Market Structure and Product Quality in the U.S. Daily Newspaper Market

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November 19, 2009

Introduction

- This paper studies the effect of ownership consolidation in the U.S. daily newspaper market
  - standard merger analyses typically focus on price effects only
  - this paper takes into account both price effects and the effects on newspaper characteristics

Questions

- For a specific market,

  map

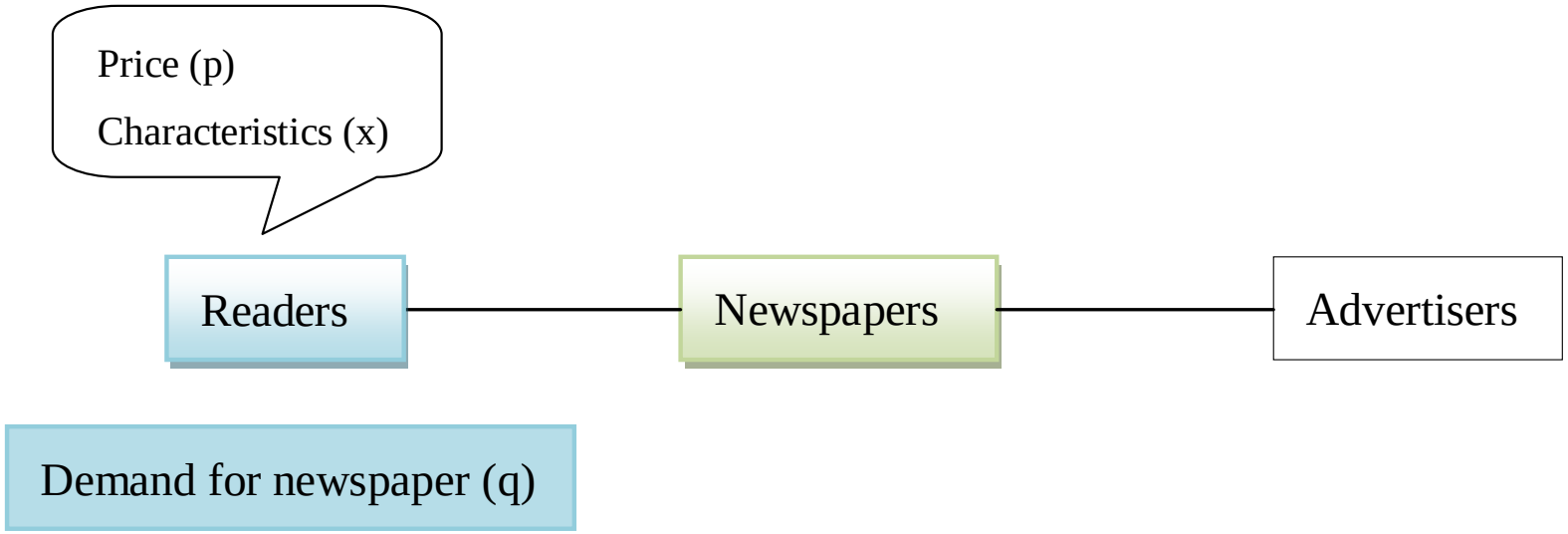
  - what happens to the characteristics and the prices of newspapers after an ownership consolidation?
    - the space devoted to news (news hole)
    - the number of opinion-section staff
    - the number of reporters
    - newspaper subscription price and advertising rate
  - what are the welfare implications?
- What is the correlation between the effects of ownership consolidation and the underlying market characteristics?

Outline

- Build a structural model of the daily newspaper market (Model)
  - oligopoly market (vs. Crawford and Shum (2006))
  - continuous choice set for product choice (vs. Draganska, Mazzeo and Seim (2006))
  - profit function derived from demand systems (vs. Mazzeo (2002))
- Collect newspaper and market data to estimate the model (Estimation)
- Use estimated model to address the two research questions (Simulation)
  - the Minneapolis market
  - all duopoly and triopoly markets in the 2005 sample
- Conclude (Conclusion)

Newspaper Demand

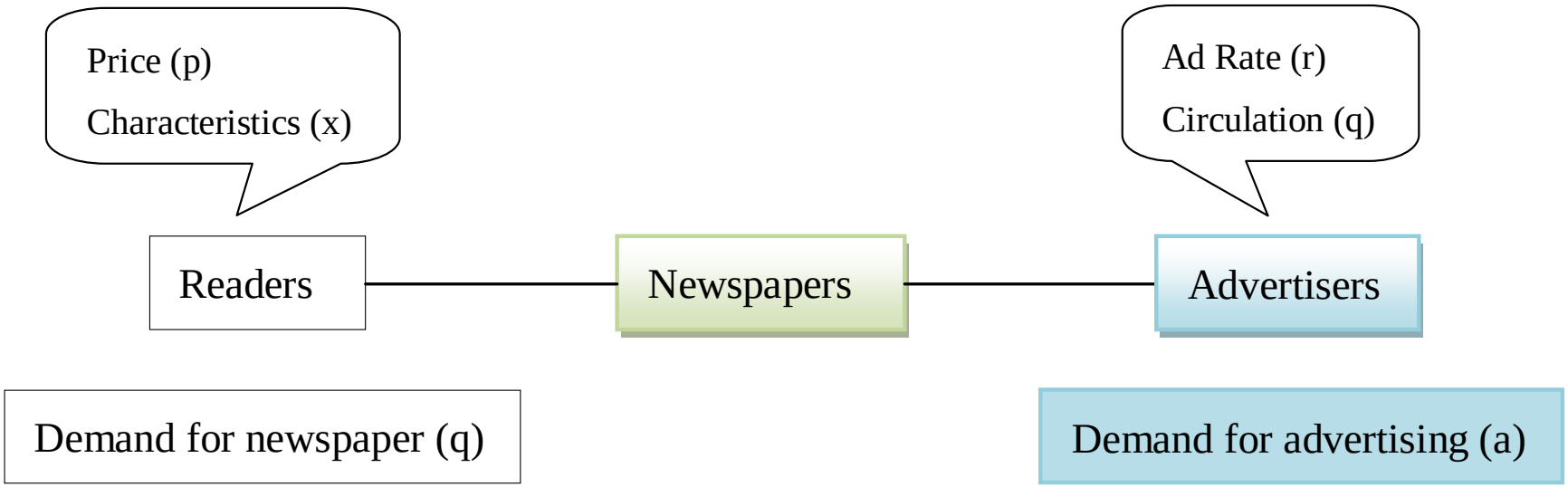
Newspaper Demand



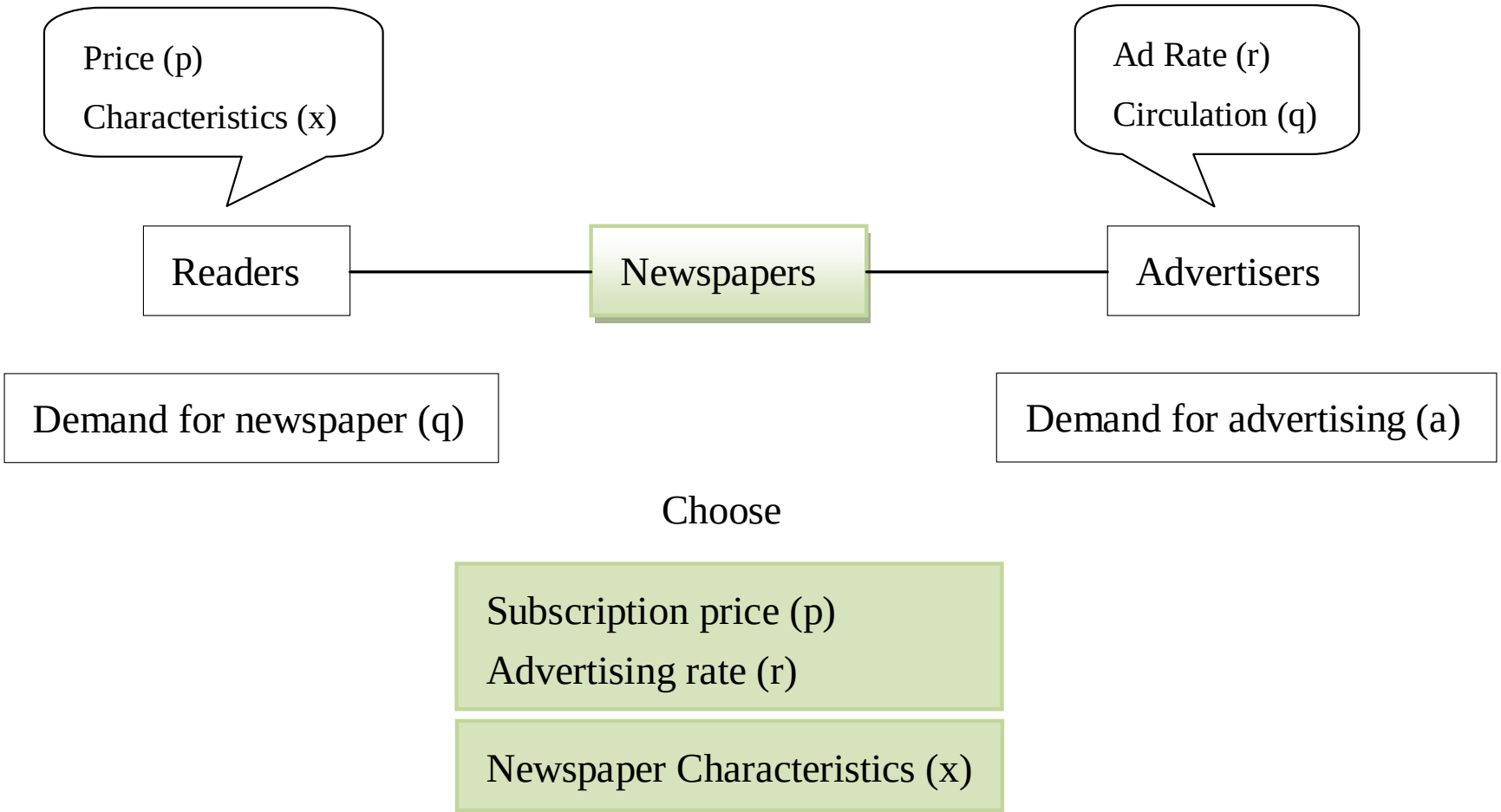
$u_{ijt}: p_{jt}, x_{jt}, D_{ct}(demographics), \xi_{jct}(unobservable), \epsilon_{ijt}$

