Competition and Ideological Diversity:
Historical Evidence from US Newspapers

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November 2012

Abstract

We use data on US newspapers from the early 20th century to study the economic incentives that shape ideological diversity in the media. We show that households prefer like-minded news, and that newspapers seek both to cater to household tastes and to differentiate from their competitors. We estimate a model of newspaper demand, entry and political affiliation choice in which newspapers compete for both readers and advertisers. We find that economic competition enhances ideological diversity, that the market undersupplies diversity, and that incorporating the two-sidedness of the news market is critical to evaluating the effect of public policy.

JEL classification: L11, L52, L82
Keywords: entry models, differentiation, media, two-sided markets, advertising

*We are grateful to Alan Bester, Ambarish Chandra, Tim Conley, Christian Hansen, Igal Hendel, Caroline Hoxby, Jon Levin, Kevin Murphy, Andrei Shleifer, E. Glen Weyl, and numerous seminar participants for advice and suggestions, and to our dedicated research assistants for important contributions to this project. This research was funded in part by the Initiative on Global Markets, the George J. Stigler Center for the Study of the Economy and the State, the Ewing Marion Kauffman Foundation, the Centel Foundation / Robert P. Reuss Faculty Research Fund, the Neubauer Family Foundation and the Kathryn C. Gould Research Fund, all at the University of Chicago Booth School of Business, the Social Sciences and Humanities Research Council of Canada, and the National Science Foundation. E-mail: gentzkow@ChicagoBooth.edu, jesse.shapiro@ChicagoBooth.edu, msink@wharton.upenn.edu.

1 Introduction

Economists have long been concerned with the optimal amount of product diversity in the marketplace (Dixit

paper markets rise by a fourth, readership falls significantly, and entry increases only slightly. Softer price competition reduces the incentive to differentiate. Losses to consumer surplus and advertiser profit are only partly offset by a small gain in newspaper profit, and the share of households who read diverse papers falls by a fifth.

Allowing newspapers to set *advertising* prices jointly has a very different effect, increasing both economic welfare and diversity. Advertising prices rise, leading circulation prices to fall as newspapers compete intensely for eyeballs (Rochet and Tirole 2006). Entry increases dramatically. The incentive to differentiate from competitors weakens, but only slightly. Consumer surplus increases by almost half, significant profit is transferred from advertisers to newspapers, and the share of households who read diverse papers more than doubles. The contrasting effects of circulation and advertising price collusion highlight the importance of accounting for the two-sided nature of media markets in policy evaluation.

When newspapers are allowed to form "joint operating agreements" in which they set both circulation and advertising prices jointly, as has been permitted selectively under US law since the Newspaper Preservation Act of 1970, the advertising effect dominates, and both economic surplus and diversity increase.

The second policy we consider is regulation of joint ownership. In our model, allowing the potential entrants in a market to be co-owned has three effects. First, it allows newspapers to jointly set circulation and advertising prices. Second, it allows newspapers to internalize business-stealing effects of their entry and affiliation decisions. Third, it subjects newspapers to a common, rather than independent, shock to their cost of choosing different affiliations. We find that the net effect of allowing joint ownership is to significantly reduce newspaper entry, which in turn reduces both economic welfare and diversity.

The final policies we consider are explicit subsidies. Motivated by the structure of existing policies, we consider two types of subsidies: a fixed cost subsidy to second entrants (similar to a policy currently in force in Sweden), and a marginal cost subsidy to all newspapers (similar to postal subsidies which were long provided to US newspapers). For each type of subsidy, we compute the magnitude of subsidy that maximizes total surplus, ignoring political externalities. We find that both types of subsidies can increase economic welfare and diversity. The marginal cost subsidy in particular produces the same benefits as allowing advertising collusion, and among the policies we consider it is the most effective at increasing both economic welfare and ideological diversity.

Our work builds on other empirical models of entry and product positioning with explicit demand systems (Reiss and Spiller 1989, Einav 2007 and 2010, Draganska et al. 2009, Seim and Waldfogel forthcoming, Fan forthcoming). Like Fan (forthcoming), we study a news market with both subscription and advertising sides. An important difference between our model and past work is that we allow for unobserved market characteristics in addition to idiosyncratic firm-level shocks.

Our paper also contributes to the literature on two-sided markets. Consistent with recent theoretical work (Armstrong 2002, Ambrus and Reisinger 2006, Anderson et al. 2011), we find that the nature of advertising competition depends crucially on the extent to which consumers read multiple newspapers. We show that this force, in turn, has an important effect on firms' incentive to differentiate from their competitors.[1] Along with Fan (forthcoming) and Jeziorski (2012), ours is among the first empirical studies to estimate a microfounded model of advertising competition. In this sense, we extend past empirical work by Rysman (2004),

[1] Gabszewicz, et al. (2001, 2002), Kind et al. (2011), and Antonielli and Filistrucchi (2012), study the theoretical determinants of product differentiation in two-sided markets assuming each consumer can only consume a single product. Our results illustrate that the effect of advertising competition on differentiation is qualitatively different when consumers can consume multiple products, as suggested by Anderson et al. (2010).

Kaiser and Wright (2006), Argentesi and Filistrucchi (2007), Wilbur (2008), Chandra and Collard-Wexler (2009), Sweeting (2010), and others.

Topically, our paper is most closely related to research on the incentives that shape the political orientation of the news media. Gentzkow and Shapiro (2010) use a similar framework to study ideological

title, city, and time of day. Gentzkow et al. (2011) provide details on data collection and validation of data quality.

We define a time-constant affiliation for each newspaper, classifying a newspaper as Republican if it

cases the examination period is shorter or ends in 1923. We obtained the reports on microfilm from ABC and converted them to machine-readable text. This is, to our knowledge, the first dataset with disaggregated information on circulation for a large number of newspapers prior to the late twentieth century.

From each audit report we extract the newspaper's name, location, and circulation in each town that receives "25 or more copies daily through carriers, dealers, agents, and mail." We compute total circulation by town across all editions of the same paper and average circulation by town across all audit reports (if more than one edition or audit report is available).

We match newspapers in the ABC data to those in the US Newspaper Panel using the newspaper's name and location. We construct a cross-section of towns with at least one matching circulating newspaper. For computational reasons, we exclude 52 towns in which more than 10 newspapers are available. Not all newspapers are represented in the ABC data. In appendix D we present results excluding towns for which newspapers headquartered nearby are not represented in the data.

We match towns to 1990 Census place codes using town and state name, and we use place codes to match towns to counties. We exclude towns that we cannot successfully match to Census geographies, and a small number for which we do not have county presidential voting data.

Table 2 presents summary statistics for the towns in our sample. Our sample includes 12;188 towns, in 8;044 of which more than one daily newspaper circulates. Overall, 53 percent of multi-paper towns are ideologically diverse in the sense of having at least one Republican and at least one Democratic newspaper available.

