Flailing Firms and Joint Operating Agreements: An Application to U.S. Local Daily Print Newspapers from 1932 to 1992.

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May 27, 2024

Abstract

Price coordination is per se illegal, but antitrust authorities sometimes make exceptions to this rule in "flailing" and "failing" industries when consumers might benefit from sustained product variety provided by multiple firms. In the U.S. local daily print newspaper industry, Joint Operating Agreements (JOAs) facilitating price coordination and transfers among firms are one such exception. JOAs present a potential compromise between permitting mergers and allowing firms to fail. They help firms survive by increasing profits but may also preserve non-price aspects of competition by preventing full coordination among firms. I present a dynamic empirical framework for evaluating the long-run welfare implications of JOAs and use this framework to evaluate JOAs in the U.S. local daily print newspaper industry from 1932 to 1992. Estimating a dynamic game capturing firm exit, entry, price coordination, and endogenous transfers, I find that allowing JOAs had a negligible impact on the number of multi-firm newspaper markets remaining in 1992. My model indicates two structural reasons for the small effect: (i) collusive incentives to coordinate with a rival firm are offset by predatory incentives from the possibility of that rival exiting, and (ii) endogenous transfers incentivizing JOA entry but not joint survival create a wedge between JOA incentives and effectiveness.

*Contact: audreytiew@gmail.com, Current Affiliation: University of California, Berkeley. I thank Robin Lee, Ariel Pakes, and Myrto Kalouptsidi for their continued guidance and support. I also thank Patty Slusher from America's Newspapers, the Harvard research librarians, Michael Sinkinson, Jesse Shapiro, and Matthew Gentzkow for providing data access and helping me digitize additional data sources. I am grateful to Claire Song for excellent research assistance. I am also grateful to Tom Wollman, Oliver Hart, Jun Ishii, Ed Glaeser, and Jesse Shapiro for their valuable feedback as well as the participants of the Stanford IOPLUS Seminar, Harvard Industrial Organization Workshop and Seminar, Contracts and Organizations Workshop, and History Workshop. This research has been supported by the Lab for Economic Analysis and Policy at Harvard University.

1 Introduction

Under U.S. antitrust policy, price coordination is per se illegal. This implies that, without a formal exception, price coordination is illegal regardless of the underlying motivation and even if it could improve welfare. One of the few formal exceptions allowing price coordination is permitting Joint Operating Agreements (JOAs) in flailing or failing industries. Government authorities sanction JOAs in hopes of forestalling firm exit by allowing firms higher profits from price coordination. The motivation behind this exception comes from the possibility that consumers would be better off with the sustained market participation of those endangered firms, even at the higher price resulting from coordination. In contrast to mergers, JOAs do not allow for coordination on non-price product characteristics or firm exit decisions. As such, JOAs may even present a welfare-improving alternative to allowing mergers or firm failure in industries characterized by differentiated products, as the variety of products available to consumers depends on the number of firms supplying the market. When consumers value the sustained product variety even at a higher coordinated price, JOAs improve consumer welfare.

Whether JOAs actually improve consumer welfare is an empirical question that depends on two key tradeoffs. First, consumers must internalize the value of variety enough such that having sustained access to more variety can generate more utility than is lost from higher prices. Second, JOAs must be both incentive compatible to firms and able to forestall firm exit. One point largely ignored in the literature and policy discussion is whether and in what scenarios JOAs can sustain firms with product variety. In particular, existing discussions have not considered the voluntary nature of JOAs and the transfers JOAs facilitate. Some firms may not want to coordinate much (or at all) even when such coordination is sanctioned under a JOA, and transfers incentivizing coordination may decrease the ability of JOAs to delay exit.

I present an empirical framework for evaluating these tradeoffs in the context of U.S. local daily print newspapers from 1932 to 1992. The local daily newspaper industry has both important product variety and major concerns about firm exit. These characteristics combined led Congress to officially sanction JOAs for local daily print newspapers during my study period via the Newspaper Preservation Act (NPA). Policymakers believed that the NPA could advance public interest by "... maintaining a newspaper press editorially and reportorially independent ..." (Carlson, 1971). Though sanctioned by the government, forming JOAs was costly to newspapers, as they often faced fees associated with contracting, restructuring, and applying to the Department of Justice (DoJ) for approval.

