Overview of Merger Analysis

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Fall 2025

Merger Analysis

Some possible goals: assess effects of merger(s) on prices, product offerings, innovation, other market outcomes.

- positive analysis
- antitrust policy: enforcement of competition policy (e.g., U.S. DOJ and FTC)
  - "rule of reason"
  - goal: block mergers that would harm consumers or "harm competition"
  - total welfare typically not treated as the relevant objective
  - main focus is typically on prices
  - recently: less clear notions of harms through firm size
  - one of the few ways that policy makers can affect market structure.

Broad Categories

1. horizontal merger
   - merger between firms competing for same consumers
   - e.g., American-USAir, AT&T-DirecTV, Cigna-Anthem, Humana-Aetna, Aon-WillisTowersWatson
2. vertical merger
   - merger between firms producing at different stages of a sequential production process
   - e.g., Microsoft-Nokia, AT&T-TimeWarner
   - see July 2021 issue of *Review of IO*

The distinction between these labels is not sharp.

Some Possible Effects of a Merger

1. internalize competitive externalities (soften competition), "unilateral effects"
2. internalize inefficient pricing externalties (e.g., double marginalization, pricing of complements)
3. make collusion easier? "coordinated effects"
4. soften/enhance incentives to innovate?
5. production "efficiencies" (economies of scale/scope, or lower incentive costs)?
6. enhanced bargaining power against upstream suppliers, workers
7. extension of market power in one market (e.g., wholesale) to another (e.g., retail).

Retrospective Merger Analysis

The Idea: look at actual prices etc. before and after a merger

- clearly interesting, but challenges
- few if any natural experiments
  - data only for *approved* mergers
  - even *proposal* of merger depends on market unobservables (e.g., anticipated profits) and antitrust policy
- endogeneiity/selection biases are not easily fixed: one needs model of merger proposal and merger approval, and exclusion restrictions to provide exogenous variation
- and probably useless for agency evaluating a *proposed* merger.

Prospective Merger Analysis

Natural idea for IO economist:

- estimate model of supply and demand on pre-merger data
- counterfactual simulation:
  - change ownership structure to reflect merger
  - simulate new equilibrium outcomes (e.g., prices)
  - include any expected efficiencies
  - in principle possible to include other endogenous outcomes (e.g., as in Fan)

Can capture unilateral effects and merger efficiencies in one coherent framework. May still need more to address coordinated effects, investment incentives, upstream bargaining power,....

BLP-style Merger Analysis

- several papers in academic literature
- historically less common in antitrust policy
  - requires expertise, time, and good data
  - not easily understood by lawyers, judges
  - not always easily understood by economists not trained in modern empirical IO
- but gradually becoming more widely used (in combination with other analysis), sometimes with simple (e.g., MNLogit, nested logit) demand model.

If not BLP, what?

- internal documents regarding competition, motivation to merge
- theoretical arguments (direction of effects)
- generalize from (typically flawed) retrospective empirics
- market "concentration" analysis
- "upward pricing pressure" analysis.

Herfindahl Index of Concentration

- market "concentration" $\approx$ small number of firms sell most of the output in the market
- one concentration index ("Herfindahl" index): $H = \sum_f s_f^2$
  - s_f is firm i's market share$\times 100$
  - in general,
    - an arbitrary functional form
    - reflects firm costs, csr demand, and firm behavior
    - not a meaningful measure of firm behavior, competitiveness, or welfare.

Concentration Analysis

So why look at concentration?

- old traditions die hard
- most judges, if they learned economics at all, learned it a long time ago
- Herfindahl seems natural because the extremes DO have an interpetation
- modern IO is beyond the reach of most (lawyers, judges) not trained in economics

Concentration Analysis

What does one do with a Herfindahl?

- common practice: compare pre- and post-merger Herfindahl indices
  - doing this correctly would require post-merger equilibrium
  - typically: people just add pre-merger shares
- historically: established thresholds for "safe harbor" or "presumption of harm"
  - initial index value
  - change in index value
- efficiencies then analyzed separately
- a key issue: what is the "relevant market" (denominator of share)?

