, Scott 1982, Jans and Rosenbaum 1996, Parker and Roller 1997, Fernandez and Marin 1998, and Fu 2003). Evans and Kessides (1994), Singal (1996), Gimeno and Woo (1996, 1999), Gimeno (2002), and Zou et al. (2011) analyzed the effect of multimarket contact in the airline industry and showed that it statistically increased carriers' airfares. In addition, Baum and Korn (1999) found that airline behaviors, such as entry and exit, decreased as multimarket contact increased.

Most studies have revealed that multimarket contact has collusive effect in the airline industry. However, earlier studies in which this effect was measured involved the data of the 1980s and did not consider the presence of low-cost carriers (LCCs). There have been many

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studies on the economic impact of LCCs. Dresner et al. (1996) and Windle and Dresner (1999) analyzed the effect of LCCs' entries and found that they significantly decreased airfares. Morrison (2001) also showed that entries of LCCs influenced airfares in the LCCs' potential routes. Goolsbee and Syverson (2008) found that incumbents significantly cut airfares when threatened by Southwest's entry. Murakami (2011b) studied whether price-lowering effects due to LCC entries lasted over time and estimated the change in social welfare in accordance with the change in airfares of full-service carriers (FSCs) and LCCs. However, few previous studies have applied the idea of the competitive effect of multimarket contact to examining airline competitions with LCCs. In addition, these studies have not taken into account the relation between the collusive effect of multimarket contact and market power. For example, Jans and Rosenbaum (1996) showed that the collusive effect of multimarket contact increases as market concentration increases in the U.S. cement industry, and Fernandez and Marin (1998) suggest that the collusive effect decreases as market concentration increases in the Spanish hotel industry.

In this paper we empirically investigate whether multimarket contact increases airfares and whether market power influences the effect of multimarket contact. We estimated the simultaneous demand and price (pseudo-supply) equations to derive these effects of multimarket contact by using cross-sectional data of the year 2006 for the top 30 U.S. air markets, with 4484 sample observations. We found that multimarket contact increases airfare, and in the markets where there exist only FSCs, the effect of multimarket contact among FSCs is enforced by their preferrence for collusion. However, if there are LCCs in a market, the effect of multimarket contact is not enforced by market power. We also found that if LCCs have dominant market shares, multimarket contact does not necessarily result in carriers' collusive behavior.

In Section II we model the simultaneous demand and pseudo-supply equation system to measure the effect of multimarket contact, highlighting the impact of market power. In Section III we describe the data, and in Section IV we show the empirical results. In Section V we present concluding remarks.

II. *Econometric Model*

In this section we construct a simultaneous demand and pseudo-supply equation system to estimate the effect of multimarket contact. Dresner et al. (1996) and Murakami (2011a, 2011b) applied the simultaneous demand and pseudo supply equation model to the analysis of the competition between FSCs and LCCs, and we follow their methods. In addition, in terms of measuring the effect of multimarket contact, we follow the ideas proposed by Jans and Rosenbaum (1996), who studied the cement industry. Jans and Rosenbaum (1996) also estimated the simultaneous equation system by nonlinear 3SLS (three stage least squares), adding a multimarket contact variable to the right-hand side of the pseudo-supply equation.

Our empirical model to investigate the effect of multimarket contact is as follows:
[Demand equation]

$$\log Q_{kj} = \alpha_0 + \alpha_1 \log P_{kj} + \alpha_2 \log Dist_j + \alpha_3 \log INC_j + \alpha_4 \log POP_j + \sum_{m=3}^{10} \alpha_5^m MKT_j^m + u_{kj}$$

