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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.

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1 Introduction

Economists have long been concerned with the optimal amount of product diversity in the marketplace (Dixit and Stiglitz 1977, Mankiw and Whinston 1986). In the context of the news media, product diversity matters not only for the usual reasons of consumer and producer surplus, but also because it may contribute to the competitiveness of the marketplace of ideas, and hence of the political process (Becker 1958, Downs 1957). Thus, "the [First] Amendment rests on the assumption that the widest possible dissemination of information from diverse and antagonistic sources is essential to the welfare of the public" (*Associated Press v. United States, 1945*).

Three main policy instruments have been directed at increasing ideological diversity in media markets: relaxation of antitrust rules, limits on joint ownership, and explicit subsidies. The Newspaper Preservation Act of 1970 allowed competing newspapers to jointly set advertising and circulation prices in an effort to prevent second and third papers from exiting. The Act states its goal as "maintaining a newspaper press editorially and reportorially independent and competitive in all parts of the United States." The Federal Communications Commission has long regulated US media ownership "on the theory that diversification of mass media ownership serves the public interest by promoting diversity of program and service viewpoints" (FCC 2010). Federal, state, and local governments in the United States subsidized newspapers in the nineteenth and early twentieth centuries, and many European governments continue to do so today, with the explicit goal of maintaining diversity (Murschetz 1998).

In this paper, we study the economic forces that determine equilibrium ideological diversity in newspaper markets. We formulate a model of entry and product positioning, with competition for both consumers and advertisers. We present descriptive evidence consistent with the model's core predictions, and estimate the model using a novel town-level dataset on US newspaper circulations in 1924, combined with data on newspaper affiliations and other characteristics from Gentzkow et al. (2011). We use the estimated model to decompose the incentives that affect equilibrium diversity and evaluate the impact of the public policies discussed above.

Studying newspapers in a historical context affords several advantages that offset the intrinsic disadvantage of moving away from contemporary policy settings. First, during the time period that we study it was common for newspapers to declare explicit political affiliations (Gentzkow et al. 2006, Hamilton 2006). A newspaper's affiliation serves as a good proxy for the ideological tilt of the newspaper's content (Gentzkow et al. 2011), so the presence of explicit affiliations alleviates the challenge of measuring ideology that confronts studies of contemporary US news media (Groseclose and Milyo 2005, Gentzkow and Shapiro 2010). Second, during the period we study there were a large number of local markets in the US with multiple competing daily newspapers. Although many media markets remain fiercely competitive today, few afford researchers a large cross-section of experiments that can be used to study competitive interactions.

Our economic model embeds Gentzkow's (2007) multiple-discrete-choice demand framework in a sequential entry game in the spirit of Bresnahan and Reiss (1991) and Mazzeo (2002). In the model, newspapers first decide whether to enter the market, then choose either Republican or Democratic affiliation, taking into account household demand, the responses of other entering newspapers, and the effect of affiliation choice on subscription and advertising prices. The model allows households to exhibit a preference for newspapers whose ideology matches their own, and to regard newspapers with the same political affiliation as more substitutable than newspapers with different affiliations. The model allows advertisers to

place advertisements in multiple newspapers and to value "single-homing" and "multi-homing" consumers differently (Armstrong 2002, Ambrus and Reisinger 2006, Anderson et al. 2011).

We begin with descriptive evidence on the drivers of newspaper demand and affiliation choices. Circulation data show that consumers have a strong taste for newspapers whose ideology matches their own. An increase of 10 percentage points in the proportion of a town's votes going to Republicans increases the relative circulation of Republican papers in the town by 10 percent. Circulation data also show that newspapers with the same affiliation are closer substitutes than newspapers with different affiliations. Adding a second Republican paper to a town with one Republican and one Democratic newspaper reduces the relative circulation of the existing Republican paper by 4 percent. These findings survive flexible controls for the quality of the newspapers, for the town's overall taste for news, and for non-political attributes of both newspapers and towns.

In the context of our model, these features of consumer demand should induce newspapers to match the tastes of local consumers and to differentiate from their competitors. Our raw data provide evidence of both patterns. A 10 percentage point increase in a market's fraction Republican increases the probability that an entering newspaper chooses a Republican affiliation by 23 percentage points. Controlling for the fraction Republican, adding an additional Republican incumbent reduces an entering paper's likelihood of choosing a Republican affiliation by 15 percentage points. Our estimated model fits these descriptive patterns well.

A crucial identification issue arises from unobserved heterogeneity in household ideology. Such heterogeneity will cause the affiliations of newspapers within a given market to be positively correlated, biasing downward estimates of the incentive to differentiate. It will also cause endogeneity of the choice set, leading us to understate substitution patterns in demand. We address this issue by allowing explicitly for unobserved cross-market variation in household ideology, using a novel identification strategy that exploits correlation across markets that are close enough to share similar characteristics but far enough apart that their newspapers do not compete. We assume in the spirit of Murphy and Topel (1990) and Altonji et al. (2005) that the spatial correlation in unobservable dimensions of ideology matches that of observable measures.

We use the estimated model to measure the importance of competitive forces relative to other incentives in shaping the ideological diversity of the news market. We measure diversity by the number of markets with at least one newspaper affiliated with each party, the share of households living in such markets, and the share of households reading at least one newspaper affiliated with each party. We find that the incentive to differentiate from competitors in order to attract more readers and soften price and advertising competition (Mullainathan and Shleifer 2005) increases diversity significantly, offsetting a strong incentive to cater to the tastes of majority consumers (George and Waldfogel 2003). The net effect of these opposing forces is that equilibrium diversity is nearly as large as it would be if newspapers' affiliations were chosen to be representative of those of the local population.

Next, we frame our evaluation of specific policies by comparing the market outcomes to those that would be chosen by a social planner maximizing economic welfare, but ignoring any externalities from diversity. Relative to the first best, market entry is inefficiently low, market prices are inefficiently high, and the market incentive to differentiate politically from competitors is inefficiently weak. Thus, there is no conflict between the policy goals of maximizing economic welfare and preserving diversity in the marketplace of ideas. Policies aimed at the latter goal are likely to also be beneficial from the perspective of the former.

The first policy we evaluate is relaxation of antitrust rules. Allowing newspapers to set circulation prices jointly has negative effects on economic welfare and mixed effects on diversity. Prices in multi-

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 positioning of US newspapers in recent years. Because few modern markets have more than one newspaper, however, they cannot address the impact of competition. Other related work studies the way content relates to electoral cycles (Puglisi 2011), economic conditions (Larcinese et al. 2007), political scandals (Puglisi and Snyder 2011), and government influence (Durante and Knight 2012, Qian and Yanagizawa 2010), without explicitly modeling the role of competition. Chiang's (2010) study of US newspapers is the closest to ours in investigating equilibrium positioning of newspapers in multi-paper markets. Chiang (2010) uses household-level data to test the predictions of a variant of Mullainathan and Shleifer's (2005) model, and finds that ideologically extreme households in multi-paper markets are more likely to read a newspaper than those in single-paper markets.

Like Chiang (2010) and Gentzkow and Shapiro (2010), we focus on the commercial, rather than political, incentives of news outlets. Commercial considerations likely dominated political incentives at the time of our study (Baldasty 1992). In other work, we show that newspapers' affiliations exert, on average, at most a small effect on electoral outcomes (Gentzkow et al. 2011), and that in most times and places incumbent parties exert at most a limited influence on newspapers' political affiliations (Gentzkow et al. 2012). We note, however, that Petrova (2011) provides evidence that political patronage influenced newspaper affiliations in the late 1800s.

The remainder of the paper is organized as follows. Section 2 introduces the historical data that forms the basis of our analysis. Section 3 discusses the historical context for our data. Section 4 presents descriptive evidence on the determinants of newspaper demand and affiliations and lays out our strategy for estimating the incentive to differentiate in the presence of unobserved consumer heterogeneity. Section 5 lays out our model. Sections 6 and 7 detail the estimation and identification of the demand and supply portions of the model, respectively. Section 8 presents estimates and counterfactual simulations. Section 9 concludes.

2 Data

2.1 Cross-section of Daily Newspaper Markets

We construct a cross-section of daily newspaper markets as of 1924 that serves as the basis of our analysis of newspapers' entry and affiliation decisions.

We define the universe of potential daily newspaper markets to be all cities with populations between 3,000 and 100,000 and at least one *weekly* newspaper as of 1924. Data on the universe of cities and their populations comes from the 1924 N. W. Ayer & Son's *American Newspaper Annual.* In appendix D we present an analysis of the sensitivity of our findings to tightening the population bounds for the sample and to excluding markets close to very large cities.

