The Competitive Effect of Multimarket Contact

Guy Arie, Sarit Markovich, Mauricio Varela

Northwestern Transportation Research Center, May 2012
Thanks for coming!

What is multi-market contact?

Why should we care?
- Profits
- Welfare
- Regulation

This paper - alternative take on MMC, and specifically for the US Airline industry
Hello

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Two Airline Markets
MMC in Airline Markets

Guy Arie, Sarit Markovich, Mauricio Varela

Multi-Market Competition
American, United and Continental serve most West-bound markets out of Memphis, but not all.

Does the degree of overlap between carriers affect how they compete?

How would the United-Continental merger affect competition on the Memphis-Farmington market?

How would the Delta-NW merger affect it? AA-US Airways?
Airlines

- Flight scheduling process sets capacities between spokes and hubs
  - Also non-hub flights

- After the schedule is fixed, sell tickets up to capacity (yield management)

- Same AA seat from Memphis to Dallas can be used for Memphis to Corpus Christi, Farmington and many other locations.
  - Once the flight is full, can’t add capacity
  - If the flight isn’t full enough, reduce prices

- Most seats in the AA flight from Memphis to San Antonio are used for this route.
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Carriers have different degrees of *flexibility* with respect to a market

- Alternative use for the market’s costly resources (seats)

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- Which of United’s markets are also served by AA?

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Empiric evidence – firms that overlap more seem to be less competitive with each other

Current interpretation – overlap facilitates “mutual forbearance”
  - Firms that overlap much are more afraid to be competitive

This paper – flexibility increases competition, overlapping flexibility cancels the effect
  - Multi-market firms that overlap much stop taking advantage of their rival’s flexibility
Multi-Market Contact, Economics and This Paper

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Intuition - Mutual Forbearance (has issues)

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<tbody>
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<td>10, 10</td>
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- Continental and AA prefer soft competition by both over normal competition by both.
- But for whatever Continental does, AA maximizes profits by competing normally.
- “Making an effort” to mutually reduce competition would save each firm 4.
- Serving many markets increases the stakes - making an effort to mutually reduce competition in 100 markets would save each firm 400.
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- AA will use its flexibility to sell less seats in Memphis-CC, and more seats in Memphis-Farmington and CC-wherever.
  - If AA wasn’t flexible, it would have to still sell the seats in Memphis-CC
- Continental doesn’t serve those markets, so it doesn’t *internalize* the effect
- Having an accommodating (flexible) rival increases competition
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Multi-Market Competition
Intuition - Flexibility

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- Continental can “go first” - set very high seat capacity in Houston-CC.
- If American will set normal capacity on Houston-CC, it will use most of its seats in routes from CC that are not served by Continental.
- Because AA is more flexible Continental can commit to be a strong competitor and AA chooses to be a soft competitor.
- Why can’t AA commit?
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  - As overlap increases, outcomes move closer to the Cournot


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What is the effect of changes in the sizes of the ellipse, square and triangle
Two firms (A and B), three markets (o, A and B).
Each firm serves its own market. Both firms serve the ’o’ (overlapping) market.
Inverse demand $P(Q;m)$ where $Q$ is market quantity and $m$ is a market parameter.

Two stages:

1. Each firm $(j)$ chooses its aggregate capacity: $k_A, k_B$, pays $c \cdot k_j$
2. Each firm chooses the quantity it supplies to each market that is serves

- Quantities in the overlapping market: $q_A, q_B$
- Quantities in the private markets: $\hat{q}_A, \hat{q}_B$
Model - Details

- For the most part, linear demand

\[ P(Q; m) = a - \frac{b}{m} \cdot Q \]

- Think of \( m_j \) as the number of equally sized markets

- Second stage quantities limited by first stage capacity:

\[ q_j + \hat{q}_j \leq k_j \]

- If MMC had no effect, MR = c and

\[ q_A = q_B = m_o \frac{a - c}{3b} \]

\[ \hat{q}_j = m_j \frac{a - c}{2b} \]
Questions

- Firm aggressiveness. Characterize $c - MR_j$

- Degree of overlap for symmetric firms
  - Fix $m_A = m_B$ and $m_A + m_B + m_o$. What are the effects of increasing $m_o$?

- Private markets for asymmetric firms
  - Comparative statics with respect to $m_A$

- Welfare maximizing distribution of the private markets
  - Fix $m_o$ and $m_A + m_B$, what is the surplus maximizing $m_A$?
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Two Economic Forces

- **Flexibility** - ability to react in the second stage to rival’s strategy

  \[ \phi_j \equiv \frac{\partial q_j}{\partial q_{-j}} \leq 0 \text{ linear demand: } \phi \in \left[ -\frac{1}{2}, 0 \right] \]

- **Commitment power** - ability to allocate first stage deviation to the overlapping market

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Symmetric Firms

Theorem

Suppose \( m_0 = \lambda M \) and \( m_A = m_B = M \cdot \frac{1-\lambda}{2} \). Then:

\[
\frac{q_j}{q_j^*} = \frac{\hat{q}_j}{\hat{q}_j^*} = \frac{k_j}{k_j^*} = \frac{3 (3 + 10\lambda + 3\lambda^2)}{9 + 26\cdot \lambda + 13\lambda^2};
\]

\[
\frac{\partial \left( \frac{q_j}{q_j^*} \right)}{\partial \lambda} \geq 0 \iff \lambda \geq \frac{4\sqrt{3} - 3}{13}.
\]

Where \( q^* \) and \( k^* \) are the standard Cournot quantities.