As we detail below, formal estimation of our model requires identifying pairs of geographically proximate towns. We construct such pairs using the same algorithm that we use to construct pairs of markets (see section 2.1).

obligations. The individual journal was the organ of the political community, and commissioned with the task of expressing the group's ideas and its interests" (23). In the rare event that a newspaper deviated from the party line, they could be severely punished.[2] Consistent with this narrative evidence, Gentzkow et al.

more likely to be available in towns with more Republican households, these two effects tend to work in opposite directions. Therefore, we expect that specification (1) understates the effect of household ideology and specification (2) understates the importance of substitutes. Specification (3) shows that, as expected, both effects are estimated to be larger when the regression includes measures of both household ideology and the presence of substitutes.

In the supplemental appendix, we show that the two effects illustrated by specification (3) are robust to a number of alternative specifications. We show that the effect of household ideology survives detailed controls for the configuration of the choice set, and that the estimated substitution effects strengthen when we control more carefully for area characteristics. We also show that both the effect of household ideology and the effect of substitutes are robust to a specification with both newspaper and town fixed effects, and to controlling for non-political attributes of both newspapers and towns. Finally, we show that qualitatively similar patterns emerge when we study changes in circulation over time rather than in the cross-section.

The estimated relationships in specification (3) are economically significant. Increasing the fraction Republican among voters by 10 percentage points increases the relative circulation of Republican papers by 10 percent. 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 percent.

Figure 1 illustrates the key patterns in specification (3) of table 3 graphically. The relative readership of Republican papers is increasing in the Republican vote share. In addition, for any vote share, the average Republican paper garners more readership when the majority of its competitors are Democratic.

4.2 Determinants of Newspapers' Affiliation Choices

Given that households demand own-type newspapers and that same-type papers are more substitutable, we would expect that newspaper affiliation would respond both to household ideology and to market structure.

Table 4 shows that these expectations are borne out in our data. The table presents OLS regressions of a dummy for whether a newspaper chooses a Republican affiliation on measures of household ideology and incumbent affiliations. Specification (1) includes only household ideology, specification (2) includes only incumbent affiliations, and specification (3) includes both.

The more Republican are the households in a market, the more likely is an entering paper to choose a Republican affiliation. However, facing a Republican incumbent reduces the likelihood that an entering paper affiliates with the Republican party. Because Republican incumbents are more likely in markets with more Republican households, these two effects tend to work in opposite directions. Therefore, we expect that specification (1) understates the effect of household ideology, and specification (2) understates the effect of incumbent affiliation. Specification (3) shows that, as expected, both effects are estimated to be larger when the regression includes measures of both household ideology and incumbent affiliations.

In appendix B we exploit the panel nature of our data to show that the correlation between household ideology and newspaper affiliation decisions is not driven by reverse causality from newspaper content to voter behavior, and to show that it is robust to a number of alternative specifications.

The effects we estimate in specification (3) are economically significant. A 10 percentage point increase in the fraction Republican among households increases the likelihood of a Republican affiliation by 23 percentage points. Having a Republican incumbent instead of a Democratic incumbent reduces the likelihood of a Republican affiliation by 28 percentage points.

in any case these commodities were traded nationally. The cost of hiring editors or reporters could be affiliation-specific, but the market for such talent was geographically broad. For example, in 1920, 49 percent of prime-age (25-55) white male journalists lived in a state other than their state of birth, as against 33 percent for all prime-age white males (Ruggles et al 2010). Common ownership of newspapers in different markets is a final possible source of correlation. In appendix D we show that removing the small number of market pairs with common ownership makes little difference to our results.

Finally, we must take a stand on the extent of spatial correlation in the unobservable component of ideology. Appendix figure 1 shows that the observable component is strongly, but not perfectly correlated at distances of 100 400 kilometers. If we assumed that the unobservable component were perfectly correlated, our approach would be analogous to a fixed effects or difference-in-difference strategy. Instead, we

cost, and k_m is a market-specific fixed cost. A newspaper privately observes its own x_{jm} after entry decisions are made, at the beginning of the second stage; these shocks are the only private information in the model. We assume that $x_{jm}(t_{jm})=s_x$ is distributed mean-zero type-I extreme value, where $s_x > 0$ is a constant. We assume that $k_m=S_m$ is distributed logistic with scale parameter s_k and location parameter $m_k^0 + m_k^1 \log(S_m)$.

The profits of each advertiser are equal to $\sum_i \mathbf{1}_{n_{im} \quad 1}[a_h + (n_{im} \quad 1)a_l]$, where n_{im} is the number of newspapers read by i that contained the advertiser's ad, $\mathbf{1}$ denotes the indicator function, and $0 \quad a_l \quad a_h$. The difference between a_l and a_h captures the extent of diminishing returns in advertising impressions.

The utility of household i in market m from consuming a bundle of newspapers B is given by

$$u_{im}(B) = \sum_{j2B} \underline{b}\mathbf{1}_{q_{im}<t_{jm}} + \bar{b}\mathbf{1}_{q_{im}=t_{jm}} \quad a p_{jm} \quad g(B)G + e_{im}(B); \tag{2}$$

where $g(B)$ is the number of distinct two-newspaper subsets of bundle B such that the two newspapers have

An equilibrium of the entry stage in market m is a number J such that, in expectation, entering newspapers are profitable but a marginal entrant would not be. That is,

$$V_m(J) \quad \frac{k_m}{S_m} > V_m(J+1); \tag{7}$$

for $J \in \{1,\ldots,J^{max}-1\}$. If J

duplicated with other newspapers. The model allows for the case of zero return to duplicate impressions ($a_l = 0$) as well as the case of no diminishing returns ($a_h = a_l$).

The prediction of diminishing returns to duplicate impressions fits with narrative evidence from the period we study. It was common for advertisers to assess the duplication in readership across publications when considering where to place ads, and to consider duplicate impressions to the same household to be less

system are robust to allowing flexibly for variation in quality at the newspaper level.

The demand model also ignores horizontal differentiation that is not political in nature. As the Scripps quote in section 3 makes clear, newspapers differentiated along dimensions such as time of publication as well as political affiliation. Consistent with Scripps' prediction, among newspapers in two-paper markets in our data, the majority of those that have the same affiliation publish at different times of day, and the majority of those that have different affiliations publish at the same time of day. Our model of affiliation choices should therefore be thought of as taking as given newspapers' opportunity to differentiate optimally on non-political dimensions given their political affiliations. Consequently, the logit errors in the model should be thought of as capturing the importance to consumers of non-political horizontal characteristics.

It is well known that using symmetric logit errors to account for unobserved horizontal differentiation can lead researchers to overstate the value of new goods (Ackerberg and Rysman 2005). In presenting our counterfactual analysis below, we discuss the extent to which the welfare conclusions rely on increases in the number of newspapers in the market beyond the numbers typically observed in the data.

Finally, we should note that the welfare implications of our model depend on a specific definition of the newspaper market. First, we assume that newspapers only compete with other newspapers headquartered in the same market, and we ignore circulation in hinterland towns in modeling newspapers' affiliation, pricing and entry choices. In 1924, home-market papers constituted 90 percent of circulation in news markets, and the average newspaper sold 65 percent of copies in its home market. In appendix D we show results from a subsample that excludes markets close to large cities. Second, we aggregate all substitutes for daily newspapers into an outside option whose prices and characteristics we do not model explicitly. We deliberately choose a period of study in which there were few such substitutes. In 1924, television did not exist and radio was in its infancy as a news source (Sterling and Kitross 2001). Although weekly newspapers and magazines existed and played an important role in the media market, neither conveyed the news on a daily basis, and neither weekly newspapers nor weekly magazines achieved total weekly circulation in excess of the total *daily* circulation of daily newspapers (Field 2006).