"Market Definition"

The problem

- market share among what set of transactions?
  - YNH-St. Rafael share among New Haven hospitals or among all hospitals in NY-NJ-CT-PA Combined Statistical Area?
  - Oracle-Peoplesoft share among producers of back-office business software producers or all software producers?
- what do we even mean by "the relevant market"?
  - many debates, but if Herfindahl analysis itself makes no sense, there simply is no right answer!

Market Definition by "SSNIP Test"

- traditional criterion: "small but significant non-transitory increase in price"
  - consider sequence of market definitions (set of competing products), increasingly broad
  - what is the smallest one such that a hypothetical monopolist in this market would find it profitable to raise price... by at least 5% over current price, for at least a year
- idea: what is the smallest market (set of products) that would be profitable to monopolize and raise price $> 5\%$?
  - too few products$\rightarrow$raising price mostly "diverts" consumers to other firms, so large price increase not profitable
  - with enough products$\rightarrow$essentially all diversion is to seller's own products, large price increase profitable
- formal justification for SSNIP: *none*.

SSNIP in Practice

How do we answer the question for SNNIP test?

- from BLP-type estimation and simulation?
  (this would be/is crazy: if we have estimated BLP model, why bother with SSNIP+Herfindahls rather than directly looking at price changes and welfare??!!)
- from aggregate consumer "inflows" / "outflows"
  - e.g., patients→hospitals; what is the geographic market?
  - in the relevant market, few from outside, few to outside
  - (few typically means $< 10\%$, again arbitrary, no connection to 5% price increase)
  - idea: imports/exports $\Longleftrightarrow$ competition from outside
  - used to study many hospital mergers in 1990s
  - Capps, Dranove, & Satterthwaite (2003) showed that this can be very misleading.

Market Concentration Analysis Today

Herfindahl indices are usually still part of DOJ/FTC merger analysis, but typically not decisive on their own, at least in the agencies' decisions about challenging mergers.

One should treat them as *one descriptive* feature of the industry with at most a crude relationship to market power or likely harm from a merger.

Upward Pricing Pressure: Origins

Two firms before merger. For pre-merger firm 1

$$\pi_1 = (p_1 - c_1) Q_1(p)$$

$$FOC:$$

$$\frac{\partial Q_1(p)}{\partial p_1}(p_1 - c_1) + Q_1(p) = 0$$

Post-Merger Pricing of Firm 1's Product:

$$\pi = [p_1 - (1 - E_1) c_1] Q_1(p) + [p_2 - (1 - E_2) c_2] Q_2(p)$$

$$\frac{\partial \pi}{\partial p_1} = \underbrace{\frac{\partial Q_1}{\partial p_1}(p_1 - c_1) + Q_1(p)}_{= 0 \text{ at pre-merger eqm.}} + E_1 c_1 \frac{\partial Q_1}{\partial p_1} + [p_2 - (1 - E_2) c_2] \frac{\partial Q_2}{\partial p_1}$$

Upward Pricing Pressure

So, starting from pre-merger prices, for the merged firm

$$\frac{\partial \pi}{\partial p_1} = E_1 c_1 \frac{\partial Q_1}{\partial p_1} + [p_2 - (1 - E_2)\, c_2] \frac{\partial Q_2}{\partial p_1}$$

Divide through by $-\frac{\partial Q_1}{\partial p_1}$:

$$-E_1 c_1 - [p_2 - (1 - E_2)\, c_2] \underbrace{\frac{\partial Q_2 / \partial p_1}{\partial Q_1 / \partial p_1}}_{\text{“diversion rate from firm 1 to 2”}}$$

$$\equiv \quad UPP_1$$

Before consider any efficiencies,

$$UPP_1 = [p_2 - c_2] \frac{\partial Q_2 / \partial p_1}{\partial Q_1 / \partial p_1}$$

which measures the gain in profit from good 2 (internalized post-merger) when raise p_1 enough to reduce output by one unit.

UPP

$$UPP_1 = [p_2 - c_2] \frac{\partial Q_2 / \partial p_1}{\partial Q_1 / \partial p_1}$$

Idea: *UPP* measures net direction and magnitude of "first-round" incentives for changes in price p_1 due to merger-induced internalization of competitive pricing externalities

- size depends on size of pricing externality: how much diversion? how profitable?
- and on size of efficiency: large E_1 could offset upward pricing pressure
- symmetric for UPP_2.

