ECON-L1300 Empirical Industrial Organization: Static models – Lecture 7 – Mergers

Ari Hyytinen, Tanja Saxell, Otto Toivanen, Iivo Vehviläinen

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Aalto University
iivo.vehvilainen@aalto.fi

This week

Lecture 7 – Mergers

- Mergers
- Diversion and unilateral effects
- Merger simulation (Nevo, 2000)

Lecture 8 – Market power

- Market power (Nevo 2001)
- Antitrust in practice

"Advantages of horizontal merger

- Competition: there is less of it. A lateral integration reduces that number of competitors that there are in the marketplace. If a market has five major competitors, and two of them merge, there are now only four rivals. The integrated company can focus more on improving its product or service and less on finding out what the competition is doing and taking necessary measures."

$\rightarrow$ Or the complete opposite is the case?

Source: The Internet

Mergers – Definitions

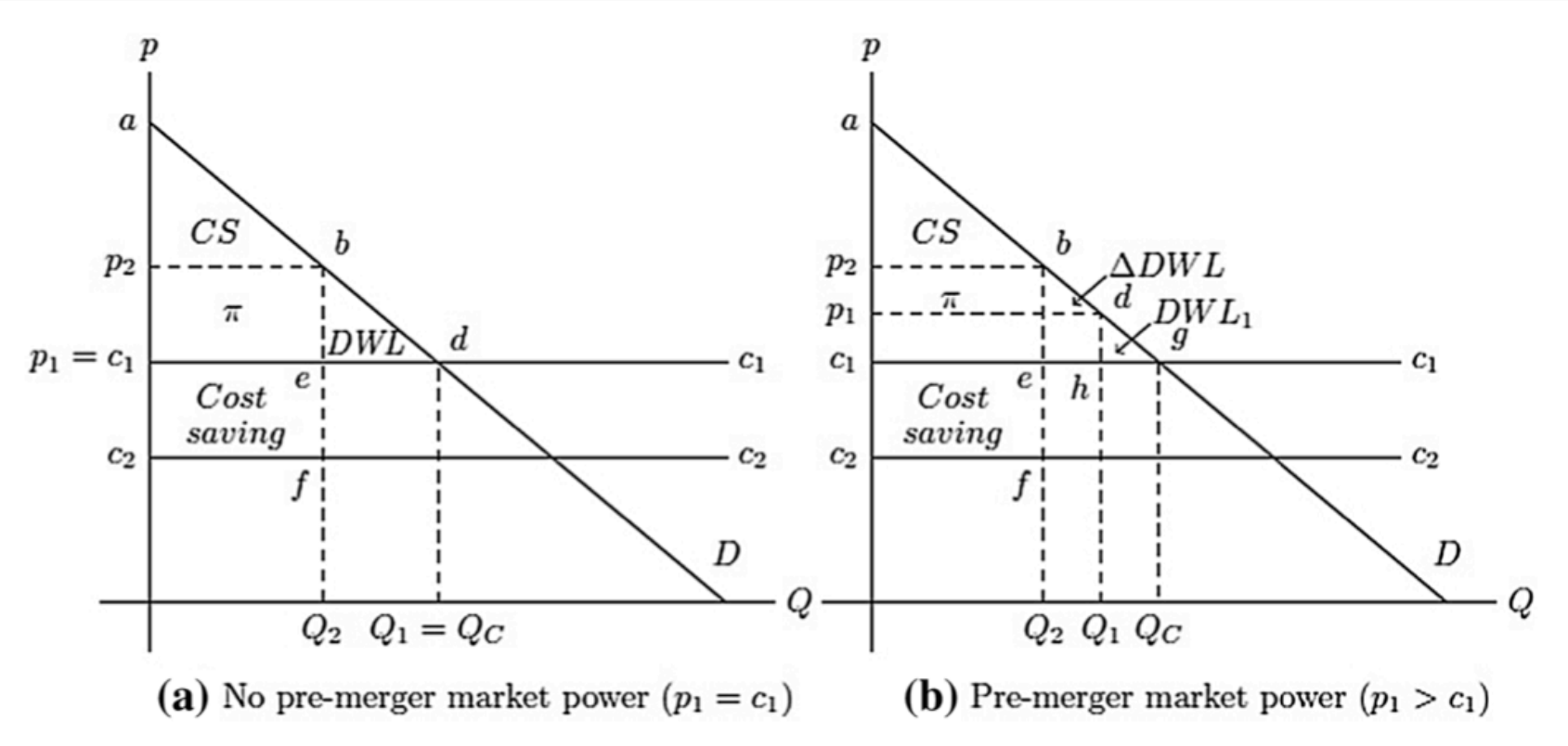
- Horizontal mergers
  - Merged firms produce substitutes
  - We focus on these
- Vertical mergers
  - Products of the firms are complements
  - Reduction of double marginalization
- Mergers of platforms in multisided markets
  - Tricky in theory and practice (e.g. Evans & Schmalensee, 2015)
  - Empirics rely heavily on the particularities of the industry, e.g. Jeziorski (2014) who uses BLP type identifying assumptions in the radio industry