6 Demand Estimation

We estimate the parameters of equation 2 by maximum likelihood using circulation data from hinterland towns. We assume that measured circulation $\hat{Q}_{jt}$ of newspaper j in town t is equal to $q_{jt}S_t z_{jt}$, where q_{jt} is the share of households purchasing newspaper j, S_t is the number of households in town t, and z_{jt} is a measurement error with $\log z_{jt} \quad N\ 0; s_z^2$, i.i.d. across newspapers and towns.

To implement the spatial identification strategy outlined in section 4.3, we assume that the share r_t of consumers in town t with $q = R$ is unobserved and may be correlated within the pairs of neighboring towns defined in section 2.2. Specifically, we assume that $r_t = \text{logit}^{\ 1}(\text{logit}(Z_t) + n_t)$, where Z_t is the observed Republican vote share in t's county and n_t is a normally distributed unobservable with mean m_n^{town} and standard deviation s_n^{town}. The logit transformation ensures that $r_t\ 2\ (0;1)$. We assume that n is correlated (and jointly normal) between pairs of neighboring towns t and

To model the endogeneity of the choice set to town ideology, we assume that the probability that $t_{jt} = R$ is logit $^{1}\ m_r^0 + m_r^1 \text{logit}(r_t)$, where m_r^0 and m_r^1 are parameters to be estimated. In our main estimates, we treat J_t as non-stochastic. In appendix D we show that our results are robust to modeling J_t as a random variable whose distribution depends on r_t and the size of the town S_t, and to allowing more flexibility in the dependence of affiliations on r_t.

As in the descriptive analysis in section 4, we use as our dependent measure the difference between the mean log circulation of Republican newspapers and the mean log circulation of Democratic newspapers in each town t. We do this to scale out variation in population, which is likely to be poorly measured and therefore a significant source of economically uninteresting variation in observed circulation.

In addition to the dependent measure, the econometrician observes Z_t and the sets J_t^R and J_t^D of Republican and Democratic papers available in town t, respectively. Given some true ideology r_t, the conditional likelihood of the data for town t is:

$$(11) \qquad L_t(r_t) = \frac{1}{\tilde{s}_t} f\left(\frac{1}{\tilde{s}_t J_t^R} \sum_{j \in J_t^R} \log \frac{\hat{Q}_{jt}}{q_{jt}} - \frac{1}{\tilde{s}_t J_t^D} \sum_{j \in J_t^D} \log \frac{\hat{Q}_{jt}}{q_{jt}}\right) \Pr(t_t | r_t; J_t)$$

where f denotes the standard normal PDF and $\tilde{s}_t = s_z \sqrt{1/J_t^R + 1/J_t^D}$. The unconditional log likelihood of the observed data is:

$$(12) \qquad \ln L = \sum_{(t;t')} \ln \int_{r_t; r_{t'}} L_t(r_t) L_{t'}(r_{t'}) \, dF^{town}(r_t, r_{t'} | Z_t; Z_{t'})$$

where $F^{town}()$ is the conditional joint distribution of r_t and $r_{t'}$

Identification

Fixing the affiliations of available newspapers, the correlation shown in table 3 between the relative demand for Republican newspapers and the observed fraction Republican Z_t identifies $\bar{b}$ relative to $\underline{b}$. The share of households reading the newspaper in towns with Z_t 2 [0:45; 0:55] then pins down the levels of $\bar{b}$ and $\underline{b}$. Given these two parameters, observed monopoly markups in towns with Z_t 2 [0:45; 0:55] identify the price sensitivity parameter a. The strategy of inferring a from the newspapers' first order conditions rather than

the m subscripts. The unconditional log likelihood of the data is:

$$\ln L = \sum_{(m;m')} \ln \int_{r_m; r_{m'}} L_m(r_m) L_{m'}(r_{m'}) \, dF^{mkt}(r_m; r_{m'} | Z_m; Z_{m'}) \tag{14}$$

where $F^{mkt}()$ is the conditional joint distribution of r_m and $r_{m'}$ and the sum is taken over all pairs of neighboring markets.

We estimate the remaining parameters $\{a_I; s_x; m_n^{mkt}; s_n^{mkt}; m_k^0; m_k^1; s_k\}$ by maximizing equation 14, evaluating the integral numerically and taking as given the demand parameters $\{a; \underline{b}; \bar{b}; G\}$ estimated as described in section 6. Details are provided in appendix A.

Identification

The variance of unobserved ideology s_n^{mkt} is identified by spatial correlation in affiliation choices as outlined in section 4.3. The higher the correlation between the affiliation choices of newspapers in neighboring markets, the higher is the inferred value of s_n^{mkt}. The overall share of newspapers choosing a Republican affiliation pins down m_n^{mkt}.

Given these parameters, the relationship shown in table 4 between the numbers of Republican and Democratic incumbents and the choices of entrants identifies the advertising parameter a_I. This parameter captures the extent of diminishing returns in advertising, and thus the extent to which newspapers earn less on overlapping readers than singleton readers. Since readership overlaps more between two papers that have the same affiliation than between two papers of different affiliations, lower values of a_I correspond to a stronger incentive to differentiate.[6] Thus, a_I is identified by the extent to which newspapers differentiate more than would be expected from the demand system alone.

The scale term s_x is identified by residual variation in newspapers' affiliation choices.

The parameters of the fixed cost distribution are then pinned down by correlation between the number of newspapers and the market's population, which determines m_k^0 and m_k^1, and the extent of variation in the number of newspapers conditional on population, which determines s_k. The dispersion parameter s_k determines how much the equilibrium number of newspapers responds to changes in profits induced by the counterfactuals we consider.

Although this heuristic discussion of identification treats the different steps as separable, the supply parameters are in fact jointly determined and jointly estimated. In particular, this means that the entry stage partly "feeds back" into the identification of the post-entry parameters. The parameter a_I, for example, is identified in part by the observed distribution of the number of entrants, because it determines the extent to which per-newspaper profits decline with the number of newspapers.

[6] Overlap need not be greater between same affiliation papers, but it turns out to be given the large estimated difference between $\bar{b}$ and $\underline{b}$ in our demand model.

8 Results

8.1 Parameter Estimates

Table 7 reports estimates of demand model parameters. The qualitative patterns are consistent with our economic intuition and with the descriptive evidence in table 3. Households dislike higher prices. Households prefer newspapers whose affiliations match their own. Same-type newspapers are substitutes in demand. There is substantial unobserved heterogeneity in household ideology across towns, which in turn is correlated with the fraction of available newspapers that are Republican. The substantial unobserved heterogeneity likely reflects the fact that we only observe Republican vote share at the county level, and true ideology varies significantly across towns within a county. (In appendix C we show that this heterogeneity matters in the sense that estimates of several key parameters change meaningfully when we omit the unobservables from the model.)

