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On the Unilateral Anticompetitive Effects of Mergers

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Merger Review

- Possibly the most economics intensive of competition matters

- Challenging due to prospective nature of the analysis
    - Need to predict effects
    - Need to predict efficiencies

- Multiple theories of harm
    - Coordinated effects theories: collusion theories
    - Unilateral effects theories: oligopoly models

Predicting or Screening for Unilateral Market Power Effects of Mergers

1. Critical Loss Analysis
2. Diversion Ratios
3. Upward Pricing Pressure (UPP)
4. Indicative Price Rise (IPR)
5. Reduced Form Regression Models
6. Merger Simulation

In all there is a desire to replace the messiness of market definition in the traditional approach.

Critical Loss Analysis

How much volume loss would cancel the benefit from higher prices?

Critical Loss Analysis

What sales loss (in %) would undo the benefits to the merged firm of prices higher by a BPI (Benchmark Price Increase)?

Three steps:

(i) estimate incremental margin and calculate the volume the group of firms would have to lose after a BPI to make increase unprofitable – this is the Critical Loss (CL)

(ii) Separately determine what the Actual Loss (AL) is likely to be as a result of the BPI

(iii) Compare CL and AL: if AL>CL, BPI is unprofitable

Critical Loss Analysis: Calculating CL

$$\Delta\pi = (P_1 - C)X_1 - (P_0 - C)X_0$$
$$= P_1X_1 - P_0\,X_0 - \mathrm{C}(X_1 - X_0)$$

$$= P_1(X_1 - X_0) + (P_1 - P_0\,)\,X_0 - C(X_1 - X_0)$$

$$\frac{\Delta\pi}{P_0X_0} = \frac{P_1}{P_0}\left(\frac{X_1 - X_0}{X_0}\right) + \left(\frac{P_1 - P_0}{P_0}\right) - \frac{C}{P_0}\left(\frac{X_1 - X_0}{X_0}\right)$$

Critical loss makes change in profits = 0

$$0 = \left(\frac{P_1 - C}{P_0}\right)\left(\frac{X_1 - X_0}{X_0}\right) + \left(\frac{P_1 - P_0}{P_0}\right)$$

CL expressed in absolute value:

$$\text{CL} = \frac{-(X_1 - X_0)}{X_0} = \frac{\left(\frac{P_1 - P_0}{P_0}\right)}{\left(\frac{P_1 - P_0}{P_0}\right) + \left(\frac{P_0 - C}{P_0}\right)} = \frac{BPI}{BPI + m_0}$$

Is this loss of sales likely if price rises by the BPI amount?

Example: if BPI is 5% and margin is 25%, CL is about 17%

Critical Loss: three more points

1. Can also be used for market definition using SSNIP (small, but significant non-transitory increase in price) as the BPI.

2. Very crude typically – estimates of AL can be pretty rough unless we do much more elaborate testing.

3. What if a price increase of X% is not profitable [because AL(X)>CL(X)] but an increase of 2X% is profitable [i.e. AL (2X) < CL (2X)] ?

Diversion Ratios

How closely do the merging firms compete?

Diversion Ratios

Definition: The diversion ratio from firm A to firm B (D_{AB}) is the fraction of sales lost by firm A when it increases its price (P_A) that go to firm B.

$$D_{AB} = \frac{-\partial X_B / \partial P_A}{\partial X_A / \partial P_A}$$

$$\underbrace{\left[\frac{\partial X_B / \partial P_A}{\partial X_A / \partial P_A}\right]}_{-D_{AB}}\left[\frac{P_A / X_B}{P_A / X_A}\right] = \frac{e_{AB}}{e_A}$$

Diversion Ratios

Yielding:

$$D_{AB} = \frac{-e_{AB}}{e_A} \cdot \frac{X_B}{X_A}$$

Note if diversion goes to all other brands according to their previous market shares (if no consumers leave the market):

$$D_{AB} = \frac{S_B}{1 - S_A}$$

Upward Pricing Pressure (UPP)

What is the immediate effect of internalizing this diversion?

Upward Pricing Pressure (UPP)

Gross UPP: $UPP_A^G = (P_B - C_B)D_{AB}$

where $D_{AB} = \left|\frac{\partial X_{B/\partial P_A}}{\partial X_{A/\partial P_A}}\right|$

UPP: $UPP_A^N = (P_B - C_B)D_{AB} - E_A C_A$

Where E_A = efficiency saving expected.

UPP with Symmetric Firms

With symmetric firms net UPP > 0 if

$$D\left(\frac{m}{1-m}\right) > E \qquad \text{where } m = \frac{P_i - C_i}{P_i}$$

Related *Gross Upward Price Pressure Index*:

$$\text{GUPPI}_A = (P_B - C_B)D_{AB} / \text{P}_A$$

to be compared to some benchmark (e.g. 5% or 10%)

Indicative Price Rise (IPR)

Predicting price increases based on diversion and margins.