[Pseudo-supply equation]

$$\log P_{kj} = \beta_0 + \beta_1 \log Q_{kj} + \beta_2 \log HHI_j + \beta_3 \log DIST_j + \beta_4 LCC_k + \beta_5 VSLCC_{kj} + (\beta_6 + \delta_1 DFSCA_j + \delta_2 DFSC_j + \delta_3 DLCC_j + \delta_4 DLCCA_j) \log MMC_{kj} + e_{kj}$$

where P_{kj} and Q_{kj} are the average airfare and output of route j of carrier k, respectively. INC_j is the arithmetic per-capita income of route j. $Dist_j$ is the distance between a city pair of route j. POP_j is the arithmetic average of the O/D (origin/destination) population. MKT_j^m is a binary variable that takes 1 for the market where m carriers compete, and the benchmark market of this binary variable is duopoly markets. This MKT_j^m variable is introduced to control the market size in the demand equation. The parameters of these variables could be positive or negative. In the negative case, for example, if too many carriers enter a market and compete for limited demand, the demand that each carrier faces could be smaller than the demand each carrier would face in a duopoly market.

$Dist_j$ in the pseudo-supply equation is used as the proxy variable of marginal cost. This variable will have a positive effect on airfares. HHI_j is the Herfindahl index, and a higher HHI_j means that the market is more concentrated. Since high concentration may lead to strong market power, the parameter will be positive. LCC_k is a binary variable that takes 1 if carrier k is an LCC. $VSLCC_{kj}$ is a binary variable that takes 1 if carrier k competes with LCC(s) in a market.

To analyze the impact of market power on multimarket contact and to determine whether the effect of multimarket contact is different between FSC-dominated markets and LCC-dominated markets, we set "the market where there is no carrier with an 80% share" as the benchmark, and statistically test the hypotheses that the effect of multimarket contact on airfares is equal between markets in which (a) an FSC has 80% share vs. FSCs, (b) an FSC has 80% share vs. FSCs and LCCs, (c) an LCC has 80% share vs. FSCs and LCCs, and (d) an LCC has 80% share vs. an LCC. To test these hypotheses, we use the coefficients of the "slope dummy" variables: they are $DFSCA_j$, $DFSC_j$, $DLCC_j$ and $DLCCA_j$. $DFSCA_j$ is a binary variable that takes 1 for a market in which an FSC has more than 80% share and there exist only FSCs. $DFSC_j$ is a binary variable that takes 1 for a market in which an FSC has more than 80% share and competes with FSCs and LCCs in route j. $DLCC_j$ is a binary variable that takes 1 for a market in which an LCC has more than 80% share and competes with FSCs and LCCs in route j. $DLCCA_j$ takes 1 for a market in which an LCC has 80% share and there exist only LCCs in route j. The parameter signs of these four binary variables will be positive if the carrier having market power tries to coexistent and co-prosper with competing carriers. MMC_{kj} is firm k's multimarket contact on route j. The sign of parameter β_6 of MMC_{kj} will be positive if multimarket contact has collusive effect. Here, u_{kj} and e_{kj} are random error terms of the demand equation and pseudo-supply equation, respectively.

Multimarket contact has been measured by several methods. Our method is to count the number of overlapping markets in which carriers compete with one another. This measurement is defined as follows:

[Multimarket contact (MMC) measurement]

$$MMC_{kj} = \frac{\sum_{k \neq l} a_{kl} D_{kj} D_{lj}}{f_j - 1}$$

TABLE 1. THE DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLES

Name	Mean	SE	Minimum	Maximum
Airfare	167.1	55.5	55.5	563.4
Passengers	4113.9	5598.2	157.0	45144.0
Population	3778600.0	2511000.0	556430.0	17161000.0
Per-capita income	40426.0	4098.8	27000.0	55101.0
Herfindahl index	386.6	146.7	108.1	813.4
Distance	1452.6	819.0	177.0	5095.0
Multimarket contact	156.1	91.2	1.5	416.0

$$a_{kl} = \sum_{j=1}^{n} D_{kj} D_{lj}$$

where D_{kj} is a binary variable that takes 1 if carrier k operates in route j. Here, f_j is the number of carriers that operate in route j. This measurement has been used in many previous studies.