Upward Pricing Pressure: Why?

UPP is meant to be a shortcut that avoids the need to estimate demand and run a merger simulation. Perceived benefits of UPP include:

- little/no need to define market (this is correct)
- don't need many parameters of demand system, "just" diversion ratio $\frac{\partial Q_2/\partial p_1}{\partial Q_1/\partial p_1}$ (something correct: scalar price coefficient α does cancel)
- no need to simulate post-merger equilibrium
- more limited data needs: diversion ratio at one point, pre-merger margins.

This is, at least partly, Confusion

- diversion ratio requires most demand derivatives
  - common practice: infer from market shares via logit formula
    (two derivatives "learned" from a single vector of market shares: no price variation needed/useful! when arbitrary functional forms perform miracles, you should be worried!)
  - "second choice" surveys or "churn" patterns: suggestive, related, but generally don't measure the right object (see recent work by Conlon and Mortimer)
- still need margins too; accounting cost data available from the merging parties subject to usual concerns; the alternative requires demand derivatives
- the hard part of a full merger simulation isn't simulating the equilibrium but estimating demand. The shortcut of calculating only UPP doesn't help much.

Upward Pricing Pressure: Other Limitations

- inherently local analysis
- ignores responses of other firms
- even ignores effects of changes in p_2 on optimal p_1!
- $\implies$ even if we somehow have good estimates of diversion and markups, attempts to infer *magnitudes* of post-merger price effects from UPP statistics can be badly misleading, and this is an exercise where *the magnitudes are what matters.*

Upward Pricing Pressure: A Useful Observation

In practice, a key question is sometimes: how big would the merger efficiencies need to be to avoid consumer harm?

UPP alone CAN answer this: if we find the % reduction (applied to both firms' marginal costs) that leads to zero UPP, then all FOC post-merger are identical to those pre-merger. This allows one to avoid computing equilibrium and consumer surplus, and to rely only on local measures of demand responses/diversion ratios.

(still need good estimates of these diversion ratios, however).

BLP-Based Merger Simulation

Some Limitations Too

- good for examining effects of merger on equilibrium prices
- not always easy to allow for effects on other product characteristics (but see Fanr)
- does not address facilitation of collusion
- alone does not address incentives for investment, entry, exit, other mergers

UPP doesn't deal with these either. So UPP might be a useful first pass, and is more tied to equilibrium behavior than SSNIP. But few advantages over BLP-style analysis—e.g., if going to use MNL as demand model, it is fairly easy to do full BLP merger analysis. More sophisticated options are now available in pyBLP.

Next: Applications

Nevo (2000)

RTE Cereals

- essentially same demand model/estimates from Nevo 2001 (but why not use the supply moments now?)
- use price-setting FOC to infer markups (marginal costs)
- change ownership structure and simulate new equilibrium
- ask what cost efficiency would be sufficient to result in zero net effect on prices
- compare predictions to ex post data for the actual mergers.

Fan (2013): Newspapers

U.S. Newspaper markets (1990-2000s)

- similar broad idea, but several twists
- two-sided market: firms sell to consumers and advertisers
- csrs can subscribe to more than one
- endogenous prices and product quality (more IV)
- partially overlapping markets: separate notions of "market" vs. "which firms compete"
- nice illustration of a type of Waldfogel IV (demographics of "neighbors" that alter markups)
- simulations of hypothetical mergers (and one actual): non-price impacts could be as important and price impacts.

Useful Fact

Some logit magic...