Calculating the Price Change: IPR

- For now: assume constant elasticities and symmetry

Let $IPR_A = \dfrac{P_A - P^*}{P^*}$ = price increase

P=old price* $\rightarrow$ *from f.o.c.* $\dfrac{P^* - c}{P} = \dfrac{-1}{e_A} = \dfrac{-1}{e_B} = m$

So *m* is premerger margins

Joint $\Pi = (P - c)(X_A + X_B)$

Calculating the IPR

Increasing both prices assuming symmetry:

$$\frac{d\Pi}{dP} = (P-c)\left[\underbrace{\frac{\partial X_A}{\partial P_A} + \underbrace{\frac{\partial X_A}{\partial P_B} + \frac{\partial X_B}{\partial P_A}}_{Symmetry} + \frac{\partial X_B}{\partial P_B}}\right] + X_A + X_B = 0$$

$$\frac{d\Pi}{dP} = (P_A-c)\left[2\frac{\partial X_A}{\partial P_A} + 2\frac{\partial X_B}{\partial P_A}\right] + 2X_A = 0$$

With some manipulation becomes:

$$\frac{(P_A-c)}{P_A}(1-D) = \frac{-X_A}{\partial X_A/\partial P_A}\frac{1}{P_A} = \frac{1}{e_A} = m$$

Calculating the IPR

So

$$\frac{(P_A - c)}{P_A}(1 - D) = m$$

$$\frac{(P_A - P^*)}{P^*} + \frac{(P^* - c)}{P^*} = \frac{(P_A m)}{(1 - D)}\frac{1}{P^*}$$

$$IPR + m = (IPR + 1)\frac{m}{1 - D}$$

IPR with Specific Demand Assumptions

Thus: with constant elasticities, we can show:

$$IPR = \frac{mD}{1 - m - D} = \frac{GUPPI}{1 - m - D}$$

As D↑ => IPR↑ and as m↑ => IPR↑

With linear demands, we can show:

$$IPR = \frac{mD}{2(1-D)} = \frac{GUPPI}{2(1-D)}$$

So, in both cases, IPR goes up with greater m and greater D

IPRs: Changing Assumptions

We can get different estimates of the by changing assumptions, e.g. with respect to

a. Symmetry
b. Shapes of demand curves
c. Considering effects of efficiencies

Reduced Form Regressions

Using data from other markets and/or other time periods.

Reduced Form Regression Models: Price Equation
(e.g. Staples-Office Depot, 1997)

Explain the price of one of merging firms (firm i) at time t using:

$$P_{it} = a_i + f(\text{competitors}_{it}) + g(\text{time and other variables})$$

a_i = firm/store fixed effect (in some regressions)

e.g. competitors variables:

f(# of rivals within 5 km at t, # of rivals 5-10 km at t)

Reduced Form Regression Models

- Estimate equation using a panel of data on firms/stores in the industry over time.
    - Most useful for retail mergers (with lots of local markets)
    - But can be large numbers of prices – need an index

- Then coefficients on competitor variables will indicate the effect of reduction in number of competitors due to merger

- Must consider endogeneity of competitor variables (e.g. IV)

- More sophisticated version of looking at before/after natural experiments of entry and exit in related markets

Merger Simulation

Merger Simulation

Basic Idea of Merger Simulation:

If we can create a model of the market we can predict the effects of a merger by running a simulation of the merger in the model. We do not need a precise definition of the market. What will we need:

1. Information about demand for all firms that impact on the prices of concern.
2. Information about costs
3. Information about the nature of competition

Merger Simulation and the Theory of Harm

Simulation models (as the others above) have almost exclusively been used to study the potential for a merger to enhance unilateral market power. But could be used to assess the potential for collusion.

Merger Simulation: Two Steps

Basic Steps

1. Front end – Estimate cost and demand parameters (elasticities and cross-elasticities)

2. Back end – combine this information with a model of market competition to predict effect of structural change in the market (i.e. the merger)

Demand Models

The challenge in demand estimation comes from the trade-off between flexibility and feasibility.

Some of the most common demand systems for merger simulation:

1. Linear and Log-linear models
2. Logit Model (e.g. Antitrust Logit Model)
3. Nested Logit Model (and extensions)
4. Almost Ideal Demand Systems (AIDS)

In general they differ in the flexibility they allow for own and cross-price elasticities.

Dealing with Costs

Approaches to incorporate cost information:

1. Exogenous costs
   - from independent sources (e.g. engineers or accountants)

2. Implicit costs
   - implied by demand and first-order conditions

3. Estimated costs
   - estimated with demand (sometimes a two-step procedure with demand estimated first)

Dealing with Costs: Efficiencies

To the extent the merger is expected to generate efficiencies this will need to be incorporated in the simulation:

- post-merger costs of merging firms will need to be adjusted to reflect new expected costs
- marginal cost changes will lead to further changes to prices
- fixed costs savings will still affect total social surplus, though not likely prices

Another challenge: What about X-inefficiency?

