Competition and Ideological Diversity: Historical Evidence from US Newspapers

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Introduction

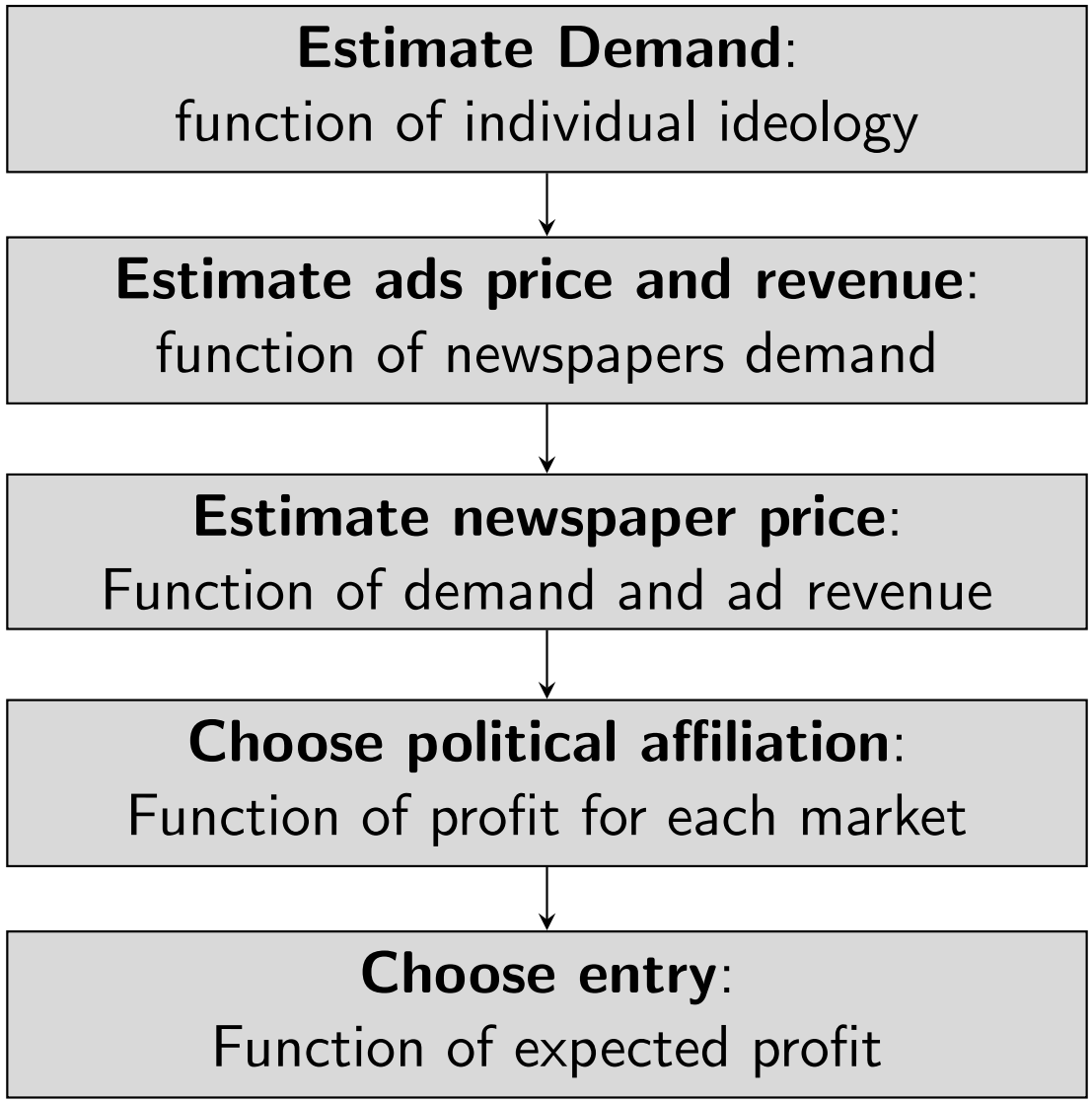
Objective:

- Formulate a model of newspaper demand, entry, and political affiliation choice,
- Given the model, estimate economic welfare, market diversity, and propose policy.

Context

- The year is 1924,
- (Most) newspapers openly declare political affiliation,
- There is no TV and Radio is at its infancy. Which for us means that the outside option is "No News", simplifying treatment.