Mergers – Impact of

- Unilateral effects
  - The merged entity has an incentive to raise prices post-merger
  - We focus on these
- Coordinated effects
  - E.g., a merger can result in an increased likelihood of tacit collusion (Ivaldi et al., 2003)
- Other considerations
  - Merger dynamics
  - Endogenous merger choice
  - Entry and exit (see Caradonna et al. 2024)
  - Investments and innovations
  - Product quality, positioning, bargaining power

Reminder: Naive merger analysis

Williamson (1968) tradeoff:



General finding (Farrell and Shapiro, 1990): If a merger does not generate synergies, then consumer surplus decreases.

Figure: Martin, 2019.

Academics: two main empirical tracks

1. Merger simulations with structural models
   - Quantify the trade-off between efficiency and DWL
   - Estimate demand system, change market structure, estimate synergies, and simulate new prices
   - This is us
2. Retrospective evaluations of mergers
   - Study price and market share effects of mergers in a given industry with reduced form, diff-in-diff, etc.

For all things missing here, consult Asker & Volker (2021).

Practice: Merger analysis

1. Market definition
   - Define relevant market
2. Measure concentration
   - HHI and upward pricing pressure
3. Merger simulation
   - Advantage: Can do counterfactuals
   - Disadvantage: Complex, data intensive, time consuming

Herfindahl–Hirschman Index

- First question in relation to a merger: When to intervene?
  - Practice: threshold values in terms of HHI
  - The 2010 Guidelines: post-merger $HHI > 2{,}500$ and $\Delta HHI > 200$ "presumed to be likely to enhance market power"
  - Defining the relevant market may be problematic, as may already require a lot of data (e.g., SSNIP)
- Demsetz critique:
  - Market structure is endogenous
  - Efficient firms can set lower prices and gain market share
- Also obvious: HHI measures market shares only

Revival of the Herfindahl–Hirschman Index

- Recent findings revive the relevance of HHI, e.g.
  - HHI reflects the ratio of producer surplus to consumer surplus for many oligopolistic models (Spiegel, 2020)
  - ΔHHI good proxy for the market power effect in differentiated product price competition with nested logit (Nocke & Schutz, 2018)
- Intuition for usefulness in some cases:
  - Even in the random-coefficients logit model, diversion-by-share emerges as products become more similar in their attributes, which suggests that the logit model often provides a good representation of narrowly defined antitrust markets (Miller & Sheu 2021)

Diversion ratios

- In general, market shares reveal little about the true substitution patterns
- Diversion ratios more to the point: how much does the change in price of good j shift demand to good k

$$D_{jk}(p_j, p_k) = \frac{\partial q_k}{\partial p_j} / \frac{\partial q_j}{\partial p_j}$$

- Why not use just cross-elasticities?
  - Scaling makes the diversion ratios comparable
  - Gives a fraction of the switchers choosing good k
- Interpretation:
  - High diversion = close substitutes $\rightarrow$ mergers increase prices
  - Very low diversion $\rightarrow$ not the same market?
  - Merger control: remedies, e.g., what needs to be divested?