Models of Competition

Three key aspects:

(i) What are the strategic variables?

- prices, quantities, qualities, advertising

(ii) How do firms choose the values of those variables:

- non-cooperatively vs. cooperatively
- simultaneously vs. sequentially

(iii) How are these choices combined to determine a market outcome?

- typically in a Nash Equilibrium

Models of Competition: Common Models

a. Homogeneous product Cournot competition
   - quantity is choice variable
   - simultaneous move
   - Cournot-Nash equilibrium

b. Differentiated product Bertrand competition
   - price is choice variable
   - simultaneous move
   - Bertrand-Nash equilibrium

Example: Homogeneous Product Cournot Model

Assume we observe:

current price *(P)*

current quantity *(X)*

number of firms *(n)*

market shares *(S_i)*

What we still need:

market elasticity of demand (*e*)

marginal costs *(c_i)*

Front End

Elasticity:

- ideas from previous research
- estimate a demand system
- if we are prepared to assume a particular simple functional form (e.g. linear) for the demand curve we can figure out the equation for the whole demand curve

e.g. if $P = a - bX$, then it is easy to show that $b = P/(Xe)$, follows from the definition of e. Then it is trivial to show that $a = P + bX = P(e+1)/e$

Marginal Costs

Back marginal costs (i.e. C_i for firm i) out of the existing data assuming profit maximization by each firm and Cournot behaviour

f.o.c. => $P - c_i + X_i P' = 0 \Rightarrow (P - c_i)/P = S_i/e$

which reveals: $c_i = P(e-S_i)/e$

Back End

Assume $P = a - b\,X$.

Let c^* be unweighted average of firm marginal costs. Taking individual firm f.o.c. and summing over all n firms we can show:

$$X = \left[\frac{n}{n+1}\right]\left[\frac{a-c^*}{b}\right] \text{ and } \quad P = \left[\frac{a+nc^*}{n+1}\right]$$

And we can simulate the merger by changing n and adjusting c^*.

Want to try?

A very simple simulation program – for teaching purposes only – is available at:

http://www.sauder.ubc.ca/Faculty/Research_Centres/Phelps_Centre_for_the_Study_of_Government_and_Business/Projects/CCPP_Merger_Simulation_Program

To use this, need data on:

(i) market shares; (ii) total market revenue; (iii) average market price; and (iv) elasticity of demand (but can test out educated guesses)

For more serious applications:

There is an "antitrust" package at CRAN (maintained by US DoJ):
https://cran.r-project.org/web/packages/antitrust/index.html
with links to the reference manual

From an R session, using the package is as simple as

```
R> install.packages("antitrust")
R> library(antitrust)
```

which automatically downloads the latest version from CRAN and unpacks it.

R itself can be downloaded (at no charge) from CRAN at
https://www.r-project.org

and by following the link for your operating system (win/mac/linux).

Experience with Merger Simulation

Just starting to get analysis of the degree to which merger simulations have accurately predicted price and output changes due to mergers. Two general results:

1. some evidence that reasonable predictions can come from simulation models, carefully done

BUT

2. great variance in predictions from models depending on modelling assumptions made

Challenges to using Merger Simulation

1. Data requirements can be extreme
   - prices, quantities, costs, product attributes etc.
2. Careful simulation requires a lot of training and time – difficult to implement under the pressures of merger review timelines – costly for both Competition Authority and private sector
3. Results very sensitive to demand model assumed.
4. Results very sensitive to approach to incorporating costs.
5. Results very sensitive to model of competition assumed.
6. Increase uncertainty for business and may be seen to reduce transparency.

Doing Merger Simulation Well

1. Use market models of competition that seem appropriate to the market.

2. Test for reasonableness of estimated and implied values (e.g. of margins, marginal costs).

3. Test for robustness of results by trying out different demand and cost models.

4. Use it to supplement more traditional approaches

Where do you use merger simulation?

Two key applications:

1. For internal purposes – to help determine if a merger presents serious market power problems

2. As part of public case challenging a merger

There is much more of 1 than 2 currently – probably wise since a public "battle of simulations" is likely to be unproductive.

Some Final Thoughts on These Methods

Just one step of a fuller review

- These techniques are generally used as initial screens, to identify mergers that are potentially problematic and worthy of further analysis
- They miss too much to be complete:
  - Reactions of non-merging firms and then counter reactions of merging firms (i.e. equilibria)
  - Entry
  - Potential for innovation
  - Non-price changes
- Each makes strong assumptions about the nature of competition and applies data that may be noisy
- That said, they all represent defensible approaches to evaluating the first unilateral effects of a merger