Model Sketch



Data

- For the supply side (Entry and affiliation), data on the number, affiliations, and circulation prices of individual newspaper are used.
  - Collected from the US Newspaper Panel
- For the demand side, data on circulation per town and newspaper is used.
  - Collect from Audit Bureau of Circulations.
- Supplementary datasets on newspaper revenue and costs, alongside readership surveys, are used to calibrate the model
- *Note: The process of matching data from the different databases is complex and a considerable amount of data is lost.*

Data Summary for markets - US Newspaper Panel

TABLE 1—SUMMARY STATISTICS FOR NEWSPAPER MARKETS

Number of newspapers	0	1	2	3+	All
Mean population	5,944	10,688	24,049	36,832	10,943
Share of newspapers that are Republican		0.60	0.50	0.68	0.57
Share of multipaper markets that are diverse			0.53	0.61	0.54
Republican vote share					
Mean	0.52	0.51	0.50	0.55	0.51
Standard deviation	0.15	0.15	0.12	0.09	0.15
Number of markets	960	612	297	41	1,910
Number of diverse markets			158	25	183
Number of newspapers		612	594	132	1,338

Notes: Data are from the cross-section of daily newspaper markets in 1924 defined in Section IB. Diverse markets are those with at least one Republican and at least one Democratic newspaper. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868 to 1928.

- Number of papers is highly correlated to population
- The share of Republican Newspapers (57%) is slightly higher than the share of Republican votes (51%)

Data Summary for towns - ABC x Panel

TABLE 2—SUMMARY STATISTICS FOR TOWNS WITH CIRCULATION DATA

Number of circulating newspapers	1	2	3+	All
Mean population	447	390	566	472
Share of newspapers that are Republican	0.52	0.54	0.57	0.55
Share of multipaper towns that are diverse		0.38	0.67	0.53
Republican vote share				
Mean	0.49	0.51	0.54	0.51
Standard deviation	0.16	0.16	0.15	0.16
Number of towns	4,144	3,737	4,307	12,188
Number of diverse towns		1,418	2,876	4,294
Number of newspaper-towns	4,144	7,474	17,161	28,779

Notes: Data are from the cross-section of news-reading towns in 1924 defined in Section IC. Diverse towns are those with at least one Republican and at least one Democratic newspaper. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868 to 1928.

- Mostly the same conclusions as before.
- Data lost by the matching process causing the share of Republican newspaper to fall to (55%)

Descriptive Evidence

- Data shows that increasing the fraction Republican among voters by 10 percentage points increases the relative circulation of Republican papers by 10 percent.
- And that adding a second Republican paper to a market with one Republican and one Democratic newspaper reduces the relative circulation of the existing Republican paper by 4%.

Descriptive Evidence

TABLE 3—DEMAND FOR PARTISANSHIP

Dependent variable: Average log(circulation) of R papers − average log(circulation) of D papers	(1)	(2)	(3)
Republican vote share	0.8517		0.9510
	(0.1910)		(0.1980)
Number of Republican papers		−0.0187	−0.0360
		(0.0134)	(0.0136)
Number of Democratic papers		0.0066	0.0174
		(0.0152)	(0.0154)
R^2	0.0101	0.0007	0.0127
Number of counties	1,219	1,219	1,219
Number of towns	4,294	4,294	4,294

Notes: Data are from the cross-section of news-reading towns in 1924 defined in Section IC. The dependent variable is the difference in mean log circulation of Republican and Democrat newspapers. Republican vote share is the average Republican share of the two-party vote in the county in presidential elections from 1868 to 1928. Sample is all towns with at least one paper of each affiliation. Standard errors in parentheses are clustered at the county level.