Even though Congress ultimately passed the NPA, there was much disagreement at the time about whether the policy could effectively preserve newspaper variety. For example, Philip A. Hart, a democratic senator from Michigan and chairman of the Antitrust Subcommittee at the time, stated of the NPA, "... while I think the bill is wrong and shall oppose it ... I am quite willing to acknowledge that other men, at least as well motivated, may reach an opposite conclusion..." (p. 772; Congress et al., eds, 1963). Moreover, whether or not the NPA did help preserve news variety and at what cost has remained an open empirical question (see, for example, the debate surrounding the Detroit JOA: Randolph and Behr 1986).

To evaluate this open empirical question of whether JOAs helped sustain news variety, I model and estimate a dynamic game of newspaper entry, exit, and price coordination decisions where newspapers entering or in JOAs pay transfers negotiated over expected discounted stream payoffs (i.e., "dynamic transfers"). This dynamic game augments Ericson and Pakes (1995) to include an incentive compatibility constraint determining whether firms join a JOA and dynamic transfers as in Lee and Fong (2013). Payoffs in this setting come from a static stage game of: (i) newspaper choices of subscriber price, advertiser price, and content quality, (ii) consumer choices of which newspapers to purchase, and (iii) advertiser choices of in which newspapers to advertise. Newspapers in a JOA coordinate on subscriber and advertiser prices but choose quality separately. I draw my model of consumer choices from Fan (2013) and my model of advertiser choices from Gentzkow et al. (2014).

The dynamic game and payoffs allow me to investigate the two tensions underlying the effectiveness and desirability of JOAs: (i) the tension between sustained product variety and prices faced by consumers and policymakers, and (ii) the tension between collusive and predatory incentives faced by "stronger" (i.e., financially healthier) firms in markets with possibly failing/flailing rivals. Firms face collusive incentives to join JOAs because price coordination enables firms to extract more surplus from consumers and earn higher profits. However, they also face predatory incentives because price coordination forestalls exit by rival firms, resulting in the "stronger" firm sharing the market with its weaker rivals for more periods. The tradeoff between these two incentives implies that a firm "stronger" than its competitor may prefer not to coordinate. Historically, firms have recognized these predatory incentives against coordination, and transfers allocating the stronger firm a larger share of the joint profits under price coordination are a central feature of JOAs. However, transfers further complicate the tension between incentives to enter JOAs and the ability of JOAs to reduce exit. The gains from joining a JOA allocated to the stronger firm via transfers may also leave the weaker firm with insufficient gains to forestall exit. As such, transfers can help create a wedge between when firms want to join JOAs and when JOAs are most effective at extending joint survival.

I derive and implement a two-step estimation method (e.g., Pakes et al. 2007) allowing for incentive compatibility constraints and dynamic transfers and modify the Pakes and McGuire (1994) algorithm to compute equilibria of the dynamic game resulting from my estimates. Using these results, I infer the extent to which JOAs did forestall exit by firms representing valuable product variety as well as the factors both helping and limiting the success of JOAs. My estimates and counterfactual exercises imply that JOA proponents were overly optimistic about how much price coordination could help preserve multiproduct markets (i.e., variety). I find that allowing JOAs had little effect sustaining newspaper survival and only increased the number of multi-paper markets remaining in 1992 by 0.04% ($<$ 1 newspaper out of 1,342 markets). However, I also find that JOA opponents were overly pessimistic about the policy's costs, with the average 4-year change in reader surplus (per reader) being only $-\$0.43$.

