The First-Order Approach to Merger Analysis

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Our Contribution

1. Generalize UPP to \GePP"
   - allow for non-pricing conduct and non-Nash equilibrium
   - generalize the diversion ratio
   - add an \end of accommodating reaction" term

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   - generalize the diversion ratio
   - add an \end of accommodating reaction" term
2. Formulate the \merger pass-through rate" necessary to convert pricing pressure to price changes
   - an intuitive combination of pre- and post-merger pass-through
3. Combine price changes into an aggregate metric of the changing consumer surplus
   - weight by quantities

$$CS \qquad \underbrace{g^{T}}_{\text{GePP}} \qquad \underbrace{\quad}_{\text{merger pass-through}} \qquad \underbrace{Q}_{\text{quantity}}$$

Prices as Strategies

Comparison to UPP and estimation of price changes are easier if we think of firms as setting prices

- As long as the map from strategies to prices is invertible, this is without loss of generality
- Other firms' non-price setting behavior is incorporated into the conjectures concerning their reactions
  - Cournot can be reformulated as a firm setting prices and conjecturing that other firms will adjust their prices to keep their quantities fixed
  - Again, the total derivative is $\frac{dQ}{dP_i} = \frac{\partial Q}{\partial P_i} + \left(\frac{\partial Q}{\partial P_{-i}}\right)^T \frac{\partial P_{-i}}{\partial P_i}$

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The pre-merger first-order condition simplifies to:

$$f_i(\cdot) \equiv -\left(\frac{dQ_i}{dP_i}^T\right)^{-1} Q_i - (P_i - mc_i) = 0$$

Generalized Pricing Pressure (GePP)

Post-merger, the merging partner j does not react:

- d^M holds xed partner's strategy $\frac{d^M A_i}{dP_i} = \frac{\partial A_i}{\partial P_i} + \frac{\partial A_i}{\partial P_{ij}} \frac{\partial P_{ij}}{\partial P_i}$
- The diversion ratio matrix is D_{ij}^P $\quad \frac{d^M Q_i}{dP_i}^{-1}{}^{T} \frac{d^M Q_j}{dP_i}^{T}$

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Examples

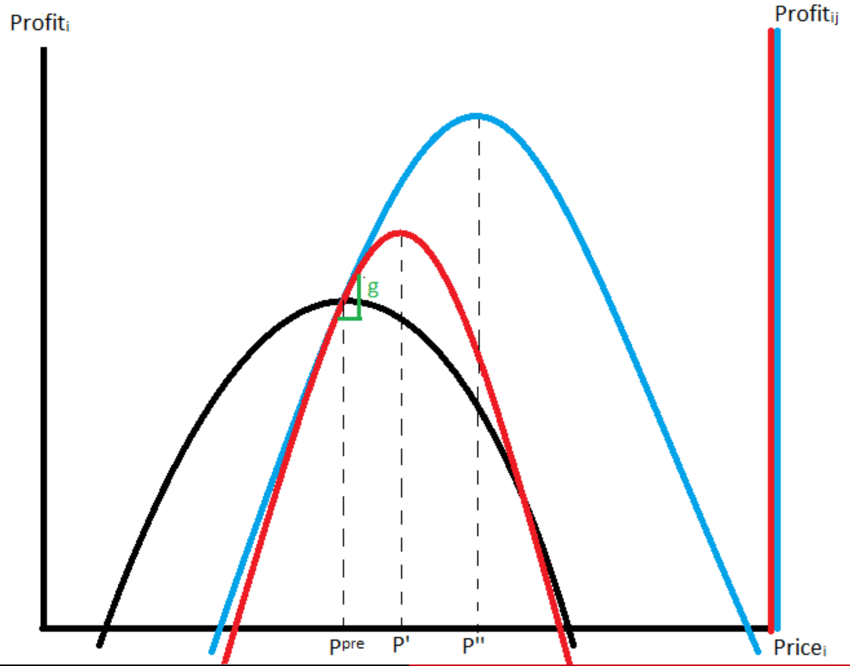
Nash-in-Prices

- In single-product case, exactly UPP
- In multi-product case, diversion by matrices

