ONLINE APPENDIX

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ONLINE APPENDIX A: NEWS AGENCY HISTORY

This appendix summarizes the institutional background on the three national wire services relevant for the paper. The goal is not to provide a complete history of telegraphic news. Rather, the discussion highlights the historical features of AP, UP, and INS that matter for the paper's setting: the 1900 reorganization of the AP, the role of UP as the main rival to AP, and the distinct ownership structure of INS. For broader histories of telegraphic news and exclusion in communication networks, see Wang (2023), John (2015), and Silberstein-Loeb (2014, 2012).

ASSOCIATED PRESS (AP)   The Associated Press traces its origins to the cooperative arrangements through which New York newspapers pooled resources to gather incoming news from ships entering the harbor (Rosewater 1930). By the late nineteenth century, the organization had become the dominant domestic wire service (Blanchard 1987). For this paper, the key institutional break is 1900. In Inter-Ocean Publishing Company. v. Associated Press (1900), the Illinois Supreme Court held that the AP's exclusionary membership rules were unlawful so long as the organization remained an Illinois corporation. The AP then dissolved the Illinois corporation and immediately reorganized in New York with the same name and membership base (Associated Press 1901). [1] Accordingly, the analysis treats 1900 as the beginning of the modern AP and of the exclusivity regime studied in the paper.

UNITED PRESS (UP)   United Press was created in 1907 through the consolidation of the Scripps-McRae, Scripps-Blades, and Publishers' Press associations (Benét 1933; Morris 1957).[2] Its business opportunity came directly from AP exclusivity: newspapers excluded from AP membership still demanded national and international telegraphic news, and the Scripps organization had an obvious interest in supplying that demand. This made UP the principal rival to AP in the period studied here.

   At the same time, the historical record indicates that UP was not simply a clone of the AP. It was a for-profit entrant backed by Scripps capital, and contemporaneous correspondence makes clear that Scripps was willing to subsidize the organization in order to expand newspaper competition. That evidence is used elsewhere in the appendix package rather than reproduced here. Online Appendix B documents the pricing logic behind UP assessments. By the interwar period, UP had nevertheless become one of the three national wire services recognized in *AP v. United States* (1945).

INTERNATIONAL NEWS SERVICE (INS)   The International News Service was founded by William Randolph Hearst in 1910 as part of the Hearst newspaper empire (Nasaw 2013). Unlike AP and UP, INS was closely integrated with a single newspaper group and appears to have served broader strategic and political goals rather than operating purely as an arm's-length commercial cooperative or entrant. Contemporary accounts emphasize Hearst's use of INS as a vehicle for distributing the content and viewpoint of his chain, and the agency at times sustained large operating losses (Rosewater 1930; Schwarzlose 1989). For the purposes of this paper, INS is therefore institutionally distinct from the AP-UP competition that is the main focus of the analysis.

IMPLICATION FOR THE DATA AND MODEL   These institutional distinctions clarify the paper's historical setting. AP and UP are the central agencies in the analysis because AP exclusivity most directly shaped competition between the dominant incumbent wire service and its principal challenger. The discussion here also complements the later appendices: Online Appendix D describes how AP, UP, and INS membership histories are constructed from the *AP v. United States* trial record and augmented with ownership information for the Scripps and Hearst chains.

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[1]The New York reorganization preserved the AP's cooperative, non-profit form under the state's Membership Corporation Law; that organizational form remains central to the AP's governance. See also State of New York 1918.

[2]The relevant organization is the "United Press Association," later commonly shortened to United Press. It is distinct from an earlier short-lived agency also called "United Press" that failed in 1898.

ONLINE APPENDIX B: UNITED PRESS ASSESSMENTS

In this section, I discuss UP's method of calculating assessments on newspapers. My knowledge of the UP's comes primarily from two documents.

The first document includes minutes and exhibits from the "United Press Rate Setting Committee" held in November 1912, hereby referred to as *Minutes*. The committee was appointed by the Scripps newspapers and the Board of UP in order to propose a method for calculating assessments on UP members broadly and Scripps newspapers specifically. At this time, Scripps newspapers contribute over 24% of total receipts of United Press.

The second document is a memo prepared in 1913, titled "System for the Determination of a Proper Basis of Charges for United Press Clients," hereby referred to as *Memo*. This memo was created as a result of the rate setting committee, as the original committee struggled to decide on a cost apportioning method given "the impracticability of adopting any of the [present suggestions]."

The assumption that UP calculates the cost of an additional member in a similar fashion to that of the AP is supported by the following statements:

- The formula for calculating the cost of an additional member depends on a similar method as the AP. Overhead charges (total news collection by the organization and administrative cost) is divided across clients "irrespective of geographical location" . The cost of the trunk line is also divided independently of geographical location as "all clients are [...] dependent upon, and should pay their faire (sic) share of the cost of maintaining a trunk line of communication from Coast to Coast." The cost of the local circuit is divided by members in that circuit: "all wire and operating cost, exclusive of Trunk Line Charges, should be divided equally among the Clients in each zone." (Page 2 of *Memo*)

The assumption that UP does not engage in strategic pricing is supported by the following statements:

- UP did not expect to lose money initially on new members: "[Board member] Rickey asked what percentage of profit the UP should retain, ultimately, as a "goal." Mr. Howard thought 15% and saw no reason why it should not. [...] The profit-making feature [of the UP] was an asset in getting clients." (Page 6 of *Minutes*)

- UP did not price discriminate by local market structure. The organization also used "rate cards" based on the market's exogenous characteristics: "It shall be left to the management of the UP and the management of each individual group to determine a card rate for the United Press service to possible non-Scripps clients in each individual city of that [region]. (Exhibit F of *Minutes*).

- UP was unable to turn a profit at the beginning or even in the long run. Scripps said, as quoted in Morris 1957: "[...] in founding the new UP, the Scripps papers actually paid out several hundred thousand dollars more than they would have paid out had they been members of the AP. However, notwithstanding these comparatively large payments, I felt that the investment, bad as it was financially in one way, was a good one beacuse it secures freedom from the temptation of one huge monopoly." At the time of the merger with INS, a UP executive told *Editor and Publisher* that "Both agencies operated under low profit margins for many years."

ONLINE APPENDIX C: NEWSPRINT PRICE CONSTRUCTION

This appendix describes the construction and validation of the newsprint price instrument used to identify subscription price elasticity.

INSTRUMENT CONSTRUCTION

I construct city-level newsprint prices using a spatial price equilibrium model following Enke (1951) and Samuelson (1952). The model solves for delivered prices that clear the market given mill capacities, transport costs, and city-level demand. I now describe each of the components of the model in detail.

Transport costs. In the implemented pipeline, freight costs are modeled as linear in distance:

$$\text{Freight}_{ij} = \tau \times d_{ij} \tag{1}$$

where d_{ij} is crow-flies distance in miles. The transport slope is calibrated from historical freight evidence described below and then held fixed when constructing the city-year instrument.

Figure 1 reports two freight-cost diagnostics. Panel (a) shows the 1939 cross-sectional relationship between observed freight rates and route distance, which motivates the linear distance specification. Panel (b) plots the time series used for calibration and validation. Note that the freight rate per ton-mile for the Three Rivers, Quebec - New York City route is consistently higher than the US national average because it is a shorter route (475 miles), so the fixed cost component represents a larger share. I use the NBER railroad freight rate series for pre-1914 extrapolation and show the Three Rivers–NYC series as validation.