$u_{i0t} = \rho(t - t_0) + \epsilon_{i0t}$

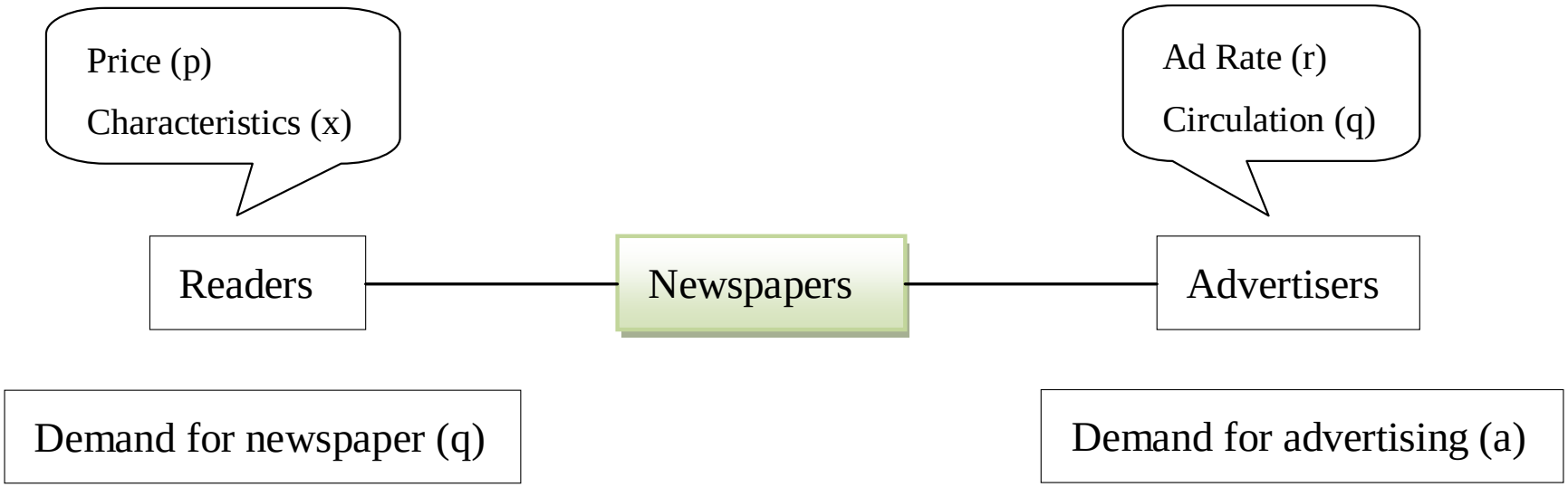
Advertising Demand



Supply


Price (p)
Characteristics (x)
Ad Rate (r)
Circulation (q)
Readers
Newspapers
Advertisers
Demand for newspaper (q)
Demand for advertising (a)
Choose
Subscription price (p)
Advertising rate (r)
Newspaper Characteristics (x)

Supply

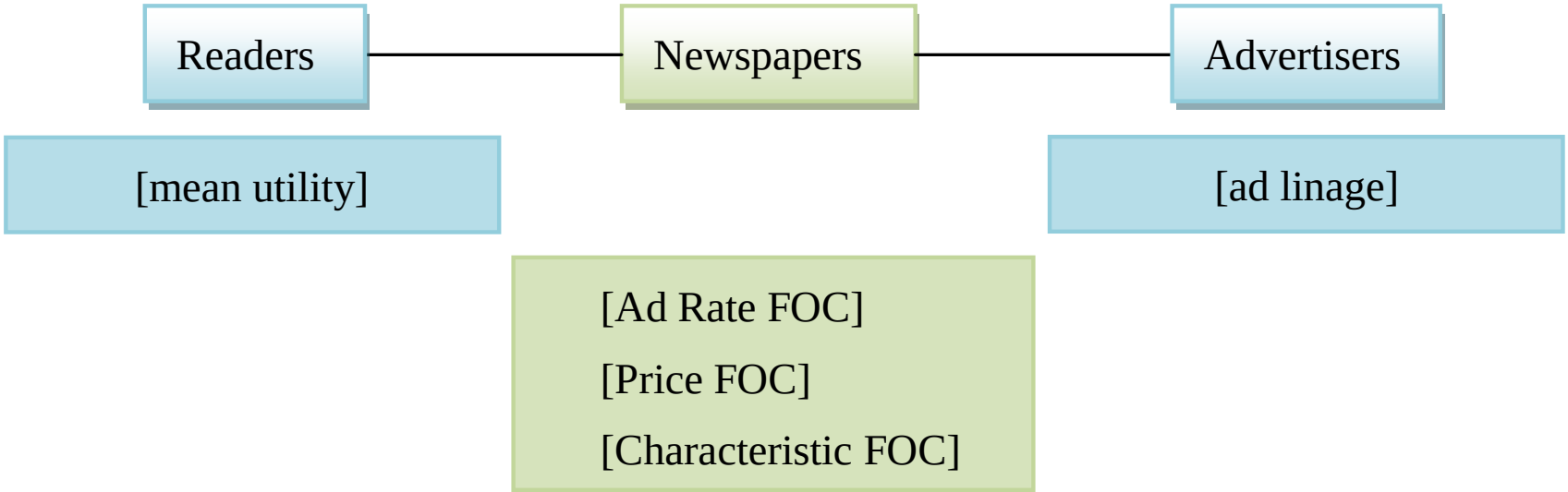


Choose

Subscription price (p)
Advertising rate (r)

News hole
Opinion staff
Reporters

Estimation Equations



▸ Estimation Equations

Endogeneity and Instrument

- Endogeneity: Prices (p, r) and characteristics (x) are endogenous, i.e. correlated with unobservable taste shocks and cost shocks

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  Demographics of competitors' counties

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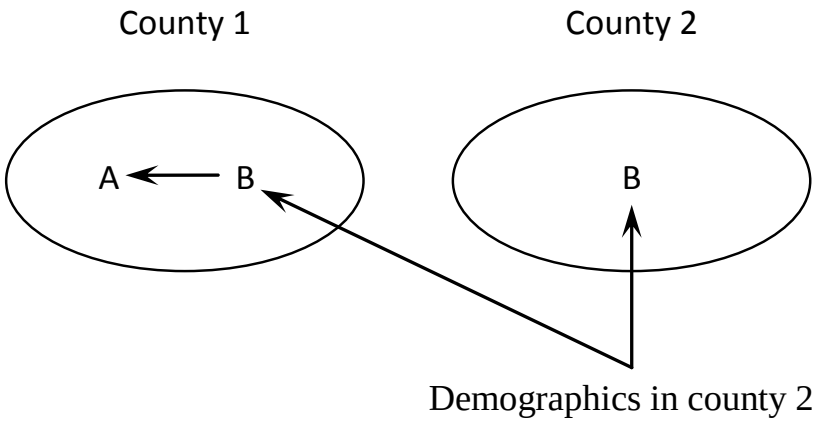

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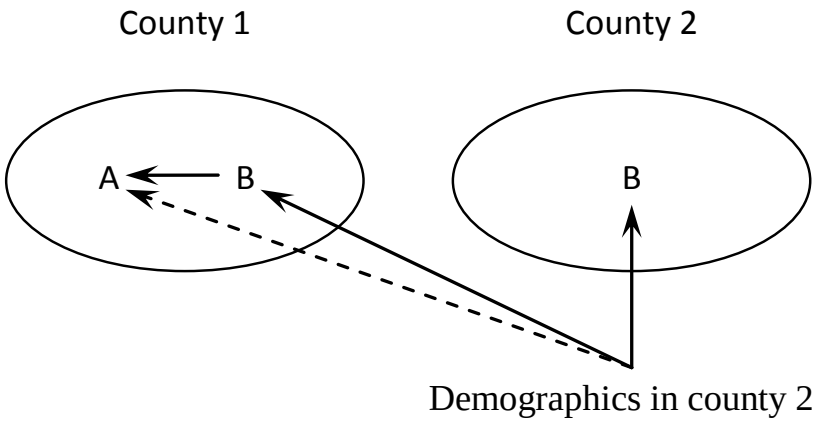

Data (1997 - 2005)

- Quantities
  - circulation
  - annual advertising linage
- Prices
  - newspaper subscription price
  - display advertising rate
- Newspaper characteristics
  - pages, opinion staff, reporters, frequency
- Demographics
  - households
  - high education % of population over 25
  - median income
  - median age
  - urbanization

▸ data definitions and sources ▸ summary statistics

Empirical Results

Utility				Display Ad Demand			
price ($100)	α	-0.560**	(0.166)		circulation	λ_1	1.758** (0.005)
log(1+newshole), mean	β_1	0.069	(0.147)		ad rate	λ_2	-1.015** (0.022)
log(1+opinion), mean	β_2	1.128**	(0.331)		constant	ϕ_1	-1.824** (0.521)
log(1+reporter), mean	β_3	0.198*	(0.108)		median income	ϕ_2	0.029 (1.224)
log(1+newshole), std. dev.	σ_1	0.013	(0.837)	MC of circulation			
log(1+opinion), std. dev.	σ_2	0.008	(11.501)		const	$\gamma_1 - \mu_1$	-575.810** (74.856)
log(1+reporter), std. dev.	σ_3	0.009	(2.099)		frequency	γ_2	1.656** (0.374)
log(market size)	ψ_1	-1.395**	(0.307)		1000 pages	γ_3	1.831 (2.660)
morning edition	ψ_2	0.161	(0.122)	Marginal ad sales cost		$\bar{\zeta}$	3.963** (0.559)
county distance	ψ_3	-2.117	(1.578)	Slope of fixed cost			
constant	φ_1	6.616**	(1.730)	opinion	constant	τ_{20}	1329509** (377660)
education	φ_2	4.744**	(1.240)		opinion	τ_{21}	113940** (26712)
median income	φ_3	-1.506*	(0.889)	reporter	constant	τ_{30}	194435* (116630)
median age	φ_4	0.165**	(0.037)		reporter	τ_{31}	1430 (1127)
urbanization	φ_5	2.699**	(0.726)	Preprint Profit	circulation	μ_2	-0.0001** (0.00009)
time	ρ	1.909**	(0.431)	** indicates 95% level of significance.			
Diminishing Utility	κ	46.258**	(14.343)	* indicates 90% level of significance.			