Descriptive Evidence

TABLE 4—DETERMINANTS OF NEWSPAPER AFFILIATION

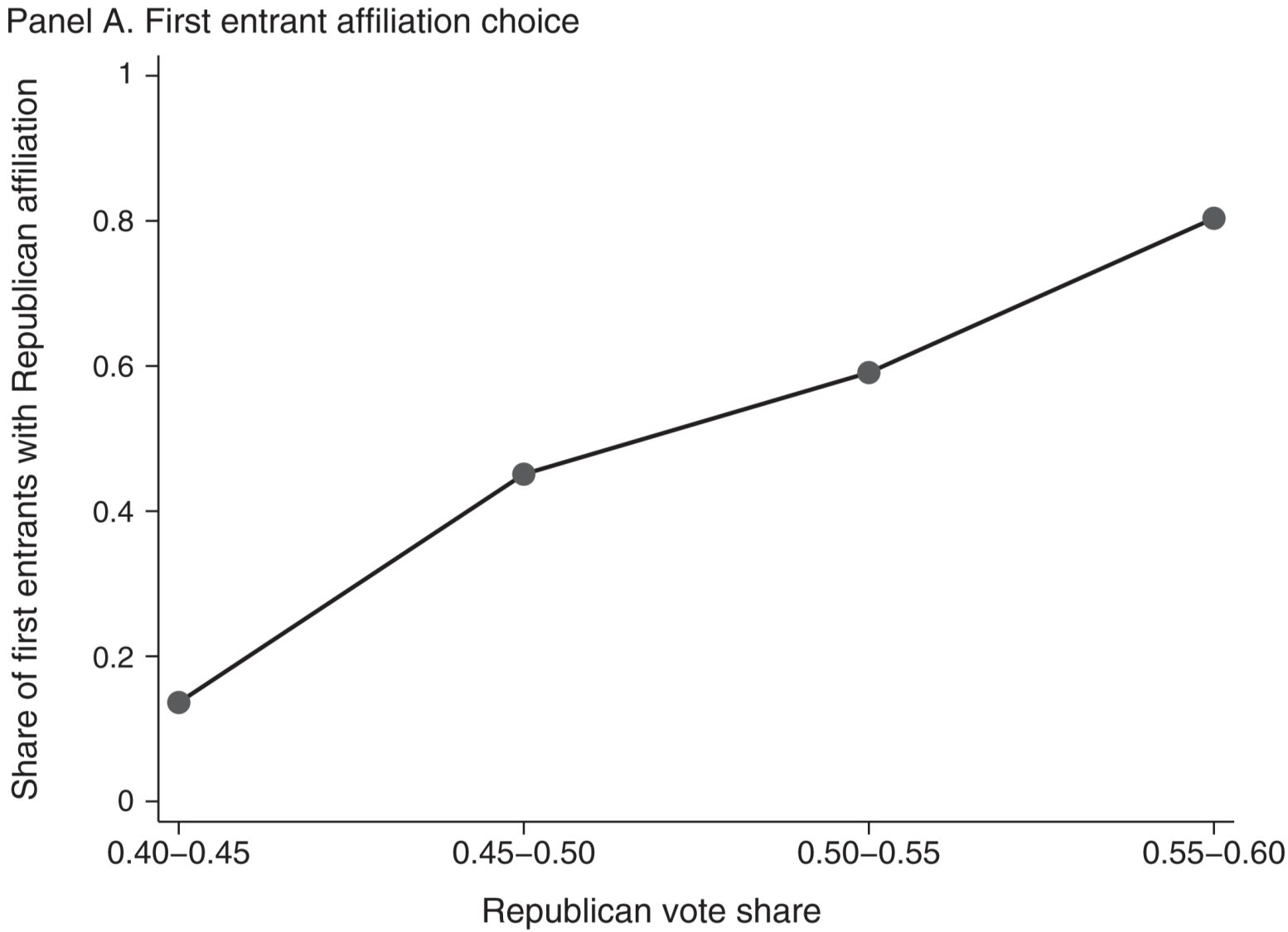
Dependent variable: Dummy for newspaper choosing R affiliation	(1)	(2)	(3)
Republican vote share	2.1824		2.3356
	(0.0557)		(0.0611)
Number of Republican incumbents		−0.0168	−0.1525
		(0.0318)	(0.0342)
Number of Democratic incumbents		−0.0190	0.1260
		(0.0377)	(0.0297)
R^2	0.3561	0.0004	0.3819
Number of markets	950	950	950
Number of newspapers	1,338	1,338	1,338

Notes: Data are from the cross-section of daily newspaper markets in 1924 defined in Section IB. The unit of analysis is the newspaper. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868 to 1928. The number of Republican/Democratic incumbents is the number of sample newspapers of the given affiliation that entered prior to the newspaper in question. Sample is all markets with at least one paper. Standard errors in parentheses are clustered at the market level.

Descriptive Evidence

- Data shows that a 10 percentage point increase in the fraction of Republican among the households increases the likelihood of a Republican affiliation by 23%
- But facing a Republican incumbent, instead of a Democratic one, reduces the likelihood by 28%.