Corollary

Effect of overlap is non-monotonic.
Application - Symmetric Firm Growth / Mergers
The Overlapping Market with Asymmetric Firms
Firm Share Increases in Rival’s Private Market Size
Empirical Prediction

If a carrier $j$ has no flexible markets with respect to $\langle a, b \rangle$, its market share in $\langle a, b \rangle$ increases with the size of its rival’s flexible and non-overlapping markets w.r.t. $\langle a, b \rangle$.

$$s_{j,r,t} = \beta \ln \left[ \mu_{j,r,t} \right] + \gamma X_{j,r,t}$$

- Limit attention to cases in which $m_B = 0$
- $\mu_{j,r,t}$ is a measure of $m_A$.
  - Use seats sold by $j$’s rival in route $r$ for all the flexible and non-overlapping markets the rival has with respect to market $r$ and carrier $j$
  - Same results with market counts and revenues
- Use US Domestic airline data (BTS DB1B) 1993 to 2010.
TABLE I
MARKET-SHARES REGRESSION RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Legacy Carriers</th>
<th>Exclude 9/11 &amp; 2008</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Ln($\mu_{jrt}$)</td>
<td>0.953*</td>
<td>0.753*</td>
<td>0.735*</td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td>(0.024)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Ln(rival’s connected routes)</td>
<td>-5.437*</td>
<td>-6.332*</td>
<td>-6.847*</td>
</tr>
<tr>
<td></td>
<td>(0.164)</td>
<td>(0.170)</td>
<td>(0.199)</td>
</tr>
<tr>
<td>Ln(route passengers)</td>
<td>1.123*</td>
<td>2.147*</td>
<td>2.380*</td>
</tr>
<tr>
<td></td>
<td>(0.176)</td>
<td>(0.176)</td>
<td>(0.192)</td>
</tr>
<tr>
<td>Ln(cost)</td>
<td>-0.802*</td>
<td>-0.798*</td>
<td>-0.717*</td>
</tr>
<tr>
<td></td>
<td>(0.083)</td>
<td>(0.083)</td>
<td>(0.090)</td>
</tr>
<tr>
<td>MS at endpoints</td>
<td>58.1*</td>
<td>54.4*</td>
<td>52.9*</td>
</tr>
<tr>
<td></td>
<td>(1.19)</td>
<td>(1.187)</td>
<td>(1.301)</td>
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<tr>
<td>Herfindahl Index</td>
<td>49.1*</td>
<td>47.1*</td>
<td>46.5*</td>
</tr>
<tr>
<td></td>
<td>(0.548)</td>
<td>(0.577)</td>
<td>(0.642)</td>
</tr>
<tr>
<td>Constant</td>
<td>63.9*</td>
<td>34.5*</td>
<td>34.1*</td>
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<tr>
<td></td>
<td>(0.215)</td>
<td>(2.074)</td>
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<tr>
<td>Rival Dummies</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Route-Carrier FE</td>
<td>YES</td>
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<tr>
<td>Carrier-Year-Quarter FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Rival Carrier-Year-Quarter FE</td>
<td>YES</td>
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<td>YES</td>
</tr>
<tr>
<td># of Observations</td>
<td>125,831</td>
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</tr>
<tr>
<td>Adjusted R-Sq</td>
<td>0.884</td>
<td>0.923</td>
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Results - Detail

- Coefficient on $\mu_{jrt}$ is positive and significant
  - A one percent increase in rival’s flexible, private, markets corresponds to a $\sim 0.75$ percentage point increase in the carrier’s share, or about 1.5 percent change in revenue.

- Effect of rival’s connected routes is negative and significant
- Effect of market share in endpoints is positive and significant
- Similar results when counting markets or revenue instead of seats
- More empirical work in a follow up paper
Concerns about Multi-Market Contact implications affect merger evaluation and regulatory involvement in markets

- Evidence for anti-competitive behavior is important
- Important to know if can actually be misinterpreting competitive behavior

This paper - differences in multi-market coverage (large private markets) increase competition

- Harder to evaluate merger implications
- Could be that Delta-NW and United-Continental are fine, but AA and US Airways would be bad
That’s It!

- Thank you
### Suggestive Evidence

#### Data - Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Share</td>
<td>0.49</td>
<td>0.31</td>
<td>0.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Rival’s Flexible &amp; Non-Overlap (ln[’000])</td>
<td>-3.19</td>
<td>3.91</td>
<td>-6.91</td>
<td>5.73</td>
</tr>
<tr>
<td>Price ($)</td>
<td>160</td>
<td>77</td>
<td>0</td>
<td>4113</td>
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<tr>
<td>Cost ($)</td>
<td>53</td>
<td>77</td>
<td>0</td>
<td>12349</td>
</tr>
<tr>
<td>Endpoint Market Shares</td>
<td>0.32</td>
<td>0.22</td>
<td>0.00</td>
<td>0.97</td>
</tr>
<tr>
<td>Rival’s Connected (ln[’000])</td>
<td>6.22</td>
<td>0.99</td>
<td>-2.80</td>
<td>8.59</td>
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<tr>
<td># of Non-Stop Carriers*</td>
<td>1.62</td>
<td>0.91</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td># of Carriers*</td>
<td>4.26</td>
<td>1.86</td>
<td>2</td>
<td>11</td>
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<tr>
<td>Herfindahl Index*</td>
<td>0.58</td>
<td>0.21</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Daily Passengers on Route*</td>
<td>453</td>
<td>752</td>
<td>5</td>
<td>11,985</td>
</tr>
</tbody>
</table>

Unit of observation is a route-carrier-year-quarter. Sample includes only obs with no flexible routes and with at least one rival on the route: 125,831 obs. (*) Unit of observation is a r-y-q: 78,454 observations.