FIGURE 1: FREIGHT-COST CALIBRATION AND VALIDATION. PANEL (A) PLOTS OBSERVED 1939 FREIGHT RATES AGAINST ROUTE DISTANCE. PANEL (B) PLOTS THE NATIONAL RAILROAD FREIGHT RATE SERIES TOGETHER WITH THE THREE RIVERS–NEW YORK CITY ROUTE USED AS A HISTORICAL VALIDATION SERIES.
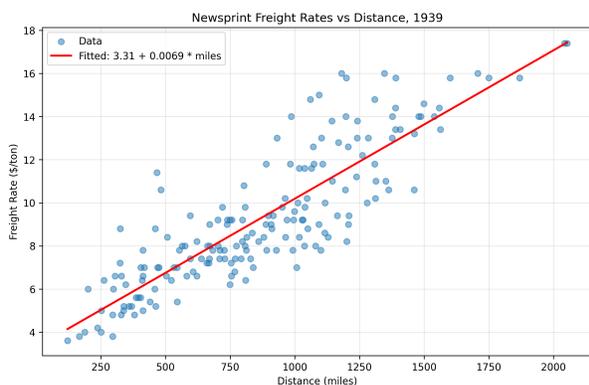
(a) Cross-section: freight rate vs. distance, 1939
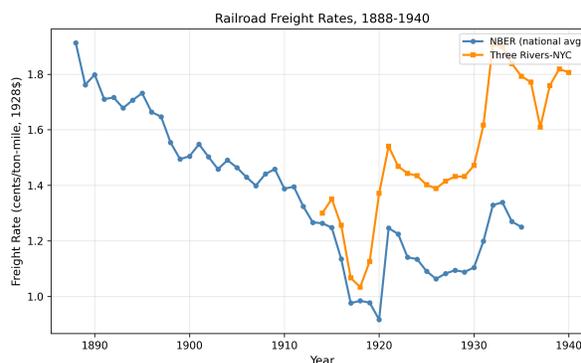
(b) Time series: freight rates (1928 dollars)

Estimation of marginal costs and predicted equilibrium prices.

I estimate marginal costs and spatial equilibrium prices by calibrating a model as follows. For each benchmark year, I solve for equilibrium shipments and prices by minimizing total delivery costs across all production zones and demand locations, aggregating demand and supply into 183

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grid zones across continental North America. Specifically, let S_i denote mill capacities, MC_t the marginal production cost for benchmark year t, τ the per-mile transport cost parameter, and d_{iz} the distance between grid location i and grid location z. The spatial equilibrium is obtained by solving:

$$\min_{\{y_{iz} \geq 0\}} \quad \sum_{i,z} \left[MC_t + \tau \cdot d_{iz} \right] y_{iz} \tag{2}$$

$$\text{subject to} \quad \sum_{z} y_{iz} \leq S_i \qquad \forall i \tag{3}$$

$$\sum_{i} y_{iz} = D_z \qquad \forall z \tag{4}$$

where y_{iz} is the quantity shipped from grid point i to grid point z, and D_z is demand at z. The dual variables on the capacity and demand constraints yield, for each zone z, an equilibrium delivered price

$$P_z = \min_i \left\{ MC_t + \tau \cdot d_{iz} + w_i \right\} \tag{5}$$

where $w_i \geq 0$ is the scarcity rent when mill i's capacity binds.

I calibrate five benchmark-year marginal costs, $\{MC_t\}_{t \in \{1890, 1900, 1910, 1920, 1930\}}$, by classical minimum distance (CMD), matching the model's quantity-weighted average mill price to observed NBER wholesale newsprint prices (National Bureau of Economic Research, 2005) (in 1928 dollars) at those benchmark years, where each target is averaged over a ± 3 year window. In practice, I solve:

$$\min_{\theta} \sum_{t \in \{1890, 1900, 1910, 1920, 1930\}} \left(\bar{P}_t^{\text{model}}(\theta) - \bar{P}_t^{\text{NBER}} \right)^2$$

Table 1 reports these five fitted marginal-cost levels and the resulting fit to the five benchmark NBER price moments. I calculate city demand as the city's population multiplied by the national average per-capita newsprint consumption for that year (Kellogg, 1948). I calculate supply by taking the capacity of newsprint mills from Co. (various years) and scaling aggregate capacity proportionally so that total supply equals total demand in each benchmark year. To construct the instrument, I then solve for delivered prices at all grid cells using the fitted benchmark marginal costs and the fixed linear distance freight schedule, and linearly interpolate between adjacent benchmark years to form a city-year panel for 1892–1940.

Model fit. To validate the model, I compare predicted delivered prices to observed historical prices from two sources: the 1917 FTC Report (Federal Trade Commission, 1917) (state-level delivered prices for 1913) and Margolin and McLendon (1952) (city-level delivered prices for 1939). The model fits the cross-sectional price gradient well: RMSE is $7.49/ton for 1913 and $3.20/ton for 1939, with an overall correlation of 0.91. Table 1 reports the estimated parameters; Figure 2 plots predictions against observed prices.

For reference, in the main IV demand specification subscription price is instrumented with year-interacted delivered city-year newsprint prices on the 16,672-observation demand sample. The corresponding Kleibergen-Paap first-stage F-statistic is 47.6, with standard errors clustered by city-year.

Parameter	Estimate	Units
MC_{1890}	$103	$/ton
MC_{1900}	$92	$/ton
MC_{1910}	$78	$/ton
MC_{1920}	$80	$/ton
MC_{1930}	$61	$/ton
RMSE	$0.09	$/ton

Model vs Observed Delivered Newsprint Prices
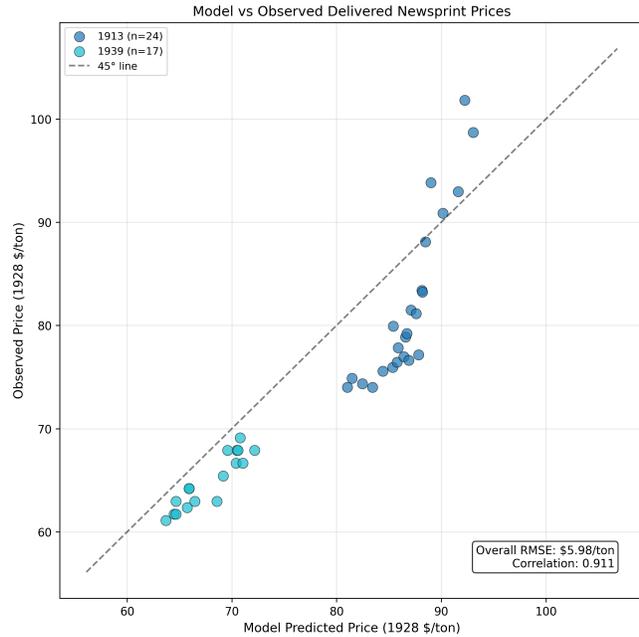
ONLINE APPENDIX D: DATA CONSTRUCTION AND VALIDATION

The primary wire-membership data come from the complete Transcript of Record from the Supreme Court of the United States, October Term 1944, in the case ultimately known as *AP v. United States* (1945). Exhibits filed in the case include the list of all English-language daily newspapers that were news agency members on September 30, 1941, and the year in which each became a member. Three exhibits provide membership rosters:

- The Associated Press roster (Vol. IV, Exhibit 1), compiled by the Auditor of the Associated Press from records of assessments.