More detailed look: Mergers change incentives

- Take first-order conditions for a single-product firm i:

$$f_i(p) \equiv -\left(\frac{\partial q_i(p)^\intercal}{\partial p_i}\right)^{-1} q_i(p) - (p_i - mc_i) = 0$$

- Merger of firms j and k leads to a change in the first-order conditions:

$$f_j(p) - \underbrace{\left[\frac{\partial q_j(p)^\intercal}{\partial p_j}\right]^{-1}\left(\frac{\partial q_k(p)^\intercal}{\partial p_j}\right)}_{\text{Diversion from } j \text{ to } k}\underbrace{(p_k - mc_k)}_{\text{Markup of } k} = 0$$

- Do make sure that you can work these out

Upward price pressure

- Incentive of the merged firm to increase prices depends on
  1. Diversion
  2. Markups
- Upward pricing pressure (UPP) measures the opportunity cost on the merging firms (ignoring cost effect to j):

$$UPP_j = D_{jk}(p_k - mc_k)$$

- Markup from diversion from j to k is internalized by the merged entity post merger
- Note: Derivation here and throughout the lecture relies on Bertrand-Nash, see Jaffe & Weyl (2013) for discussion

Merger simulation

Still need to capture the equilibrium responses of firms.

For this we need merger simulation:

- Model a demand system and estimate it
- Assume a model of competition and estimate supply
  - Cournot mergers often seemingly paradoxical (Salant et al. 1983): merged firm reduces output so that profits can drop (but premerger allocation inefficient $\rightarrow$ welfare can increase)
  - Multi-product Bertnand is the basic workhorse assumption
- Adjust marginal costs with synergies
  - Based e.g. on engineering estimate or econometric analysis
  - First guess: set synergies to zero
  - Also used the other way around: what are the synergies that would be needed to compensate the anti-competitive effects
- Solve the new equilibrium

Nevo 2000: Outline

1. Estimate a brand-level demand system for ready-to-eat cereals
   - Observable product characteristics
   - Consumer preferences depend on demographics
   - Control for unobserved brand and market specific characteristics
2. Simulate postmerger price equilibrium
   - Uses the same estimated demand model
   - Further assumptions on efficiencies and firm conduct

Nevo 2000: Demand estimation

Indirect utility given by

$$u_{ijt} = x_{jt}\beta_i^* + \alpha_i^* p_{jt} + \xi_{jt} + \epsilon_{ijt} \equiv V_{ijt} + \epsilon_{ijt},$$
$$i = 1, \ldots, I_t, \qquad j = 1, \ldots, J_t, \qquad t = 1, \ldots, T,$$

where x_{jt} product characteristics, p_{jt} price of j in market t, ξ_{jt} unobservable characteristics, ϵ_{ijt} random term. Further,

$$\begin{pmatrix} \alpha_i^* \\ \beta_i^* \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \Pi D_i + \Sigma \nu_i, \qquad \nu_i \sim N(0, I_{K+1}),$$

where D_i contains demographies and Π gives how tastes vary by demographies and unobserved consumer attributes ν_i.

Consumers choose the product with the highest utility and there is an outside good (consumers do not choose any product). The market shares are then given by:

$$s_{jt}(x_{.t}, p_{.t}, \xi_{.t}; \theta) = \int_{A_{jt}} dP^*(D, v, \epsilon) = \int_{A_{jt}} dP^*_{\epsilon}(\epsilon)\, dP^*_{v}(v)\, dP^*_{D}(D),$$

i.e, by integration over the population distribution functions.