We take data on daily newspapers from the US Newspaper Panel introduced in Gentzkow et al. (2011). The data are drawn from annual directories of US newspapers from 1869 and from every presidential year from 1872 to 1924, inclusive. In each year, we extract the name, city, political affiliation, and subscription price of every English-language daily newspaper. We match newspapers across years on the basis of their

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 ever declares a Republican affiliation and Democratic if it ever declares a Democratic affiliation. In the handful of cases in which a newspaper declares a Republican affiliation in one year and a Democratic affiliation in another, we use the affiliation declared most often by the newspaper. We exclude from our sample 142 newspapers whose only declared affiliation is Independent and 36 newspapers that never declare an affiliation of any kind. In appendix D we present results for the subsample of markets that do not contain an independent newspaper in 1924 and the subsample that do not contain an unaffiliated newspaper in 1924.

We define a newspaper's year of entry as the year in which it first appears in a newspaper directory in our panel. For each market in our universe with two or more daily newspapers, we define the order of entry of the newspapers as the order of their years of entry. If two or more newspapers in a market have the same year of entry, we break ties randomly.

We match markets to Census place definitions in 1990 and match each Census place to the county containing the largest share of the place's population in 1990. We use the Census place-county match to combine city-level newspaper data with county-level voting data from various sources, as in Gentzkow et al. (2011). Our main measure of consumer ideology is the average share of the two-party presidential vote going to Republicans over the period 1868 to 1928. We exclude a small number of markets for which we cannot identify the presidential vote share. In appendix D we present results excluding markets in the South, where the Democrats were dominant.

Table 1 presents summary statistics for our cross-section of markets. Our sample includes $1,910$ markets, 950 of which have at least one daily newspaper, and 338 of which have more than one daily newspaper. Population is highly correlated with the number of newspapers. In total there are $1,338$ newspapers in the sample, of which 57 percent are Republican. Overall, 54 percent of multi-paper markets are ideologically diverse in the sense of having at least one Republican and at least one Democratic newspaper. In the average market, Republican and Democratic presidential candidates tend to get a similar number of votes, but there is substantial cross-market variation in the vote share.

As we detail below, formal estimation of our model requires identifying pairs of geographically proximate markets. We construct such pairs as follows. We identify all pairs of markets in which both markets are located in the same state and are between 100 and 400 kilometers apart. Among all such pairs, we identify the pair with lowest absolute difference in log population, breaking ties randomly. We then remove the matched markets from consideration and find the pair with the next lowest population difference. We repeat this matching process until all markets are matched.

2.2 Town-level Circulation Data

We assemble a separate cross-section of towns in which daily newspapers circulate but in which no daily newspaper is headquartered. We use these "hinterland" towns as the basis of our demand analysis because, as we detail below and in the supplemental appendix, they allow us to exploit variation in demand for the same newspaper across geographic areas with different ideological composition and choice sets (Gentzkow and Shapiro 2010).

Data on circulation by town comes from the 1924 Audit Bureau of Circulations (ABC) Auditor's Reports of individual newspapers. In most cases these audits cover a twelve-month period ending in 1924; in some

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).

2.3 Cost and Revenue Data

We obtain 1927 cost and revenue data on 94 anonymous newspapers from the Inland Daily Press Association (Yewdall 1928). Since Inland Press does not identify individual newspapers, we match each record in the US Newspaper Panel to the record in the Inland Press data with the closest circulation value. Performing this match allows us to estimate cost and revenue components for each newspaper in the US Newspaper Panel.

We compute the variable cost of each newspaper as the annual per-copy cost of printing and distribution, including paper and ink costs and mailing and delivery costs. We compute fixed costs per copy as the difference between annual total costs per copy and annual variable costs per copy. We also compute the annual per-copy advertising revenue of each newspaper. Finally, we compute the annual per-copy circulation revenue of each newspaper (revenue from subscriptions and single-copy sales).

2.4 Readership Survey Data

We supplement our town-level circulation data with aggregate reports from 17 survey studies of newspaper readership, covering 9 (mostly large) cities over the period 1929-1969. We provide publication details for each report in the supplemental appendix.

From each report we compute, for each pair of newspapers, the share of subscribers to either newspaper who subscribe to both. We use this measure of overlap in readership to check the validity of our model's

implications regarding multiple readership.

3 Historical Background on Newspaper Affiliations

The median newspaper in our 1924 cross-section entered its market prior to 1896. At that time it was common for newspapers to choose an explicit affiliation with either the Democratic or the Republican party (Gentzkow et al. 2006, Hamilton 2006). The practice faded over time: by the mid-twentieth century it was rare for newly-formed newspapers to declare an explicit affiliation.

We use political affiliation as a proxy for the political orientation of a newspaper's content and hence for its likely appeal to readers of different political stripes. A connection among newspaper affiliation, content, and audience was explicit in newspapers' own pronouncements. For example, in 1868, the Democratic *Detroit Free Press* announced, "The *Free Press* alone in this State is able to combine a Democratic point of view of our state politics and local issues with those of national importance" (Kaplan 2002, 23). Similarly, in 1872, the Republican *Detroit Post* declared as its mission "To meet the demands of the Republicans of Michigan and to advance their cause" (Kaplan 2002, 22). In Gentzkow et al. (2011) we report quantitative evidence for our newspaper panel showing that newspapers devoted more attention to the presidential candidates of their own party than those of the opposing party. Many other quantitative and qualitative studies support a strong connection between affiliation and content (Hamilton 2006, Gentzkow et al. 2006, Kaplan 2002, Summers 1994).

We will treat political affiliation as a way for a newspaper to differentiate commercially from its competitors. Anecdotal evidence suggests that newspaper owners thought of political affiliation in those terms. James E. Scripps declared in 1879 that "As a rule, there is never a field for a second paper of precisely the same characteristics as one already in existence. A Democratic paper may be established where there is already a Republican; or vice versa; an afternoon paper where there is only a morning; a cheap paper where there is only a high-priced one; but I think I can safely affirm that an attempt to supplant an existing newspaper...of exactly the same character has never succeeded" (quoted in Hamilton 2006, 47). Through the early twentieth century, James' brother, E.W. Scripps, exploited the nominal independence of his newspaper chain to adapt editorial content to market conditions, emphasizing Republican ideas in markets with established Democratic newspapers, and Democratic ideas when Republicans were entrenched (Baldasty 1999, 139).

We exclude unaffiliated newspapers from our analysis. We do this primarily because the group of newspapers that never declare a Republican or Democratic affiliation includes many specialized commercial papers (e.g., mining industry trade journals) that can plausibly be treated as separable in demand from affiliated newspapers. This decision also has the effect of excluding newspapers that always declared their affiliation as Independent, some of which may well have competed economically with the newspapers in our sample. In appendix D we show that our results are robust to excluding from our sample markets in which affiliated papers may have competed with Independent or unaffiliated papers.

We model a newspaper's political affiliation as a binary characteristic. This decision is motivated by qualitative and quantitative evidence suggesting that papers of the same affiliation were relatively homogeneous in their content, hewing closely to the party line. Newspaper proprietor Horace Greeley writes in his autobiography: "A Democratic, Whig, or Republican journal is generally expected to praise or blame, like or dislike, eulogize or condemn, in precise accordance with the views and interest of its party" (1872, 137). According to Kaplan (2002), "In professing allegiance to a party, the Detroit press assumed specific

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. (2011) show that the political orientation of voters strongly predicts the affiliations of local papers, but is only weakly correlated with their content conditional on affiliation.

We model affiliation as static even though newspapers often switched from declaring a Republican or Democratic affiliation to declaring an Independent affiliation. We do this because Gentzkow et al. (2011) show that differences in Republican candidate mentions between originally Republican and originally Democratic papers is similar whether or not their current affiliation is Independent. That is, formerly affiliated newspapers do not become noticeably less partisan after dropping their explicit declaration of party allegiance.

Although the assumption of fixed, binary affiliations is reasonable in light of the evidence, it is nevertheless an approximation. The historical record provides examples of content differences among papers of the same affiliation, particularly on issues where disagreements between factions within the party were significant (Summers 1994, 43-58). In the supplemental appendix, we present evidence on the extent to which newspapers of a given affiliation adjust their content in response to changes in consumer preferences or the competitive landscape. There is qualitative evidence consistent with such adjustment, but the precision of the exercise is limited so we cannot say confidently that such adjustment took place. To the extent that binary affiliations are a coarse summary of a more continuous space of political content, caution is needed in linking our results to effects on underlying content. Our results capture diversity at the level of party affiliations, not intra-party factions or shadings.

4 Descriptive Evidence

4.1 Partisanship and Newspaper Circulation

In the model introduced below, household utility from reading a newspaper depends on (i) the match between the newspaper's type and the household's type and (ii) the presence of substitute newspapers in the household's consumption bundle.

As table 3 illustrates, both factors play a significant role in driving observed demand. The table presents OLS regressions of the Republican-Democrat difference in mean log circulation (i.e. the average of log circulation among Republican papers minus the average log circulation among Democratic papers) on measures of household ideology and/or the presence of substitutes. Specification (1) includes only household ideology, specification (2) includes only counts of substitute newspapers, and specification (3) includes both. Given the construction of the dependent measure, coefficients can be interpreted as the marginal effect of a given variable on the circulation of Republican papers relative to Democratic papers.