As noted above, HHI_j measures the degree of market concentration. Bailey et al. (1985) suggested that the market concentration is an endogenous variable determined by output, distance, and other exogenous factors. In addition, Waldfogel and Wulf (2006) suggest that the variable of multimarket contact may be endogenous. Thus we must check the endogeneity of these variables. To test the null hypothesis that $\log HHI_j$ and $\log MMC_{kj}$ are not correlated with the error term e_{kj}, we carried out the Hausman test for each variable. The test result was that we rejected the null hypotheses for both cases at the 1% level of significance ($\chi_{(1)} = 188.37$ and 11.67, respectively).

III. *The Data*

We used the carrier-specific data of the scheduled operations in city-pair routes. They are cross-sectional data of the year 2006 collected from DB1A (a database), which files a 10% random choice of samples from all the U.S. domestic flight operations. Per-capita individual income and demographic data were collected from *Regional Accounts Data*, from the Bureau of Economic Analysis. We omitted monopoly markets, carriers that did not have 10% market share in duopoly markets, and carriers that did not have 5% share in triopoly or greater markets. Carriers reported as carrier XX (carriers that are not filed in IATA codes) in DB1A were also omitted. After exclusions, there were 4484 observations that supplied data for our analysis. These data consist of non-connecting flights from the top 30 largest U.S. airports and their regions and include 487 duopoly markets, 460 tripoly markets, 195 four-carrier-operating markets, 101 five-carrier-operating markets, 87 six-carrier-operating markets, 41 seven-carrier-operating markets, 2 eight-carrier-operating markets, and 2 ten-carrier-operating markets. The descriptive statistics of continuous variables are shown in Table 1.

To classify the sampled nineteen carriers into FSCs and LCCs, we calculated the carrier's unit cost with the cost data from the Air Carrier Financial Reports, *Form 41, Financial Data*, and estimated the 95% confidence interval of carriers' unit costs. We excluded a number of carriers that operated at the very low unit cost level, and we excluded carriers with very small networks, carriers that were allied with another airline, and carriers that went bankrupt around

Table 2. Estimated Results

Variable	Model 1			Model 2		
	Parameter	Standard error	p-Value	Parameter	Standard error	p-Value
Demand equation						
Airfare	−0.497	0.074	0.000	−0.751	0.081	0.000
Distance	0.142	0.043	0.001	0.333	0.044	0.000
Per-capita income	0.284	0.092	0.002	0.395	0.108	0.000
Average population	0.158	0.021	0.000	0.227	0.023	0.000
Tripoly market	−0.511	0.025	0.000	−0.577	0.029	0.000
4-firm market	−1.095	0.036	0.000	−1.262	0.039	0.000
5-firm market	−1.589	0.044	0.000	−1.821	0.047	0.000
6-firm market	−2.388	0.049	0.000	−2.702	0.051	0.000
7-firm market	−2.834	0.060	0.000	−3.220	0.063	0.000
8-firm market	−3.404	0.146	0.000	−3.854	0.169	0.000
10-firm market	−4.041	0.138	0.000	−4.557	0.157	0.000
Constant	4.684	0.939	0.000	2.544	1.079	0.018
Pseudo-supply equation						
Output	0.587	0.021	0.000	0.681	0.026	0.000
Herfindahl index	−1.791	0.017	0.000	−2.740	0.020	0.000
Distance	0.224	0.026	0.000	−0.008	0.034	0.815
LCC	−0.290	0.009	0.000	−0.257	0.015	0.000
VSLCC	−0.151	0.007	0.000	−0.125	0.013	0.000
MMC (β_6)	0.059	0.005	0.000	0.057	0.005	0.000
DFSCA (δ_1)				0.077	0.032	0.017
DFSC (δ_2)				0.029	0.041	0.477
DLCC (δ_3)				−0.193	0.028	0.000
DLCCA (δ_4)				−0.176	0.060	0.003
Constant	9.427	0.316	0.000	15.924	0.403	0.000
System R-square	0.966			0.954		
Test of the overall significance	$\chi_{21}=15175.000$			$\chi_{21}=13827.000$		
$H_0: \beta_6+\delta_3=0$				−0.136		0.000
$H_0: \beta_6+\delta_4=0$				−0.118		0.050