Table 8 reports estimates of supply model parameters. Again, the qualitative patterns match expectations. Consistent with our economic model, advertising rates are lower for overlapping readers than for singleton readers, implying that advertising competition enhances the incentive to differentiate politically. We find some evidence of unobservable heterogeneity in household ideology, but it is less important than on the demand side, and we cannot reject the null hypothesis that the standard deviation of the unobservable is zero. The fact that unobservables are less important in the supply model than in the demand model may come from the fact that county vote share is a better proxy for the ideology of large markets than of small towns.

Our demand parameters imply significant overlap in the readership of competing newspapers. In simulation we find that in two-paper markets an average of 19 percent of those who read one paper also read the other. This magnitude is reasonable: in our detailed readership surveys we find an average overlap of 16 percent. Our demand parameters also imply that overlap is greater between newspapers of the same affiliation. In two-paper markets with same-affiliation papers, mean overlap is 20 percent; in two-paper markets with different-affiliation papers, it is 18 percent. In the supplemental appendix, we show evidence from the readership surveys that is consistent with this qualitative pattern.

The estimated parameters of the fixed cost distribution appear reasonable. In simulation we find that the mean fixed cost of monopoly newspapers is $8.88 per copy, as against $7.56 in the Inland Press data. The concept measured by the model incorporates sunk costs and opportunity costs that may not be reflected in financial data, so it is intuitive that the estimated fixed costs are somewhat higher than those in the Inland Press data. The model implies that fixed costs per capita decline very slowly with the size of the market: a ten percent increase in population reduces fixed costs per capita by only 6 cents. This is consistent with the Inland Press data, which show essentially no relationship between fixed costs per copy and the number of copies sold.

In the supplemental appendix, we present estimates of the main regression specifications in tables 3 and 4 using data simulated from the model at the estimated parameters. We also present a figure illustrating the fit of the entry model. These regressions and figure show that the estimated model fits key features of the data well.

8.2 Determinants of Diversity

Table 9 assesses how market forces determine the extent of political diversity in equilibrium. For our baseline model and each of a series of counterfactuals, we perform 5 independent simulations of the affiliation choices of all newspapers in our empirical sample. In these counterfactuals, we hold the number of newspapers in each market fixed to isolate the drivers of affiliation choices.

We define a newspaper market to be diverse if it has at least one Republican paper and one Democratic paper. We report the average across simulations of the number of markets with diverse papers, the share of households in a market with diverse papers, and the share of households reading at least one paper of each type. In simulations from our baseline model, 140 markets have diverse papers. This is slightly more than half of all multi-paper markets. Twenty-two percent of households live in a market with diverse papers, and 3.6 percent actually read at least one paper of each affiliation on a typical day.

In our first counterfactual, we assume that each entering newspaper chooses its affiliation as if it expected to be the only newspaper in the market. Comparing this case to the baseline provides a measure of the total effect of competition on diversity. The number of multi-paper markets that are diverse falls by nearly half, to 72. The share of households in a market with diverse papers falls to 12 percent, and the share of household reading diverse papers falls to 2.0 percent. This establishes one of our main results: the economic incentive to differentiate is a powerful force encouraging diversity.

In our second counterfactual, we assume that each entering newspaper chooses its affiliation as if its market had equal numbers of Republican and Democratic households. Comparing this case to the baseline captures the extent to which catering to consumer tastes tends to reduce diversity. Measures of diversity increase in this case by between a third and a half.

In our third counterfactual, we assume that each entering newspaper chooses its affiliation as if $x_{jm}(t_{jm}) = 0$ for all j, m, and t_{jm}. The cost shocks x_{jm} are simply a residual in the model, but one can interpret them as capturing the personal political preferences of owners, along with other idiosyncratic factors. Eliminating such factors would reduce the number of diverse markets from 140 to 104: a nontrivial reduction, but not as large as the effect of ignoring competitors.

In our fourth and final counterfactual, we assume that newspaper owners are randomly chosen from the households in the market and a newspaper's affiliation is simply its owner's affiliation. Under this scenario, the access to and readership of diverse papers are very close to the baseline values. Thus, the net effect of competition, catering to consumer tastes, and idiosyncratic preferences of owners, is that newspapers are broadly representative of their consumers.

8.3 Equilibrium and Welfare-Maximizing Outcomes

In the first column of table 10, we report market structure, prices, and welfare for our baseline model.[7] As in table 9, each reported value is the average over five simulations. We also repeat the baseline diversity statistics from table 9 in the final three rows for comparison with what follows.

[7] We define consumer surplus in market m as total realized utility divided by the marginal utility of money:

$$\sum_{i=1}^{S_m} u_{im}(B_i)/a \tag{15}$$

where B_i is the utility-maximizing bundle for household i and a is the price coefficient in our demand system. As with other elements of the demand system, we treat the population as large and assume that consumer surplus is equal to its expectation. We

Of the 960 markets in our baseline simulation with at least one newspaper, 250 have two or more. Thirty-eight percent of households read at least one newspaper. The average annual subscription price of

in each market.

The results in table 10 show that there is no conflict between the goal of maximizing economic welfare and the goal of maintaining diversity in the marketplace of ideas. Policies that increase entry, as well as policies which promote diversity conditional on entry, would likely increase economic welfare even if the political externalities to diversity were small.

8.4 Competition Policy

In table 11, we turn to the first of our policy counterfactuals: relaxation of antitrust rules. The most prominent such policy in the United States is the Newspaper Preservation Act of 1970, which allows newspapers in the same market to form "joint operating agreements" (Busterna and Picard, 1993). Papers in such agreements are allowed to make joint decisions about prices and advertising rates (and combine many of their back-office operations), on the condition that they remained editorially independent.

We model joint operating agreements by assuming that all entering newspapers choose their prices and advertising rates to maximize the sum of their profits.[9] We assume that entry and affiliation decisions continue to be made non-cooperatively. We assume that papers in joint operating agreements keep all of their own subscription revenue and that they share advertising revenue in proportion to their circulations.[10]

The first column of table 11 repeats our baseline results for reference. The second and third columns show the separate effects of allowing joint setting of circulation prices and advertising rates respectively.

Allowing price collusion reduces economic welfare and has little effect on diversity. Average prices in multi-paper markets rise significantly, from \$6.19 to \$7.84. Advertising revenue per reader increases slightly, as a consequence of less overlap in newspaper readership. The number of markets with two or more newspapers rises modestly from 250 to 276. Most of the gain to newspapers is offset by this increase in competitiveness, so total newspaper profit increases only slightly, while consumer surplus and advertiser profit both fall significantly. Additional entry also offsets the reduced incentive to differentiate due to softer price competition, and so effects on diversity are modest: the share of households with access to diverse papers rises slightly, while the share reading them falls by a fourth.