The greater is the Republican share of households in a town, the greater will be the relative circulation of Republican newspapers. However, having more Republican newspapers available will tend to depress the circulation of the average Republican paper due to substitution effects. Because Republican newspapers are

[2]Kaplan (2002, 58-61) discusses the case of the Democratic *Detroit Free Press*, which in 1872 refused to endorse Horace Greeley, the Democratic nominee for the presidency. The paper was widely criticized by party leaders, loyal partisan readers, and competitors. "Influential Democrats" threatened to start a competing Democratic paper in response. Ultimately, the rebellious owners of the *Free Press* were bought out by loyal interests, and the paper switched to supporting Greeley.

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.

Figure 2 illustrates the key patterns in specification (3) of table 4 graphically. Panel A shows that the probability of the first entrant choosing a Republican affiliation is increasing in the Republican vote share in the market. Panel B shows that the probability of the second entrant choosing a Republican affiliation is increasing in the Republican vote share and is lower when the first entrant's affiliation is Republican.

4.3 Controlling for Unobserved Ideology

Tables 3 and 4 show that accounting for heterogeneity in consumer ideology greatly affects our inferences regarding newspaper competition. Adding our observable proxy for our ideology to our descriptive models leads us to estimate stronger substitution patterns in demand and stronger differentiation effects in affiliation choice.

Finding such an important role for an observable proxy for consumer ideology begs the question of whether unobservable variation in ideology remains a source of bias in our estimates. In this section, we outline an identification strategy that exploits spatial correlation in consumer ideology to identify the role of unobserved heterogeneity across towns and markets. We exploit the pairs of markets and towns defined in sections 2.1 and 2.2 respectively. Recall that the markets or towns in each pair are between 100 and 400 kilometers apart and that pairs are chosen so that the markets or towns in the pair are as similar as possible to one another in population.

Table 5 illustrates the underlying logic of our strategy in the context of newspapers' affiliation choices. The first column shows that the correlation between the affiliation choices of the second and first entrants in the same market is slightly positive. This is similar to the relationship shown in column (2) of table 4. We expect that it reflects a combination of a negative differentiation effect and a positive correlation due to variation in consumer ideology. The second column shows that the correlation between the affiliation choices of the second entrant in one market and the first entrant in its *neighboring* market is strongly positive. Assuming there is no competitive interaction at distances of 100 kilometers and above, we expect that this reflects variation in consumer ideology alone. The difference in correlation between the two columns, then, can be thought of as a measure of the differentiation effect that adjusts for unobservable variation in consumer ideology.

Table 6 illustrates the same logic for demand estimation. The first column shows that towns whose available newspapers are majority Republican exhibit slightly lower relative demand for Republican newspapers. This is similar to the relationship shown in column (2) of table 3. The second column shows that a town whose neighbor has primarily Republican newspapers on offer exhibits greater relative demand for Republican newspapers. The difference in correlation between the two columns is a measure of the substitution effect that accounts for both observable and unobservable ideology.

Although we will not literally use this differencing strategy, we will exploit the spatial information illustrated in tables 5 and 6 to identify the unobservables in our formal model. Doing so will require three key assumptions. First, we assume that our pairs of markets and towns are close enough to share similar ideology but far enough apart that their newspapers do not interact directly. Appendix figure 1 shows direct support for this assumption. Two counties located $100-400$ kilometers apart have a highly correlated Republican vote share and fraction white. However, newspapers headquartered in the first county rarely circulate in the second at such distances.

Second, we assume that there are no spatially-correlated supply-side variables that affect the relative profitability of different affiliations. Variable costs such as paper and ink were not affiliation-specific, and

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 follow Murphy and Topel (1990) and Altonji et al. (2005) and assume that the correlation of the unobservables is the same as the correlation of the observables. In appendix D we present evidence on the sensitivity of our findings to variation in the assumed spatial correlation.

5 Model

5.1 Setup

We consider a cross-section of markets indexed by $m \in \{1,...,M\}$. Each market has J^{max} potential entrants.

We index the J_m newspapers that choose to enter market m in equilibrium by $j \in \{1,...,J_m\}$. Each entering newspaper chooses a political affiliation $\tau_{jm} \in \{R,D\}$, a circulation price p_{jm}, and an advertising price a_{jm}. The market has a unit mass of homogeneous potential advertisers, and S_m households indexed by i. Each household has a political affiliation $\theta_{im} \in \{R,D\}$. We denote the share of households with $\theta_{im} = R$ by ρ_m and assume that ρ_m is common knowledge to market participants but unobserved by the econometrician.

The J_m newspapers may also be available in one or more hinterland towns, which we index by $t \in \{M+1,...,M+T\}$. A given town t may receive newspapers from more than one market m. We assume that these towns are sufficiently small that they have a negligible impact on newspaper profits, and thus do not affect the entry, affiliation, and pricing decisions we model below. We do not explicitly model the process that determines which newspapers are available in which towns, but we allow in estimation for the possibility that the choice set may be correlated with unobserved town characteristics.

The game proceeds in five stages. First, the potential entrants choose sequentially whether or not to enter. Second, the newspapers that have entered sequentially choose their affiliations in order of their indices j. The assignment of these indices is random and not learned until the second stage. Third, newspapers simultaneously choose their circulation prices. Fourth, newspapers simultaneously choose their advertising prices, after which each advertiser simultaneously decides whether or not to advertise in each newspaper. Finally, households choose to consume any bundle of the available newspapers, or no newspaper at all. At the end of each stage, all newspapers' choices are observable to all other newspapers.

The profits of entering newspaper j are given by

$$\pi_{jm} = S_m \left[\left(p_{jm} + a_{jm} - MC \right) q_{jm} - \xi_{jm}\left(\tau_{jm}\right) \right] - \kappa_m, \tag{1}$$

where a_{jm} is newspaper j's advertising revenue per copy sold, MC is a marginal cost common to all newspapers and markets, q_{jm} is the share of households purchasing newspaper j, $\xi_{jm}(\tau_{jm})$ is an affiliation-specific

cost, and κ_m is a market-specific fixed cost. A newspaper privately observes its own ξ_{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 $\xi_{jm}(\tau_{jm})/\sigma_\xi$ is distributed mean-zero type-I extreme value, where $\sigma_\xi > 0$ is a constant. We assume that κ_m/S_m is distributed logistic with scale parameter σ_κ and location parameter $\mu_\kappa^0 + \mu_\kappa^1 \log(S_m)$.

The profits of each advertiser are equal to $\sum_i \mathbf{1}_{n_{im}\geq 1}[a_h + (n_{im}-1)a_l]$, where n_{im} is the number of newspapers read by i that contained the advertiser's ad, $\mathbf{1}$ denotes the indicator function, and $0 \leq a_l \leq a_h$. 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

$$u_{im}(B) = \sum_{j\in B}\left(\underline{\beta}\mathbf{1}_{\theta_{im}\neq\tau_{jm}} + \overline{\beta}\mathbf{1}_{\theta_{im}=\tau_{jm}} - \alpha p_{jm}\right) - g(B)\Gamma + \varepsilon_{im}(B), \tag{2}$$

where $g(B)$ is the number of distinct two-newspaper subsets of bundle B such that the two newspapers have the same political affiliation and $\varepsilon_{im}(B)$ is a type-I extreme value error. Note that the utility from consuming no newspapers is $\varepsilon_{im}(\emptyset)$. Although the number of consumers per market is finite, we treat it as large and so assume that q_{jm} is equal to the expected share of consumers buying paper j conditional on the τ_{jm} and p_{jm}, which is straightforward to derive by integrating over ε_{im} and θ_{im}.[3] We assume that this demand specification applies to both newspaper markets and hinterland towns.

5.2 Equilibrium

At the beginning of the entry stage, all potential entrants are symmetric and share the same information sets. Let $P_m(\tau)$ denote the equilibrium probability that the second-stage affiliation vector is τ conditional on $|\tau|$ newspapers entering. Given affiliations τ, let $v_{jm}(\tau)$ denote the equilibrium value of $(p_{jm} + a_{jm} - MC)q_{jm}$, and let $\overline{\xi}_{jm}(\tau)$ denote the expected value of $\xi_{jm}(\tau_j)$ conditional on newspaper j choosing its affiliation optimally.

The per-household expected variable profit of each entering newspaper is:

$$V_m(J) = \frac{1}{J}\sum_{j=1}^{J}\sum_{\tau\in\mathscr{T}_J}\left(v_{jm}(\tau) - \overline{\xi}_{jm}(\tau)\right)P_m(\tau), \tag{6}$$

where $\mathscr{T}_J$ is the set of τ vectors with $|\tau| = J$. The average over j reflects the fact that newspapers do not know their indices at the time they enter.