Descriptive Evidence: Summary



Descriptive Evidence: Summary

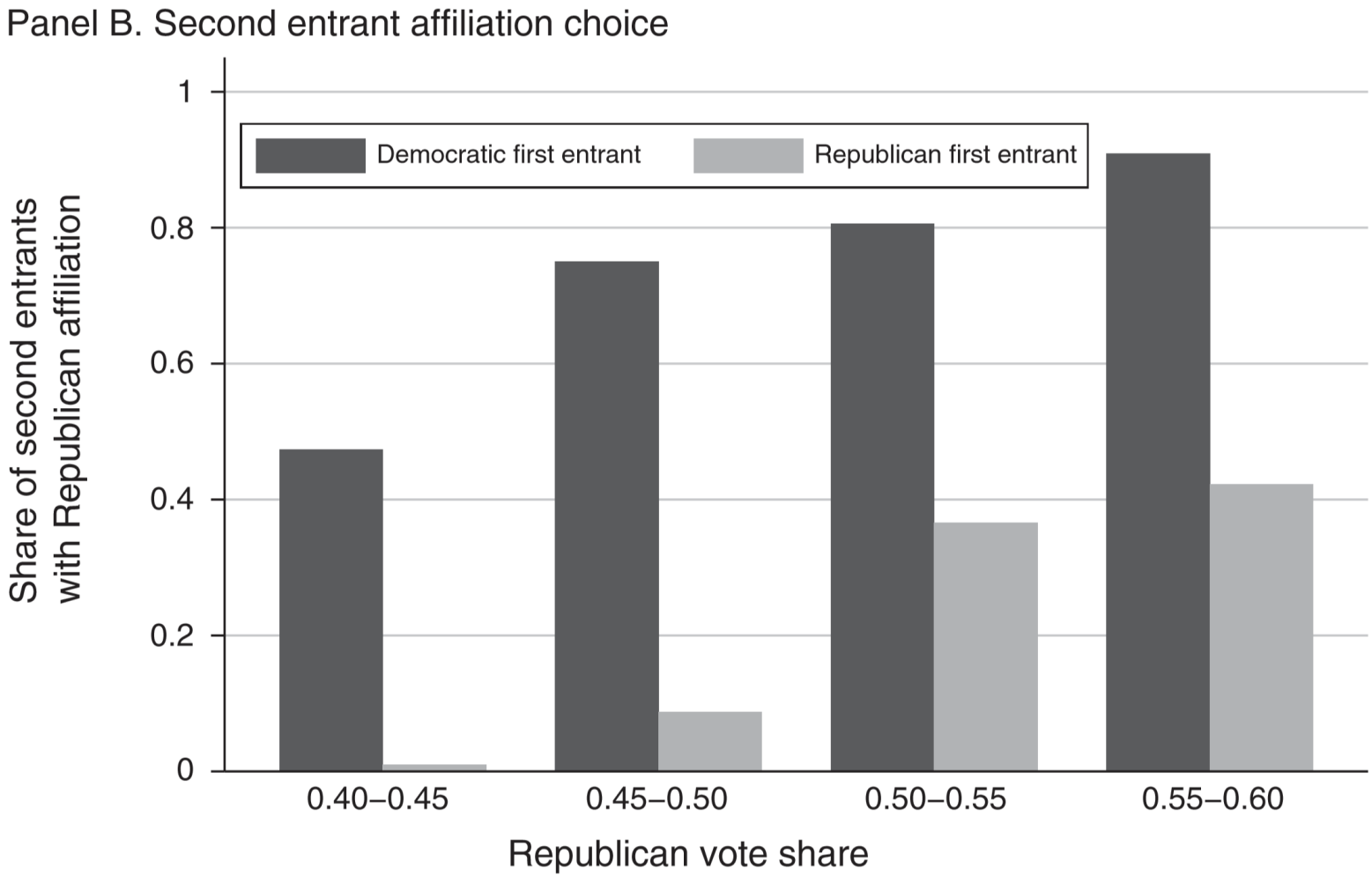


FIGURE 1. DETERMINANTS OF NEWSPAPER AFFILIATIONS

Model Setup

- There are M markets. Each one is indexed by $m \in 1, ..., M$.
- Each market has a unit mas of homogeneous advertisers and a mass S_m of households. Households are indexed by $i \in 1, ..., S_m$
- J_m is the number of newspapers that choose to enter market m. Newspapers are indexed by $j \in 1, ..., J_m$.
- Each entering newspaper choose a political affiliation $\tau_{jm} \in \{R, D\}$.
- Each household has a political affiliation $\theta_{im} \in \{R, D\}$.
- ρ_m represents the share or Republican households within the market and is common knowledge.

Model Setup: Consumer problem

The household utility function is given by:

$$u_{im}(\mathcal{B}) = \sum_{j \in \mathcal{B}} (\underline{\beta} \mathbf{1}_{\theta_{im} \neq \tau_{jm}} + \bar{\beta} \mathbf{1}_{\theta_{im} = \tau_{jm}} - \alpha p_{jm}) - g_s(\mathcal{B}) \Gamma_s - g_d(\mathcal{B}) \Gamma_d + \epsilon_{im}(\mathcal{B})$$

where:

- $\mathcal{B}$ is the consumed bundle newspapers,
- p_{jm} is the price of newspaper j,
- $g_s(\mathcal{B})$ is the number of distinct two-newspaper subsets of bundle $\mathcal{B}$ such that the two newspaper have the same political affiliation,
- $g_d(\mathcal{B})$ is the number of distinct two-newspaper subsets of bundle $\mathcal{B}$ such that the two newspaper have the different political affiliation,
- $\epsilon_{im}(\mathcal{B})$ is a type-I extreme value error,
- $\epsilon_{im}(\varnothing)$ is the outside good ("No News") utility.

Model Setup: Advertising market

The advertiser profit is given by:

$$\int_i \mathbf{1}_{n_{im} \geq 1}[a_h + (n_{im} - 1)a_l] - a_{jm} q_{jm} S_m$$

Where:

- n_{im} is the number of newspaper read by i,
- a_h and a_l are the value to advertiser of first and subsequent impressions respectively, with $0 \leq a_l \leq a_h$.