Advertising collusion, on the other hand, causes large increases in both economic welfare and diversity. Because our baseline estimates imply significant competition in the advertising market ($a_l < a_h$), advertising

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[9] Formally, we define a collusive price of newspaper j as the j^{th} element of a price vector p that solves

$$p \quad 2 \arg\max_{p} \sum_{j=1}^{J_m} p_j + a_{jm}(p) \quad MC \quad q_{jm}(p) \tag{17}$$

where here we make explicit the dependence of advertising rates and demand on the full vector of prices. We define the collusive per-reader advertising revenue of newspaper j as

$$a_{jm} = a_h \quad \frac{1 \quad q_{0m}}{\sum_{k=1}^{J_m} q_{km}} \quad + a_l \quad 1 \quad \frac{1 \quad q_{0m}}{\sum_{k=1}^{J_m} q_{km}} \tag{18}$$

where q_{0m} is the share of households purchasing no newspaper.

[10] These assumptions are a reasonable match to the revenue-sharing arrangements of joint operating agreements authorized under the Newspaper Preservation Act (Busterna and Picard, 1993). In some cases a newspaper's share of revenue is a "sliding" function of the newspaper's contribution to revenue or to total advertising sales. In other cases, the revenue sharing rule is fixed in advance, but in such cases is usually related to the initial capital investment of the newspapers, and hence to their financial health at the time of the agreement. In both types of arrangements, a newspaper with a greater circulation will generally be entitled to a greater share of the joint venture's revenue.

and advertising prices both rise, and newspaper readership falls. Total surplus per household falls from $4:26 to $3:75, with consumer and advertiser surplus falling, and newspaper profit rising. The number of markets with diverse papers, the share of households in markets with diverse papers, and the share of households

household rises from \$4:26 to \$6:71 per year. Sixty-seven percent of households have access to diverse papers, and 22 percent read diverse papers on a given day.

9 Conclusions

We find evidence that partisanship influences the composition of readership and that it affects patterns of substitution among competing papers. We find, in turn, that entering newspapers take competitors' partisan affiliations into account when choosing their own.

We estimate a model of newspapers' choice of political affiliation that matches these key facts. We use the model to evaluate the economic determinants of ideological diversity and to evaluate several important policies. We find that competitive incentives are a crucial driver of ideological diversity. We show that there is no conflict between the goal of maximizing economic welfare and the goal of preserving ideological diversity. We find that accounting for the two-sided nature of the market is critical for evaluating competition policies, that permitting advertising collusion increases both welfare and diversity, and that permitting outright joint ownership reduces welfare and diversity. We show that subsidies of the kind commonly employed by governments to encourage the growth and diversity of media markets are a particularly effective tool for promoting both economic and political goals.

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Table 1: Summary Statistics for Newspaper Markets

Number of Newspapers	0	1	2	3+	All
Mean population	5944	10688	24049	36832	10943
Share of newspapers that are Republican		0.60	0.50	0.68	0.57
Share of multi-paper 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	1910
Number of newspapers	0	612	594	132	1338

Notes: Data are from supply estimation sample described in section 2.1. 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 1868-1928.

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 multi-paper 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	4144	3737	4307	12188
Number of newspaper-towns	4144	7474	17161	28779

Notes: Data are from demand estimation sample described in section 2.2. 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 1868-1928.

Table 3: Demand for Partisanship

Dependent variable: Average log(circ) of R papers - Average log(circ) of D papers

	(1)	(2)	(3)
Republican vote share	0.8516		0.9509
	(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)
R2	0.0101	0.0007	0.0127
Number of counties	1219	1219	1219
Number of towns	4294	4294	4294

Notes: Data are from the demand estimation sample described in section 2.2. 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 1868-1928. Standard errors in parentheses are clustered at the county level.

Table 4: Determinants of Newspaper Affiliation

Dependent variable: Dummy for newspaper choosing R affiliation

	(1)	(2)	(3)
Republican vote share	2.1824		2.3330
	(0.0557)		(0.0610)
Number of Republican incumbents		-0.0126	-0.1469
		(0.0315)	(0.0337)
Number of Democratic incumbents		-0.0140	0.1286
		(0.0376)	(0.0295)
R2	0.3561	0.0002	0.3812
Number of markets	950	950	950
Number of newspapers	1338	1338	1338

Notes: Data are from the supply estimation sample described in section 2.1. The unit of analysis is the newspaper. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868-1928. The number of Republican/Democratic incumbents is the number of sample newspapers of the given affiliation that entered prior to the newspaper in question. Standard errors in parentheses are clustered at the market level.

Table 5: Affiliation Choices in Own and Neighboring Markets

Share of second entrants choosing R affiliation

	Second Entrant in:	
	Own Market	Neighboring Market
First Entrant's Affiliation:		
Democratic	0.49	0.32
Republican	0.53	0.65
Number of markets	269	

Notes: Data are from supply estimation sample described in section 2.1 and include all markets with at least two newspapers in which the neighboring market has at least one newspaper.

Table 6: Circulation Patterns in Own and Neighboring Towns

Average log(circ) of R papers - Average log(circ) of D papers

	Circulation in:	
	Own Town	Neighboring Town
Available Newspapers in Town:		
Majority Democratic	0.0295	0.0177
Majority Republican	0.0248	0.0307
Number of towns	1986	

Notes: Data are from demand estimation sample described in section 2.2 and include all pairs of towns with at least one newspaper of each affiliation in each town, excluding towns with an equal number of Democratic and Republican newspapers.

Table 7: Parameter Estimates (Demand Model)

Price coefficient (a)	0.1793
	(0.0023)
Mean utility for different-affiliation paper ($\underline{b}$)	-0.1687
	(0.0582)
Mean utility for same-affiliation paper ($\overline{b}$)	0.7416
	(0.0649)
Substitutability between same-type papers (G)	0.2336
	(0.0552)
Standard deviation of log of measurement error (s_z)	0.7004
	(0.0076)
Mean of unobservable shifter of fraction Republican (m_n^{town})	0.11.331 0 rb.978]TJETq1 0 0 1 317.

Meandard deviation of loobservable sh50

Table 8: Parameter Estimates (Supply Model)

Advertising revenue per reader of non-singleton bundles (a_l)	6.6815 (0.8996)

Table 9: Determinants of Equilibrium Diversity

	Markets with diverse papers	Share of hhlds in markets with diverse papers	Share of hhlds reading diverse papers
Baseline	140	0.22	0.036
When choosing affiliation, newspapers:			
Ignore competitors' choices	72	0.12	0.020
Ignore household ideology	203	0.30	0.048
Ignore idiosyncratic cost shocks (x)	104	0.17	0.029
Owners chosen at random from local households and newspaper type equals owner type	143	0.23	0.038

Notes: Table shows averages over 5 counterfactual simulations at the parameters reported in tables 7 and 8. A market has diverse papers if it has at least one Republican and one Democratic paper, and a household reads diverse papers if it reads at least one Republican and one Democratic paper. "Baseline" is simulation of the estimated model. "Ignore competitors' choices" is a counterfactual in which each paper chooses its affiliation as if it will be the only paper in the market. "Ignore household ideology" is a counterfactual in which each paper chooses its affiliation as if its market were 50 percent Republican ($r = 0.5$). "Ignore idiosyncratic cost shocks" is a counterfactual in which each paper chooses its affiliation as if $x = 0$. "Owners chosen at random" is a counterfactual in which each paper's affiliation is a random draw from the ideology of households in its market. The number of newspapers is fixed at its baseline value in all counterfactuals.