---

[3] Let

$$u_m^\theta(B) = \sum_{j\in B}\left(\underline{\beta}\mathbf{1}_{\theta\neq\tau_{jm}} + \overline{\beta}\mathbf{1}_{\theta=\tau_{jm}} - \alpha p_{jm}\right) - g(B)\Gamma \tag{3}$$

denote the mean utility of households of type θ for bundle B given prices and affiliations p_m and τ_m. Then the share of households of type θ who purchase newspaper j is

$$q_{jm}^\theta(p_m,\tau_m) = \frac{\sum_{\{B\in\mathbb{B}:j\in B\}}\exp\left(u_m^\theta(B)\right)}{\sum_{B'\in\mathbb{B}}\exp\left(u_m^\theta(B')\right)}, \tag{4}$$

where $\mathbb{B}$ is the set of all bundles of the papers in market m. The market-wide share of households purchasing newspaper j is then

$$q_{jm}(p_m,\tau_m) \quad = \quad \rho_m q_{jm}^R(p_m,\tau_m) + (1-\rho_m)q_{jm}^D(p_m,\tau_m). \tag{5}$$

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,

$$V_m(J^*) \geq \frac{\kappa_m}{S_m} > V_m(J^*+1), \tag{7}$$

for $J^* \in \{1,...,J^{max}-1\}$. If $V_m(1) < \frac{\kappa_m}{S_m}$ then $J^* = 0$ is an equilibrium, and if $V_m(J^{max}) > \frac{\kappa_m}{S_m}$ then $J^* = J^{max}$ is an equilibrium. The equilibrium J^* is unique so long as V_m is strictly decreasing.

An equilibrium of the affiliation stage in market m is a vector τ^* such that each τ_j^* maximizes $\left(\mathrm{E}_{\tau_{j^+}^*} v_{jm}\left(\left[\tau_{j^-}^*, \tau_j^*, \tau_{j^+}^*\right]\right) - \xi_{jm}\left(\tau_j^*\right)\right)$, where $\tau_{j^-}^*$ and $\tau_{j^+}^*$ are vectors of affiliations of the newspapers with indices less than and greater than j, respectively. Given realized cost shocks ξ_{jm} for market m, there is a unique equilibrium vector of affiliation choices that can be identified by backward induction.

An equilibrium of the pricing stage in market m is a vector p^* such that each element p_j^* satisfies:

$$p_j^* \in \arg\max_{p_j} \left(p_j + a_{jm}(p_j, p_{\sim j}) - MC\right) q_{jm}(p_j, p_{\sim j}). \tag{8}$$

Here we represent explicitly the fact that demand (and hence advertising prices) depends on the prices charged by the newspapers. We write $p_{\sim j}$ to denote the vector of newspaper j's competitors' prices.

Following results in Anderson et al. (2011), it is straightforward to show that any pure strategy equilibrium of the advertising stage in market m must have all advertisers advertising in all newspapers, with newspaper j's advertising price equal to:

$$a_{jm} = a_h exclusive_{jm} + a_l (1 - exclusive_{jm}), \tag{9}$$

where $exclusive_{jm}$ is the share of newspaper $j's$ readers who read no other newspaper. Although demand has not yet been realized at the advertising stage, $exclusive_{jm}$ is a function only of affiliations and prices, and so is fixed from the perspective of the newspapers when they choose a_{jm}.

5.3 Discussion

We specify the model to parsimoniously capture key economic features of the newspaper market that drive the consumer, newspaper, and advertiser decisions that we model.

Our entry model follows Bresnahan and Reiss (1991). One important departure from their work is that we allow the distribution of fixed costs to depend on market size. We do this because newspapers' fixed investments, notably editorial costs, are endogenous to the quality of the newspaper and hence to the size of the market served (Berry and Waldfogel 2010). In section 8 we report evidence that our estimates of the fixed costs of newspapers of different size are a good match to balance sheet data. In appendix D we show that our findings are robust to allowing a more flexible dependence of the distribution of fixed costs on population.

Our model of advertising competition draws heavily on the theoretical literature on competition in two-sided markets with multi-homing (Armstrong 2002, Ambrus and Reisinger 2006, Anderson et al. 2011). Allowing for advertising competition is important because advertising accounted for the majority of newspaper revenue during the period we study. In equilibrium, each newspaper charges advertisers only for the incremental value of the impressions the newspaper can deliver, which is reduced if these impressions are

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 valuable than unique impressions.[4] Indeed, these practices explain the existence of the readership surveys that we use for a portion of our analysis.

We do not allow the quantity of ads to either increase or decrease the utility of a newspaper to consumers. This is a departure from many two-sided market models, but it is consistent with empirical evidence for print media (Kaiser and Song 2009).

We further assume that advertisers' valuations are homogeneous, an unrealistic assumption whose main effect on our analysis is the implication that all advertisers are served in equilibrium. We view this as an approximation to a model in which newspapers can effectively price discriminate among advertisers, a reasonable assumption given the importance of individually negotiated advertising rates, at least for major advertisers. Our model also ignores any dependence of advertiser valuations on consumer types (Chandra 2009). Relaxing this assumption would require richer data on advertising rates than we have available.

Our demand specification follows Gentzkow (2007) in allowing explicitly for multiple readership. This is crucial given the importance of audience duplication for advertising competition. As we discuss in section 8 below, our model and our readership survey data both imply a significant amount of multiple readership during the period we study, which in turn means that there is significant competition in the advertising market.

The demand model puts political affiliations at the center of consumers' decision-making. In the model, a household receives per-newspaper utility $\overline{\beta}$ for each newspaper in its consumption bundle that has the same affiliation as the household, and per-newspaper utility $\underline{\beta}$ for each newspaper that has a different affiliation. The household's utility is diminished by an amount Γ for every pair of newspapers with the same affiliation and by α for every dollar spent. An important restriction is that we do not allow diminishing returns in utility for newspapers of different affiliations. In appendix D we present results from a demand model that relaxes that restriction.

The demand model nests several cases of interest. When $\Gamma = 0$ and $\underline{\beta} = \overline{\beta}$, the demand model is equivalent to one in which each newspaper is a monopolist facing logit demand. In the limit as $\underline{\beta} \to -\infty$, the demand model is equivalent to one in which there are two distinct markets, one for R newspapers and one for D newspapers. In the limit as both $\underline{\beta} \to -\infty$ and $\Gamma \to \infty$, demand for newspapers of a given affiliation takes the familiar logit form, with each household choosing to read at most one newspaper.

The demand model ignores vertical differentiation among newspapers. Because we do not use cross-sectional variation in prices to identify the price coefficient α, and because we identify our model in part from variation in demand for a *given* newspaper, we do not expect that omitting quality variation from the model introduces an endogeneity bias (Berry et al. 1995). In appendix D we show results from a model that allows utility to depend on distance to a newspaper's headquarters, an important shifter of quality. In the supplemental appendix, we show explicitly that the crucial cross-sectional patterns that identify our demand

[4] In his text on advertising campaigns, Martin (1921) writes that "The same advertisement seen in two or three newspapers is certainly more effective than if seen in one, but some advertisers are convinced that it is not worth three times as much to have an advertisement seen in three papers, reaching largely the same readers, as to have it seen in one."

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 $q_{jt}S_t\zeta_{jt}$, where q_{jt} is the share of households purchasing newspaper j, S_t is the number of households in town t, and ζ_{jt} is a measurement error with $\log\zeta_{jt} \sim N\left(0, \sigma_\zeta^2\right)$, i.i.d. across newspapers and towns.

To implement the spatial identification strategy outlined in section 4.3, we assume that the share ρ_t of consumers in town t with $\theta = R$ is unobserved and may be correlated within the pairs of neighboring towns defined in section 2.2. Specifically, we assume that $\rho_t = \text{logit}^{-1}\left(\text{logit}\left(Z_t\right) + \nu_t\right)$, where Z_t is the observed Republican vote share in t's county and ν_t is a normally distributed unobservable with mean μ_ν^{town} and standard deviation σ_ν^{town}. The logit transformation ensures that $\rho_t \in (0,1)$. We assume that ν is correlated (and jointly normal) between pairs of neighboring towns t and t', but independent across pairs, with the within-pair correlation restricted to match that of the observable Z:

$$\frac{\text{Cov}\left(\nu_t, \nu_{t'}\right)}{\text{Var}\left(\nu_t\right)} = \frac{\text{Cov}\left(\text{logit}\left(Z_t\right), \text{logit}\left(Z_{t'}\right)\right)}{\text{Var}\left(\text{logit}\left(Z_t\right)\right)}. \tag{10}$$

To model the endogeneity of the choice set to town ideology, we assume that the probability that $\tau_{jt} = R$ is $\text{logit}^{-1}\left(\mu_\rho^0 + \mu_\rho^1 \text{logit}(\rho_t)\right)$, where μ_ρ^0 and μ_ρ^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 ρ_t and the size of the town S_t, and to allowing more flexibility in the dependence of affiliations on ρ_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 $\mathscr{J}_t^R$ and $\mathscr{J}_t^D$ of Republican and Democratic papers available in town t, respectively. Given some true ideology ρ_t, the conditional likelihood of the data for town t is:

$$L_t(\rho_t) = \frac{1}{\tilde{\sigma}_t}\phi\left(\frac{1}{\tilde{\sigma}_t\left|\mathscr{J}_t^R\right|}\sum_{j\in\mathscr{J}_t^R}\log\left(\frac{\hat{Q}_{jt}}{q_{jt}}\right) - \frac{1}{\tilde{\sigma}_t\left|\mathscr{J}_t^D\right|}\sum_{j\in\mathscr{J}_t^D}\log\left(\frac{\hat{Q}_{jt}}{q_{jt}}\right)\right)\Pr(\tau_t|\rho_t, J_t) \tag{11}$$

where ϕ denotes the standard normal PDF and $\tilde{\sigma}_t = \sigma_\zeta\sqrt{1/\left|\mathscr{J}_t^R\right| + 1/\left|\mathscr{J}_t^D\right|}$. The unconditional log likelihood of the observed data is:

$$\ln L = \sum_{(t,t')}\ln\int_{\rho_t,\rho_{t'}} L_t(\rho_t)\, L_{t'}(\rho_{t'})\, dF^{town}(\rho_t, \rho_{t'}|Z_t, Z_{t'}) \tag{12}$$

where $F^{town}()$ is the conditional joint distribution of ρ_t and $\rho_{t'}$ and the sum is taken over all pairs of neighboring towns.