Model Setup: Supply

Newspapers profit is given by:

$$\pi_{jm} = S_m[(p_{jm} + \psi_{jm} a_{jm} - MC)q_{jm} - \xi_{jm}(\tau_{jm})] - \kappa_m$$

Where:

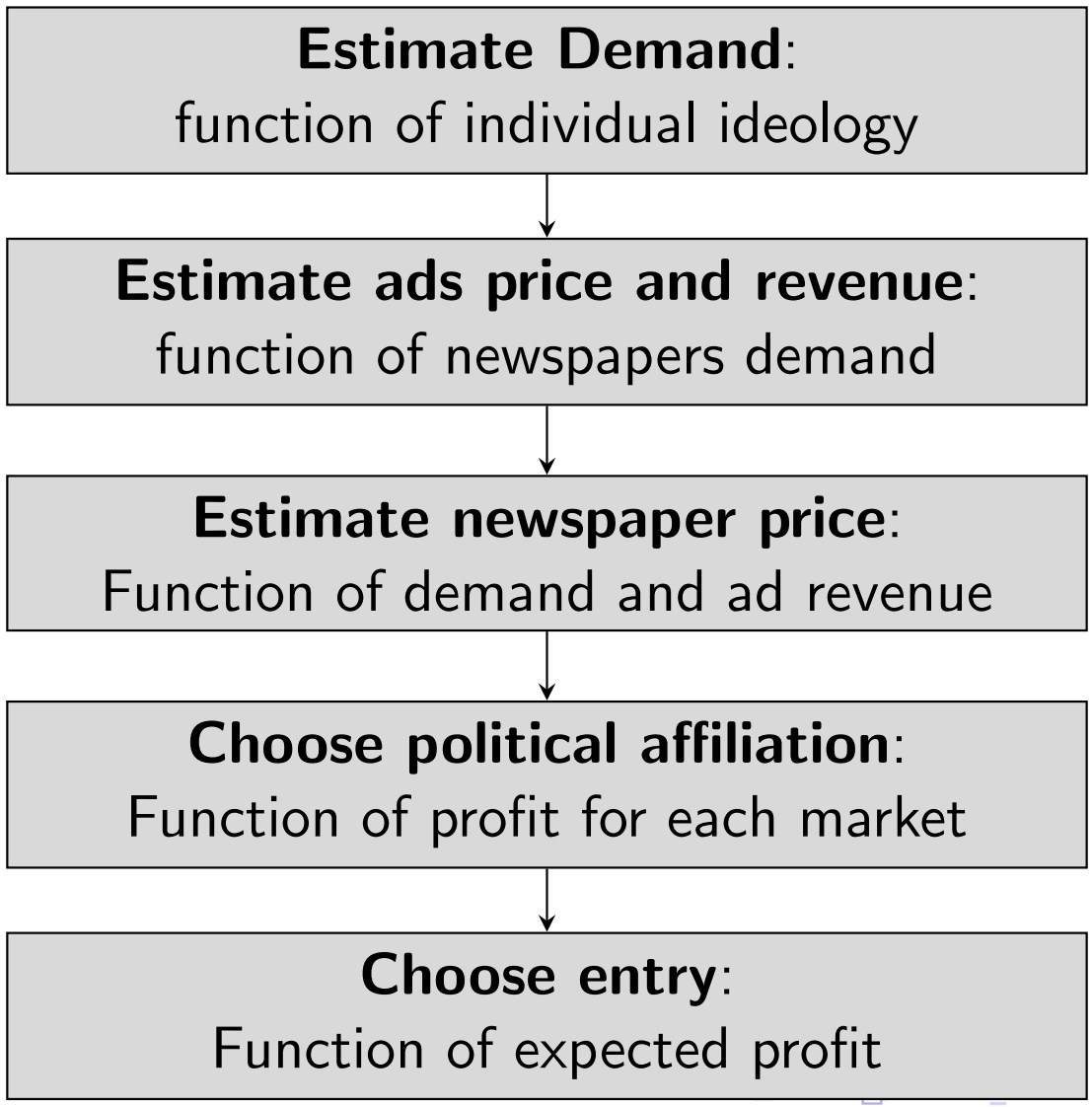
- π_{jm} is the profit of newspaper j,
- q_{jm} is the market share of newspaper j, given by the previous equation,
- ψ_{jm} is the mass of advertisers advertising in newspaper j,
- a_{jm} is newspaper j's per-copy advertising price,
- MC is a marginal cost common to all newspapers and markets,
- $\xi_{jm}(\tau_{jm})$ is an affiliation specific cost,
- κ_m is a market-specific fixed cost.
- All above variables are market m-specific.

Model Setup: Supply Cont..

- κ_m / S_m is distributed logistic with scale parameter σ_κ and a location parameter $\mu_\kappa^0 + \mu_\kappa^1 \log(S_m)$.
- $\xi_{jm}(\tau_{jm})/\sigma_\xi$ a is distributed mean-zero type-I extreme value, where $\sigma_\xi > 0$ is a constant.

Equilibrium

An equilibrium is achieved though the 5 step process described before:



5th and Final Step: Consumer Equilibrium

Solving the consumer problem results in the followings market shares:

$$q_{jm}^{\theta} = \frac{\sum_{\{\mathcal{B} \in \mathbb{B} : j \in \mathcal{B}\}} \exp(u_m^{\theta}(\mathcal{B}))}{\sum_{\mathcal{B}' \in \mathbb{B}} \exp(u_m^{\theta}(\mathcal{B}'))}$$

Where:

- q_{jm}^{θ} is the share of newspaper j among households of affiliation θ in market m.
- $u_m^{\theta}(\mathcal{B})$ is the utility for household of affiliation θ of bundle $\mathcal{B}$
- $\mathbb{B}$ is the set of all possible newspapers' bundles in market m.