Table 10: Equilibrium and Surplus-Maximizing Outcomes

	Baseline	Chosen to Maximize Total Surplus:	
		Post-Entry Outcomes	Entry and Post-Entry Outcomes
Markets with newspapers	960	960	1910
Markets with multiple newspapers	250	250	1894
Share of hhlds reading a newspaper	0.38	0.54	0.96
Avg. price in multi-paper markets	6.19	0.27	0.74
Avg. ad rev. per reader in multi-paper markets	10.43	10.78	9.86
Per household:			
Consumer surplus	3.37	6.93	20.36

Table 11: Competition Policy

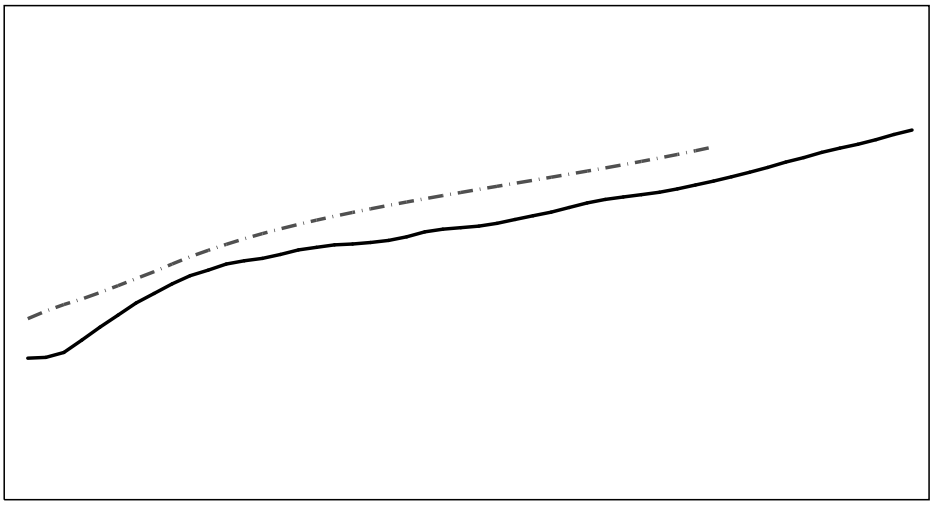
	Baseline	Allow Price Collusion	Allow Advertising Collusion	Allow Joint Operating Agreements	Allow Joint Ownership
Markets with newspapers	960	960	960	960	960
Markets with multiple newspapers	250	276	459	467	168
Share of hhlds reading a newspaper	0.38	0.36	0.46	0.44	0.35
Avg. price in multi-paper markets	6.19	7.84	5.79	6.77	6.33
Avg. ad rev. per reader in multi-paper markets	10.43	10.77	11.44	11.58	11.92
Per household:					
Consumer surplus	3.37	2.98	4.87	4.30	2.88
Newspaper profit	0.39	0.40	0.52	0.57	0.87
Advertiser profit	0.50	0.40	0	0	0
Total surplus	4.26	3.78	5.39	4.86	3.75
Diversity					

Table 12: Subsidies

	Baseline	Optimal Fixed-Cost Subsidy	Optimal Marginal-Cost Subsidy
Amount of subsidy		$13316 per paper	$7 per reader per year
Markets with newspapers	960	960	1900
Markets with multiple newspapers	250	849	1448
Share of households reading a newspaper	0.38	0.52	0.78
Avg. price in multi-paper markets	6.19	6.40	4.05
Avg. ad rev. per reader in multi-paper markets	10.43	10.09	9.48
Per household:			
Consumer surplus	3.37	5.50	10.03
Newspaper profit	0.39	0.36	1.40
Advertiser profit	0.50	1.39	2.57
Cost of subsidy	0.00	2.20	7.29
Total surplus	4.26	5.05	6.71
Diversity			
Markets with diverse papers	140	516	876
Share of hhlds in markets with diverse papers	0.22	0.51	0.67
Share of hhlds reading diverse papers	0.036	0.107	0.217

Notes: Table shows averages over 5 counterfactual simulations at the parameters reported in tables 7 and 8. A market has diverse papers if it has at least one Republican and one Democratic paper, and a household reads diverse papers if it reads at least one Republican and one Democratic paper. “Baseline” is simulation of the estimated model. Subsidies are chosen to maximize total surplus. “Optimal Fixed-Cost Subsidy” provides a fixed per-household

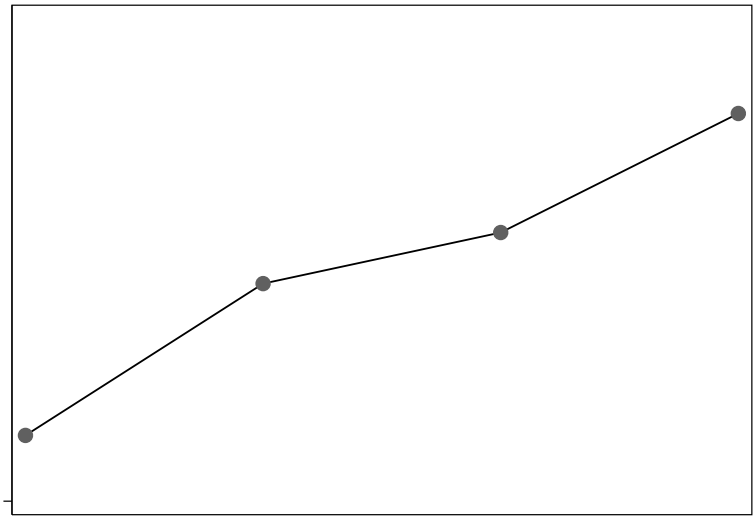
Figure 1: Demand for Partisanship



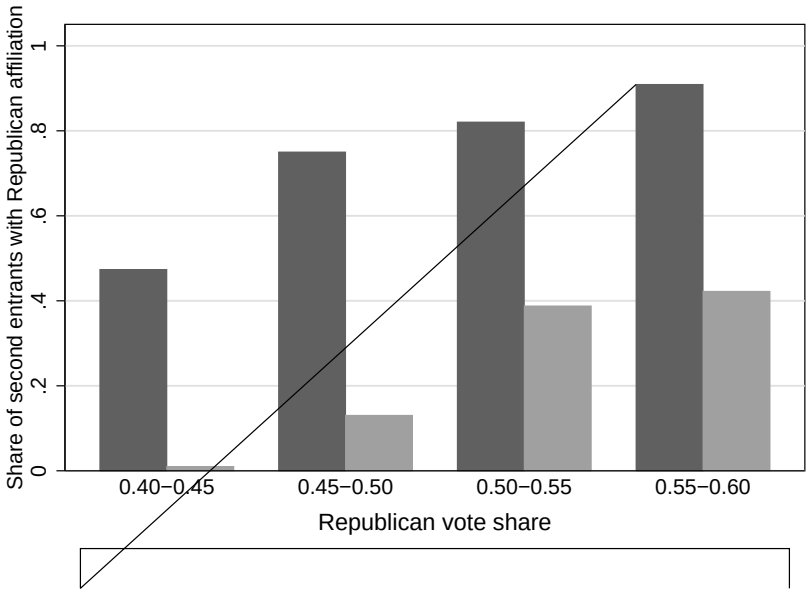
Notes: Data are from the demand estimation sample described in section 2.2. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868-1928. The sample includes all towns with at least one Democratic newspaper and at least one Republican newspaper in which the Republican vote share is between 0:4 and 0:6. "Majority R papers" refers to the set of towns in which there are more Republican than Democratic newspapers available. "Majority D papers" refers to the set of towns in which there are more Democratic than Republican newspapers available. The plot is a local polynomial plot of degree 0, using the Epanechnikov kernel with a bandwidth of .03 for the full sample and .07 for the majority R / majority D samples.