We introduce additional data moments to complete identification of our model. First, we calibrate the marginal cost MC to the average variable cost of monopoly newspapers in markets with $Z_m \in [0.45, 0.55]$, as inferred from the Inland Press data. Second, we calibrate the monopoly advertising revenue per reader a_h to the average annual advertising revenue per copy of monopoly newspapers in markets with $Z_m \in [0.45, 0.55]$, as inferred from the Inland Press data. Third, for any candidate value of the other parameters of the model, we choose the price coefficient α and the utility shifter $\underline{\beta}$ so that the predicted average price and circulation per household of monopoly newspapers in markets with equal shares of Republicans and Democrats matches the observed average price and circulation per household of monopoly newspapers in markets with $Z_m \in [0.45, 0.55]$. In appendix D we present evidence on the sensitivity of our estimates to changes in the calibrated values of MC and a_h.[5]

We estimate the remaining parameters $\left\{\overline{\beta}, \Gamma, \sigma_\zeta, \mu_\nu^{town}, \sigma_\nu^{town}, \mu_\rho^0, \mu_\rho^1\right\}$ by maximizing equation 12, evaluating the integral numerically. Details are provided in appendix A.

[5] Annual circulation revenue is typically below posted prices, partly because of discounts to subscribers. We compute the average discount as the average ratio of subscription price to annual circulation revenue, and apply this discount to all subscription prices to compute the effective price of each newspaper.

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 $\overline{\beta}$ relative to $\underline{\beta}$. The share of households reading the newspaper in towns with $Z_t \in [0.45, 0.55]$ then pins down the levels of $\overline{\beta}$ and $\underline{\beta}$. Given these two parameters, observed monopoly markups in towns with $Z_t \in [0.45, 0.55]$ identify the price sensitivity parameter α. The strategy of inferring α from the newspapers' first order conditions rather than using explicit variation in prices follows Gentzkow (2007).

The relationship between the share of a town's available newspapers that are Republican and Z_t identifies the parameters μ_ρ^0 and μ_ρ^1.

The variance of unobserved ideology σ_ν^{town} is identified by spatial correlation in circulation as outlined in section 4.3. The higher the correlation between the relative circulation of Republican papers in town t and the relative number of Republican newspapers available in neighboring town t', the higher the inferred value of σ_ν^{town}. Given this parameter, the within-town relationship between the relative circulation of Republican papers and the relative number of Republican newspapers identifies Γ. This reduced-form relationship is shown in table 3. The more increasing the number of Republican newspapers decreases the relative circulation of the average Republican paper, the more substitutable we infer same-type papers to be, and the higher the value we assign to Γ.

The average relative circulation of Republican papers identifies μ_ν^{town}. The parameter σ_ζ, which governs the importance of measurement error in circulation, is then identified by the variance of residual circulation.

Although this heuristic discussion of identification treats the different steps as separable, the demand parameters are in fact jointly determined and jointly estimated.

7 Supply Estimation

Taking the demand parameters estimated in section 6 as given, we estimate the remaining parameters by maximum likelihood using our market-level data on newspaper entry and affiliation choices.

To implement the spatial identification strategy outlined in section 4.3, we assume that ρ_m is unobserved and may be correlated within the pairs of neighboring markets defined in section 2.1. We assume that $\rho_m = \text{logit}^{-1}(\text{logit}(Z_m) + \nu_m)$, with ν_m distributed normally with mean μ_ν^{mkt} and standard deviation σ_ν^{mkt}. We assume that the analogue of equation 10 holds for ν_m and Z_m.

We set the number of potential entrants J^{max} to 6, which is one more than the maximum number of newspapers observed in any market in our data. In simulations of our baseline model with $J^{max} = 10$, we find that fewer than one percent of markets have more than 6 entrants.

The econometrician observes Z_m, population S_m, the number of entering newspapers J_m, and the affiliation choices τ_m. The conditional likelihood of the data for market m given ρ_m and $J_m < J^{max}$ is:

$$L_m(\rho_m) = \begin{cases} 1 - G_m(V(J_m+1, \rho_m)) & \text{if } J_m = 0 \\ [G_m(V(J_m, \rho_m)) - G_m(V(J_m+1, \rho_m))] P(\tau_m, \rho_m) & \text{if } J_m > 0 \end{cases} \tag{13}$$

where G_m is the CDF of κ_m / S_m. Here we make explicit that both $V()$ and $P()$ depend on ρ_m and so drop

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

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

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

We estimate the remaining parameters $\left\{a_l, \sigma_\xi, \mu_\nu^{mkt}, \sigma_\nu^{mkt}, \mu_\kappa^0, \mu_\kappa^1, \sigma_\kappa\right\}$ by maximizing equation 14, evaluating the integral numerically and taking as given the demand parameters $\left\{\alpha, \underline{\beta}, \overline{\beta}, \Gamma\right\}$ estimated as described in section 6. Details are provided in appendix A.

Identification

The variance of unobserved ideology σ_ν^{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 σ_ν^{mkt}. The overall share of newspapers choosing a Republican affiliation pins down μ_ν^{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_l. 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_l correspond to a stronger incentive to differentiate.[6] Thus, a_l is identified by the extent to which newspapers differentiate more than would be expected from the demand system alone.

The scale term σ_ξ 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 μ_κ^0 and μ_κ^1, and the extent of variation in the number of newspapers conditional on population, which determines σ_κ. The dispersion parameter σ_κ 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_l, 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 $\overline{\beta}$ and $\underline{\beta}$ 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 $\xi_{jm}(\tau_{jm}) = 0$ for all j, m, and τ_{jm}. The cost shocks ξ_{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:

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

where B_i is the utility-maximizing bundle for household i and α 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 competitive newspapers is \$6.19 (in 1924 dollars), and the average advertising revenue per reader per year is \$10.43. Total surplus is \$4.26 per household per year, which breaks down into \$3.37 of consumer surplus, \$0.39 of newspaper profit, and \$0.50 of advertiser profit.

In the final two columns of table 10, we compare these equilibrium outcomes to those that would be chosen by a social planner whose goal is to maximize total surplus. Importantly, we do not assume that the social planner internalizes any political externalities associated with ideological diversity. These simulations therefore allow us to evaluate whether there is any tradeoff between the objectives of maximizing economic welfare and preserving diversity in the marketplace of ideas.

The second column of table 10 holds the number of newspapers fixed at baseline values, but allows the social planner to choose affiliations, circulation prices, and advertising prices. The social planner chooses substantially lower prices than occur in market equilibrium, with an average price in multi-paper markets of only \$0.27, leading the share of households reading newspapers to increase by about half. The social planner also chooses more ideological diversity than occurs in market equilibrium: the number of markets with diverse papers increases from 140 to 177, and the share of households reading diverse papers increases by a factor of three.

The third column of table 10 allows the social planner to control newspapers' entry decisions as well as post-entry outcomes. The results show that in market equilibrium the number of newspapers falls well short of the social optimum. The social planner increases the number of markets with at least one paper from 960 to 1910 and the number of markets with multiple papers from 250 to 1894. Increased entry further increases diversity: the number of households in markets with diverse papers rises to 93 percent, and more than half of households read diverse papers on any given day.

The source of insufficient entry here is the distortion formalized by Spence (1975): in markets with fixed costs, entrants do not internalize the effect of entry on the surplus of inframarginal consumers.[8] The result is not mechanical. In the standard symmetric logit model, which our model nests as a limit case, the number of firms in the free entry equilibrium can be greater or fewer than the first-best (Anderson et al. 1992). Insufficient entry arises at the estimated parameters because consumers capture a large share of surplus and because the significant (and empirically realistic) amount of multiple readership means the business-stealing externality highlighted in Mankiw and Whinson (1986) is relatively small.

