Ownership Consolidation and Product Characteristics: A Study of the US Daily Newspaper Market

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Overview

Model

Model - B. Supply

- Sources of profits for a newspaper publisher:
  - Selling newspaper to readers $\rightarrow$ Choose price
  - Selling advertising space to advertisers $\rightarrow$ Choose advertising rate
- But since some newspaper characteristics are endogenous, publishers also need to choose endogenous characteristics
- Model the supply side as a **two stage game**:
  - First stage: Choose characteristics x_{jt} for newspaper j at year t
  - Second stage: Choose newspaper prices $p^*_{jt}(\boldsymbol{x})$ and advertising rates $r^*_{jt}(\boldsymbol{x})$

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Model - B. Supply

(Suppressing the t subscript for the rest of the supply section)

Profit function for newspaper j:

$$\pi_j^I(\boldsymbol{x}_j) = \pi_j^{II}(p_j^*(\boldsymbol{x}), r_j^*(\boldsymbol{x}); \boldsymbol{x}_j) - f_C(\boldsymbol{x}_j, \nu_j; \boldsymbol{\tau}) \tag{1}$$

- $\boldsymbol{x}_j$: endogenous newspaper characteristics
- $p_j^*(\boldsymbol{x})$: newspaper price
- $r_j^*(\boldsymbol{x})$: newspaper advertising rate
- ν_j: unobservable cost shocks
- $\boldsymbol{\tau}$: fixed costs parameters

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Variable profits from circulation and advertising (preprint + display)

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Model - B. Supply

$$\text{Variable profits } \pi_j^{II} \begin{cases} \text{Circulation profits} \\ \text{Display advertising profits} \\ \text{Preprint (advertising) profits} \end{cases}$$

(a) Display advertising

(b) Preprint advertising

Circulation profits

- Difference between circulation revenue determined by demand and variable costs of printing and delivery
- Model variable costs of printing and delivery in terms of its average:

$$ac_j^{(q)} = \left(\gamma_1 + \gamma_2 f_j + \gamma_3 (x_{1j} + a_j)\right) \log(Q_j)^{\gamma_4} + \omega_j \tag{2}$$

where

- f_j: publication frequency (number of issues per year)
- $(x_{1j} + a_j)$: annual pages (x_{1j} is non-ad pages, a_j is ad pages)
- Q_j: total circulation
- ω_j: unobservable factor

$$\text{Circulation profits} = (p_j - ac_j^{(q)})\, q_j$$

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Model - B. Supply

Q_j total circulation

- $Q_j = q_j$ demand for newspaper j when
  - j's publisher publishes only one newspaper
  - Home counties of j's publisher's other newspapers aren't in the same metropolitan statistical area (MSA) as newspaper j
- Otherwise, Q_j = sum of circulations of j's publisher's all other newspapers whose home counties are in the same MSA as newspaper j

Display advertising profits

- Difference between display advertising demand and costs
- Costs are mainly from two sources:
  - Costs of printing ads (included in the circulation profits analysis)
  - Marginal advertising sales costs (Bertrand Nash form):

$$mc_j^{(a)} = \left(1 + \frac{1}{\lambda_2}\right)(\bar{\zeta} + \zeta_j) \tag{12}$$

where

- λ_2: price elasticity of demand for display advertising
- ζ_j: mean-zero exogenous random variable

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Assumed constant marginal costs for simplicity

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Quantity demanded for display ad for newspaper j

Preprint advertising profits

- Essentially a delivery service provided by newspapers
- Author didn't observe advertising rate for preprints, so preprint profits are simply assumed to be a quadratic function of circulation

$$\text{Preprint advertising profits} = \mu_1 q_j + \frac{1}{2}\mu_2 q_j^2 \tag{3}$$

- One major limitation admitted by the author – with better data on preprint advertising rate, preprint profits can be more accurately modeled.

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Bring all parts together

$$\pi_j^{II}(p_j^*(\boldsymbol{x}), r_j^*(\boldsymbol{x}); \boldsymbol{x}_j) = \underbrace{\left(p_j - ac_j^{(q)}\right) q_j}_{\text{Circulation}} + \underbrace{\left(r_j - mc_j^{(a)}\right) a_j}_{\text{Display ad}} + \underbrace{\left(\mu_1 q_j + \frac{1}{2}\mu_2 q_j^2\right)}_{\text{Preprint ad}} \tag{14}$$

Fixed costs

- Fixed costs captures the costs of choosing specific product characteristics that are independent of circulation or advertising quantity
- Approximated using a quadratic function, then for newspaper j, the slope of the kth endogenous characteristic x_{kj} is

$$\frac{\partial f_c}{\partial x_{kj}} = \tau_{k0} + \tau_{k1} x_{kj} + \nu_{kj} \tag{15}$$

Aside: Potential of collusion in data

- Some newspaper publishers in the data are in a **Joint Operation Agreements (JOA)**
- Business in JOA combine business operations, but still maintain separate and competitive editorial operations
- For such businesses, the author assumed
  - In the first stage, publishers in JOA choose their characteristics separately
  - In the second stage, all publishers in the same JOA choose prices and advertising rates to maximize joint profits for given newspaper characteristics

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Solving the equilibrium backwards

Stage 2: Choose p_{jt} and r_{jt} by taking FOCs of π^I_{jt}, holding x_{jt} constant

$$r_{jt} = \bar{\zeta} + \frac{\gamma_3}{1 + \frac{1}{\lambda_2}} \log(Q_{jt})^{\gamma_4} q_{jt} + \zeta_{jt} \tag{16}$$

$$\boldsymbol{p} = \boldsymbol{\Delta}^{-1}\boldsymbol{q} - \left[\boldsymbol{\Lambda} + (\mu_1 + \mu_2 \boldsymbol{q})\right] + \boldsymbol{\Gamma}\boldsymbol{q} + \boldsymbol{ac}^{(q)} \tag{17}$$

$$\boldsymbol{\Delta}_{hj} = \begin{cases} -\frac{\partial q_j}{\partial p_h} & \text{same publisher for } h, j \\ 0 & \text{otherwise} \end{cases} \qquad \boldsymbol{\Gamma}_{hj} = \begin{cases} -\frac{\partial ac_j^{(q)}}{\partial Q_j} & \text{same publisher \& in the same MSA for } h, j \\ 0 & \text{otherwise} \end{cases}$$

$$\boldsymbol{\Lambda}_j = -\frac{1}{\lambda_2} \frac{\partial a_j}{\partial q_j} r_j$$

Model - C. Necessary Equilibrium Conditions

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Effect of circulation on total advertising

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Model - C. Necessary Equilibrium Conditions

Effect of economy of scale and scope in printing and delivering newspapers

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Stage 1: Choose the kth endogenous characteristics x_{kjt} by taking FOC of π^I_{jt}

$$\sum_{h \in \mathcal{J}_{mt}} \left(\frac{\partial \pi^{II}_{ht}}{\partial x_{kjt}} + \sum_{j' \in \mathcal{J}_{g(jt)}} \frac{\partial \pi^{II}_{ht}}{\partial p_{j't}} \frac{\partial p^*_{j't}}{\partial x_{kjt}} \right) = \tau_{k0} + \tau_{k1} x_{kjt} + \nu_{kjt} \tag{18}$$

where

- $\mathcal{J}_{mt}$: set of newspapers from j's publisher m in the year t
- $\mathcal{J}_{g(jt)}$: set of all newspapers that are interacting in the game with newspaper j in year t

Thank You!