Nevo 2000: Supply estimation

In equilibrium, first order conditions for firm j are

$$s_j(p) + \sum_{r \in \mathcal{F}_f} (p_r - mc_r) \frac{\partial s_r(p)}{\partial p_j} = 0.$$

Defining the following matrix ($\mathcal{H}_t$ in the Supply lecture)

$$\Omega^{pre}_{jr}(p) = \begin{cases} -\partial s_j(p)/\partial p_r, & \text{if } \exists f\text{: } \{r, j\} \subset \mathcal{F}_f; \\ 0, & \text{otherwise.} \end{cases}$$

gives the following markup and marginal cost equations

$$p - mc = \Omega^{pre}(p)^{-1} s(p) \Rightarrow mc = p - \Omega^{pre}(p)^{-1} s(p).$$

Nevo 2000: Equilibrium concept

$$p - mc = \Omega^{pre}(p)^{-1}s(p) \Rightarrow mc = p - \Omega^{pre}(p)^{-1}s(p).$$

Implications:

1. Marginal costs are estimated using the demand model
2. Assumed Nash-Bertrand pricing game
   - Nevo 2001: no evidence on collusion

Nevo 2000: Post-merger prices

Post-merger prices are given by

$$p^* = \widehat{mc} + \Omega^{post}(p^*)^{-1}s(p^*),$$

Assumptions:

1. The same model of firm conduct post-merger
2. No change in marginal costs, i.e. production costs or retailer markups
3. Ω^{pre} and Ω^{post} differ only in ownership structure: no change in strategy of firms, characteristics, or the value of the outside good

Nevo 2000: Post-merger prices – closer look

$$p^* = \widehat{mc} + \Omega^{post}(p^*)^{-1}s(p^*),$$

- Solving p^* is equivalent to solving a system of nonlinear equations of dimension J, needs to be done in each market
- Tricky, because of the non-convexities
  - Numerically challenging as need to ensure sufficient smoothness of the GMM objective to be minimized
  - Don't know if the equilibria are unique solutions to the systems of equations implied by the first-order conditions
- Conlon and Gortmaker 2020 improve on the standard numerical implementation, but heed with caution here!

Nevo 2000: Data

- IRI Infoscan scanner data
  - Market shares (one serving per consumer per day)
  - Prices
  - 25 brands in 67 cities over 20 quarters
- Other data
  - Advertising data
  - Characteristics from cereal boxes
  - Demographics and cost instruments

Table 1: Example of product data

market_ids	city_ids	quarter	product_ids	firm_ids	brand_ids	shares	prices	sugar	mushy
C01Q1	1	1	F1B06	1	6	0.008	0.114	18	1
C01Q1	1	1	F1B07	1	7	0.013	0.132	4	1
C01Q1	1	1	F1B09	1	9	0.006	0.130	3	0
C01Q1	1	1	F1B11	1	11	0.018	0.155	12	0
C01Q1	1	1	F1B13	1	13	0.027	0.137	14	0
C01Q1	1	1	F1B17	1	17	0.025	0.144	3	1
C01Q1	1	1	F1B30	1	30	0.005	0.128	4	0
C01Q1	1	1	F1B45	1	45	0.005	0.150	14	0
C01Q1	1	1	F2B05	2	5	0.038	0.109	1	0
C01Q1	1	1	F2B08	2	8	0.008	0.132	11	0
C01Q1	1	1	F2B15	2	15	0.007	0.112	4	1
C01Q1	1	1	F2B16	2	16	0.030	0.115	3	1
C01Q1	1	1	F2B19	2	19	0.100	0.111	13	0
C01Q1	1	1	F2B26	2	26	0.013	0.128	13	0
C01Q1	1	1	F2B28	2	28	0.024	0.175	16	1
C01Q1	1	1	F2B40	2	40	0.009	0.134	10	0
C01Q1	1	1	F2B48	2	48	0.003	0.147	3	0
C01Q1	1	1	F3B06	3	6	0.019	0.110	20	1
C01Q1	1	1	F3B14	3	14	0.011	0.137	7	0