Therefore, the final market share is given by:

$$q_{jm} = \rho_m q_{jm}^R + (1 - \rho_m) q_{jm}$$

4th Step: Advertising Equilibrium

$$a_{jm}(\mathbf{p}, \boldsymbol{\tau}) = a_h \mathcal{E}_{jm}(\mathbf{p}, \boldsymbol{\tau}) + a_l(1 - \mathcal{E}_{jm}(\mathbf{p}, \boldsymbol{\tau}))$$

Where:

- $\mathbf{p}$ and $\boldsymbol{\tau}$ are the price and affiliation vector of newspapers in market m,
- $\mathcal{E}_{jm}$ is the share of newspaper j's that are exclusive,
- Note: this is simply a pondered mean of exclusive and non-exclusive advertasing prices,
- It is not clear to me how $\mathcal{E}_{jm}$ is estimated.

3th Step: Newspaper price

$$p_j^* \in \arg\max_{p_j}(p_j + a_{jm}(\mathbf{p}^*, \boldsymbol{\tau}) - MC)q_{jm}(\mathbf{p}^*, \boldsymbol{\tau})$$

- Given demand and ad price, choose newspaper price to maximize profit,
- A proof of the uniqueness for optimal price in not provide. Matlab doesn't care and neither do the authors.

2th Step: Newspaper price

- Firms now sequentially choose affiliations given the number of newspapers and their affiliation-specific shocks.
- That is: given expected profits, firms choose affiliations.
- Formally:

$$\tau_j^* = \arg\max_{\tau} E_{\tau_{j+}^*}[\nu_{jm}([\boldsymbol{\tau}_{j-}^*, \tau, \boldsymbol{\tau}_{j+}^*]) - \xi_{jm}(\tau_j^*))]$$

Where:

- ν_{jm} is the equilibrium value for $(p_{jm} + a_{jm} - MC)q_{jm}$

1th Step: Entry

Finally firms decide either to enter or not. The per-household expected variable profit is:

$$V_m(J) = \frac{1}{J} \sum_{j=1}^{J} \sum_{\boldsymbol{\tau} \in \mathcal{T}_J} (\nu_{jm}(\boldsymbol{\tau}) - \bar{\xi}_{jm}(\boldsymbol{\tau})) P_m(\boldsymbol{\tau})$$

- where $\mathcal{T}_J$ is the set of $\boldsymbol{\tau}$ vectors with $|\boldsymbol{\tau}| = \mathbf{J}$.

Therefore, if V_m is strictly decreasing in J, the decision rule:

$$V_m(J^*) \geq \frac{\kappa_m}{S_m} > V_m(J^* + 1)$$

- In other words, firms entries if profit is greater than zero
- We can't prove that V_m is strictly decreasing, that is not a problem though because it is **intuitive**

Demand Estimation

Remember, we have:

- Newspaper circulation per town (Q_{jt})
- Town population (S_t)
- Republican vote share per town (Z_t)

We need:

- Newspaper market share (q_{jt})
- Republican affiliation share - household (ρ_t)
- Republican affiliation share - newspaper (τ_{jt})

In order to find the parameters that makes:

$$q_{jm}^{\theta} = \frac{\sum_{\{\mathcal{B} \in \mathbb{B} : j \in \mathcal{B}\}} \exp(u_m^{\theta}(\mathcal{B}))}{\sum_{\mathcal{B}' \in \mathbb{B}} \exp(u_m^{\theta}(\mathcal{B}'))}$$

Demand Estimation

We assume that:

$$Q_{jt} = q_{jt} S_t \zeta_{jt}$$

Where:

- $log\zeta_{jt} \sim N(0, \sigma_\zeta^2)$ is a measurement error.

And estimate ρ_t and τ_{jt}, by:

$$\rho_t = \text{logit}^{-1}(\text{logit}(Z_t) + \nu_t)$$

$$Pr(\tau_{jt} = R) = \text{logit}^{-1}(\mu_\rho^0 + \mu_\rho^1 \text{logit}(\rho_t))$$

Where:

- ν_t is a normally distributed error term with mean μ_ν^{town} and standard deviation σ_ν^{town}.
- μ_ρ^0 and μ_ρ^1 are parameters to me estimated
- the double logit ensures that the numbers are between $(0, 1)$

Demand Estimation - Notes

- Note that we don't use the affiliation strategy described in the equilibrium section. That is because that strategy is only valid in the newspaper headquarter market and not in the hinterland tows whose data is used to estimate demand.
- Headquarter markets are ignored in demand estimation because reasons other than political affiliation is assumed to dominate the demand function.