We stress, though, that the fact that diversity falls short of the social optimum does not rely only on the entry margin: it arises even when we do not allow the social planner to choose the number of newspapers. Moreover, even when the social planner chooses the number of newspapers, the potential for welfare gains does not hinge on out-of-sample increases in the number of newspapers: we show in the supplemental appendix that the social optimum looks qualitatively similar even if we severely cap the number of newspapers

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define advertiser surplus in market m as the total value of advertisements placed less total advertising expenditures:

$$S_m \left((1 - q_{0m})(a_h - a_l) + \sum_{j=1}^{J_m} q_{jm} (a_l - a_{jm}) \right), \tag{16}$$

where q_{0m} is the share of households purchasing no newspaper. We define total surplus as the sum of consumer surplus, advertiser surplus, and newspaper profits.

[8] For early discussions of the tendency toward inefficient entry in concentrated markets see Hotelling (1938) and the work of Jules Dupuit as summarized in Ekelund and Hebert (1999, 159-191).

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

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

$$p^* \in \arg\max_{p} \sum_{j=1}^{J_m} \left(p_j + a_{jm}(p) - MC\right) q_{jm}(p) \tag{17}$$

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

$$a_{jm} = a_h \left(\frac{1 - q_{0m}}{\sum_{k=1}^{J_m} q_{km}} \right) + a_l \left(1 - \frac{1 - q_{0m}}{\sum_{k=1}^{J_m} q_{km}} \right) \tag{18}$$

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.

collusion increases advertising revenue per reader from $10.43 to $11.44. The increase in advertising revenue leads newspapers to reduce circulation prices to consumers, consistent with the well-known "seesaw principle" in two-sided markets (Rochet and Tirole 2006). Entry increases dramatically, with the number of markets with multiple papers almost doubling, from 250 to 459. These factors together cause consumer surplus and newspaper profit to increase by a half and a third respectively. Although some of this is a transfer from advertisers, total surplus increases increases from $4.26 to $5.39 per household per year. The large increase in entry more than offsets the reduced incentive to differentiate due to reduced advertising competition, and so diversity rises on all measures: the number of markets with diverse papers doubles, the share of households with access to diverse papers increases by 60 percent, and the share of households reading diverse papers more than doubles.

Joint operating agreements combine the effects of price and advertising collusion. The effects of the latter dominate the effects of the former, with both economic welfare and diversity increasing, though by less than under advertising collusion alone. Total surplus per household rises from $4.26 to $4.86, and the share of households reading diverse papers rises to 7.0 percent.

An important take-away from these results is that the two-sided nature of media markets substantially changes the evaluation of policy instruments. Price and advertising collusion are frequently treated as symmetric in the policy debate,[11] while in fact the two are very different. Joint setting of prices amounts to a tax on marginal readership and only a modest spur to entry, while joint setting of advertising rates amounts to a subsidy to marginal readership and a massive spur to entry. In a world where entry, readership, and diversity are all inefficiently low, permitting advertising collusion may be a surprisingly attractive policy to a regulator concerned with both economic welfare and democracy.

8.5 Ownership Regulation

In the final column of table 11, we evaluate the effect of relaxing ownership regulation. In the United States, and in most other countries of the world, the government limits the ability of individual firms to control multiple media outlets in the same market.[12]

We consider a counterfactual at the opposite extreme, in which all potential entrants in a given market are jointly owned. In the last stage, entering newspapers set collusive circulation and advertising prices as in joint operating agreements. In the affiliation choice stage, the common owner chooses a vector of affiliations to maximize total profits. In the entry stage, the common owner chooses the number of newspapers to maximize expected total profits. We assume that all entrants share a common affiliation-specific cost shock ξ.[13] We continue to assume that the draw on ξ is not known at the entry stage, and compute the expected values $V(J)$ by numerically integrating over the ξ via Monte Carlo simulation.

The results show that joint ownership significantly reduces both welfare and diversity. Entry is significantly reduced, with the number of markets with multiple newspapers falling from 250 to 168. Circulation

[11] See, e.g., the discussion of the debate surrounding the Newspaper Preservation Act of 1970 in Oppenheim and Shields (1981, 187-189).

[12] Ownership regulations apply most often to broadcast media and newspaper-broadcast cross-ownerhsip. For example, in the US today, the FCC limits ownership of a daily newspaper and a TV or radio station in the same local market, as well as ownership of multiple radio or television stations in the same market. Direct regulation of newpaper ownership is less common, though it does exist. In France, for example, no newspaper acquisition will be approved if the combined entity will have a circulation share greater than 30 percent (McEwen 2007).

[13] That is, we assume that $\xi_{jm}(\tau_{jm}) = \xi_{j'm}(\tau_{j'm}) \forall j, j' s.t. \tau_{jm} = \tau_{j'm}$.

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 reading diverse papers all fall by about a third.

The effect of joint ownership on affiliation choices is subtle. Note that most of the drop in diversity is a consequence of reduced entry; the share of multi-paper markets with diverse papers remains roughly stable. This reflects two offsetting effects on differentiation. On the one hand, allowing newspapers to internalize the effect of their affiliation choices on their competitors significantly increases the incentives to differentiate (Sweeting 2010). On the other hand, the fact that we assume jointly owned newspapers share a common cost shock ξ significantly increases the within-market correlation of affiliation choices, providing a strong force in the other direction.

8.6 Subsidies

The final policy we evaluate is newspaper subsidies. We base our counterfactuals on two real policies: a fixed cost subsidy in Sweden, which favors a local market's "second papers" (i.e., papers with lower circulation than the largest paper in the market; see Gustaffson et al. 2009), and postal subsidies in the United States, which at the time of our study constituted a meaningful subsidy to the delivery costs of many newspapers (Kielbowicz 1994). We model the first by assuming that second and subsequent entrants receive a subsidy of K_F dollars. We model the second by assuming that each newspaper receives a marginal cost reduction of K_M dollars. We calculate the total cost of each subsidy as $(1+\lambda)$ times the dollar amount transferred to newspapers, where λ is the marginal cost of public funds. We set $\lambda = 0.3$ (Einav et al. 2010, Poterba 1996). We compute the level of each subsidy that maximizes total surplus, ignoring any political externalities.

Table 12 shows the results. The surplus-maximizing fixed cost subsidy amounts to a payment of $\$13,316$ per year to the average second or subsequent entrant, or approximately 17 percent of pre-subsidy revenue. For comparison, the Swedish fixed cost subsidy amounts to roughly 15 percent of pre-subsidy revenue (Gustaffson et al. 2009). As expected, this causes a large increase in the number of newspapers, and nearly all markets with at least one entrant become multi-paper markets. This increased competition leads to increases in the welfare of consumers and advertisers and no meaningful change in newspaper profit. Subtracting the cost of the subsidy itself, we find an increase in total surplus per household from \$4.26 to \$5.05. Diversity increases dramatically, with the number of diverse markets rising from 140 to 516 and the share of households reading diverse papers tripling to 11 percent.

The surplus-maximizing marginal cost subsidy amounts to an average payment of \$7 per copy per year, equivalent to a 51 percent reduction in marginal cost. For comparison, the US postal subsidy amounted to a roughly 12 percent reduction in marginal cost.[14] Of all the policies we consider, this one is the most effective in increasing economic welfare and diversity, both because it promotes entry in markets that previously had no papers, and because it increases readership conditional on the number of papers. The number of markets with any paper rises from 960 to $1,900$, and the number with multiple papers rises to $1,448$. Prices fall substantially, and the share of households reading a paper rises to 0.78. The welfare of consumers, newspapers, and advertisers rises dramatically. After deducting the cost of the subsidy, total surplus per

[14] In 1924, the post office's cost of publication delivery exceeded its revenue by a factor of more than three (Kielbowicz 1994). We estimate that postage accounted for 6 percent of variable costs, so the implicit subsidy was approximately 12 percent of variable costs.

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 (α)	0.1793
	(0.0023)
Mean utility for different-affiliation paper ($\underline{\beta}$)	-0.1687
	(0.0582)
Mean utility for same-affiliation paper ($\overline{\beta}$)	0.7416
	(0.0649)
Substitutability between same-type papers (Γ)	0.2336
	(0.0552)
Standard deviation of log of measurement error (σ_ζ)	0.7004
	(0.0076)
Mean of unobservable shifter of fraction Republican (μ_ν^{town})	0.1116
	(0.0585)
Standard deviation of unobservable (σ_ν^{town})	0.2739
	(0.0136)
Parameters governing share of town's newspapers that are Republican	
μ_ρ^0	-0.2017
	(0.1174)
μ_ρ^1	1.9931
	(0.0335)
Calibrated parameters:	
Marginal cost (MC)	8.1749
Spatial correlation of unobservable ($\frac{\text{Cov}(\nu_t, \nu_{t'})}{\text{Var}(\nu_t)}$)	0.7233
Number of towns	12188
Number of newspapers	670
Number of newspaper-towns	28779

Notes: Table shows the estimated parameters of the demand model with asymptotic standard errors in parentheses. See section 6 for details on estimation method.