2006. As a result, we defined AirTran Airways, Spirit Airlines, Jet Blue Airways, and Southwest Airlines as LCCs.

IV. *Empirical Results*

We estimated demand and price (pseudo-supply) equations simultaneously by an iterative 3SLS method to measure the effect of multimarket contact. Table 2 presents the results. Model 1 provides estimated parameters of the system equation without coefficient binary variables of the price equation, and Model 2 provides estimated parameters of the system equation with those variables. The results indicate that the parameters of variables meet the expected signs and are statistically significant, except for the case of the Herfindahl index and the Distance in the price equation with binary variables. The reason for the unexpected sign of the Herfindahl index parameter is that there are lots of markets where LCCs have a large market share. In such a case, the more concentrated markets are, the lower the level of average airfares in the market.

The results for both cases show that the coefficient of multimarket contact is significantly positive. These results indicate that multimarket contact has collusive effect and are consistent with previous studies that suggest multimarket contact has led to collusive establishment of high airfares in the airline industry.

The parameter of DFSCA is significantly positive. This result shows that the collusive effect of multimarket contact is increased if a carrier has market power in the market in which there exist only FSCs. The parameter of DFSC is not significantly positive. This result suggests that the enforcement of collusive effect from an FSC's market power is offset by the competition with LCCs. The coefficients of DLCC and DLCCA are significantly negative, and these results indicate that the collusive effect is deceased by competition with dominant LCCs. We reject the hypothesis that $\beta_6+\delta_3=0$ by the Wald test, and $\chi^2=21.768$ with degree of freedom (d.o.f.) $=1$, P-value$=0.000$. This result implies that a dominant LCC competes aggressively with FSCs and tries to throw rivals out of a market, regardless of multimarket contact. We also reject the hypothesis that $\beta_6+\delta_4=0$ by the Wald test, and $\chi^2=3.833$ with degree of freedom (d.o.f.)$=1$, P-value$=0.050$, indicating that multimarket contact among LCCs does not influence LCC's ticket prices. Boguslaski et al. (2004) indicated that the presence of an LCC in a market did not influence other LCCs' entry behavior, and this implies that LCCs tend to compete with each other aggressively.

V. *Conclusion*

Many researchers have analyzed the effect of multimarket contact in certain industries and empirically support the hypothesis that multimarket contact has a collusive effect. Although most authors have shown that multimarket contact has a collusive effect in the airline industry, these studies do not take into account the presence of LCCs and market powers. Thus we investigated whether the collusive effect of multimarket contact is changed by FSCs' or LCCs' large market power.

By using cross-sectional data of the year 2006 with 4484 sample observations, we found that: (1) multimarket contact led to high airfares due to collusion among carriers; (2) in the case where only FSCs exist in a market and there is an FSC with 80% share, multimarket contact has a more collusive impact; (3) in the case where FSCs and LCCs exist in a market and there is an FSC with 80% share, the collusive effect of multimarket contact does not increase; (4) in the cases where FSCs compete with LCCs and where there are only LCCs in a market, and an LCC has 80% share, multimarket contact has price-lowering effects.

Our finding (1) is consistent with those of previous studies. In addition, our contributions are that we found facts (2), (3), and (4) by using rigid econometric models and a large number of sample observations in an attempt to avoid data selection bias.

Of course, this study has some limitations. First, although we used abundant sample observations, we may need to update the dataset to panel data. A lot of previous analyses use panel data to measure the effect of multimarket contact. Second, we may have to investigate whether the behaviors of airlines under multimarket contact lead to more collusive behavior such as mergers or alliances. Knowing this would be important for determining entry and exit policy. Using panel data and investigating whether multimarket contact leads to mergers or alliances will be done in our future research.

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