▸ model parameters

Simulation: Outline

- Question: For a specific market, what happens to the characteristics and the prices of newspapers after an ownership consolidation? What are the welfare implications?
- Simulation: Ownership consolidation of *Star Tribune* and *Pioneer Press*

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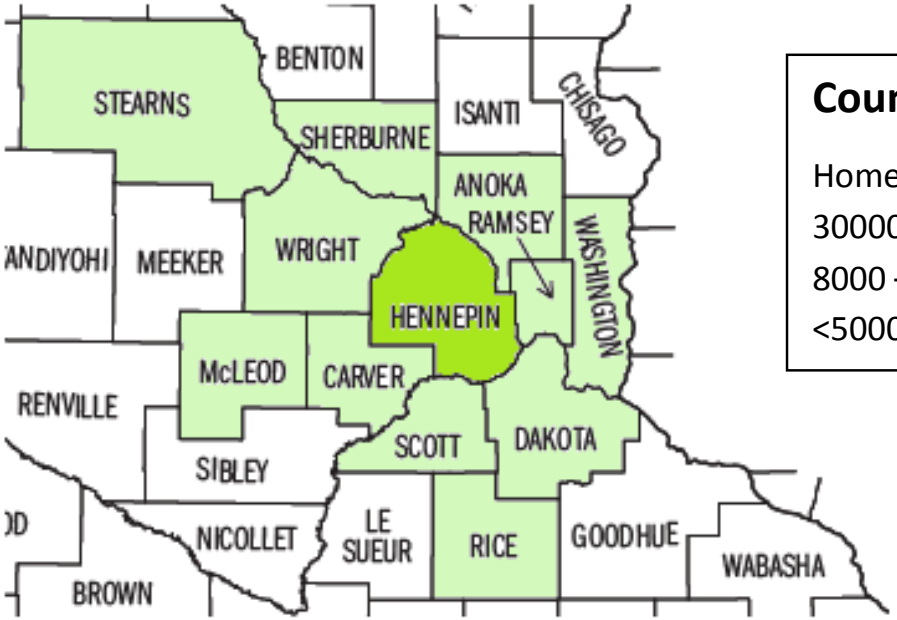
- Simulation: Ownership consolidation of *Star Tribune* and *Pioneer Press*

- Question: What is the correlation between the effects of ownership consolidation and the underlying market characteristics?
- Simulation: Welfare analysis of mergers in duopoly and triopoly markets

Newspaper Coverage



County Circulation of *Star Tribune*

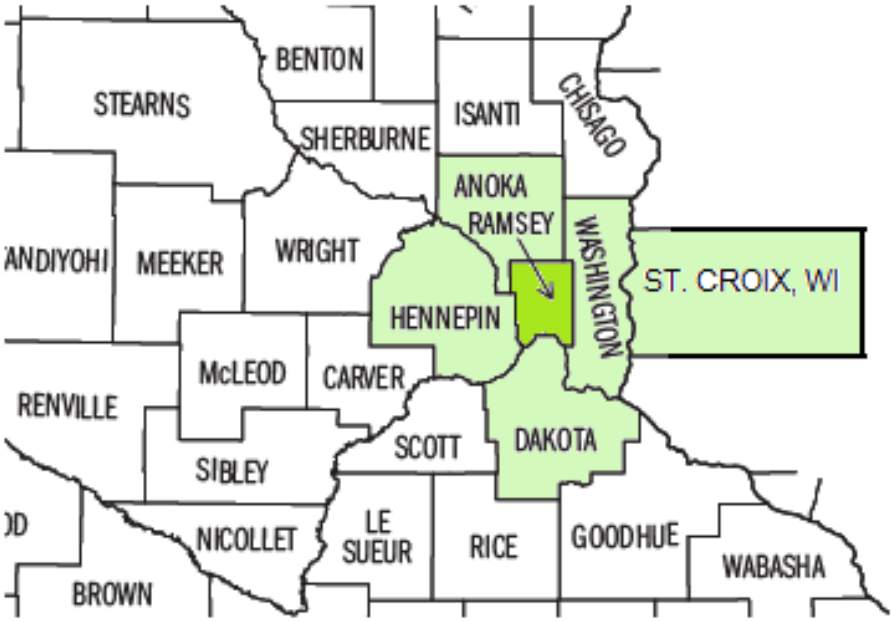
Home County: Hennepin 172615

30000 – 31000: Anoka, Ramsey, Dakota

8000 – 12000: Wright, Carver, Scott, Washington

<5000: Sherburne, Stearns, McLeod, Rice

Newspaper Coverage



County Circulation of *Pioneer Press*

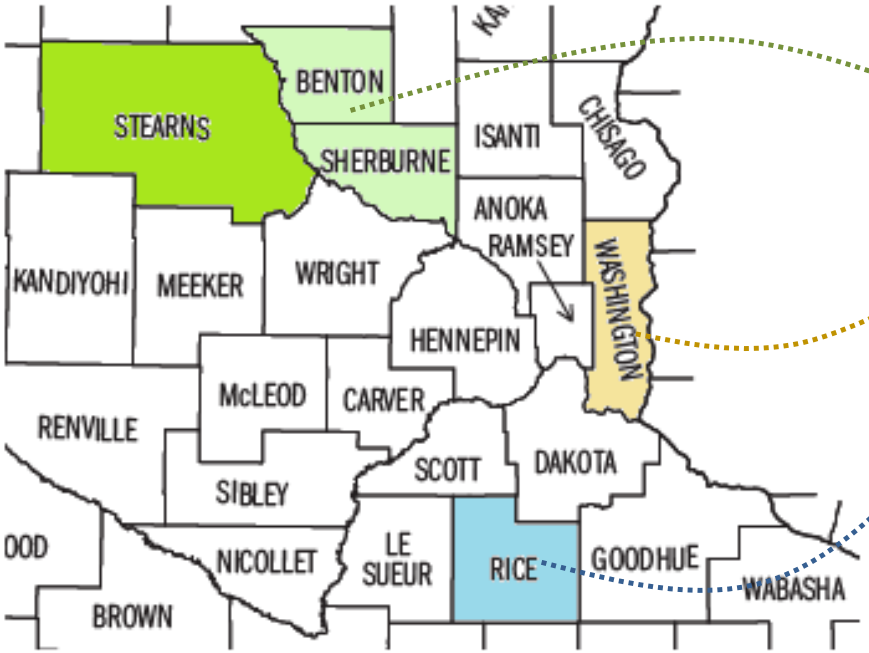
Home County: Ramsey 75655

29000 – 31000: Washington, Dakota

11752: Hennepin

<7000: Anoka, St. Croix

Newspaper Coverage



St. Cloud Times (24578)

Stearns, Benton, Sherburne

Stillwater Gazette (3341)

Washington

Faribault Daily News (6384)

Rice

Findings and Intuitions

Table 6. Without Quality Adjustment

	price ($/year)			ad rate ($/column inch)			circulation		
	before	after	change	before	after	change	before	after	change
Star Tribune	173	182	9	230.88	223.90	-6.98	317337	310288	-7049
Pioneer Press	172	204	32	153.08	135.31	-17.77	159864	141908	-17956
other newspapers	...								

Table 7. With Quality Adjustment

	price ($/year)			ad rate ($/column inch)			circulation		
Star Tribune	173	181	8	230.88	223.84	-7.04	317337	310224	-7113
Pioneer Press	172	198	26	153.08	131.12	-21.96	159864	137673	-22191
other newspapers	...								
	news space (pages/year)			opinion			reporter		
Star Tribune	11639	11788	149	29.08	28.86	-0.22	110.92	110.09	-0.83
Pioneer Press	12794	14690	1896	19.92	18.84	-1.08	66.92	62.78	-4.14
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other newspapers	...								

Welfare Implications

Overall Welfare Changes

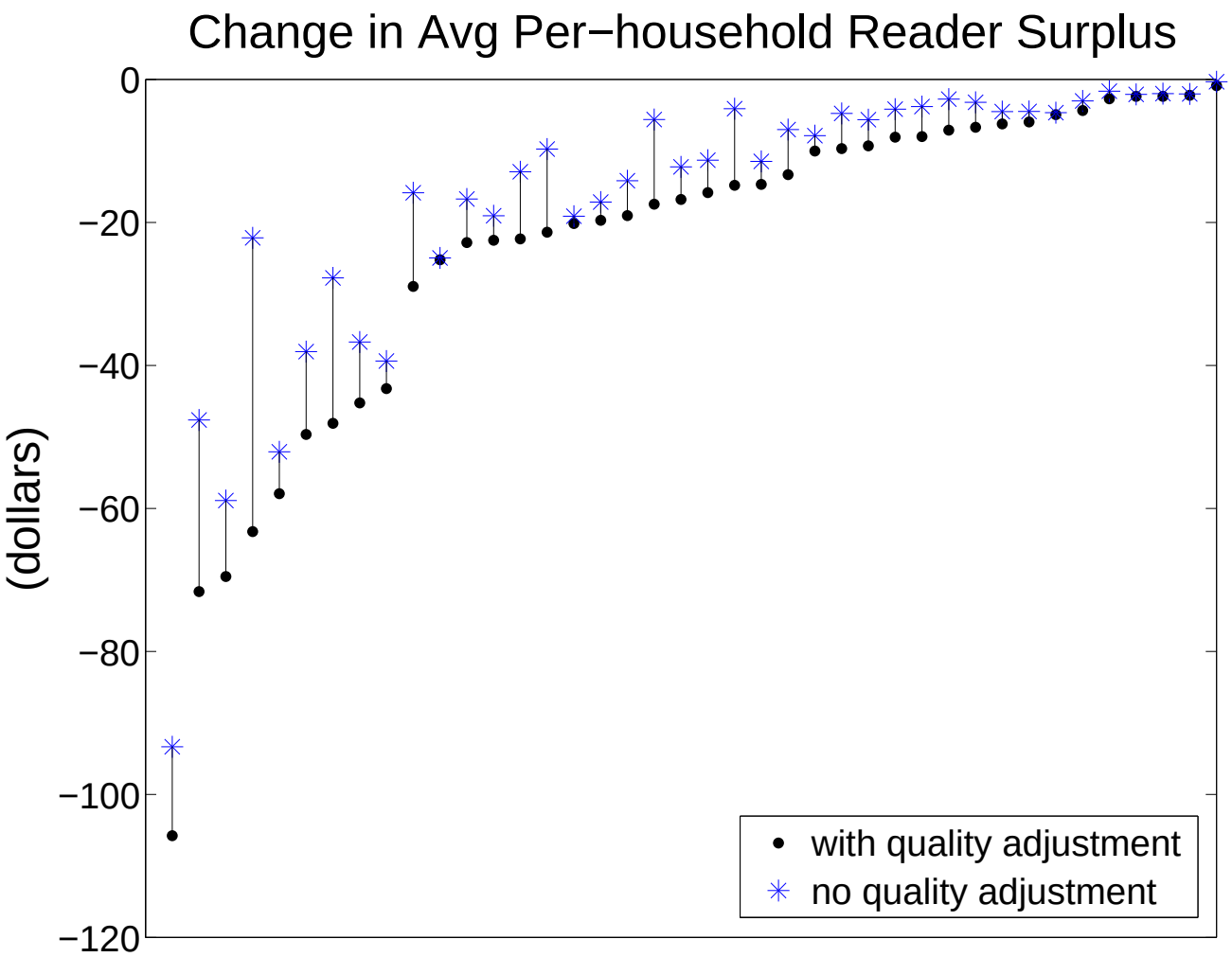
	Δ(Reader Surplus)	Δ(Publisher Surplus)
with quality adjustment	-7.94 million	0.52 million
without quality adjustment	-7.93 million	0.91 million