Pass-through

GePP, like UPP, only gives pricing pressure, not price changes

- *Pass-through* is the rate at which changes in marginal cost are passed through to prices
- It's intuitive to think that pass-through rates should be used to convert pricing pressure into price changes
- Disagreement in the literature over which pass-through rate choice
    - Froeb, Tschantza, Werden (2005) claim post-merger
    - Farrell and Shapiro (2010) claim pre-merger


Profit$_i$
Profit$_{ij}$
g
P^{pre}
P'
P''
Price$_i$

We use a Taylor expansion to find the relevant pass-through rate

- Even though mergers are a discrete change in industry structure, we can use standard comparative static approaches as long as the changes in incentives are small
- Requires that the first-order conditions be invertible

Theorem

If f is the vector first-order conditions and g is the vector of GePPs and $(f+g)$ and $\frac{\partial f(P)}{\partial P} + \frac{\partial g(P)}{\partial P}$ are invertible, then,

$$\Delta P \approx \underbrace{-\left(\frac{\partial f(P)}{\partial P} + \frac{\partial g(P)}{\partial P}\right)^{-1}\Bigg|_{P^0}}_{\text{merger pass-through}} \underbrace{g(P^0)}_{\text{pricing pressure}} .$$

Pre-, post- and merger pass-through

- Pre-merger: $\leftarrow \; = \quad \frac{\partial f}{\partial P}^{-1}$
- Post-merger: $\rightarrow \; = \quad \frac{\partial f}{\partial P} + \frac{\partial g}{\partial P}^{-1} D$
  - where $D \quad \begin{bmatrix} I & D_{12} & 0 \\ D_{21} & I & 0 \\ 0 & 0 & I \end{bmatrix}$
- Merger: $\quad = \quad \frac{\partial f}{\partial P} + \frac{\partial g}{\partial P}^{-1}$
  - Pre-merger cost impacts

Identifying merger pass-through

We can't directly observe merger pass-through...two approaches:

1. Exact identi cation
   - Two merging rms
     - Use Slutsky symmetry to identify w/ Bertrand or Cournot
   - With more rms, need stronger assumptions
     - Weyl-Fabinger horizontality or independent discrete choice
2. Approximating merger pass-through with pre-merger pass-through
   - If g is small
     - Then likely that $\frac{\partial g}{\partial P}$ also small $\Rightarrow$
     - Otherwise "smallness" not very robust
     - If g is small because D is small $\Rightarrow$ $\rightarrow$
   - If merger small, e ect on pass-through are likely to also be small

Approximation Error and Validity

The error term $\frac{1}{2} @^2 h \quad ^1$

[redacted]

Welfare as a common currency

In the end, we care about Welfare

- Consumer Surplus
  - $P^{\mathsf{T}} Q$
    - Laspeyres, Paasche, Marshall-Edgeworth or Fisher
  - Normalize by value of trade for unit-free measure

$$P^{\mathsf{T}} Q = P^{\mathsf{T}} Q$$

- Social Surplus
  - $DWL \quad (P \quad \text{mc})^{\mathsf{T}} \quad Q \quad (P \quad \text{mc})^{\mathsf{T}} \frac{@Q}{@P} dP \; :$
  - Ignores externalities and any other out-of-market a ects

Comparison to merger simulation

\Approximateness"

- With MS's assumptions, we would get the same results
  - Functional forms tie down the higher order Taylor terms
    - But they also tie down pass-through rates
    - We think it's better to try to measure these empirically
  - Our approach maksuren892es5ithroachterms

Simplifying the formula for applications

The more general, robust formula requires more inputs

- Many possible simplifying assumptions
  1. Pass-through
  2. Firm heterogeneity
  3. Conduct: Bertrand, Cournot, consistent
- Bertrand conduct, zero cross-pass-through, and unit own pass-through give UPP^{T} Q
- Our value added diminishes, but useful for robustness checks

Conclusion

This paper:

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Future Directions:

1. How accurate is the rst-order approximation and when?
2. Add more richness: dynamics, products, quality choice
3. Best ways to simplify the formula in salient cases
4. Empirical work on pass-through