The model estimates and counterfactuals point to both incentive compatibility and market primitives as underlying reasons for these negligible effects. Incentive compatibility applies through the tradeoff between the collusive and predatory incentives firms face. As a result of high exit probabilities in the newspaper industry, predatory incentives from a rival potentially exiting offset some of the collusive incentives to join JOAs. While allowing for endogenous transfers can mitigate some of these disincentives to JOA entry, transfers also contributed to the wedge between when JOAs most sustain variety and when firms choose to enter into JOAs. In general, I find that JOAs help increase the weaker firm's survival more when firm strengths are relatively asymmetric but that collusive incentives are more dominant when both firms are strong. As a result, eliminating all costs to coordination (e.g., no longer requiring approval by the DoJ) could have incentivized more asymmetric pairs of firms to coordinate, increasing the number of remaining multiproduct, multi-firm markets by 2.54%. Notably, allowing for endogenously determined transfers incentivizes stronger firms to enter JOAs potentially at the cost of JOA efficacy. This may account for some industry observers claiming that JOAs "crippled" the weaker papers in the agreements (Barringer, 1999).

Market primitives matter in the form of increasingly available alternative media sources. Low average profit levels in the daily newspaper industry driven by the emergence of outside options such as radio and television greatly limited the extent to which coordination could increase profits and consequently reduce exit probabilities in some local markets. However, variation across markets in the value of the outside option also provides insight into when JOAs can improve consumer welfare. In counterfactual simulations with positive exit probabilities and barring market entry, I find that JOAs may still be a valuable policy intervention in the case of "flailing" markets with mild or moderate exit probabilities rather than failing markets with the highest probabilities of exit.

This project ties in with the literatures on the newspaper industry and dynamic games. With respect to how ownership structure impacts available product variety in the newspaper industry, this project builds most directly off of the discussions in Gentzkow et al. (2014) and Fan (2013). Gentzkow et al. (2014) focus on how competition in the short run induces firm asymmetry by incentivizing firms to produce newspapers of different political affiliations to soften price competition. They further note how access to this variety improves consumer welfare. This work contributes to this discussion by showing that the desire to soften price competition that leads firms to provide short run variety may make sustaining variety in the longer run more difficult. In particular, when exit probabilities are high, firms that are more asymmetric or that provide less similar products may gain even less from price coordination relative to becoming a monopolist. This results in the financially stronger firm also having relatively stronger predatory incentives against coordination designed to help preserve variety.[1]

Fan (2013) provides a counterpart to the arguments made in Gentzkow et al. (2014) by showing how after a merger, the merged firm may choose to reduce product variety to max-

[1] On one hand, consider a democratic and republican newspaper in a market of mostly democratic readers (Market A). The democratic newspaper will be stronger and experience greater "predatory" motives when considering cooperation with the republican newspaper. On the other hand, consider two democratic papers in a market of primarily democratic readers (Market B). The newspapers will be of more similar strengths, and neither firm will experience particularly strong predatory motives that can overcome the collusive motives underlying JOAs. In a repeated games setting, Market A is more likely to become a monopoly market because one paper has a much higher probability of exit and there are weaker incentives to coordinate. Consequently, consumers in Market A may be worse off than those in Market B, as they are left with no diversity and no price competition in the long-run even though Market A began with greater news diversity.

imize profits. As such, newspapers under joint ownership decrease consumer surplus by both increasing prices and decreasing variety. By focusing instead on JOAs, this project captures how, similarly to mergers, JOAs may incentivize newspapers to increase prices and choose alternative product characteristics and how, in a static sense, JOAs may also harm consumer welfare. However, it also highlights why JOAs can be an attractive alternative to mergers from the perspective of a policymaker. If one believes that important product variety will not be sustained after a merger, JOAs, by barring firms from coordinating on non-price characteristics, may be preferable. Under a JOA, jointly optimizing over content, for instance, is technically not part of the possible action set. This distinction motivates why, relative to merger, JOAs have the potential to improve consumer welfare in a repeated game when readers highly value variety.[2] In considering JOAs as a merger alternative, consumers and policymakers trade off slightly higher JOA prices up front to avoid even higher monopoly prices and reduced variety in the future.