- The United Press roster (Vol. IV, Exhibit 2), submitted by the Vice President and General Business Manager of United Press Associations.

- The International News Service roster (Vol. V, Exhibit 9), submitted by the President of King Features Syndicate, the parent firm of INS.

Each exhibit records state, city, paper name, field (morning/evening/Sunday), and year became subscriber. For the purposes of this paper, the relevant object is the stock of U.S. English-language daily newspapers taking the full telegraph service from each agency. I therefore use these exhibits to measure full-service daily memberships, excluding peripheral services such as features or heavily condensed "pony" reports delivered outside the main leased-wire relationship. Since these figures were submitted under oath, I treat them as authoritative for the 1941 cross-section and the reported join dates of newspapers appearing in the rosters.

Group ownership augmentation

I supplement the court rosters with group-ownership information. In 1907, E. W. Scripps merged three regional press associations to form United Press; I tag every Scripps-owned paper as a UP member from 1907 or their ownership start date, whichever is later. Since Hearst fully owned INS, I mark all Hearst-owned papers as INS members starting from their acquisition dates.

Matching to the GSS panel

I merge the wire-membership records into the Gentzkow, Shapiro, and Sinkinson (GSS) US Newspaper Panel, which provides newspaper characteristics at four-year intervals from 1900 to 1940. The merge proceeds in three steps.

Step 1: Geography. Wire-service market definitions can differ from GSS city definitions (based on 1990 Census place codes). I construct a crosswalk mapping each wire-service city to its GSS city identifier.

Step 2: Paper name matching. I match newspapers active in 1940 in the GSS panel to the court rosters by city, paper name, and field. Exact matches are absorbed first; remaining cases use fuzzy string matching, with ambiguous cases resolved by manual inspection.

Step 3: Predecessor resolution. When a matched newspaper's GSS entry date is later than its wire join date, the paper is typically the result of a merger or name change. I manually identify predecessors using AP directories, the Editors and Publishers' Yearbook, and archival newspaper scans. The goal is to recover a stable city-wire relationship over time: from the perspective of the news agency, what matters is continued presence in a city-field market, not the exact newspaper title holding the subscription in a given year. I therefore group related titles into a single franchise when the underlying membership relationship is preserved across these changes.

The merged panel covers over 98% of the court-record membership for each wire service.

Comparison with secondary sources

Figure 3 compares the court-record membership counts (merged into the GSS panel) against figures reported in secondary historical sources. The court records are a cross-section of members as of 1941 with retrospective join dates, so the pre-1941 time series is reconstructed from those join dates. The resulting trajectories broadly track those reported in secondary sources for both AP and UP, supporting the use of the rosters to recover long-run movement in membership. The levels are systematically higher in the secondary sources because those figures often include Sunday-only and weekly newspapers, college subscribers, radio stations, international clients, and "pony" subscribers receiving a condensed service rather than the full leased wire.
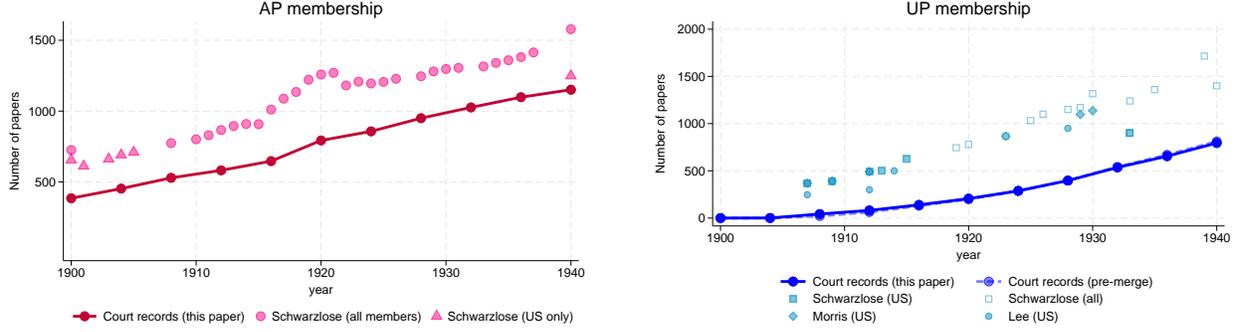
Because the rosters are a 1941 cross-section, they may understate short-lived memberships that ended before the snapshot date. I interpret the roster as representing the long-run installed base of full-service subscribers, while potentially underrepresenting temporary memberships that ended before 1941. To the extent that the omitted observations are marginal members that were not durable, this survivorship does not mechanically work against the paper's counterfactuals, which operate through the durable subscriber base over which the agencies' network effects and scale economies were realized.

ONLINE APPENDIX E: MICROFOUNDATION OF NEWSPAPERS MULTIHOMING NEWSWIRES

In this appendix, I provide a microfoundation for the demand system that interprets bundling (newspapers subscribing to multiple news agencies). In the main text, the reduced-form value from subscribing to both AP and UP is (suppressing controls, fixed effects, and product and place subscripts):

$$u\left(\{AP, UP\}\right) = \beta\left(n_t^{AP} + n_t^{UP} - \kappa \cdot \min\left\{n_t^{AP}, n_t^{UP}\right\}\right), \kappa \in [0, 1]$$

where n_t^W is the network strength of a wire W, and κ measures overlap in coverage.

Consider a continuum of topics $k \in [0, 1]$. Each wire service $w \in \{AP, UP, INS\}$ provides coverage intensity $x_w(k) \geq 0$ on that particular topic. The definition of "topic" could be news from a place, a potential event of the day, or a specific angle to an event. Readers value coverage across topics, and for simplicity I assume that a topic can only be either covered or not, so $x_w(k) \in \{0, 1\}$ for a wire w. This assumption means there is full satiation within events, so additional parallel coverage yields no additional value. Then

$$n_t^w = \int_0^1 \mathbf{1}\left\{x_w(k) > 0\right\} dk$$

is the measure of distinct events covered by wire w. For two wires, the value the reader gets from

their news coverage is

$$n_t^{AP} + n_t^{UP} - \int_0^1 \min \{x_{AP}(k), x_{UP}(k)\} \, dk.$$

The last term is the degree of overlap between the two wires: the set of events where one newswire already covers that the other is redundant coverage. To map this to the reduced-form parameter κ, assume that the overlap share is stable over time and proportional to the smaller network that the newspaper subscribes to. Then

$$\int_0^1 \min \{x_{AP}(k), x_{UP}(k)\} \, dk \approx \kappa \min \{n_t^{AP}, n_t^{UP}\},$$

which yields the reduced-form specification above.

ONLINE APPENDIX F: DYNAMIC CHOICE PROBABILITIES AND LIKELIHOOD

This appendix derives the choice probabilities and likelihood contribution for the dynamic entry and wire-membership model in the main text.