Avg Change in Reader Surplus per Household (with quality adjustment)

county	$\overline{\Delta RS}_{ct}$	county	$\overline{\Delta RS}_{ct}$
Anoka	-4.36	Rice	-3.18
Benton	-0.70	Scott	-3.74
Carver	-3.25	Sherburne	-1.59
Dakota	-9.83	Stearns	0.43
Hennepin	-4.48	Washington	-5.44
McLeod	-2.02	Wright	-2.30
Ramsey	-14.58	St. Croix, WI	-9.10

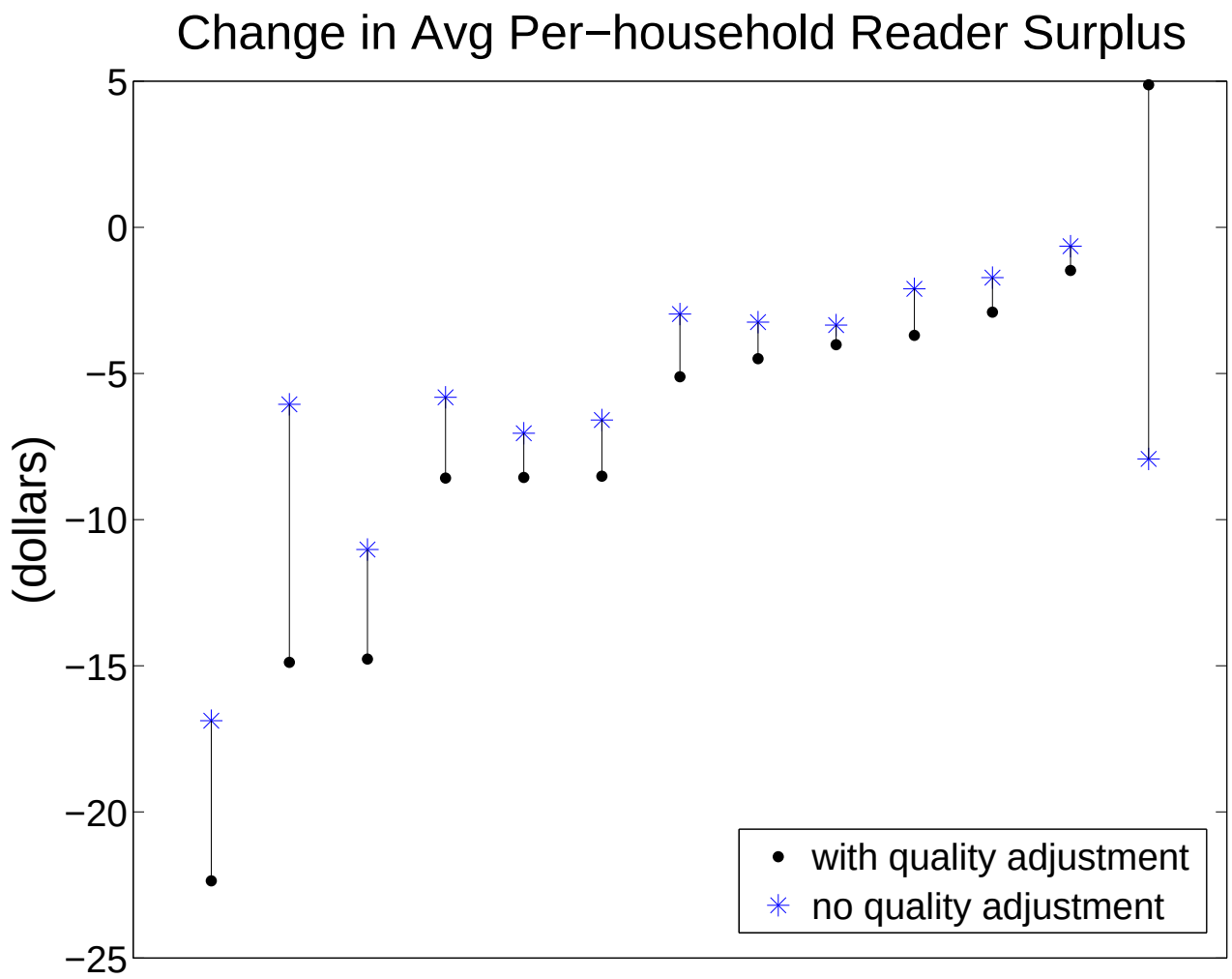
Welfare Analysis of Duopoly Mergers

40 duopoly markets in the 2005 sample



Welfare Analysis of Triopoly Mergers

13 triopoly markets in the 2005 sample



Market Characteristics and Welfare Effects

Regression of avg per household readers' change ($\overline{\Delta RS}$)

Independent Variable	
overall newspaper penetration	$-$
overlap of the two largest newspapers	$-$
asymmetry of the two largest newspapers	$+$
triopoly dummy	$+$
triopoly$\times$(overlap of the merged newspapers and their competitor)	$+$

Negative sign: readers' welfare loss $\left(-\overline{\Delta RS}\right)$ increases

Market Characteristics and Bias in Welfare Effects

Regression of the bias in avg per household readers' change

Bias = ($\overline{\Delta RS}$, no quality adjustment)-($\overline{\Delta RS}$, quality adjustment)

Independent Variable	
triology dummy	–
overall newspaper penetration	+
price elasticity	–

Conclusion

- Quality matters for merger analysis. For example, ignoring quality adjustment typically leads to an underestimation of the welfare loss.
- The effect of a merger depends on the underlying market structure. Reader's welfare loss is positively correlated with taste for newspapers in general, overlapping and negatively correlated with the asymmetry of newspaper size and the number of competitors.
- Profit function is convex in circulation, implying that a multiple-newspaper publisher has an incentive to shift circulation from small newspapers to its larger newspapers.

Newspaper	Publisher
Star Tribune	McClatchy
Pioneer Press	Knight Ridder
St. Cloud Times	Gannett
Stillwater Gazette	American Community Newspapers
Faribault Daily News	Huckle Publishing

Ownership consolidation →

Newspaper	Publisher
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St. Cloud Times	Gannett
Stillwater Gazette	American Community Newspapers
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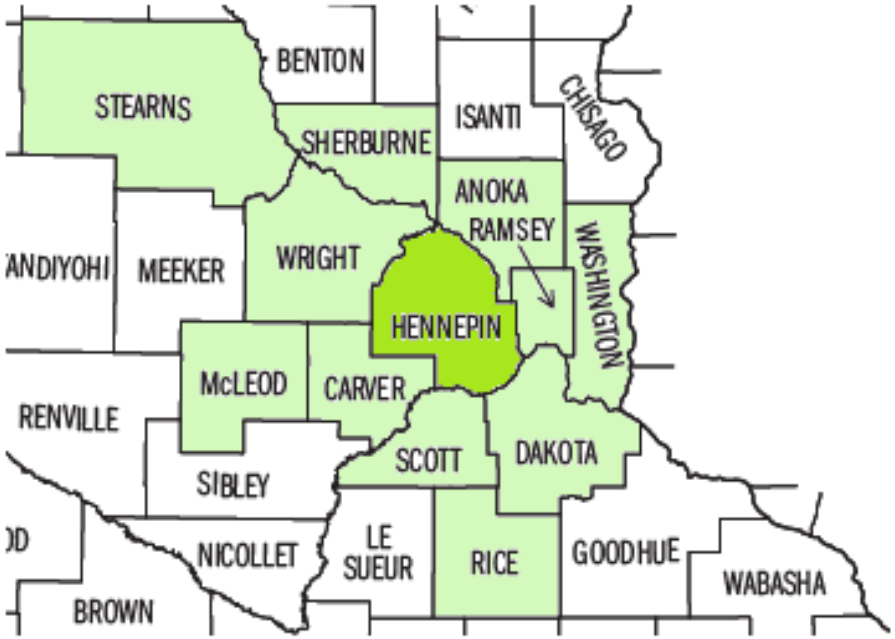
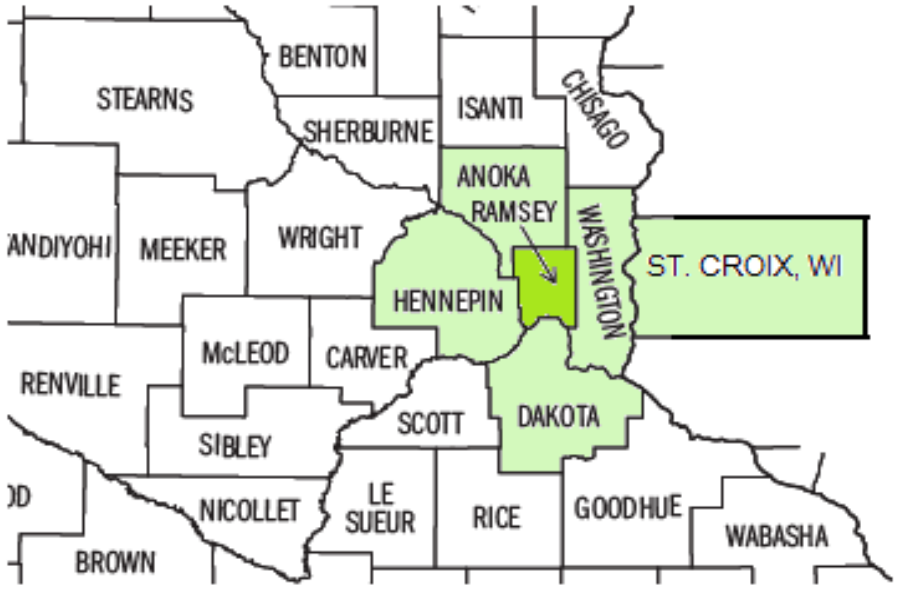
Minneapolis Star Tribune



St. Paul Pioneer Press



return

Newspaper Industry

- Ownership consolidations are common
  - for example, the number of independently owned newspapers dropped by 55% in the past 25 years
- Newspaper characteristics matter
- Price data and characteristics data are available

return

Multiple Discrete Choice Model

Household i

- compares $u_{ij}, j = 1, ..., J$ with u_{i0}

  u_{ij} : utility from newspaper j
  u_{i0} : utility from the outside choice

- if newspaper j is the best choice, compares $u_{ih} - \kappa, h \neq j$ with u_{i0}

  κ: diminishing utility

Utility

Utility from newspapers

$$u_{ijt} = p_{jt}\alpha + \boldsymbol{x}_{jt}\boldsymbol{\beta}_i + \boldsymbol{y}_{jct}\boldsymbol{\psi} + \boldsymbol{D}_{ct}\boldsymbol{\varphi} + \xi_{jct} + \varepsilon_{ijt}$$

