

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

by Ying Fan (2013 AER)

XXXX

December 10, 2020

Model

Model - B. Supply

- Sources of profits for a newspaper publisher:
 - Selling newspaper to readers → Choose price
 - Selling advertising space to advertisers → Choose advertising rate

Model - B. Supply

- Sources of profits for a newspaper publisher:
 - Selling newspaper to readers → Choose price
 - Selling advertising space to advertisers → Choose advertising rate
- But since some newspaper characteristics are endogenous, publishers also need to choose endogenous characteristics

Model - B. Supply

- Sources of profits for a newspaper publisher:
 - Selling newspaper to readers → Choose price
 - Selling advertising space to advertisers → 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 $p_{jt}^*(\mathbf{x})$ and advertising rates $r_{jt}^*(\mathbf{x})$

Model - B. Supply

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

Profit function for newspaper j :

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

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


Model - B. Supply

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

Profit function for newspaper j :

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

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



Variable profits from circulation
and advertising (preprint + display)

Model - B. Supply

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

Profit function for newspaper j :

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

Fixed costs

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

Variable profits from circulation
and advertising (preprint + display)

Model - B. Supply

Variable profits $\pi_j^{''}$ $\left\{ \begin{array}{l} \text{Circulation profits} \\ \text{Display advertising profits} \\ \text{Preprint (advertising) profits} \end{array} \right.$



(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:

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

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

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:

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

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

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

Model - B. Supply

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:

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

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

Quantity demanded for newspaper j

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


Model - B. Supply

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:

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

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

Quantity demanded for newspaper j

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


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):

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

where

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

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):

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

where

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

$$\text{Display advertising profits} = (r_j - mc_j^{(a)}) a_j \quad (13)$$

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):

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

where

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

$$\text{Display advertising profits} = (r_j - mc_j^{(a)}) a_j \quad (13)$$

Quantity demanded for display ad for newspaper j

Model - B. Supply

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):

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

where

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

Assumed constant
marginal costs for
simplicity

$$\text{Display advertising profits} = (r_j - mc_j^{(a)}) a_j \quad (13)$$

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

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

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

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

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

Model - B. Supply

Bring all parts together

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

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 k th endogenous characteristic x_{kj} is

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

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

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

Model - C. Necessary Equilibrium Conditions

Solving the equilibrium backwards

Stage 2: Choose p_{jt} and r_{jt} by taking FOCs of π_{jt}^I , holding \mathbf{x}_{jt} constant

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

$$\mathbf{p} = \mathbf{\Delta}^{-1} \mathbf{q} - [\mathbf{\Lambda} + (\mu_1 + \mu_2 \mathbf{q})] + \mathbf{\Gamma} \mathbf{q} + \mathbf{ac}^{(q)} \quad (17)$$

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

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

Model - C. Necessary Equilibrium Conditions

Solving the equilibrium backwards

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

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

$$\mathbf{p} = \mathbf{\Delta}^{-1} \mathbf{q} - [\mathbf{\Lambda} + (\mu_1 + \mu_2 \mathbf{q})] + \mathbf{\Gamma} \mathbf{q} + \mathbf{ac}^{(q)} \quad (17)$$

Effect of circulation on total advertising

$$\Delta_{hj} = \begin{cases} -\frac{\partial q_j}{\partial p_h} & \text{same publisher for } h, j \\ 0 & \text{otherwise} \end{cases}$$

$$\Gamma_{hj} = \begin{cases} -\frac{\partial ac_j^{(q)}}{\partial Q_j} & \text{same publisher \& in} \\ & \text{the same MSA for } h, j \\ 0 & \text{otherwise} \end{cases}$$

$$\Lambda_j = -\frac{1}{\lambda_2} \frac{\partial a_j}{\partial q_j} r_j$$

Model - C. Necessary Equilibrium Conditions

Solving the equilibrium backwards

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

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

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

$$\mathbf{p} = \mathbf{\Delta}^{-1} \mathbf{q} - [\mathbf{\Lambda} + (\mu_1 + \mu_2 \mathbf{q})] + \mathbf{\Gamma} \mathbf{q} + \mathbf{ac}^{(q)} \quad (17)$$

Effect of circulation on total advertising

$$\Delta_{hj} = \begin{cases} -\frac{\partial q_j}{\partial p_h} & \text{same publisher for } h, j \\ 0 & \text{otherwise} \end{cases}$$

$$\Gamma_{hj} = \begin{cases} -\frac{\partial ac_j^{(q)}}{\partial Q_j} & \text{same publisher \& in the same MSA for } h, j \\ 0 & \text{otherwise} \end{cases}$$

$$\Lambda_j = -\frac{1}{\lambda_2} \frac{\partial a_j}{\partial q_j} r_j$$

Model - C. Necessary Equilibrium Conditions

Stage 1: Choose the k th endogenous characteristics x_{kjt} by taking FOC of π_{jt}^I

$$\sum_{h \in \mathcal{J}_{mt}} \left(\frac{\partial \pi_{ht}^I}{\partial x_{kjt}} + \sum_{j' \in \mathcal{J}_g(jt)} \frac{\partial \pi_{ht}^I}{\partial p_{j't}} \frac{\partial p_{j't}^*}{\partial x_{kjt}} \right) = \tau_{k0} + \tau_{k1} x_{kjt} + \nu_{kjt} \quad (18)$$

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!