CHOICE PROBABILITIES

Recall that the mover's payoff from choosing wire bundle W is

$$V_{jmt}^*(W) = \bar{V}_{jmt}(W) + \eta_{jmt}(W),$$

where $\bar{V}_{jmt}(W)$ is the deterministic component and $\eta_{jmt}(W)$ follows the generalized extreme value error structure from Section 5.3.2 of the main text. I partition the feasible set into a non-wire nest $\mathcal{B}_{0,jmt}$ and a wire nest $\mathcal{B}_{1,jmt}$, where

$$\mathcal{B}_{0,jmt} = \overline{W}_{jmt} \cap \{\text{Out, No wire}\}, \qquad \mathcal{B}_{1,jmt} = \overline{W}_{jmt} \cap \{\text{bundles containing AP or UP}\}.$$

The wire nest has dissimilarity parameter $\mu \in (0, 1]$, while the non-wire nest's dissimilarity parameter is normalized to one. The deterministic component depends on whether the mover faces an *entry* or *update* period:

$$\bar{V}_{jmt}(W) = \begin{cases} \delta \, CV_{jm,t+1}(W, s_{-j}) & \text{entry period, } W \neq \text{Out} \\ 0 & \text{entry period, } W = \text{Out} \\ \pi_{jmt}(W, s_{-j}) + \delta \, CV_{jm,t+1}(W, s_{-j}) & \text{update period} \end{cases}$$

where $\pi_{jmt}(W, s_{-j}) = \mathbb{E}_\xi[v_{jmt}(W, s_{-j})] - WC_{jmt}(W) - FC_{jmt}$ is the flow payoff (expected variable profit net of wire and fixed costs), δ is the per-period discount factor, and $CV_{jm,t+1}$ is the continuation value at $t + 1$, defined below. In an entry period, the mover is a one-shot potential entrant: if it chooses $W = \text{Out}$, it stays out and exits the game, so its value is zero; if it enters with bundle $W \neq \text{Out}$, no current-period variable profits are realized and its payoff is the discounted continuation value as an incumbent starting next period.

Define the nest sums

$$D_{0,jmt} = \sum_{W \in \mathcal{B}_{0,jmt}} \exp\left(\bar{V}_{jmt}(W)\right), \qquad D_{1,jmt} = \sum_{W \in \mathcal{B}_{1,jmt}} \exp\left(\bar{V}_{jmt}(W)/\mu\right). \tag{6}$$

Then the nested-logit choice probability is

$$\Pr(W \mid \overline{W}_{jmt}) = \begin{cases} \dfrac{\exp\left(\bar{V}_{jmt}(W)\right)}{D_{0,jmt} + D_{1,jmt}^{\mu}} & \text{if } W \in \mathcal{B}_{0,jmt}, \\[2ex] \dfrac{\exp\left(\bar{V}_{jmt}(W)/\mu\right) D_{1,jmt}^{\mu-1}}{D_{0,jmt} + D_{1,jmt}^{\mu}} & \text{if } W \in \mathcal{B}_{1,jmt}. \end{cases} \tag{7}$$

Equivalently, for $W \in \mathcal{B}_{1,jmt}$ the choice probability factors into a between-nest term and a within-wire-nest term:

$$\Pr(W \mid \overline{W}_{jmt}) = \frac{D_{1,jmt}^{\mu}}{D_{0,jmt} + D_{1,jmt}^{\mu}} \times \frac{\exp\left(\bar{V}_{jmt}(W)/\mu\right)}{D_{1,jmt}}.$$

When $\mu = 1$, equation (7) collapses to the standard logit formula.

The mover's ex-ante expected value (before the shock realization) is the nested-logit inclusive value,

$$IV_{jmt} = \log\left(D_{0,jmt} + D_{1,jmt}^{\mu}\right), \tag{8}$$

under the normalization of the overall shock scale to one.

ALTERNATING MOVES AND CONTINUATION VALUES

Following Igami and Uetake (2019), I use stochastically alternating moves with a two-player market. In each period, nature selects player j to be the mover with probability p_j and player $-j$ with probability p_{-j}. The continuation value before nature selects a mover is

$$CV_{jmt}(s_j, s_{-j}) = p_j \cdot IV_{jmt} + p_{-j} \cdot CV_{jmt}^{\text{wait}}, \tag{9}$$

where IV_{jmt} is the inclusive value from equation (8) when j is the mover, and CV_{jmt}^{wait} is j's continuation value when $-j$ is the mover (i.e., j waits).

When $-j$ moves, player j does not draw shocks or make a choice. In an update period, j earns its flow payoff under the current state and receives a continuation that depends on what $-j$ chooses:

$$CV_{jmt}^{\text{wait}}(s_j, s_{-j}) = \begin{cases} \displaystyle\sum_{a \in \overline{W}_{-j}} \Pr(a)\left[\pi_{jmt}(s_j, a) + \delta\, CV_{jm,t+1}(s_j, a)\right] & \text{update period} \\[3ex] \displaystyle\delta \sum_{a \in \overline{W}_{-j}} \Pr(a)\, CV_{jm,t+1}(s_j, a) & \text{entry period} \end{cases} \tag{10}$$

where $\Pr(a)$ is the mover $-j$'s choice probability from equation (7), and the sum is over $-j$'s feasible actions. In an update period, the mover's action a changes the within-period market structure before prices are set, so the non-mover's current-period flow payoff is evaluated at (s_j, a) as well. In an entry period, by contrast, no variable profits are realized, so only the continuation value

depends on the mover's action. The analogous expressions hold with j and $-j$ swapped.

FEASIBILITY

The feasible set $\overline{W}_{jmt}$ is determined by two factors: the exclusive contracting regime currently in effect and the mover's existing bundle. Wire membership is irreversible: once a newspaper joins a wire, it cannot drop it. Thus, the mover can only *add* to its current bundle. For instance, an incumbent carrying AP alone can choose to add UP (moving to AP+UP) but cannot drop AP. A potential entrant may additionally choose $W = \text{Out}$ (not entering). The feasibility constraints rule out infeasible actions by assigning them probability zero.

LIKELIHOOD

The estimation sample consists of mover events: market-period observations (j, m, t) in which the mover makes an observed choice W_{jmt}^{obs}. The log-likelihood is

$$\mathcal{L}(\theta) = \sum_{(j,m,t)} \log \Pr\left(W_{jmt}^{\text{obs}} \mid \overline{W}_{jmt}; \theta\right), \tag{11}$$

where θ collects the cost parameters. I estimate θ by maximum likelihood. In the inner loop, I solve each market's dynamic game separately by backward induction to obtain the predicted choice probabilities. In the outer loop, I search over θ to maximize the likelihood, following the nested fixed-point (NFXP) approach of Rust (1987).

SCALE NORMALIZATION

The overall scale of the payoff shocks is not separately identified from the cost parameters. In equation (7), only relative payoffs matter, so multiplying all payoff-relevant objects by a constant and rescaling the shock distribution accordingly leaves the likelihood unchanged. I therefore normalize the outer-nest scale to one throughout. The dissimilarity parameter μ governs within-wire-nest correlation relative to that normalized outer scale and is calibrated rather than estimated in the likelihood step.

BACKWARD INDUCTION

The game has a finite horizon with a terminal "lock-in" period T^{Lock}, after which no further entry or membership changes occur. After T^{Lock}, newspapers continue to earn flow payoffs under the locked-in market structure for n_{buffer} additional periods, but no discrete choices are made. The terminal continuation value at T^{Lock} is the discounted sum of these locked-in payoffs:

$$CV_{jm,T^{\text{Lock}}+1}(s_j, s_{-j}) = \frac{1 - \delta^{n_{\text{buffer}}}}{1 - \delta} \pi_{jm}(s_j, s_{-j}).$$

Beyond the buffer horizon, $CV = 0$. At the preferred discount factor $\delta = 0.9$, the six-period buffer captures approximately 47% of the infinite-horizon present value for firms in the final period ($\frac{1-\delta^6}{1-\delta} = 4.69$ versus $\frac{1}{1-\delta} = 10.0$).