Table 2: Example of agent data

market_ids	city_ids	quarter	weights	nodes0	nodes1	nodes2	nodes3	income	income^2	age	child
C01Q1	1	1	0.05	0.43	-1.50	-1.15	0.16	0.50	8.33	-0.23	-0.23
C01Q1	1	1	0.05	-0.73	0.13	-0.50	0.13	0.38	6.12	-2.53	0.77
C01Q1	1	1	0.05	-0.62	-0.14	0.80	-0.80	0.11	1.03	-0.01	-0.23
C01Q1	1	1	0.05	-0.04	1.26	-0.68	0.26	-1.49	-25.58	-0.83	0.77
C01Q1	1	1	0.05	-0.47	0.23	1.04	0.09	-0.32	-6.52	-0.23	-0.23
C01Q1	1	1	0.05	0.80	-0.71	1.89	-0.34	-0.34	-6.88	0.85	-0.23
C01Q1	1	1	0.05	1.51	0.04	0.45	-1.20	-0.01	-1.15	0.14	-0.23
C01Q1	1	1	0.05	-0.36	0.91	0.76	2.09	0.30	4.73	0.30	-0.23
C01Q1	1	1	0.05	-0.11	-0.35	-0.18	-0.11	-0.33	-6.73	-0.34	-0.23
C01Q1	1	1	0.05	-0.86	-1.39	-0.13	-0.94	1.01	18.33	0.67	-0.23
C01Q1	1	1	0.05	0.66	1.81	0.46	-1.00	1.12	20.60	0.30	-0.23
C01Q1	1	1	0.05	1.00	0.17	-0.41	-1.39	-0.57	-10.96	0.24	-0.23
C01Q1	1	1	0.05	0.34	1.83	-1.59	-0.15	1.54	29.31	0.03	-0.23
C01Q1	1	1	0.05	0.76	-1.29	0.78	-0.52	-0.18	-4.07	0.27	-0.23
C01Q1	1	1	0.05	0.81	-0.09	0.93	-0.57	0.09	0.83	-0.74	0.77
C01Q1	1	1	0.05	-0.88	0.24	-2.04	-1.75	-1.67	-28.32	-1.28	0.77
C01Q1	1	1	0.05	0.39	-0.56	-1.70	1.03	-0.40	-7.93	-0.74	0.77
C01Q1	1	1	0.05	0.86	0.54	-0.16	2.02	0.32	4.93	0.14	-0.23
C01Q1	1	1	0.05	1.62	-0.21	1.08	0.19	1.39	26.26	0.14	-0.23
C01Q1	1	1	0.05	-1.51	-1.25	1.15	-0.04	0.21	2.93	0.89	-0.23

Nevo 2000: Instruments

- Identifying assumption: population moment condition

$$E[Z' \cdot \omega(\theta^*)] = 0,$$

  - Requires a set of exogenous instruments Z
  - The error term ω_{jt} is the unobserved city-quarter deviation from the overall mean valuation of the brand

- Proxies for cost shifters: Hausman IVs
  - Marginal costs the same in any two cities
  - Assume: city-specific valuations independent across cities
  - Uncorrelated with market specific valuation

Nevo 2000: Estimation

Now let's see the implementation

https://pyblp.readthedocs.io/en/stable/_notebooks/tutorial/nevo.html

Can these types of merger simulations be trusted?

- Ex-post evaluation of merger simulations
  - Simulate the model
  - Observe real price and market share shifts
  - Infer change in competitive behavior post-merger
- Example: Björnerstedt & Verboven, 2016
  - Study a larger merger in the Swedish market for painkillers
  - Obtain roughly the right price levels marketwide but cannot explain the firm level prices
  - Suggest an cost increase or tacit collusion as explanations
- Example: Miller & Weinberg, 2017
  - Document the price impacts of the MillerCoors joint venture (reviewed as a merger)
  - Reject the hypothesis that increase in prices is caused by a shift from one Nash-Bertrand equilibrium to another

Recap

- BLP framework a consistent starting point for horizontal merger analysis in differentiated multi-product markets
- Issues remain, both conceptual and technical
  - Need to impose quite a lot of structure and heavy assumptions on, e.g., synergies
  - Technically PyBLP is a great leap forward
- Next time:
  - Discussion of the practice of merger control
  - Continue with the cereals, market power (Nevo 2001)