Table 8: Parameter Estimates (Supply Model)

Advertising revenue per reader of non-singleton bundles (a_l)	6.6815
	(0.8996)
Standard deviation of affiliation cost shocks (σ_ξ)	0.1936
	(0.0265)
Mean of unobservable shifter of fraction Republican (μ_ν^{mkt})	-0.0139
	(0.0179)
Standard deviation of unobservable (σ_ν^{mkt})	0.0917
	(0.0978)
Parameters governing the distribution of fixed costs	
μ_κ^0	8.2634
	(0.4577)
μ_κ^1	-0.5952
	(0.0587)
σ_κ	0.3323
	(0.0328)
Calibrated parameters:	
Advertising revenue per reader of singleton bundles (a_h)	13.2811
Spatial correlation of unobservable ($\frac{\text{Cov}(\nu_m, \nu_{m'})}{\text{Var}(\nu_m)}$)	0.7217
Number of markets	1910
Number of newspapers	1338

Notes: Table shows the estimated parameters of the supply model with asymptotic standard errors in parentheses. See section 7 for details on estimation method.

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 (ξ)	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 ($\rho = 0.5$). "Ignore idiosyncratic cost shocks" is a counterfactual in which each paper chooses its affiliation as if $\xi = 0$. "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
Newspaper profit	0.39	-4.04	-19.57
Advertiser profit	0.50	6.79	9.49
Total surplus	4.26	9.69	10.28
Diversity			
Markets with diverse papers	140	177	1632
Share of hhlds in markets with diverse papers	0.22	0.28	0.93
Share of hhlds reading diverse papers	0.036	0.123	0.555

Notes: Table shows averages over 5 counterfactual simulations at the parameters reported in tables 7 and 8. The distribution of profits between newspapers and advertisers is indeterminate in the two counterfactuals shown; we assume that advertisers capture all surplus from advertising. 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. In column (2), the number of newspapers is fixed at its baseline value and a social planner chooses affiliations, ad prices, and circulation prices to maximize total surplus, with the constraint that all prices must be weakly positive. In column (3), the social planner also chooses the number of papers in each market. Average price is an annual subscription price. Average ad revenue is reported per reader per year. Surplus and profit numbers are reported in annual dollars per household.

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					
Markets with diverse papers	140	151	280	284	94
Share of hhlds in markets with diverse papers	0.22	0.24	0.36	0.36	0.16
Share of hhlds reading diverse papers	0.036	0.029	0.084	0.070	0.022

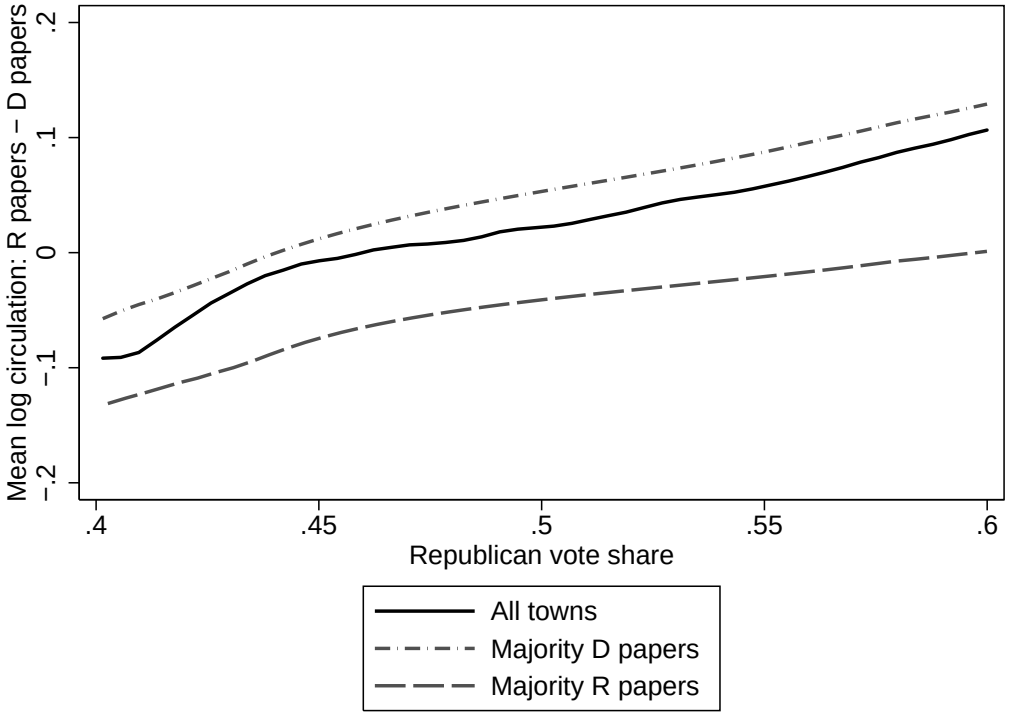
Notes: Table shows averages over 5 counterfactual simulations at the parameters reported in tables 7 and 8. A market has diverse papers if it has at least one Republican and one Democratic paper, and a household reads diverse papers if it reads at least one Republican and one Democratic paper. "Baseline" is simulation of the estimated model. Columns (2)-(4) are counterfactuals in which entering papers set prices, ad rates, or prices and ad rates, respectively, to maximize their total profits. Column (5) is a counterfactual in which all potential entrants in a given market are jointly owned. Joint ownership means that newspapers make entry, affiliation, pricing, and ad rate decisions to maximize joint profits subject to a common affiliation cost shock ξ. Average price is an annual subscription price. Average ad revenue is reported per reader per year. Surplus and profit numbers are reported in annual dollars per household.

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 payment to the second and all following entrants. "Optimal Marginal-Cost Subsidy" provides a payment per copy sold to all papers. Average price is an annual subscription price. Average ad revenue is reported per reader per year. Surplus and profit numbers, as well as cost of subsidy, are reported in annual dollars per household. Cost of subsidy includes a 30% cost of public funds.

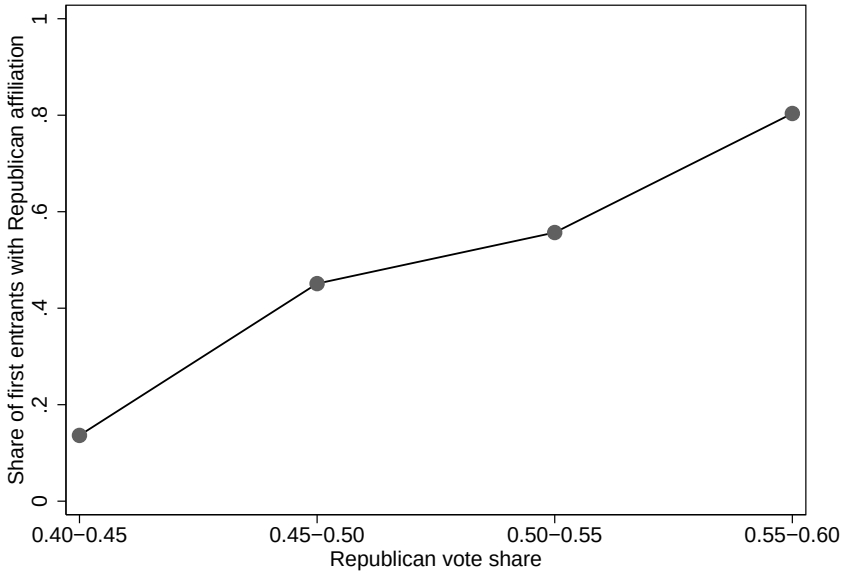
Figure 1: Demand for Partisanship



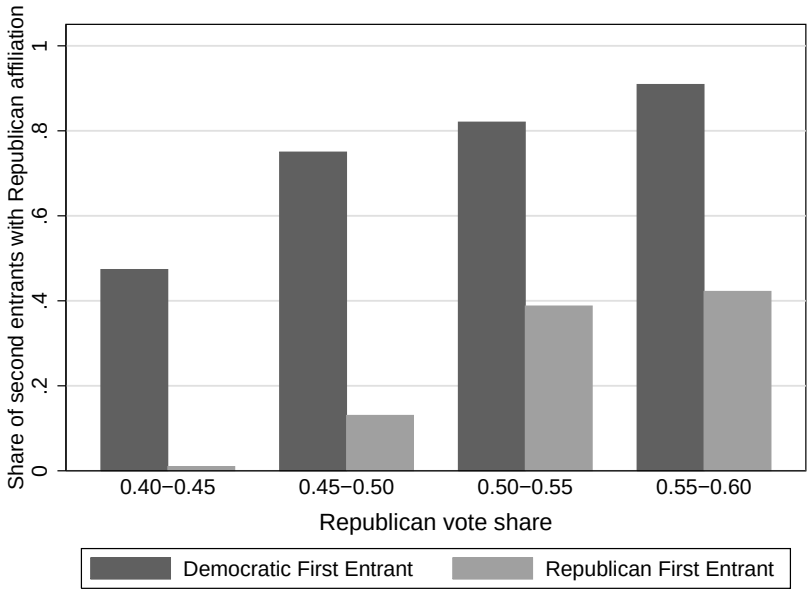
Notes: Data are from the demand estimation sample described in section 2.2. Republican vote share is the average Republican share of the two-party vote in presidential elections from 1868-1928. The sample includes all towns with at least one Democratic newspaper and at least one Republican newspaper 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 Γ to be positive. (The descriptive evidence in table 3 strongly suggests that $\Gamma > 0$, and if $\Gamma < 0$ 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 κ_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 et al. 2006). We compute asymptotic standard errors using a numerical Hessian, adjusting standard errors in the supply stage for the use of a two-step procedure following Murphy and Topel (1985).