Working backward from T^{Lock}, I compute the continuation values at each state pair (s_j, s_{-j}) using equations (7)–(10). Since the game is finite-horizon and each period's choice problem has a unique solution for any realization of shocks, the backward induction yields unique expected values at every state and period, conditional on the belief path for aggregate network evolution. This is analogous to the sequential equilibrium in Igami and Uetake (2019), who exploit the same finite-horizon and alternating-move structure to obtain uniqueness.

ONLINE APPENDIX G: DYNAMIC ESTIMATION SAMPLE CONSTRUCTION

MARKET AND TIME DEFINITIONS

A *market* is a city-field pair (c, f), where c indexes the city and $f \in \{\text{morning}, \text{evening}\}$ is the publication field. Morning and evening editions in the same city are treated as separate markets because they serve distinct reader segments and, historically, faced separate wire-contracting decisions. In the pre-1928 periods, about 1% of paper-years are coded as "All-Day"; they are recoded as "Evening" when no more precise time-of-publication information is available from subsequent years.

Time is in four-year periods: 1912, 1916, 1920, 1924, 1928, 1932, 1936, and 1940. A newspaper joining a wire service in year y is assigned to period $\lceil y/4 \rceil \times 4$. For example, a paper joining AP in 1911 is recorded as an AP subscriber in the 1912 cross-section; a paper joining in 1913 first appears in 1916.

Each four-year period is split into two periods following the alternating-move structure of the dynamic model (Online Appendix F). In the *entry period* (odd time index), nature selects a potential entrant to decide whether to enter and, if so, with which wire bundle. In the *update period* (even time index), nature selects an incumbent to decide whether to change its wire membership. With a start year of 1912 and eight census years, the panel has $T = 16$ periods.

The first entry period ($t = 1$) captures the transition from 1908 to 1912. The lagged state at $t = 1$ is the market structure observed in 1908; this serves as the initial condition for the dynamic game. After the last data period (1940), firms are locked into their terminal state for three additional four-year periods (1944, 1948, 1952), earning their current flow payoff minus ongoing costs with no further moves permitted. This lock-in continuation value serves as the terminal condition for backward induction.

NEWSPAPER UNITS: FRANCHISES

The unit of observation on the firm side is the *franchise*, not the individual newspaper. A franchise groups physical newspapers (identified by GSS permanent IDs) that represent continuity of a wire subscription. Three types of links define a franchise:

1. *Explicit succession links.* The GSS records a "next permanent ID" field when a newspaper changes its title or merges with another publication.

2. *Library of Congress collection matches.* Papers sharing the same LoC collection identifier are linked, capturing title changes that the GSS succession field may miss.

3. *Wire-bundle churn matches.* When a paper exits and another enters the same city-field in the same period, and both carry at least one common wire service (or both carry none), they are linked as a presumed continuation.

Single-year franchises (those appearing in only one census cross-section and entering before 1940) are dropped. When a succession link merges two papers that carry different wires (e.g., one with AP and one with UP), a new resulting franchise is credited as an entrant with the union of their bundles (AP+UP).

TWO-PLAYER MARKET REDUCTION

The dynamic model uses two-player markets with stochastically alternating moves. In the estimation window, 96.6% of market-years have at most two simultaneously active franchises. For markets that exceed two firms in any period, I apply the following reduction:

1. *Drop large metros.* Five cities—New York (Manhattan), Los Angeles, Boston, Chicago, and San Francisco—are dropped unconditionally.

2. *Select two representative firms.* For remaining markets with more than two simultaneous firms, I retain the longest-tenured AP subscriber and the longest-tenured UP subscriber. When both exist, this preserves within-market AP-versus-UP variation. If only one wire is present, the remaining slot goes to the firm with the highest mean market share across all years. If neither wire is present, both slots are filled by the two firms with the highest mean market shares across all years.

STATE, MOVER, AND ACTION ASSIGNMENT

For each market-period, the panel records the market state, the identity of the mover, and the chosen action.

State. The market state is a pair of wire bundles, one per firm slot (inactive if the slot is vacant). When a new firm enters into a vacant slot, it inherits that slot.

Entry periods. In the entry period, the mover is the firm in the vacant slot. The action is either to stay out or to enter with a chosen wire bundle. If no slot is vacant (both incumbents are active), no entry period is recorded.

Update periods. In the update period, the mover is an active incumbent. Priority goes to firms whose wire bundle changes. If no firm changes state, the first active incumbent (by slot index) is recorded as the mover, with the action equal to its unchanged wire bundle.

Simultaneous moves. The alternating-move structure assigns one mover per period. In 22 market-periods (0.09%), both firms enter within the same four-year interval; in 9 additional cases, both incumbents change wire bundles. Because each period can attribute a decision to only one mover, the second firm's change is not recorded.

SAMPLE CHARACTERISTICS

The resulting 1912-start estimation panel contains 2,070 markets observed over up to 16 periods, yielding 26,337 market-period observations. The panel is unbalanced: entry periods are omitted

when both firm slots are occupied (no vacancy to fill), and update periods are omitted when both slots are vacant (no incumbent to move).

Of the 26,337 observations, 14,567 (55%) are entry periods and 11,770 (45%) are update periods. In entry periods, 89.5% of movers choose to stay out. Among those who enter, the most common bundles are no wire (5.99%), AP only (2.83%), and UP only (1.11%). In update periods, the diagonal transition rates are high—incumbents typically retain their current bundle—ranging from 84% (AP+INS, bundle 6) to 97% (AP+UP+INS, bundle 7).

Exclusion violations—market-periods where both firms carry the same wire service—account for 1.5% of observations. These arise because the two-player reduction occasionally assigns both slots to firms that happen to share a wire, or because the irreversibility constraint produces markets where both incumbents accumulate the same bundle over time.

ONLINE APPENDIX H: STATIC-VALUE-SURFACE AND FLOW-PAYOFF APPROXIMATION

Estimating the dynamic entry model requires evaluating equilibrium variable profits v_{jmt}^* for every market-time-bundle combination considered during backward induction. For speed, I pre-compute a smooth approximation of the profit function and evaluate it at each required point.

Sufficient statistics for variable profit

The key observation is that, conditional on market structure, the equilibrium variable profit of a newspaper depends on its characteristics only through three variables:

1. δ_{jmt}^R: the mean reader utility of newspaper j excluding the price term (i.e., $g(W_{jmt}) + \beta_{\mathrm{INS}} INS_{jmt} + X_{mt}^\top \gamma + \bar{\xi}_{jm} + \xi_{jmt}$),

2. δ_{jmt}^A: the advertising demand shifter (the non-share components of $\log a_{jmt}$ in the advertising revenue equation of the main text),

3. MC_{jmt}: the marginal cost of producing a copy.

This follows because, given market structure (monopoly or duopoly) and the competitors' characteristics, the Bertrand-Nash equilibrium prices, market shares, advertising revenues, and profits are deterministic functions of (δ^R, δ^A, MC). I define the *static value surface* as the mapping

$$\tilde{v} : (\delta^R, \delta^A, MC) \mapsto v^*,$$

separately for monopoly and duopoly market structures. In duopoly, the mapping takes a six-dimensional input (three statistics for each firm) and returns profits for both firms.[3]

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[3]Bertrand-Nash duopoly pricing equilibria need not be unique in general. The fixed-point iteration is initialized at marginal cost, selecting a single equilibrium when multiple exist.