Focusing on transfers and firm exit in a repeated games setting also contributes to the discussions regarding tacit collusion and mergers in the dynamic games literature. While the focus of this project is on legal exemptions allowing price coordination, the model and estimation method allowing for efficient transfers negotiated over discounted stream payoffs also provide a test for when collusion can be sustained. Since collusion is often necessarily tacit, the literature does not dwell on how the possibility of transfers affects incentives to collude (e.g., Fershtman and Pakes 2000; Igami and Sugaya 2022). Allowing for transfers expands the state space under which collusion can be sustained, and allowing for efficient transfers creates a "best case" scenario for prospective collusive firms. Under efficient transfers, firms can sustain collusion so long as the sum of discounted stream payoffs across all firms from collusion is higher than the sum under competition. Consequently, finding that collusion is not sustainable under efficient transfers implies that it is never sustainable. Moreover, the methods I suggest also provide a foundation to think about when collusion is sustainable when firms can approximate transfer

[2] Consider, for example, the EchoStar (now DISH) and DIRECTV merger proposed and blocked in 2002. The companies suggested the merger on the grounds that they were struggling to compete with cable. They also argued that efficiencies from the merger would help the companies carry a greater variety of local television stations. However, regulators blocked the merger, citing these claims as non-credible (*Justice Department File Suit to Block ECHOSTAR's Acquisition of Hughes Electronics*, 2002). Requiring the firms to remain separate entities who coordinated under price but competed in terms of product quality and variety may have addressed some of the DoJ's concerns. These issues continue into the present day. DISH and DIRECTV have raised the possibility of merger again in 2022, now citing harm from internet competition (Price, 2022).

mechanisms via methods such as market sharing.

In addition to the literature on collusion, this paper extends the literature on dynamic merger decisions (see Igami and Uetake 2020; Mermelstein et al. 2020) by studying a related type of endogenous ownership structure. Aside from the specific product characteristics on which firms are allowed to coordinate, a key difference between JOA and merger incentives is that analyzing merging firms does not require evaluating the same predatory incentives. Whereas coordinating firms make separate exit decisions, exit decisions in the merger setting are made jointly. Thus, when considering merger, the stronger firm internalizes the possibility of buying out a competitor and shutting them down to become a monopolist.

The rest of the paper is as follows: Section 2 provides background on the local daily print newspaper industry and antitrust exemptions allowing firm coordination. Section 3 describes my data. Section 4 provides some descriptive evidence of the effect of price coordination on exit and the determinants of incentive compatibility. Section 5 describes the static stage game I use to motivate static profits and how I estimate those profits. Section 6 lays out a dynamic game of firm market entry, market exit, coordination decisions, and dynamic transfers. Section 7 discusses how I estimate the parameters of the dynamic game. In section 8, I provide my parameter estimates. Section 9 motivates and presents counterfactual exercises looking at different ways of allowing coordination. Section 10 concludes.[3]

2 Background

2.1 Application to Local Daily Newspapers: 1932-1992

2.1.1 Industry Decline

A defining characteristic of the local daily print newspaper industry from 1932 to 1992 (and into the present day) was its slow and persistent decline. Figure 1 shows how the fraction of markets with more than one newspaper decreased from 42% in 1932 to 22% in 1992. A key reason for this attrition was the spread of radio in the 1920s and 1930s and the rise of television starting in the 1950s.

While in hindsight these technological advances appear inevitable, there was skepticism at

[3]Figures and Tables are listed at the end in sections 11 and 12, respectively.

the introduction of each new technology about how influential they could become. For example, even David Sarnoff, the founder of the Radio Corporation of America and NBC, was originally skeptical about the spread of radio. He once stated, “The [radio] has no imaginable commercial value. Who would pay for a message sent to no one in particular?” Similar skepticism existed about the introduction of television and, eventually, the internet. At the 1939 World’s Fair, a New York Time’s reporter remarked, “ The problem with television is that people must sit and keep their eyes glued to the screen; the average American family hasn’t time for it” (Crolius, Ali, 1993). Paul Krugman is infamously recorded as stating, “By 2005 or so, it will become clear that the Internet’s impact on the economy has been no greater than the fax machine’s” (Yarow, 2013). The unanticipated popularity of these other forms of media perhaps explains why newspapers had a limited ability to mitigate the impact of these shocks by, for example, (better) integrating these technologies at the onset.