Demand Estimation

Then, the conditional likelihood of the data for town t is:

$$L_t(\rho_t) = \frac{1}{\tilde{\sigma}_t}\phi\left(\frac{1}{\tilde{\sigma}_t|\mathcal{J}_t^R|}\sum_{j\in\mathcal{J}_t^R}\log(\frac{\hat{Q}_{jt}}{q_{jt}}) - \frac{1}{\tilde{\sigma}_t|\mathcal{J}_t^D|}\sum_{j\in\mathcal{J}_t^D}\log(\frac{\hat{Q}_{jt}}{q_{jt}})\right) Pr(\boldsymbol{\tau}|\rho_t, J_t)$$

Where:

- $\tilde{\sigma}_t = \sigma_\zeta\sqrt{1/|\mathcal{J}_t^R| + 1/|\mathcal{J}_t^D|}$

The unconditional log likelihood of the observed data is:

$$\log L = \sum_{t,t'}\log\int_{\rho_t,\rho_{t'}} L_t(\rho_t)L_{t'}(\rho_{t'})dF^{\text{town}}(\rho_t,\rho_{t'}|Z_t,Z_{t'})$$

We choose parameters $\{\bar{\beta}, \Gamma_s, \sigma_\zeta, \mu_\nu^{\text{town}}, \sigma_\nu^{\text{town}}, \mu_\rho^0, \mu_\rho^1\}$ to maximize above log likelihood.

Demand Estimation

- We are still left to estimate the demand parameters $\alpha, \underline{\beta}, \Gamma_d$
- To estimate this parameters we first estimated MC and a_h using Revenue and Cost data.
- Then choose the price coefficient α and the utility shifter $\underline{\beta}$ so that the predicted average price and circulation per household match the data
- Finally we choose the subtitution parameter Γ_d so that the predicted overlap in readership matches the data.

Supply Estimation

We now observe:

- Market population (S_m),
- Republican vote share per market (Z_m),
- Number of newspaper entrants (J_m),
- Affiliation choices τ_m.

And we need:

- Republican affiliation share (ρ_m)

To find the parameters that best fit the number of observed entrants J_m to the one estimated by the model:

$$J^* \text{ such that } V_m(J^*) \geq \frac{\kappa_m}{S_m} > V_m(J^* + 1)$$

The conditional likelihood of the data for market m is:

$$L_m(\rho_m) = \begin{cases} 1 - G_m(V(J_m + 1, \rho)), & \text{if } J_m = 0 \\ [G_m(V(J_m, \rho_m)) - G_m(V(J_m + 1, \rho_m))]Pr(\tau_m, \rho_m) & \text{if } J_m > 0 \end{cases}$$

Where:

- G_m is the CDF of κ_m / S_m

Therefore the unconditional log likelihood is:

$$\log L = \sum_{(m,m')} \log \int_{\rho_m, \rho_{m'}} L_m(\rho_m) L_{m'}(\rho_{m'}) dF^{\text{mkt}}(\rho_m, \rho_{m'} | Z_m, Z_{m'})$$

And the parameters $\{a_I, \sigma_\xi, \mu_\nu^{\text{mkt}}, \sigma_\nu^{\text{mkt}}, \mu_\kappa^0, \mu_\kappa^1, \sigma_\kappa\}$ are chosen to maximize above likelihood.

Results - Demand Estimation

TABLE 5—PARAMETER ESTIMATES (*Demand model*)

Price coefficient (α)	0.1798
	(0.0032)
Mean utility for different-affiliation paper ($\underline{\beta}$)	−0.2906
	(0.0676)
Mean utility for same-affiliation paper ($\overline{\beta}$)	0.8137
	(0.0759)
Substitutability between same-type papers (Γ_s)	0.5645
	(0.0669)
Substitutability between different-type papers (Γ_d)	0.3004
	(0.0469)
Standard deviation of log of measurement error (σ_ζ)	0.7017
	(0.0077)
Mean of unobservable shifter of fraction Republican (μ_ν^{town})	0.0466
	(0.0422)
Standard deviation of unobservable (σ_ν^{town})	0.2783
	(0.0135)
Parameters governing share of town's newspapers that are Republican	
μ_ρ^0	−0.0714
	(0.0850)
μ_ρ^1	1.9952
	(0.0336)
Calibrated parameters	
Marginal cost (MC)	8.1749
Spatial correlation of unobservable $\left(\frac{\text{cov}(\nu_t, \nu_{t'})}{\text{var}(\nu_t)}\right)$	0.7233
Number of towns	12,188
Number of newspapers	670
Number of newspaper-towns	28,779

Results - Demand Estimation

Highlights:

- Price coefficient (α) is positive and significant,
- Utility from same affiliation paper ($\bar{\beta}$) is positive and significant,
- Utility from different affiliation paper ($\underline{\beta}$) is negative and significant,
- Γ_d and Γ_s are both positive and significant (Diminishing return holds).

Therefore the model holds as expected!