Figure 2: Determinants of Newspaper Affiliations

Panel A: First Entrant Affiliation Choice



Panel B: Second Entrant Affiliation Choice



Notes: Data are from the supply estimation sample described in section 2.1. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868-1928. The sample includes all markets with two or more newspapers in which the Republican vote share is between 0:4 and 0:6.

Appendices

A Estimation Details

We approximate the integrals in equations 12 and 14 using sparse grid integration with Gaussian kernel and accuracy 3 (Heiss and Winschel 2008, Skrainka and Judd 2011). In the supplemental appendix, we present estimates of the model in which we reduce and increase the accuracy by 1. We constrain all standard deviations and the parameter G to be positive. (The descriptive evidence in table 3 strongly suggests that $G > 0$, and if $G < 0$ the model may not admit an interior solution at the entry stage.) We choose starting values either at zero or at a value (typically one) reflecting the expected order of magnitude of the parameter. The supplemental appendix presents Monte Carlo experiments and experiments with random starting values for both the demand and supply steps of the estimation.

Evaluation of the supply model likelihood requires imposing equilibrium in the entry, affiliation choice, pricing, and advertising pricing stages. We provide above an analytic characterization of the unique equilibria of the affiliation and advertising pricing stages. For given fixed costs k_m and variable profit function $V_m(J)$, the entry stage game admits a unique solution provided $V(J)$ is strictly decreasing in J. In repeated simulations we find that this property holds for all markets at the estimated parameters. The equilibrium of the pricing game is characterized by a system of first-order conditions, which we solve numerically. We choose a starting value close to the observed prices and verify that the solution is not sensitive to local variation (plus or minus \$1 per copy) in the choice of starting value at the estimated parameters.

We maximize the likelihood using KNITRO's active-set algorithm for unconstrained problems (Byrd

the evidence in Gentzkow et al. (2011) that reverse causality from newspaper affiliation to voting behavior was not a major factor during our period of study.

Column (3) of appendix table 1 shows that, conditional on the average Republican vote share, the lag vote share is correlated with newspaper affiliations, but that including it in the model has only a small effect on the explanatory power of the model as measured by the R^2. This finding is consistent with extant evidence that political preferences were highly spatially persistent during the period we study (Glaeser and Ward 2006) and supports our use of the average vote share as the observable proxy for ideology in formal estimation.

C Evidence on Model Specification

Appendix table 2 presents estimates of select parameters from our baseline model and from an alternative model in which we assume there is no unobservable town- or market-level heterogeneity in consumer ideology. Consistent with the findings we report in section 8.1, we find that key demand parameters are sensitive to excluding unobservable heterogeneity from the model, whereas key supply parameters are less so.

D Alternative Specifications

In appendix tables 3 and 4, we show how our key results vary with alternative specifications of the model. Appendix table 3 reports, for each specification and counterfactual, the share of households reading at least one paper of each affiliation, averaged over five simulations. Appendix table 4 reports, for each specification and counterfactual, the total surplus per household, averaged over five simulations. Each table has five columns. The first column reports results for the baseline model. The second column reports results assuming that the social planner chooses all entry and post-entry decisions as in the final column of table 10. The third and fourth columns report results with joint operating agreements and joint ownership, respectively, as in the final two columns of table 11. The fifth column reports results assuming the optimal marginal cost subsidy is in place, at the value computed for the case shown in the final column of table 12.

The first row of the table repeats the results from our main specification for reference. In parentheses, we show standard errors for each counterfactual, computed as the standard deviation across 5 sets of parameters, each drawn from the asymptotic (joint) distribution of the demand and supply parameters.

The second through fifth rows explore changes to parameters whose values we calibrate from balance-sheet data. In each case we change a single calibrated value, re-estimate the model, and recompute counterfactuals. The second and third specifications increase and decrease the calibrated marginal cost by 10 percent relative to the baseline value. The fourth and fifth specifications increase and decrease the calibrated

The eighth through thirteenth rows explore changes to model specification. In each case we change a feature of the model, estimate the modified model, and recompute counterfactuals.

markets in the South meaningfully affects our quantitative results. Because of the dominance of the Democratic party, Southern markets demand (and receive) little diversity, so removing Southern markets increases baseline diversity and increases the scope for welfare gains from improving diversity.

Appendix Table 1: Determinants of Newspaper Affiliation

Dependent variable: Dummy for newspaper choosing Republican affiliation

	(1)	(2)	(3)
Republican vote share	2.1344	2.2346	1.9400
	(0.0568)	(0.0711)	(0.1028)
Number of Republican incumbents	-0.0771	-0.0823	-0.0767
	(0.0129)	(0.0134)	(0.0128)
Number of Democratic incumbents	0.0634	0.0698	0.0635
	(0.0125)	(0.0129)	(0.0125)
Lag Republican vote share			0.2048
			(0.0870)
Instrument with lag vote share?		X	
R2	0.2865	0.2859	0.2876
Number of markets	1338	1338	1338
Number of newspapers	3179	3179	3179

Notes: Data are from US Newspaper Panel from 1872-1928. The unit of analysis is the newspaper. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868-1928. Lag Republican vote share is the Republican share of the two-party vote in the presidential election prior to the entry of the newspaper. The sample excludes newspapers for which data on Republican share of the two-party vote in the election prior to entry is unavailable. Model (1) is an OLS regression. Model (2) is a 2SLS regression in which the lag vote share is used as an instrument for the Republican vote share. All models include fixed effects for the year of entry (the first presidential election year in which the newspaper is present in the panel). The number of Republican/Democratic incumbents is the number of newspapers of each affiliation present in the year of entry. Standard errors in parentheses are clustered at the market level.