Chebyshev polynomial approximation

I approximate the static value surface using Chebyshev polynomials. For monopoly, I construct a tensor-product grid of Chebyshev-Gauss-Lobatto nodes spanning the empirically relevant range of each sufficient statistic:

Dimension	Bounds	Nodes	Role
δ^R	$[-3, 3]$	15	Reader demand shifter
δ^A	$[1.0, 3.5]$	8	Advertising demand shifter
MC	$[-2, 22]$	5	Marginal cost
Total (monopoly)		600	

The bounds are chosen to cover the range of estimated values from the demand system and cost recovery, with margin for extrapolation. Chebyshev-Gauss-Lobatto nodes cluster near the boundaries of each dimension, minimizing interpolation error for smooth functions relative to a uniform grid of the same size.

At each grid point, I solve the Bertrand-Nash pricing equilibrium numerically using fixed-point iteration on best responses, with a derivative-free optimizer as a fallback for non-converged cases. Because the tensor-product Chebyshev grid is complete, the monopoly profit and price functions are fitted by exact Chebyshev interpolation on the grid nodes.

For duopoly, the input space is six-dimensional (three statistics per firm). A full tensor-product grid would be prohibitively large, so I instead use a Smolyak sparse grid over the same per-dimension bounds and fit the profit function by least squares on the Chebyshev basis. The solver finds the simultaneous best-response equilibrium for both firms at each sparse grid point.

Approximation quality

I evaluate the approximation by drawing 10,000 uniformly random test points within the grid bounds, solving the equilibrium exactly at each, and comparing the polynomial approximation to the exact solution. The out-of-sample R^2 for the duopoly profit approximation is 0.9995; for duopoly prices it is 0.9999.

ONLINE APPENDIX I: CALIBRATED NON-WIRE EXIT PROBABILITY

Incumbent exit is modeled as an exogenous stochastic event that occurs between periods.

Movers anticipate the opponent's exit probability $q_{m,t}$ when computing continuation values: the expected future value is a mixture over the opponent staying and the opponent exiting.

CALIBRATION. Exit probabilities are calibrated directly from the entry estimation sample rather than estimated jointly with the cost parameters. I compute the fraction of incumbent movers in update periods whose observed action is market exit, stratified by population tercile and era. Population terciles are assigned within each era to account for secular population growth over the sample period.

We observe an overall exit rate of approximately 6.9% in our study sample. Due to the construction of the data, all exits are either among non-wire papers or via merger of wire papers. Table 2 reports the nine calibrated exit probabilities.

TABLE 2: CALIBRATED EXIT PROBABILITIES BY POPULATION TERCILE AND ERA

| | Population tercile | | |
Era	Low	Mid	High
Early (1908–1916)	0.072	0.069	0.059
Mid (1920–1928)	0.077	0.111	0.086
Late (1932–1940)	0.039	0.048	0.063
Overall		0.069	

Notes: Each cell reports the share of incumbent movers in update periods whose observed action is market exit. Population terciles are computed within each era using log city population.

ONLINE APPENDIX J: VARIABLE PROFIT GOODNESS OF FIT

This appendix reports implied objects from the demand and advertising estimates to verify that the model produces economically reasonable magnitudes. Figure 4 collects six diagnostics.

Panel (a) plots the distribution of implied own-price elasticities. The reader-side elasticity has a median of -0.64; including the advertising revenue channel raises the median to -1.56, as a price increase reduces both reader demand and the per-reader advertising revenue that newspapers internalize. Panel (b) translates these into variable profit gains relative to a no-wire newspaper in a representative market (Cleveland morning, $MC = \$14.04$): AP yields about a 14–24% profit advantage, while UP ranges from roughly 13% to 20%.

Panels (c) and (d) report implied marginal costs and markups. Marginal costs increase with city size, from \$5 in the smallest population decile to \$14 in the largest. Markups decline modestly with competition: \$11 for monopolists versus \$10 for three-paper markets.

Panels (e) and (f) report per-reader advertising revenue. Advertising revenue increases with city size (\$11 to \$18.50) and with the number of competitors (\$12.50 for monopolists to \$17 for three-paper markets), consistent with larger markets supporting both more newspapers and deeper advertiser demand.

FIGURE 4: DEMAND AND SUPPLY-SIDE DIAGNOSTICS. ALL DOLLAR VALUES IN 1928 DOLLARS.
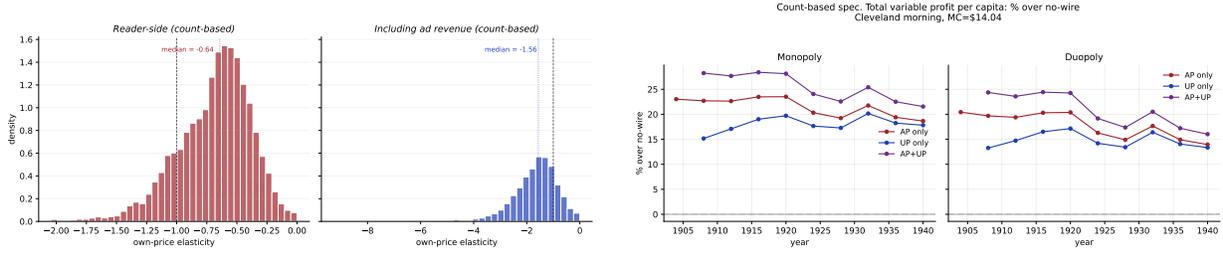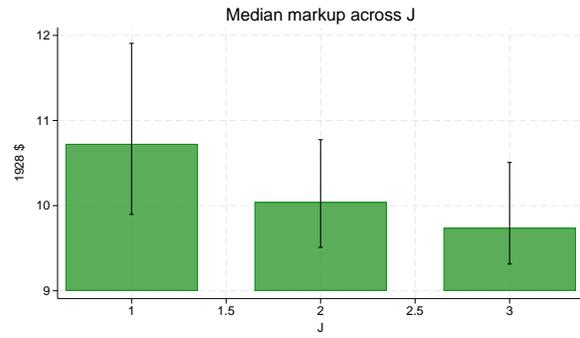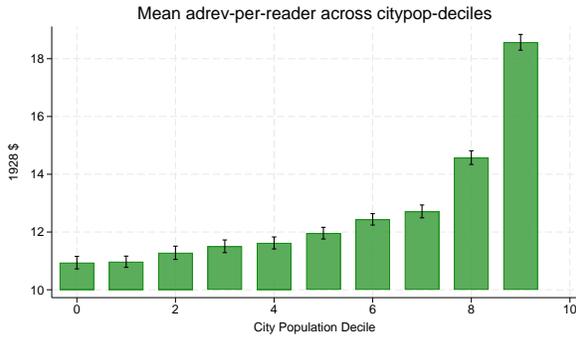