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- **Newspaper features**

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- **Newspaper features**
  - Annual subscription price (p_{jt})

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- **Newspaper features**
  - Annual subscription price (p_{jt})
  - Endogenous newspaper characteristics $(\boldsymbol{x}_{jt})$
    - news space
    - opinion staff
    - reporters

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- **Newspaper features**
  - Annual subscription price (p_{jt})
  - Endogenous newspaper characteristics $(\boldsymbol{x}_{jt})$
  - Exogenous characteristics $(\boldsymbol{y}_{jct})$
    - market size
    - morning edition dummy
    - distance b/w county c and the head county of newspaper j

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  - ξ_{jct}: unobservable county/year-specific taste for newspaper j
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Utility from the outside choice: $u_{i0t} = \rho\,(t - t_0) + \varepsilon_{i0t}$

Aggregation and Extension to BLP

- Demand for newspapers

  aggregation $\Longrightarrow$

  market share: $s_j(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct})$, where δ_{jct} is the mean utility

  circulation: $q_j = \sum_c \underbrace{\text{market size}_{ct} \cdot s_j(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct})}_{\text{county circulation}}$

▸ s function

Aggregation and Extension to BLP

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- **Estimation equation [S]**

  - generalization of BLP: $s_{jct} = s_j\left(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}\right) \Longrightarrow \delta_{jct}$

    ▸ Theorem 1

  - estimation equation:

    $\delta_{jct} = p_{jt}\alpha + \boldsymbol{x}_{jt}\boldsymbol{\beta} + \boldsymbol{y}_{jct}\boldsymbol{\psi} + \boldsymbol{D}_{ct}\boldsymbol{\varphi} - (t - t_0)\,\rho + \xi_{jct}$

Theorem 1 (Generalization of BLP)

Theorem 1. *For any* $(\boldsymbol{s}, \boldsymbol{x}) \in R^J \times R^{KJ}, \sigma \in R^K, \kappa \in R^+$ *and distribution functions* $P_{\boldsymbol{\varsigma}}(.;\boldsymbol{\sigma})$*, define operator* $F : R^J \to R^J$ *pointwise as* $F_j(\boldsymbol{\delta}) = \delta_j + \ln s_j - \ln s_j(\boldsymbol{\delta}, \boldsymbol{x}; P_{\boldsymbol{\varsigma}}, \boldsymbol{\sigma}, \kappa)$*, where*

$$s_j(\boldsymbol{\delta}, \boldsymbol{x}; P_{\boldsymbol{\varsigma}}, \boldsymbol{\sigma}, \kappa) = \int \Psi_j^{(1)} dP_{\boldsymbol{\varsigma}}(\boldsymbol{\varsigma}; \boldsymbol{\sigma}) + \sum_{j' \neq j, 0} \int \int \left(\Psi_{j,j'}^{(2)} - \Psi_j^{(3)} \right) dP_{\boldsymbol{\varsigma}}(\boldsymbol{\varsigma}; \boldsymbol{\sigma}),$$

and $\vartheta_{ij} = \sum_{k=1}^K \sigma_k x_{kj} \varsigma_{ki}$*,*

$$\begin{aligned}
\Psi_j^{(1)}(\boldsymbol{\delta}_c, \boldsymbol{x}_c, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}) &= \frac{\exp(\delta_{jc} + \vartheta_{ij})}{1 + \sum_{h=1}^{J_c} \exp(\delta_{hc} + \vartheta_{iht})}, \\
\Psi_{j,j'}^{(2)}(\boldsymbol{\delta}_c, \boldsymbol{x}_c, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}, \kappa) &= \frac{\exp(\delta_{jc} + \vartheta_{ij})}{\exp(\kappa) + \sum_{h \neq j'} \exp(\delta_{hc} + \vartheta_{iht})}, \\
\Psi_j^{(3)}(\boldsymbol{\delta}_c, \boldsymbol{x}_c, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}, \kappa) &= \frac{\exp(\delta_{jc} + \vartheta_{ij})}{\exp(\kappa) + \sum_{h=1}^{J_c} \exp(\delta_{hc} + \vartheta_{iht})}.
\end{aligned}$$

If (1) $0 < s_j < 1$ *for* $\forall j = 1, ..., J$ *and (2)* $\sum_{j=1}^J s_j < 2$*, then the operator* F *has a unique fixed point.*

return

Heterogenous Taste

Household i's taste for characteristics k:

$$\beta_{ki} = \beta_k + \sigma_k \upsilon_{ki},$$

where β_k, σ_k are the mean and standard derivation and υ_{ki} follows a standard normal distribution

return

Market Penetration Function

- Probability of j being chosen by i:

$$\begin{aligned}
&\Pr\left(u_{ijc} \geq \max_{h=0,\ldots,J_c} u_{ihc}\right) \\
&+ \sum_{j' \neq j,0} \Pr\left(u_{ij'c} \geq u_{ijc} \geq \max_{h=1,\ldots,J_c,\, h\neq j'} u_{ihc} \;\&\; u_{ijc} - \kappa \geq u_{i0c}\right) \\
= \quad & \Psi_j^{(1)}(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}) + \sum_{j' \neq j,0} \left[\Psi_{j,j'}^{(2)}(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}, \kappa) - \Psi_j^{(3)}(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}, \kappa)\right]
\end{aligned}$$

where

$$\begin{aligned}
\Psi_j^{(1)}(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}) &= \frac{\exp(\delta_{jct} + \vartheta_{ijt})}{1 + \sum_{h=1}^{J_{ct}} \exp(\delta_{hct} + \vartheta_{iht})}, \\
\Psi_{j,j'}^{(2)}(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}, \kappa) &= \frac{\exp(\delta_{jct} + \vartheta_{ijt})}{\exp(\kappa) + \sum_{h \neq j'} \exp(\delta_{hct} + \vartheta_{iht})}, \\
\Psi_j^{(3)}(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}, \boldsymbol{\varsigma}_i; \boldsymbol{\sigma}, \kappa) &= \frac{\exp(\delta_{jct} + \vartheta_{ijt})}{\exp(\kappa) + \sum_{h=1}^{J_{ct}} \exp(\delta_{hct} + \vartheta_{iht})}.
\end{aligned}$$

and $\vartheta_{ijt} = \sum_{k=1}^{K} \sigma_k x_{kjt} \varsigma_{ki}$.

Market Penetration Function

- County market penetration is the aggregation of households' newspaper choices in a county, i.e.

$$s_{jct}\left(\boldsymbol{\delta}_{ct}, \boldsymbol{x}_{ct}; \boldsymbol{\sigma}, \kappa\right) = \int \Psi_j^{(1)} d\Phi\left(\boldsymbol{\varsigma}_i\right) + \sum_{j' \neq j, 0} \int \left(\Psi_{j,j'}^{(2)} - \Psi_j^{(3)}\right) d\Phi\left(\boldsymbol{\varsigma}_i\right).$$

return

Demand for Advertising

- **Ad demand**

  Following Rysman (2004), the demand for advertising in newspaper j:

$$a\left(r_j, q_j, \eta_j\right) = e^{\eta_j} q_j^{\lambda_1} r_j^{\lambda_2}$$

  where r_j is advertising rate and η_j $(= \sum_c \frac{q_{jc}}{q_j} \boldsymbol{D}_c \boldsymbol{\phi})$ captures the demographics of j's market

▸ An advertiser's problem

- **Estimation equation [ADV]**

$$\underset{\text{ad linage}}{\log a_j} = \underbrace{\sum_c \frac{q_{jc}}{q_j} \boldsymbol{D}_c \boldsymbol{\phi}}_{\text{demographics of } j\text{'s mkt}} + \lambda_1 \underset{\text{circulation}}{\log q_j} + \lambda_2 \underset{\text{ad rate}}{\log r_j} + \underset{\text{measurement error}}{\iota_j}$$

An Advertiser's Problem

- A representative advertiser

$$\max_{\{a_j\}} \sum_j \left(\eta'_j q_j^{\lambda'_1} A_j^{\lambda'_2} a_j^{\lambda'_3} - r_j a_j \right), 0 < \lambda_2 < 1, \eta'_j > 0,$$

r_j: advertising rate, q_j: circulation, A_j: total advertising space, η'_j: demographics of counties covered by j

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- Demand: $a_j = \left(\lambda'_3 \eta'_j\right)^{\frac{1}{1-\lambda'_3}} q_j^{\frac{\lambda'_1}{1-\lambda'_3}} A_j^{\frac{\lambda'_2}{1-\lambda'_3}} r_j^{\frac{1}{\lambda'_3 - 1}}$

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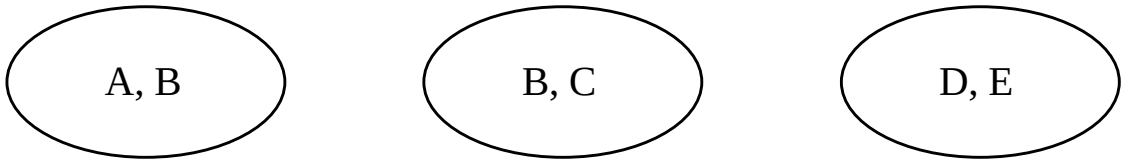
- Aggregation: $A_j = \left(\lambda'_3 \eta'_j\right)^{\frac{1}{1-\lambda'_2-\lambda'_3}} q_j^{\frac{\lambda'_1}{1-\lambda'_2-\lambda'_3}} r_j^{\frac{1}{\lambda'_2+\lambda'_3-1}}$

return

Supply (Set of Players)

- Defining a set of players (example)

▸ formal definition



County 1 County 2 County 3

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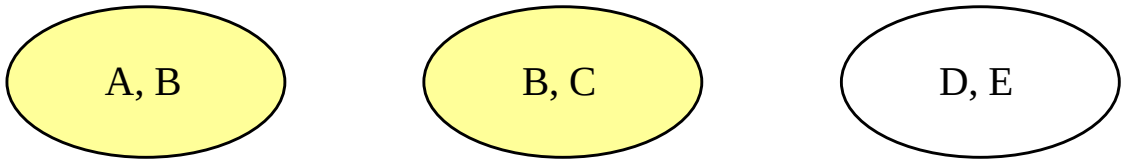

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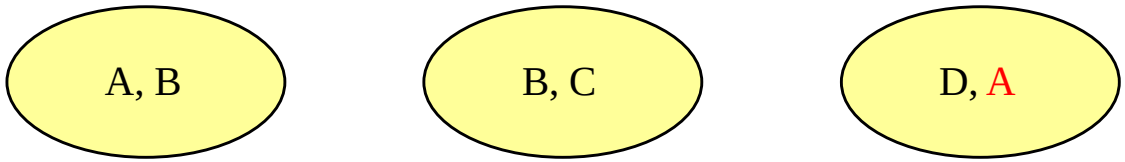