Results - Supply Estimation

TABLE 6—PARAMETER ESTIMATES (*Supply model*)

Advertising revenue per reader of non-singleton bundles (a_l)	7.4447
	(1.2626)
Standard deviation of affiliation cost shocks (σ_ξ)	0.2277
	(0.0298)
Mean of unobservable shifter of fraction Republican (μ_ν^{mkt})	−0.0114
	(0.0184)
Standard deviation of unobservable (σ_ν^{mkt})	0.1523
	(0.0684)
Parameters governing the distribution of fixed costs	
μ_κ^0	8.7354
	(0.4860)
μ_κ^1	−0.6448
	(0.0618)
σ_κ	0.3607
	(0.0345)
Calibrated parameters	
Advertising revenue per reader of singleton bundles (a_h)	13.4707
Spatial correlation of unobservable $\left(\frac{\text{cov}(\nu_m, \nu_{m'})}{\text{var}(\nu_m)}\right)$	0.7217
Number of markets	1,910
Number of newspapers	1,338

Results - Supply Estimation

Highlights:

- a_h is "significantly" (?) higher than a_l

Also as expected.

Results - Relevance

TABLE 7—DETERMINANTS OF EQUILIBRIUM DIVERSITY

	Markets with diverse papers	Share of households in markets with diverse papers	Share of households reading diverse papers
Baseline	143	0.22	0.029
Ignore competitors' choices	68	0.11	0.014
Ignore household ideology	211	0.31	0.038
Ignore idiosyncratic cost shocks	110	0.18	0.024

- To interpret the relevance of our parameters alternative scenarios are simulated,
- Table 7 shows that our parameters of interest have a dramatic effect on the simulations,
- The effect of idiosyncratic cost shocks (the residual term) is less relevant.

Results - What would a social planner do?

TABLE 8—EQUILIBRIUM AND SURPLUS-MAXIMIZING OUTCOMES

		Chosen to maximize total surplus	
	Baseline	Post-entry outcomes	Entry and post-entry outcomes
Markets with newspapers	951	951	1,910
Markets with multiple newspapers	256	256	1,845
Share of households reading a newspaper	0.39	0.53	0.91
Average price in multipaper markets	5.48	0.04	0.05
Average ad revenue per reader in multipaper markets	11.24	11.55	11.31
Per household			
Consumer surplus	3.44	6.55	15.69
Newspaper profit	0.41	−6.27	−17.51
Advertiser profit	0.39	6.86	10.39
Total surplus	4.24	7.15	8.56
Diversity			
Markets with diverse papers	143	175	1,370
Share of households in markets with diverse papers	0.22	0.27	0.84
Share of households reading diverse papers	0.029	0.091	0.334

Results - What would a social planner do?

- To maximize Total Surplus the Social planner lower newspaper price to almost zero, expand the reach and diversity of the market.
- That is, in the Baseline model we have insufficient entry of newspapers.
- What is the best policy to minimize this inefficiency?

Results - Policy

TABLE 9—POLICY EXPERIMENTS

	Baseline	Allow price collusion	Allow advertising collusion	Allow joint operating agreements	Allow joint ownership	Optimal subsidy
Markets with newspapers	951	951	951	951	954	1,883
Markets with multiple newspapers	256	290	400	415	126	1,253
Share of households reading a newspaper	0.39	0.36	0.44	0.42	0.33	0.74
Average price in multipaper markets	5.48	7.53	5.07	6.61	6.13	3.21
Average ad revenue per reader in multipaper markets	11.24	11.60	12.14	12.30	12.54	10.60
Per household						
Consumer surplus	3.44	2.98	4.46	3.79	2.63	8.93
Newspaper profit	0.41	0.42	0.44	0.50	0.86	1.07
Advertiser profit	0.39	0.29	0	0	0	1.68
Cost of subsidy						5.63
Total surplus	4.24	3.69	4.90	4.29	3.49	6.05
Diversity						
Markets with diverse papers	143	157	225	238	62	704
Share of households in markets with diverse papers	0.22	0.24	0.31	0.32	0.11	0.57
Share of households reading diverse papers	0.029	0.021	0.052	0.039	0.011	0.133

Results - Policy

- Allowing price collusion reduces economic welfare and has little effect on diversity.
- Advertising collusion, on the other hand, causes large increases in both economic welfare and diversity.
- Joint operation, which combines the effect of price collusion and advertising collusion, has a overall positive effect on diversity but a neutral effect on welfare.
- Joint ownership significantly reduces welfare, diversity, and the number of newspapers.
- A marginal cost subsidy, that is a transfer of K dollars per newspaper sold, reveals the greatest increase in total surplus.

Conclusions

- Competitive incentives are a crucial driver of ideological diversity,
- There is no conflict between the goal of maximizing economic welfare and the goal of preserving ideological diversity,
- It's important to distinguish between advertising collusion, which has a positive effect on welfare and diversity, price collusion, which has mixed effects, and joint operation, which is inferior to advertising collusion.