(a) Own-price elasticities

(b) Variable profit % over no-wire
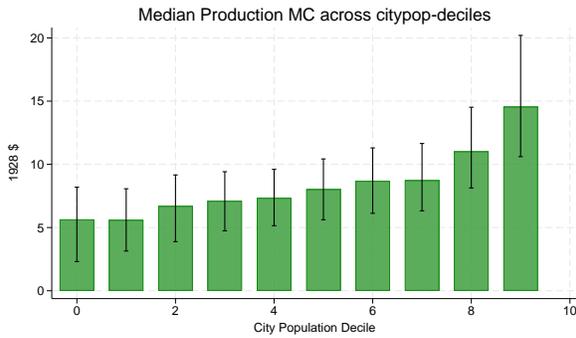
(c) Marginal cost by population decile

(d) Markup by number of newspapers

(e) Ad revenue by population decile
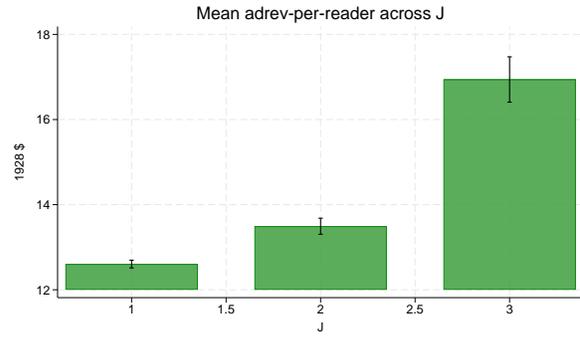
(f) Ad revenue by number of newspapers

ONLINE APPENDIX K: ALTERNATIVE DEMAND NORMALIZATIONS AND ROBUSTNESS

ALTERNATIVE DEMAND NORMALIZATIONS

Table 3 reports the count-based logit IV demand specification under three alternative AP-UP wire-intercept controls: no wire intercept, an "any wire" intercept, and a "number of wires" intercept. Wire controls refer only to AP and UP; INS enters separately as its own indicator.

Table 4 reports the analogous population-based specification under the same three AP-UP wire-intercept controls. Table 5 summarizes the implied redundancy estimates across the count-based and population-based specifications.

TABLE 3: READER DEMAND ESTIMATES UNDER ALTERNATIVE AP-UP WIRE INTERCEPTS

Variable	Parameter	(1) No dummy	(2) Any wire	(3) Num. wires
Price	α	-0.134	-0.134	-0.134
		(0.018)	(0.018)	(0.018)
Network strength	β_1	0.045	0.038	0.032
		(0.003)	(0.022)	(0.020)
Indicator for at least one wire	β_0^{any}		0.041	
			(0.135)	
Number of wires	β_0^{num}			0.080
				(0.123)
Redundancy	κ	0.846	0.815	1.170
		(0.107)	(0.171)	(0.717)
INS	β_{INS}	0.265	0.264	0.264
		(0.041)	(0.041)	(0.041)
Log city population	γ_{pop}	-0.520	-0.519	-0.518
		(0.057)	(0.057)	(0.057)
Franchise FE		Yes	Yes	Yes
Year $\times$ Time of Publication FE		Yes	Yes	Yes
Pop Decile FE		Yes	Yes	Yes
F		47.56	47.49	47.46
Observations		16,672	16,672	16,672

Notes: Table reports the count-based logit IV demand specification under three alternative AP-UP wire-intercept controls: no wire intercept, an "any wire" intercept, and a "number of wires" intercept. Wire controls refer only to AP and UP; INS enters separately as its own indicator. The specification includes franchise fixed effects, year $\times$ edition fixed effects, population-decile fixed effects, and log city population. Subscription price is instrumented with year-interacted delivered city-year newsprint prices. Standard errors clustered by city-year are in parentheses.

		(1)	(2)	(3)
Variable	Parameter	No dummy	Any wire	Num. wires
Price	α	-0.134	-0.134	-0.134
		(0.018)	(0.018)	(0.018)
Network strength	β_1	0.016	0.054	0.036
		(0.001)	(0.032)	(0.029)
Redundancy	κ	0.818	0.951	0.382
		(0.106)	(0.046)	(0.299)
Indicator for at least one wire	β_0^{any}		-0.653	
			(0.557)	
Number of wires	β_0^{num}			-0.336
				(0.499)
INS	β_{INS}	0.262	0.264	0.263
		(0.041)	(0.041)	(0.041)
Log city population	γ_{pop}	-0.515	-0.521	-0.519
		(0.057)	(0.057)	(0.057)
Franchise FE		Yes	Yes	Yes
Year $\times$ edition FE		Yes	Yes	Yes
Pop decile FE		Yes	Yes	Yes
Kleibergen-Paap F		47.60	47.60	47.59
Observations		16,672	16,672	16,672

Notes: Table reports the population-based logit IV demand specification under three alternative AP-UP wire-intercept controls: no wire intercept, an "any wire" intercept, and a "number of wires" intercept. Wire controls refer only to AP and UP; INS enters separately as its own indicator. The specification includes franchise fixed effects, year $\times$ edition fixed effects, population-decile fixed effects, and log city population. Subscription price is instrumented with year-interacted delivered city-year newsprint prices. Standard errors clustered by city-year are in parentheses.

TABLE 5: REDUNDANCY ESTIMATES ACROSS DEMAND NORMALIZATIONS

Specification	Wire intercept	Estimate	SE
Count-based	None	0.846	(0.107)
Count-based	Any wire	0.815	(0.171)
Count-based	Num. wires	1.170	(0.717)
Population-based	None	0.818	(0.106)
Population-based	Any wire	0.951	(0.046)
Population-based	Num. wires	0.382	(0.299)

Notes: Table reports the implied redundancy parameter κ across the count-based and population-based logit IV demand specifications under the three alternative AP-UP wire-intercept normalizations.

ONLINE APPENDIX L: VALIDATION AGAINST OBSERVED AP AND UP PAYMENTS

This appendix compares model-implied wire costs to observed newspaper payments to AP and UP. The entry cost model produces per-city, per-period wire costs in per-capita dollar units. These are compared cross-sectionally to observed assessment records: AP assessments in 1926 and UP contract data in 1911 and 1926–1932. For each cross-section, I match cities that appear in both the model's estimation sample and the payment records, then compare per-capita model costs to per-capita observed rates.

CROSS-SECTIONAL CORRELATIONS

Table 6 reports rank correlations and log-log OLS relationships between model-implied wire costs and observed per-capita payments across cities. The model's cross-sectional predictions align well with the payment data, particularly for UP. The Spearman rank correlation is 0.65 for AP in 1926 ($n = 464$ cities) and 0.86 for UP in 1932 ($n = 33$ cities). Pooling UP data across 1926–1932 yields a rank correlation of 0.81 ($n = 44$ cities). The log-log OLS R^2 ranges from 0.41 (UP 1911) to 0.63 (UP 1932), indicating that the model explains a substantial share of the cross-sectional variation in wire payments even though payment data played no role in estimation.