Appendix Table 2: Sensitivity of Parameter Estimates to Omitting Unobservables From Model

	Baseline	No Unobservables
Demand parameters		
$\underline{b}$		

Appendix Table 3: Alternative Specifications (Households Reading Diverse Papers)

		Baseline	Social Planner	Allow Joint Operating Agreements	Allow Joint Ownership	Optimal Marginal-Cost Subsidy
(1)	Preferred estimate	0.04	0.56	0.07	0.02	0.22
	(Standard Errors)	(0.002)	(0.056)	(0.002)	(0.002)	(0.023)
	Changing Calibrated Values					
(2)	Increase marginal cost by 10%	0.04	0.57	0.07	0.02	0.25
(3)	Decrease marginal cost by 10%	0.04	0.54	0.07	0.02	0.19
(4)	Increase a_h by 10%	0.04	0.53	0.07	0.02	0.18
(5)	Decrease a_h by 10%	0.04	0.59	0.07	0.02	0.28
(6)	Increase spatial correlation of unobservables by 10%	0.04	0.56	0.07	0.02	0.22
(7)	Decrease spatial correlation of unobservables by 10%	0.04	0.55	0.07	0.02	0.21
	Modifying Model Specification					
(8)	Endogenous J in demand model	0.04	0.53	0.07	0.02	0.21
(9)	Add flexibility to fixed cost distribution	0.03	0.56	0.06	0.02	0.21
(10)	Add flexibility to affiliation choice in demand model	0.04	0.56	0.07	0.02	0.22
(11)	Add substitutability parameter between different-type papers	0.04	0.56	0.07	0.02	0.22
(12)	Constrain different-type substitutability parameter to half of same-type	0.03	0.52	0.06	0.02	0.21
(13)	Add distance to headquarters as utility shifter in demand model	0.04	0.65	0.08	0.02	0.26
	Modifying Estimation Sample					
(14)	Tighten population cut-offs for markets	0.03	0.61	0.07	0.02	0.24
(15)	Remove markets with independent papers	0.04	0.51	0.07	0.02	0.20
(16)	Remove markets with unaffiliated papers	0.03	0.53	0.07	0.02	0.21
(17)	Remove markets near major cities	0.04	0.37	0.07	0.02	0.15
(18)	Remove towns with missing data for nearby newspapers	0.04	0.58	0.07	0.02	0.23
(19)	Remove market pairs with cross-market co-ownership	0.03	0.55	0.07	0.02	0.21
(20)	Remove towns and markets in the South	0.05	0.78	0.09	0.03	0.52

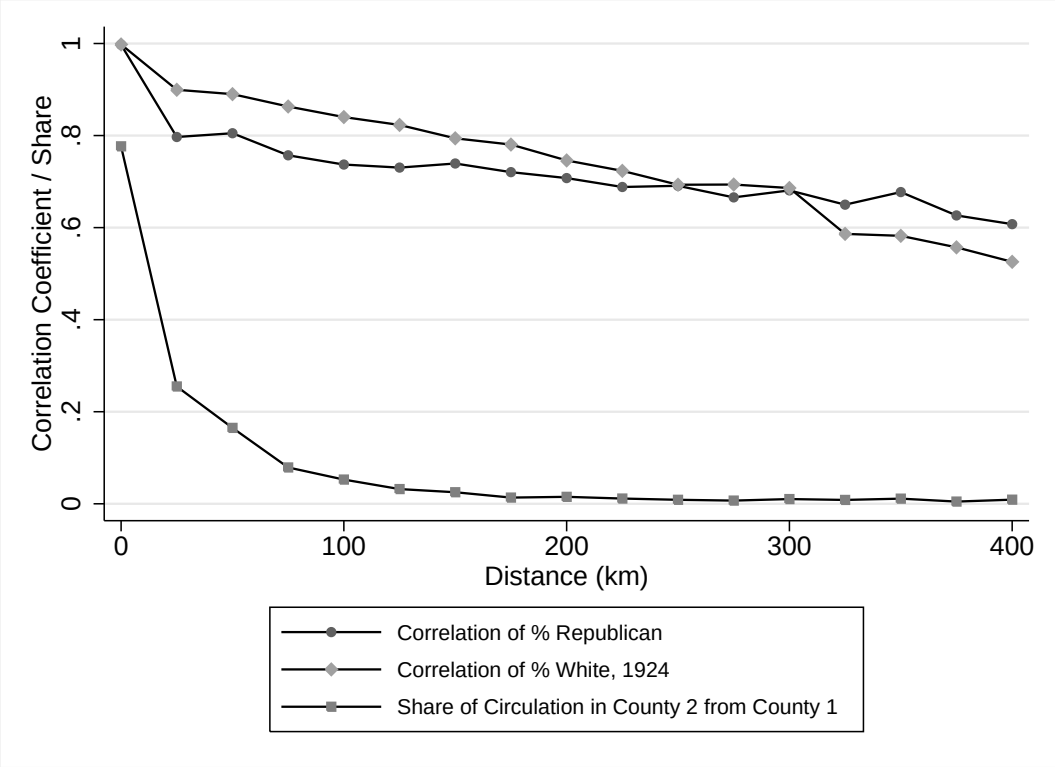
Notes: See appendix D for details.

Appendix Table 4: Alternative Specifications (Total Surplus)

		Baseline	Social Planner	Allow Joint Operating Agreements	Allow Joint Ownership	Optimal Marginal-Cost Subsidy
(1)	Preferred estimate	4.26	10.28	4.86	3.75	6.71
	(Standard Errors)	(0.089)	(0.416)	(0.077)	(0.101)	(0.214)
	Changing Calibrated Values					
(2)	Increase marginal cost by 10%	3.88	9.50	4.44	3.41	6.17
(3)	Decrease marginal cost by 10%	4.63	11.07	5.29	4.09	7.23
(4)	Increase a_h by 10%	4.86	11.57	5.56	4.30	7.54
(5)	Decrease a_h by 10%	3.65	9.03	4.17	3.19	5.80
(6)	Increase spatial correlation of unobservables by 10%	4.25	10.35	4.87	3.75	6.75
(7)	Decrease spatial correlation of unobservables by 10%	4.26	10.22	4.86	3.75	6.69
	Modifying Model Specification					
(8)	Endogenous J in demand model	4.26	10.06	4.85	3.77	6.61
(9)	Add flexibility to fixed cost distribution	3.93	10.02	4.59	3.48	6.44
(10)	Add flexibility to affiliation choice in demand model	4.26	10.35	4.89	3.76	6.74
(11)	Add substitutability parameter between different-type papers	4.26	10.28	4.86	3.75	6.71
(12)	Constrain different-type substitutability parameter to half of same-type	4.20	9.87	4.55	3.52	6.59
(13)	Add distance to headquarters as utility shifter in demand model	4.23	11.26	4.94	3.72	7.15
	Modifying Estimation Sample					
(14)	Tighten population cut-offs for markets	4.05	10.77	4.76	3.56	6.83
(15)	Remove markets with independent papers	4.21	9.86	4.77	3.73	6.50
(16)	Remove markets with unaffiliated papers	4.13	10.00	4.72	3.65	6.53
(17)	Remove markets near major cities	4.70	8.94	5.14	4.21	6.30
(18)	Remove towns with missing data for nearby newspapers	4.24	10.34	4.80	3.69	6.75
(19)	Remove market pairs with cross-market co-ownership	4.16	10.11	4.76	3.66	6.59
(20)	Remove towns and markets in the South	4.03	15.78	4.93	3.30	10.04

Notes: See appendix D for details.

Appendix Figure 1: Spatial Decay in Newspaper Shipments and Demographic Correlations



Notes: Data are from the US Census and the Audit Bureau of Circulation data described in section 2.2. The first two lines show the correlation coefficient of fraction Republican and fraction white for counties located in the same state, at different centroid distances. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868-1928. The third line shows the share of newspaper circulation in county 2 accounted for by newspapers headquartered in county 1, for counties located at different centroid distances. Only counties containing at least one market in the sample described in section 2.1 are included.