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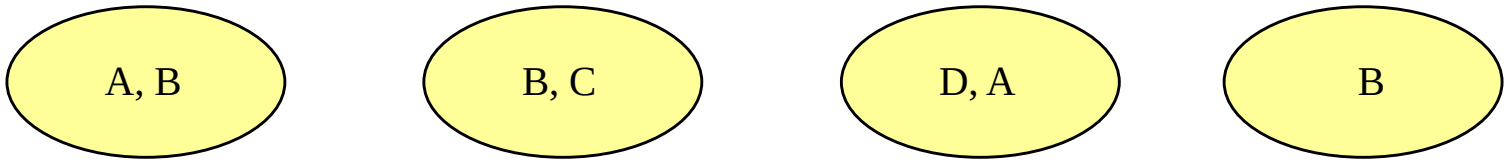

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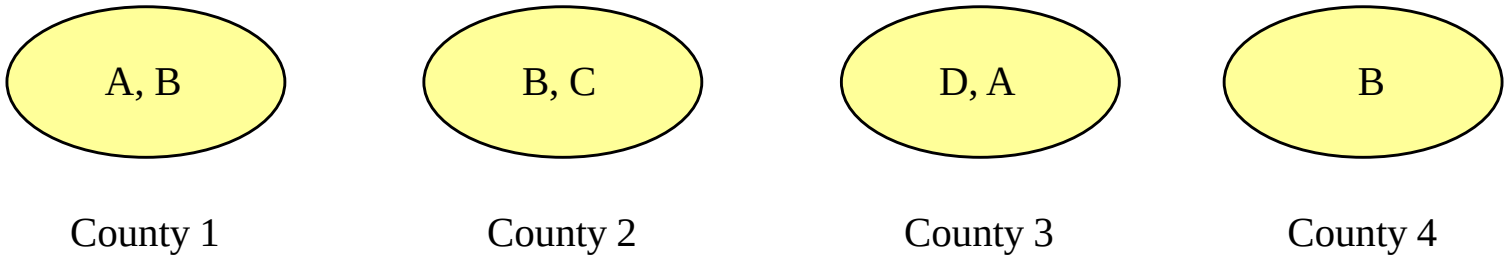
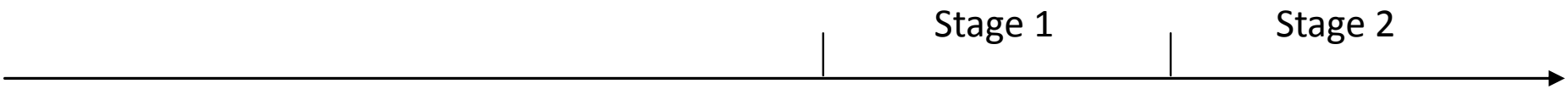


- Partial overlapping — a real example:

Supply (Timing and Information)

A two-stage complete information game



Ownership, County Coverage

Unobservable Taste [ξ]

County Demographics [D]

Shocks to marginal cost of increasing q or a [ω, ζ]

Exogenous Characteristics [y]

Shocks to marginal cost of increasing x [ν]

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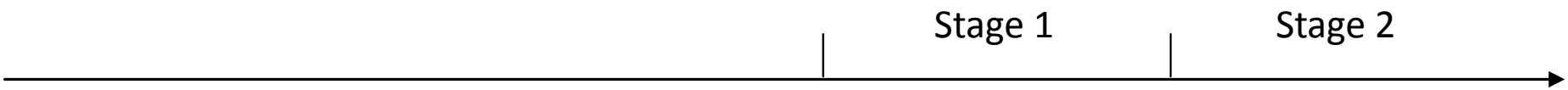
A two-stage complete information game



Ownership, County Coverage

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Product Choice [X]

County Demographics [D]

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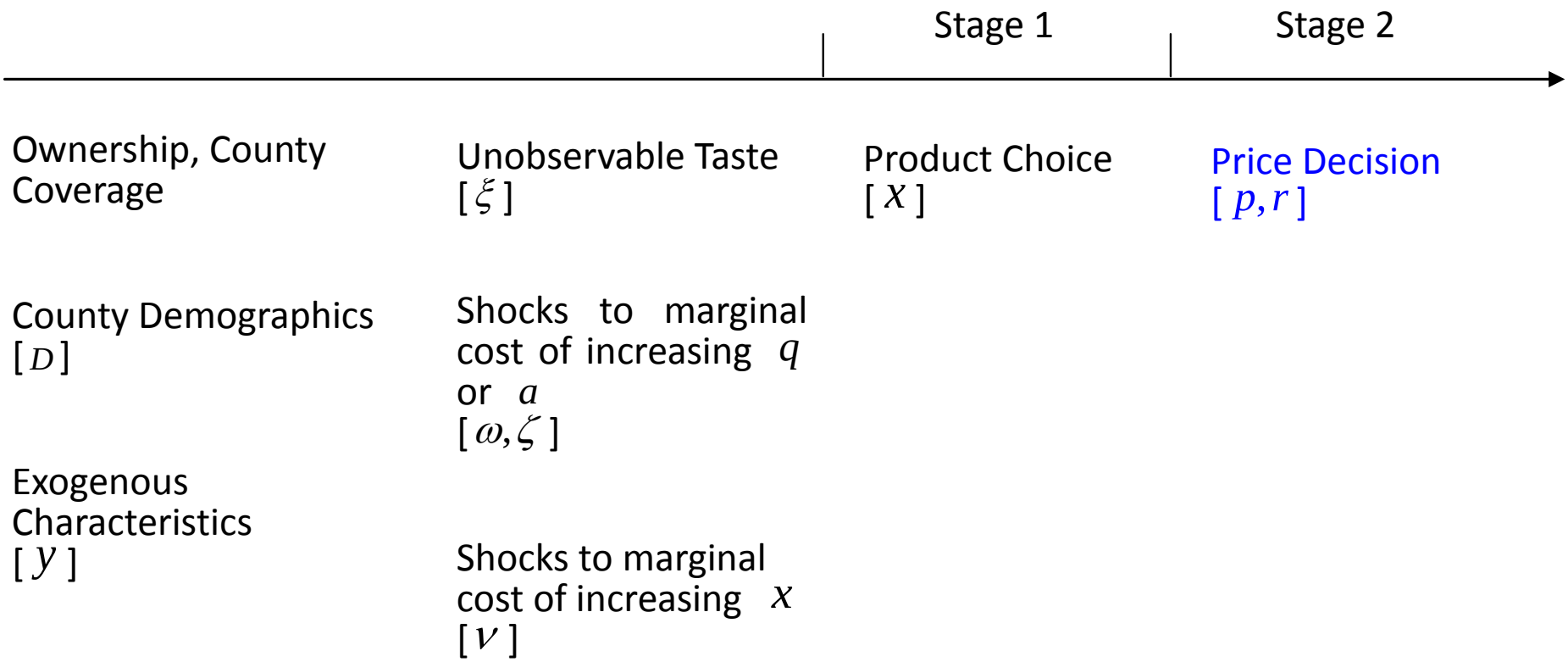

Supply (Second Stage: Price Decision)

- Profit function for the second-stage decision:

mc functions

$$\pi^{\text{II}}(\boldsymbol{p}, \boldsymbol{r}, \boldsymbol{x})$$

$$= \sum_j \underbrace{\left(p_j q_j - mc_j^{(q)} q_j\right)}_{\text{circulation profit}}$$

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- Optimality conditions:

$$\text{(price foc)} \quad q_j + \sum_h \left(p_h - mc_h^{(q)}\right) \frac{\partial q_h}{\partial p_j} + \sum_h \frac{\partial \pi_h^{(a)}}{\partial p_j} = 0$$

↑ price affects ad profit through affecting circulation

$$\text{(adrate foc)} \quad a_j + \left(r_j - mc_j^{(a)}\right) \frac{\partial a_j}{\partial r_j} - \frac{\partial mc_j^{(q)}}{\partial a_j} \frac{\partial a_j}{\partial r_j} q_j = 0$$

↑ more ads lead to higher printing cost

Supply (First Stage: Characteristics Decision)

- Profit function for the first-stage decision:

$$\pi^{\mathrm{I}}(\boldsymbol{x}) = \underbrace{\pi^{\mathrm{II}}(\boldsymbol{p}^*(\boldsymbol{x}), \boldsymbol{r}^*(\boldsymbol{x}), \boldsymbol{x})}_{\text{variable profit}} - \underbrace{fc(\boldsymbol{x})}_{\text{fixed cost}}$$

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- Optimality condition (wrt characteristic k)

$$\sum_{\substack{h \text{ belongs} \\ \text{to a owner}}} \Bigg(\underbrace{\frac{\partial \pi_h^{\mathrm{II}}}{\partial x_{kj}}}_{\substack{\uparrow \\ \text{direct effect of} \\ \text{product choice}}} + \underbrace{\sum_{\substack{j' \text{ in a} \\ \text{game}}} \frac{\partial \pi_h^{\mathrm{II}}}{\partial p_{j'}} \frac{\partial p_{j'}^*}{\partial x_{kj}} + \frac{\partial \pi_h^{\mathrm{II}}}{\partial r_h} \frac{\partial r_h^*}{\partial x_{kj}}}_{\substack{\text{indirect effect of product choice} \\ \text{through affecting eqm prices}}} \Bigg) - \underbrace{mc_{kj}^{(x)}}_{\substack{\uparrow \\ \text{slope of} \\ \text{fixed cost}}} = 0$$

Marginal Cost Functions

$$
\begin{aligned}
mc_j^{(q)} &= \gamma_1 + \gamma_2 f_j + \gamma_3 n_j f_j + \omega_j, \\
mc_j^{(a)} &= (1 + 1/\lambda_2)\left(\bar{\zeta} + \zeta_j\right) \\
mc_{kj}^{(x)} &= \tau_{0k} + \tau_{1k} x_{kj} + \nu_{kj}
\end{aligned}
$$

- f_j: publication frequency (issues per year)
  n_j: average pages per issue

return

Formal Definition of the Set of Players

Assumptions

- Assumption 1. A newspaper competes only with the newspapers in its Newspaper Designated Market (NDM).
  NDM: the geographic area which a newspaper considers to be the market it serves
- Assumption 2. Marginal cost of increasing circulation is independent of circulation.
  Marginal advertising sales cost is independent of advertising sales.
- Assumption 3. The behavior of the three national newspapers Wall Street Journal, New York Times and USA Today are taken as given in the model.