B Panel Evidence on Determinants of Affiliation

Table 4 presents descriptive statistics for newspapers' choice of affiliation calculated for our main sample, which is a cross-section of markets as of 1924. Appendix table 1 produces analogous summary statistics for our full panel of newspapers, which differs from the main sample in including newspapers that entered and exited prior to 1924.

Column (1) of appendix table 1 shows a specification analogous to specification (3) of table 4. Column (2) of appendix table 1 instruments for our main measure of household ideology with the Republican share of the two-party vote in the presidential election prior to the newspaper's entry. Column (3) includes the lag vote share as a control.

Column (1) of appendix table 1 supports the key qualitative conclusions of specification (3) of table 4. Quantitatively, the specification in the appendix table shows a similar effect of household ideology and a smaller effect of incumbent affiliation. The latter difference is likely due to the fact that the sample in the appendix table includes incumbents not present in 1924, and hence disproportionately likely to be smaller, less successful newspapers.

Column (2) of appendix table 1 shows that the estimated coefficients do not change much when we instrument for consumer ideology with the vote share prior to the newspaper's entry. This finding corroborates

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 value of a_h by 10 percent relative to the baseline value. These changes leave our key qualitative conclusions unchanged. Not surprisingly, as these parameters directly affect the economic efficiency of newspaper readership, changing them has some quantitative effect on the welfare calculations and hence the scope for welfare-improving changes.

The sixth and seventh specifications increase and decrease the calibrated values of both $\frac{\text{Cov}(\nu_t,\nu_{t'})}{\text{Var}(\nu_t)}$ and $\frac{\text{Cov}(\nu_m,\nu_{m'})}{\text{Var}(\nu_m)}$ by 10 percent relative to their baseline values. These changes have little effect on our quantitative results.

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.

The eighth row presents estimates from a specification in which we modify the demand model to treat the number of newspapers available in a town as endogenous. In particular, we model the number of newspapers J_t in a town t as a Poisson random variable whose log mean is a linear function of $\log(S_t)$, ρ_t, ρ_t^2.

The ninth row adds flexibility to the fixed cost distribution in the supply model by allowing $\frac{\kappa_m}{S_m}$ to be distributed logistic with location parameter $\mu_\kappa^0 + \mu_\kappa^1 \log(S_m) + \mu_\kappa^2 \log(S_m)^2$.

The tenth row presents estimates from a specification in which we allow greater flexibility in the way in which consumer ideology affects the affiliations of newspapers that are available in a given town. In particular, we assume that the probability that a given newspaper available in town t is Republican is $\text{logit}^{-1}\left(\mu_\rho^0 + \mu_\rho^1 \text{logit}(\rho_t) + \mu_\rho^2 \text{logit}(\rho_t)\right)$.

The eleventh and twelfth rows extend the model to include an additional substitutability parameter between different-type papers. Letting subscripts s and d refer to same- and different-type papers, we generalize our utility model so that the utility of household i from bundle B is given by

$$u_{im}(B) = \sum_{j \in B} \left(\underline{\beta} \mathbf{1}_{\theta_{im} \neq \tau_{jm}} + \overline{\beta} \mathbf{1}_{\theta_{im} = \tau_{jm}} - \alpha p_{jm} \right) - g_s(B)\Gamma_s - g_d(B)\Gamma_d + \varepsilon_{im}(B), \tag{19}$$

where $g_s(B)$ and $g_d(B)$ denotes the number of distinct two-newspaper subsets of bundle B such that the two newspapers have the same and different affiliations, respectively. In the ninth row we estimate the parameters Γ_s and Γ_d freely. These are jointly identified only by functional form, so results should be taken with some caution. In the tenth row we constrain Γ_d to be equal to one-half of the point estimate of Γ in our baseline specification and estimate Γ_s freely.

The thirteenth row extends the demand model to allow the utility from reading a newspaper to depend on distance. We assume that the utility of bundle B is reduced by $\sum_{j \in B} \alpha_d dist_j$ where $dist_j$ is the distance from the town to the newspaper's home market and α_d is a parameter that we estimate.

None of these changes to model specification meaningfully affects the qualitative conclusions from comparing across counterfactuals.

The remaining rows of the table present estimates from various subsets of the main estimation sample. The sample in the fourteenth row tightens the population restrictions defining the universe of potential daily newspaper markets by 25%, by excluding all market pairs containing a market with population smaller than 3,750 or larger than 75,000. The sample in the fifteenth row excludes any market pair containing one or more independent newspapers in 1924. The sample in the sixteenth row excludes any market pair containing one or more unaffiliated newspapers as of 1924. The sample in the seventeenth row excludes any market pair containing a market within 100km of any of the ten most populous cities as of the 1920 Census. The sample in the eighteenth row drops any town pair for which our town-level circulation data omit a newspaper in at least one town's nearest news market. The sample in the nineteenth row excludes any market pair containing a pair of papers in different markets that are owned by the same chain as of 1932. (Our ownership data are from the 1932 *Editor and Publisher Yearbook*. The earlier annual directories that we use to construct our main sample do not include lists of chain-owned newspapers.) The sample in the twentieth row excludes any market pair containing a market in the South.

None of these changes to the sample affects our qualitative conclusions. As we would expect, removing

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		
$\underline{\beta}$	-0.1687	-0.1254
	(0.0582)	(0.0477)
$\overline{\beta}$	0.7416	0.6936
	(0.0649)	(0.0527)
Γ	0.2336	0.1563
	(0.0552)	(0.0473)
Supply parameters		
a_l	6.6815	6.6788
	(0.8996)	(0.8915)
σ_ξ	0.1936	0.1807
	(0.0265)	(0.0238)

Notes: Column "baseline" presents estimates of a selection of parameters from tables 7 and 8. Column "no unobservables" presents estimates of the same parameters from a model in which we constrain $\sigma_\nu^{mkt} = \sigma_\nu^{town} = 0$ and treat τ_t as nonstochastic in demand estimation.

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

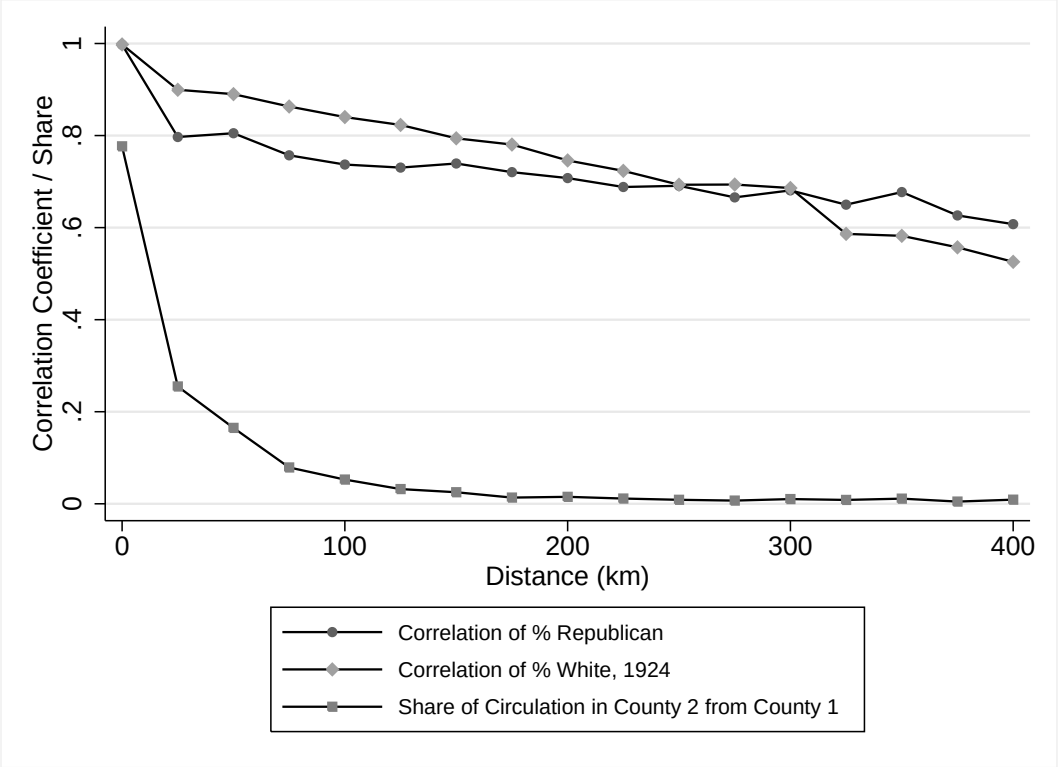
Notes: See appendix D for details.

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.