The successive fall in reader demand resulting from each new technology led to what industry observers have called a “death spiral” for newspapers (e.g., Mcardle 2009). The notion of a “death spiral” comes from the two-sided nature of newspaper markets (Anderson and Waldfogel, 2015). On one side, newspapers sell news content to readers. On the other, they sell advertising space to advertisers. While readers value the content of newspapers, advertisers value the readership a newspaper has, and the amount of advertising revenues a newspaper earns is positively correlated with its readership. Consequently, the decreases in readership led to shrinking reader and advertising revenues, precipitating firm exit.

This decline may not have been socially efficient for two reasons. First, newspapers do not fully internalize the value of variety to consumers when making their exit decisions. In particular, newspapers are not always able to extract readers’ full valuation of variety as revenue, and what they can extract may not be sufficient for them to remain in the market. As such, in markets where consumers highly value variety, there can still be welfare loss from newspaper exit. Second, newspapers’ historical role as the “fourth estate” could provide additional social value that is uninternalized by firms, readers, or advertisers. Gentzkow et al. (2004) note that newspapers played a historically important role in reducing government corruption during the Progressive Era. Mahone et al. (2019) note that new alternative forms of information such as radio, television, and internet may not produce a similar quality and quantity of local news.

They write, "Local newspapers significantly outperform local TV, radio, and online-only outlets in news production, both in overall story output and in terms of stories that are original, local, or address a critical information need [such as political life, civic information, etc.]." When assessing how their willingness to pay for variety, individual readers may not internalize, for instance, the value of the news in helping them keep a check on government corruption at various levels (e.g., local, state).

2.1.2 Joint Operating Agreements

The relaxed stance taken by the federal government towards price coordination in the local newspaper industry reflects policymaker perceptions of the industry's social value. The Department of Justice (DoJ) has largely allowed Joint Operating Agreements (JOAs) under which local daily newspapers in the same market were allowed to explicitly contract on coordination measures such as price fixing, market allocation, monopoly advertising prices, and profit pooling (Picard, 1987, 2007; Romeo et al., 2003). However, JOAs allowed for only limited coordination, and the key restriction in these agreements was that each newspaper had to separately fund its news and editorial staff. This limitation meant that JOAs would preserve variety in the sense that papers would continue to produce content independently. In practice, JOAs also included transfers among firms reflecting agreed upon revenue-loss splits. Newspapers also frequently renegotiated, amended, and extended their JOA contract terms depending on how well one paper was doing in terms of metrics such as relative circulation or revenue (Busterna and Picard, 1993).

Initially, the government's support for JOAs was implicit. The *Albuquerque Journal* and *Albuquerque Tribune* formed the first JOA in 1933. Subsequently, "for more than 30 years," these agreements were "overlooked" by antitrust authorities (Barwis, 1980). Barwis (1980) connects this intentional negligence to the 1930 Supreme Court case *International Shoe Co. v FTC* which established a precedent for the "failing firm defense." This defense extended antitrust exemptions to firms headed towards future bankruptcy. The case also set down additional criteria requiring that authorities consider "public interest" when deciding whether to challenge agreements. Barwis (1980) argues that the "failing firm defense" was likely used to justify overlooking the the Albuquerque JOA, as many newspapers suffered financially during the Great Depression. Thus, the lack of prosecution against JOAs before 1960 may reflect a willingness of antitrust authorities to allow newspapers more market power in exchange for more periods of socially valuable news variety.