Formal Definition of the Set of Players

The set of players

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- the set of players: the publishers of a closure with respect to the operation "interacting"

return

Model Parameters

- Demand for newspapers: $(\alpha,\boldsymbol{\beta},\boldsymbol{\psi},\boldsymbol{\varphi},\boldsymbol{\sigma},\rho,\kappa)$

$$u_{ijct}=p_{jt}\alpha+\boldsymbol{x}_{jt}\boldsymbol{\beta}_i+\boldsymbol{y}_{jct}\boldsymbol{\psi}+\boldsymbol{D}_{ct}\boldsymbol{\varphi}+\xi_{jct}+\varepsilon_{ijt}$$

$$u_{i0t}=\rho(t-t_0)+\varepsilon_{i0t}$$

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- Demand for display advertising: $(\lambda_1,\lambda_2,\boldsymbol{\phi})$

  $a_j=e^{\eta_j}\,q_j^{\lambda_1}\,r_j^{\lambda_2},\eta_j=\sum_{c:\ c\in\mathcal{C}_j}\frac{q_{jc}}{q_j}\boldsymbol{D}_c\boldsymbol{\phi}$

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  $\mu_1 q_j+\mu_2 q_j^2/2$

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- Preprint profit: μ_2

  $\mu_1 q_j+\mu_2 q_j^2/2$

- Cost: $\left(\gamma_1-\mu_1,\gamma_2,\gamma_3,\bar{\zeta},\boldsymbol{\tau}_0,\boldsymbol{\tau}_1\right)$

  $mc_j^{(q)}=\gamma_1+\gamma_2 f_j+\gamma_3 n_j f_j+\omega_j$

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

  $mc_{kj}^{(x)}=\tau_{0k}+\tau_{1k}x_{kj}+\nu_{kj}$

  $\pi^{\mathrm{II}}=\sum_j\left[p_j q_j-mc_j^{(q)}q_j\right]+\left[r_j a_j-mc_j^{(a)}a_j\right]+\left[\mu_1 q_j+\mu_2 q_j^2/2\right]$

return

Estimation Equations

[S] $$\delta_{jct}\left(\boldsymbol{s}_{ct};\boldsymbol{\sigma},\kappa\right)=p_{jt}\alpha+\boldsymbol{x}_{jt}\boldsymbol{\beta}+\boldsymbol{y}_{jct}\boldsymbol{\psi}+\boldsymbol{D}_{ct}\boldsymbol{\varphi}-\left(t-t_0\right)\rho+\xi_{jct}$$

[ADV] $$\log a_{jt}=\sum_c \frac{q_{jct}}{q_{jt}}\boldsymbol{D}_{ct}\boldsymbol{\phi}+\lambda_1\log q_{jt}+\lambda_2\log r_{jt}+\iota_{jt}$$

[RFOC] $$r_{jt}=\bar{\zeta}+\frac{\gamma_3}{1+1/\lambda_2}q_{jt}+\zeta_{jt}$$

[PFOC] $$p_{jt}=-\left[\left(\frac{\partial \boldsymbol{q}'_m}{\partial \boldsymbol{p}_m}\right)^{-1}\left(\boldsymbol{q}_m-\frac{1}{\lambda_2}\frac{\partial \boldsymbol{a}'_m}{\partial \boldsymbol{p}_m}r_m\right)\right]_{jt}$$
$$+\gamma_1+\gamma_2 f_{jt}+\gamma_3 n_{jt}f_{jt}-\left(\mu_1+\mu_2 q_{jt}\right)+\omega_{jt}$$

[XFOC] $$\sum_{h\in\mathcal{J}_{mt}}\left(\frac{\partial \pi^{\mathrm{II}}_{ht}}{\partial x_{kjt}}+\sum_{j'\in\mathcal{J}_{g(jt)}}\frac{\partial \pi^{\mathrm{II}}_{ht}}{\partial p_{j't}}\frac{\partial p^*_{j't}}{\partial x_{kjt}}+\frac{\partial \pi^{\mathrm{II}}_{ht}}{\partial r_{ht}}\frac{\partial r^*_{ht}}{\partial x_{kjt}}\right)$$
$$=\tau_0+\tau_k x_{kjt}+\nu_{kjt}$$

return

Data Description and Sources

	Variable	Data Description	Data Source
Newspaper Demand	q_{jct}	County circulation	ABC, SRDS
Display advertising Demand	a_{jt}	Annual Display Advertising linage (column inch)	TNS
Price of Newspaper	p_{jt}	Annual Subscription Price (1997 $)	E&P
Price of Display Advertising	r_{jt}	Adverting Rate (1997 $/column inch)	E&P
Newspaper Characteristics	x_{2jt}	Weighted sum of reporters and correspondents	Bacon
	x_{3jt}	Weighted sum of columnists and editorial editors	Bacon
	f_{jt}	Frequency of publication (issues/52 week)	E&P
	y_{2jt}	Edition (morning or evening)	E&P
	n_{jt}	Average pages per issue	E&P
County Distance	y_{3jct}	Distance between county c and the head county of newspaper j (100km)	E&P, Census
Owner		Publisher	Bacon
County Demographics	D_{2c}	% of population over 25 with bachelor's degree or higher	Census
	D_{3c}	Median income (1997 $)	Census
	D_{4c}	Median age	Census
	D_{5c}	% of urban population	Census
	D_{6ct}	Number of households	ABC

ABC: County Circulation Report by Audit Bureau of Circulation

Bacon: Bacon's Newspaper Directory

E&P: Editor and Publisher International Year Book

SRDS: SRDS Circulation

TNS: TNS Media Intelligence

return

Summary Statistics

Summary Statistics of Player Newspapers in Sample

	mean	median	std	min	max	obs
market penetration (%)	19.13	11.77	18.62	0.3	97.08	23877
county distance (100km)	0.71	0.47	0.81	0	6.64	
total circulation	22,729	9,849	43,847	1,132	783,212	6316
price of newspapers ($)	101.47	97.15	33.75	15	365.31	
price of display advertising ($/column inch)	26.58	13.31	45.19	3.27	748.70	
frequency (issues/52 weeks)	310.70	312	53.87	208	364	
pages (pages/issue)	28.93	23.71	20.79	8	254.57	
opinion staff	2.11	1	2.92	0	20	
reporters	22.28	4	43.04	0	218.67	

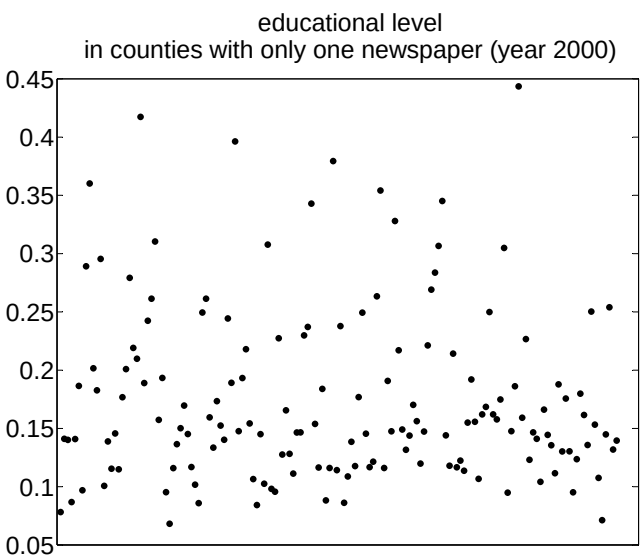
Summary Statistics

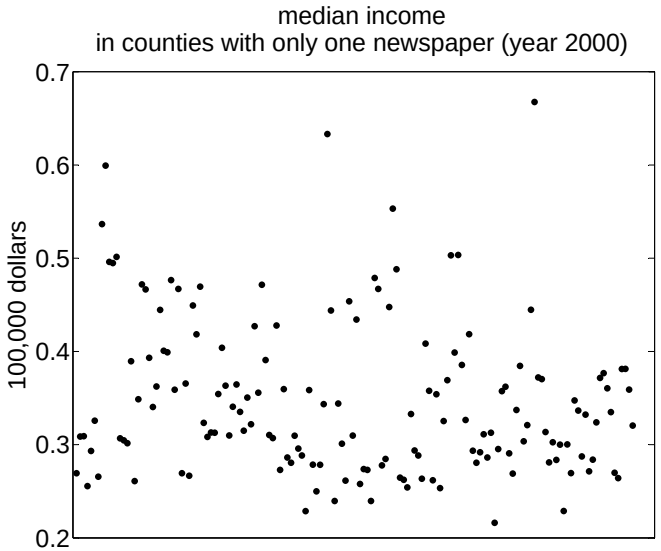
Summary Statistics of the Demographic Characteristics of Counties in Sample

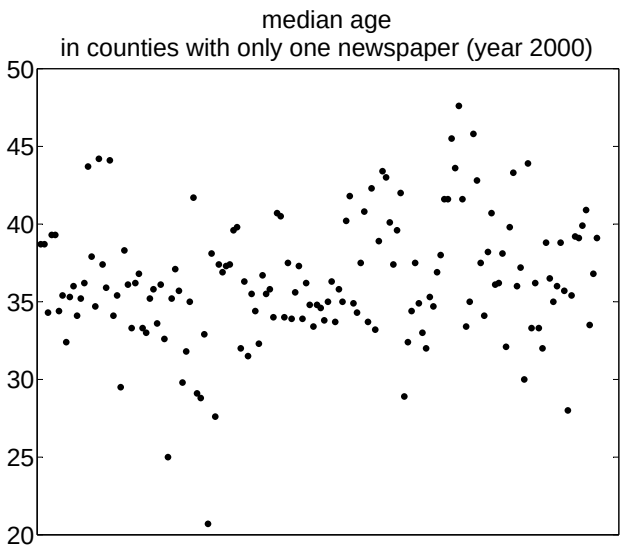
	mean	median	std	min	max
high education % of pop over 25	17.11	15.22	7.26	5.64	60.48
median income ($1,000)	34.25	32.85	7.31	16.36	80.12
median age	36.52	36.70	3.82	20.70	54.30
urbanization (%)	49.82	50.96	26.51	0	1
Households	36687	15588	85687	710	3282266