TABLE 6: MODEL COST VS. OBSERVED PAYMENT: CROSS-SECTIONAL CORRELATIONS

			Rank	Log-log OLS	
Wire	Year	n	Spearman ρ	Slope (SE)	R^2
AP	1926	464	0.650	1.66 (0.08)	0.46
UP	1911	33	0.640	3.06 (0.66)	0.41
UP	1932	33	0.855	1.73 (0.24)	0.63
UP	1926–1932	44	0.807	1.79 (0.23)	0.60

Notes: The dependent variable is log total per-capita wire payment (in 1928 dollars); the independent variable is the log model-implied per-capita wire cost. AP assessments are from the 1926 AP assessment ledger; UP data are from individual UP newspaper contracts. The 1911 UP cross-section uses model costs from the first estimation period (1912). The 1926–1932 UP panel averages observed rates within city across years and uses interpolated 1929 model costs.

SCATTER PLOTS

Figure 5 plots model costs against observed per-capita payments in levels. The OLS fit line (red) and the 45-degree line (dashed) are overlaid.

FIGURE 5: MODEL COST VS. OBSERVED PER-CAPITA PAYMENT. LEFT: AP, 1926 ($n = 464$). RIGHT: UP, 1932 ($n = 33$).
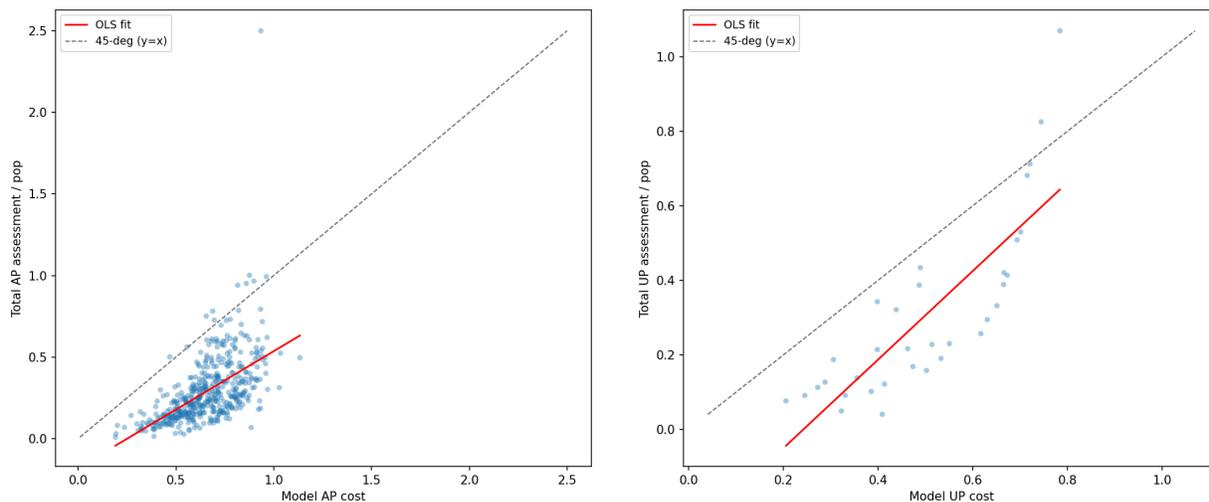
ONLINE APPENDIX M: SENSITIVITY OF COUNTERFACTUAL TO CALIBRATED μ

This appendix reports the sensitivity of the counterfactual results to the calibrated nesting parameter μ, which governs substitution across wire-service options. In the main text, $\mu = 0.25$ is calibrated from the ratio of wire-service assessments to total newspaper operating costs in mid-1920s accounting data. Because μ is not identified from the estimation data, I verify that the headline counterfactual findings hold across $\mu \in \{0.25, 0.75, 0.9, 1.0\}$, spanning a broad range from substantial within-wire substitution to the flat logit.

For each value of μ, I re-estimate all entry cost parameters and re-run the forward simulation under both the baseline (exclusive territory contracts) and counterfactual (free entry) regimes, holding demand-side estimates fixed. Table 7 reports predicted total UP membership at the 1940 endpoint of the baseline simulation and at the 1940 endpoint of the counterfactual.

TABLE 7: SENSITIVITY OF COUNTERFACTUAL UP MEMBERSHIP TO CALIBRATED μ

μ	Baseline N_{UP}	Free entry N_{UP}	% Δ
0.25	*452*	*39*	*−91*
0.75	336	43	−87
0.90	256	47	−82
1.00	239	51	−79

Note: Each row re-estimates entry cost parameters at the indicated μ and solves for the converged fixed point in the forward simulation. All columns report 1940 endpoint values. "Baseline" is the exclusivity regime; "Free entry" removes AP exclusive territory contracts. N_{UP} is predicted total UP newspaper membership from the converged fixed-point network counts, including the residual network outside the estimation sample. Observed total UP membership in 1940 is 673. The row in italics ($\mu = 0.25$) is the calibration used in the main text.

The baseline predictions illustrate how μ governs the model's allocation of entrants across wires. Higher values of μ dampen within-wire substitution and reduce predicted UP adoption in 1940. The calibrated $\mu = 0.25$ implies substantially more UP adoption than the higher-μ alternatives, but all specifications deliver the same qualitative counterfactual.

The central result—that removing exclusive territory contracts collapses UP—is robust across the calibrations reported in the table. UP membership falls by 79 to 91 percent, with the decline larger at lower μ where wire options are closer substitutes and the departure of forced-UP newspapers triggers a stronger cost-side feedback spiral. Even at $\mu = 1$ (the flat logit case with no within-nest correlation), UP membership falls by nearly 80 percent.

Because the market structure changes under free entry—near-complete exit from UP, expanded AP membership, increased local competition—are qualitatively identical across μ, the direction of the consumer welfare gains and AP incumbent profit losses reported in the main text is likewise robust.

ONLINE APPENDIX N: EQUILIBRIUM MULTIPLICITY IN THE FORWARD ITERATION

The forward iteration computes a fixed point of the mapping from aggregate network beliefs—wire service membership and readership—to market-level entry and adoption decisions. Because persubscriber wire cost falls with the number of subscribers, this mapping can admit multiple fixed points. To explore the robustness of the main counterfactual to the choice of starting beliefs, I initialize the iteration from two starting points: (i) observed network variables, used in the main text, and (ii) maximal UP beliefs, in which every sample market subscribes to UP and UP readership equals the total sample population.

Table 8 reports the converged total number of UP papers in 1940 under each initialization, for both the baseline (exclusive territory contracts) and counterfactual (free entry) regimes.

TABLE 8: EQUILIBRIUM MULTIPLICITY IN THE FORWARD SIMULATION

	N_{UP}, 1940	
	Observed start	Maximal UP start
Baseline	452	953
Free entry	39	99
% Δ	-91	-90

Note: Each column reports the converged fixed point of the forward iteration initialized from different network beliefs. "Observed start" uses observed wire service membership and readership as initial beliefs. "Maximal UP start" initializes UP membership at the total number of sample markets (2,045) and UP readership at the total sample population (66.3 million), with AP at observed levels. Reported totals add back the observed residual network outside the estimation sample. Both columns converge to tolerance $\varepsilon < 0.01$ in relative network variable changes. The row "% Δ" reports the percentage change from baseline to free entry within each equilibrium.

Both regimes admit two equilibria. In the high-UP equilibrium, a larger UP network lowers per-subscriber wire cost, sustaining more UP papers. Nevertheless, the qualitative finding is robust:

removing AP exclusive territory contracts causes UP membership to collapse by about 90 percent under both equilibria. The counterfactual results reported in the main text use the observed-start equilibrium.

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