- let $\kappa_1, \ldots, \kappa_J$ be constants
- suppose $\epsilon_1, \ldots, \epsilon_J \sim$ *iid* type 1 extreme value (MNL)
- then

$$E_\epsilon \left[\max_j \{\kappa_j + \epsilon_j\} \right] = \ln \left(\sum_j e^{\kappa_j} \right) + \text{constant}.$$

$$E_\epsilon\left[\max_j\left\{\kappa_j+\epsilon_j\right\}\right]=\ln\left(\sum_j e^{\kappa_j}\right)+\text{constant}.$$

Examples of use:

1. $E_\epsilon\left[\max_j\left\{\kappa_j+\epsilon_j\right\}\right]$ is ex ante value of the choice problem
2. $E_\epsilon\left[\max_{j\in J}\left\{\kappa_j+\epsilon_j\right\}\right]-E_\epsilon\left[\max_{j\in J'}\left\{\kappa_j+\epsilon_j\right\}\right]$ is the expected value of being able to choose from the set J instead of J'. Used, e.g., to evaluate the value of new product, or value of adding hospital to insurer network.
3. If conditional indirect utilities are $x_j\beta_i-\alpha_i p_j+\epsilon_{ij}$, $\max_{j\in J}\left\{x_j\beta_i-\alpha_i p_j+\epsilon_{ij}\right\}$ is the indirect utility; so

$$E_\epsilon\left[\max_j\left\{x_j\beta_i-\alpha_i p_j'+\epsilon_{ij}\right\}\right]-E_\epsilon\left[\max_j\left\{x_j\beta_i-\alpha_i p_j+\epsilon_{ij}\right\}\right]$$

is the compensating variation for price change from p to p' for a consumer with type (α_i,β_i). Useful for welfare analysis.

Next: Some comments on welfare

Comments on Welfare: The Role of Epsilon

A reminder: As a model of *behavior* (e.g., demand elasticities) we can interpret ϵ_{ijt} as (a) unobserved taste, (b) consumer misperception of product, (c) device for allowing "errors" in choices. (This observation pre-dates even McFadden.)

But for welfare analysis, we must choose an interpretation. Standard is to treat as taste shock, i.e., ϵ_{ijt} "counts" toward welfare. This is not necessary, although it maintains the usual connection of welfare to revealed preference. With large support for ϵ vector, it also has some undesirable features much like "red bus/blue bus" example: adding a red bus when already have a blue bus will give *arbitrarily large* welfare gains to *positive measure* of consumers. (Not just in logit models!) Random coeffs reduce this effect, but still present.

Comments on Welfare: Valid Aggregate Welfare Measures

In general, obtaining valid notions of aggregate welfare is a tricky business. Beware that applied work often ignores important nuances (from first-year micro or even freshman micro) necessary to justify aggregate welfare statements (absent Pareto rankings).

Use of compensating/equivalent variation is best practice and relies on the notion of a "potential Pareto improvement," i.e., an increase in social welfare *if we assume optimal redistribution* (according to whatever the correct SWF is). Same as "Kaldor-Hicks" efficiency.

This has its limitations. But it is usually viewed as the only proper theoretical foundation for aggregate welfare statements. Otherwise we get in the business of comparing utilities across people (or, equivalently, taking a stand on what the correct SWF is).

Comments on Welfare: Individual Welfare?

In Nevo (any estimated random utility model), one *could* construct not only CS/CV/EV, but also the entire *distribution of individual welfare changes*. This is true despite the fact that we have *no consumer level choice data*. **This should worry you.** Note, e.g., that in general a given change in the joint CDF of random utilities tells us *nothing* about what happens to any individual consumer.

The functional form of the model allows us to map aggregate demand to a population of individual demand and individual welfare. The functional forms in this case then serve not only to approximate demand but also for decomposition of aggregate behavior into individual behavior. Beware of miracles performed by functional forms!

Comments on Welfare: Local vs. Non-Local Changes

Regardless of the model and data, some types of welfare questions are more difficult than others. This is clear already from classical linear supply and demand case.

e.g., for measuring welfare implications of a small tax, assuming linear demand and supply (or other functional forms) may not matter much because analysis is local and only changes (not levels) matter. For measuring the value created by a good, however, we have to integrate under the demand curve all the way up to the "choke price." Typically this will rely heavily on extrapolation using our assumptions about tails of preference distributions.

Comments on Welfare: Summary

Welfare analysis is hard but too important to ignore.

- We should do our best, paying attention to the underlying theory, acknowledging honestly the limitations we are forced to live with
- Waiting for perfection produces no knowledge and often results in letting less informed analysis guide decision making.
- Overstating the case is bad science and will backfire, at least in the long run.