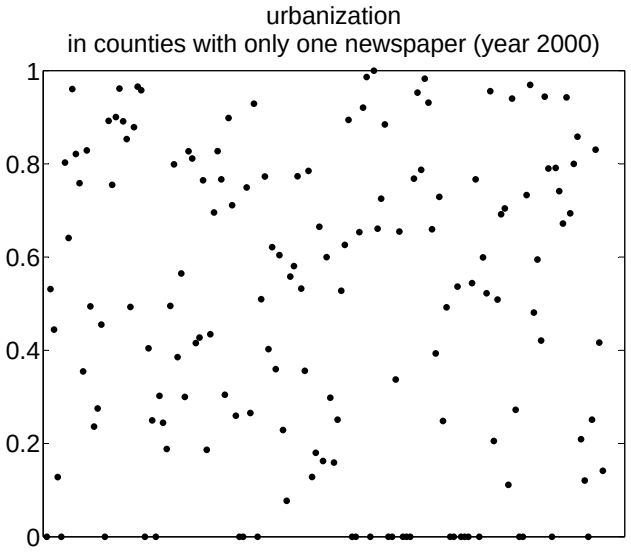
return

Demographics in Counties with Only One Newspaper









First-stage Regression Results

- Estimation equation:
  (mean utility)$_{jc}$ linear in $\underbrace{\text{(price)}_j, \text{(characteristics)}_j}_{\text{Endogenous}}$, (demographics)$_c$
- First-stage regression of price on instruments

		demographics				excluded instrument					
						iv1				iv2	iv3
	const	edu	income	age	urban	edu	income	age	urban	urban	hhl
est	62.55	34.12	26.33	27.74	9.46	92.84	-10.55	59.35	8.58	-3.90	12.20
se	3.76	5.69	5.70	8.88	1.49	10.10	8.87	6.18	2.21	1.57	1.36
t	16.62	6.00	4.62	3.12	6.33	9.19	-1.19	9.60	3.88	-2.49	9.00

iv1: mean of demographics over counties covered by j except county c
iv2: mean of demographics of counties covered by j's competitors but not covered by j
iv3: mean of the number of households in counties covered by j

return

Correlation of Demographics in Neighboring Counties

	educational level	median income	median age	urbanization
correlation	0.1725	0.2388	0.1179	0.1369

correlation between D_{jc} and (mean of $D_{jc'}$, $c' \neq c$ covered newspaper j)

return

Changes in Coverage

Coverage areas*	1	2	3	4	5	6	7	8	9
Percentage**	47%	28%	10%	5%	3%	2%	1%	1%	2%

*: number of observed different coverage areas of a newspaper between 1997 and 2005

**: percentage of newspapers with this number of different coverage areas

Changes in Owner, Characteristics, Prices

year	1998	1999	2000	2001	2002	2003	2004	2005
owner	15%*	10%	12%	6%	6%	8%	6%	12%
opinion	39%	33%	39%	45%	43%	41%	42%	39%
reporter	53%	48%	50%	59%	58%	68%	66%	65%
price	100%	100%	100%	100%	100%	100%	100%	100%
adrate	100%	100%	100%	100%	100%	100%	100%	100%
nominal price	19%	24%	47%	48%	5%	2%	1%	41%
nominal adrate	72%	64%	78%	59%	58%	46%	44%	79%

*: percentage of newspapers with a different owner in 1998 (different from 1997)

Ownership Consolidation between 1997 and 2005

There are 122 ownership consolidation cases in the sample, involving 406 year/papers

year	consolidation cases
1998	26
1999	26
2000	19
2001	11
2002	11
2003	7
2004	11
2005	11

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Empirical Implications

- Taste for characteristics:
  halve news space $\Longleftrightarrow$ 8.5 dollars
  halve opinion staff $\Longleftrightarrow$ 140 dollars
  halve reporters $\Longleftrightarrow$ 24.5 dollars
- Demographics on taste for newspapers
  $+$ education, median age, urbanization
  $-$ median income
- Ad demand $(a_j = e^{\eta_j} q_j^{\lambda_1} r_j^{\lambda_2})$:
  $\hat{\lambda}_1 > 1$: convex in circulation

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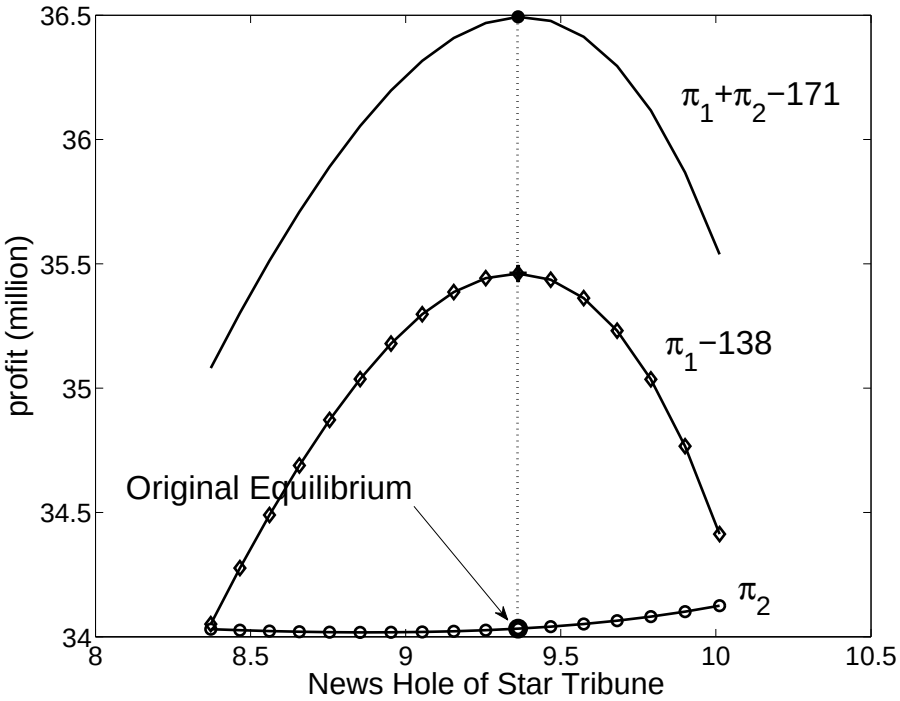
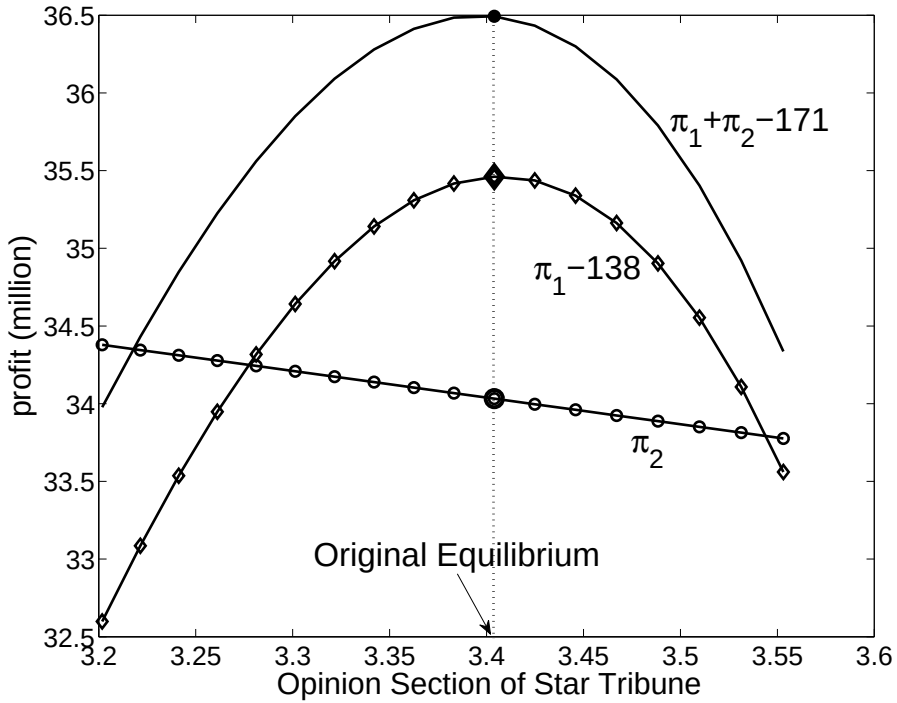

36.5
36
35.5
35
34.5
34
8
8.5
9
9.5
10
10.5
profit (million)
News Hole of Star Tribune
π1+π2−171
π1−138
π2
Original Equilibrium


36.5
36
35.5
35
34.5
34
33.5
33
32.5
3.2
3.25
3.3
3.35
3.4
3.45
3.5
3.55
3.6
profit (million)
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π1+π2−171
π1−138
π2
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return

Welfare Measures

- **Reader surplus**

  Expected compensating variation (Small and Rosen (1981))

$$CV_{ct} = E_i \left(\frac{V_{ict}^0 - V_{ict}^1}{\alpha} \right),$$

  where

$$V_{ict}^0 = \ln \left(\sum_{j=0}^{J_{ct}} e^{U_{ijct}^0} \right)$$

$$+ \sum_{j=1}^{J_{ct}} \ln \left(\sum_{h \neq 0,j} e^{U_{ihct}^0 - \kappa} + 1 \right) - (J_{ct} - 1) \ln \left(\sum_{h \neq 0} e^{U_{ihct}^0 - \kappa} + 1 \right),$$

  where $U_{ijct}^0 = u_{ijct}^0 - \varepsilon_{ijct}$ is the utility before the merger net of the extreme value taste shock

Welfare Measures

- Advertiser surplus

$$AS = \left(\frac{1}{\lambda_3' - 1} \right) a_j r_j,$$

where $\frac{1}{\lambda_3' - 1}$ is the representative advertiser's demand elasticity with respect to price

▸ advertiser's problem

- Publisher surplus: profit

Change in Advertiser Surplus and Publisher Surplus

- Overall welfare change for advertisers

	Δ(Advertiser Surplus)
with quality adjustment	-5.59%
without quality adjustment	-4.96%

- Change in publisher surplus with quality adjustment

newspapers	Δ (Publisher Surplus)
Star & Pioneer	374000
Stillwater Gazette	84460
Faribault Daily News	29500
St. Cloud Times	24110

return

Annual Newspaper Advertising Expenditure

	Print ($Mill)	Online ($Mill)
1997	$41,330	
1998	$43,925	
1999	$46,289	
2000	$48,670	
2001	$44,305	
2002	$44,102	
2003	$44,939	$1,216
2004	$46,703	$1,541
2005	$47,408	$2,027
2006	$46,611	$2,664
2007	$42,209	$3,166

Source: NAA

U.S. Advertising Expenditures - All Media (2003)

	Expenditures ($Mill)	Percent (%)
Newspapers	44,939	18.3
Magazines	11,435	4.7
Broadcast television	41,932	17.1
Cable television	18,814	7.7
Radio	19,100	7.8
Direct mail	48,370	19.7
Yellow pages	13,896	5.7
Miscellaneous	31,990	13.0
Business papers	4,004	1.6
Out of home	5,443	2.2
Internet	5,650	2.3
Total — all media	245,573	100.0

Source: Facts about Newspapers 2004 (NAA)

Entry and Exit of Daily Newspapers

year	entry	exit
1997		22
1998	2	5
1999	0	8
2000	3	10
2001	3	12
2002	5	2
2003	1	7
2004	8	7
2005	3	