Moreover, had it not been for an attempted merger in 1964 between two JOA newspapers, the Arizona *Citizen* and *Star*, the DoJ might have continued to overlook JOAs (Picard, 2007). Barwis (1980) writes, "It was this [offer by the *Citizen* to purchase the *Star*] which brought the case to the attention of the Antitrust Division of the Justice Department" (p. 30). By passing the Newspaper Preservation Act of 1970, Congress formally endorsed the value of maintaining multi-paper markets at the cost of allowing price coordination among local newspapers in the same market. The purpose of this Act was to officially uphold the previously de facto antitrust exemption allowing newspapers to enter into JOAs after the DoJ formally prosecuted the Arizona *Citizen* and *Star*. At face value, this Act reflects policymaker hopes that price coordination would help multi-paper markets survive and preserve the social value of variety provided by these markets.

2.2 Antitrust Exemptions Across Industries

Antitrust exemptions allowing some degree of coordination among firms also exist in a number of other industries. Major examples include airlines and hospitals.[4] In the hospital industry, coordination among firms also takes the form of joint operating agreements under which firms make some joint financial decisions similar to those under newspaper JOAs. With respect to airlines, coordination occurs as airline alliances and codesharing. The industries share some notable characteristics: (i) periods of industry-wide negative shocks to profits that increased the probability of exit, and (ii) some degree of product variety that is important to public welfare.

These common characteristics provide the motivation behind the often controversial antitrust exemptions made for these industries. In each of these settings, policymakers believed that decreased long-run consumer access to variety brought on by firm exit could harm welfare. In the context of hospitals, hospitals have began experiencing declining operating margins during the 2008 recession, with a 21.3% decline in operating margins between 2018 and 2019

[4]Other industries include shipping and oil and gas.

(Shulkin, 2020). Subsequently, hospital joint operating agreements allowing hospitals to coordinate on a variety of actions (e.g., budgeting/ financial planning, negotiation with managed care companies) gained renewed popularity after the 2008 recession (McGuireWoods, 2013). The hope in this setting is for hospitals to continue to provide more variety in terms of location and services under these agreements.

Starting in the 1980s, airlines experienced a series of shocks such as an oil embargo, a major strike, and a recession (Cook, 1996). Subsequently, they formed the the first major air alliance (Star Alliance) in 1997. Aimed at maintaining consumer access to more routes, these air alliances facilitate cooperation via codesharing, under which airlines publish the same flights as part of their schedules, and all airlines can sell seats on the same flight. Bilotkach (2018) notes that, "Under antitrust immunity [granted by the department of transportation], partner airlines obtain the explicit right to set the fares jointly for the inter-airline itineraries" (p. 41). Policymakers motivate these exemptions with the argument that higher profits from coordination helps airlines continue to provide a greater variety of routes and flight frequencies.

Notably, whether antitrust exemptions allowing coordination actually increases consumer or social welfare in each of these settings is an empirical question. This study provides an empirical approach that can be used to evaluate the welfare tradeoffs between allowing firms more market power and facilitating longer access to variety under this policy.

3 Data

I combine data from several sources to create a panel of all U.S. local daily newspapers for every presidential election year between 1932 and 1992. This panel includes data needed to estimate static reader demand, advertiser demand, and supply-side cost parameters. It also contains information on newspaper entry, exit, JOA status, and JOA contract terms used to estimate the dynamic portion of the model. Tables 1 and 2 respectively summarize some of the market and newspaper characteristics captured in the data. In anticipation of focusing my later analysis on market-years with at most 2 papers, I compare the characteristics of newspapers in the full sample of local papers to the subsample of those in market-years with ≤ 2 firms. I find that equilibrium newspaper characteristics are generally similar, with overlapping confidence intervals, across the full sample and subsample with the subsample means being slightly lower, as it includes markets with smaller populations.

3.1 Newspaper Characteristics

My primary source of newspaper characteristics data is the U.S. Newspaper Panel from Gentzkow et al. (2011). This panel contains information on the city and county in which a newspaper is based, reader subscription prices, advertising prices, total circulation, and political affiliation in election years from 1886 to 2004. I use the reported newspaper headquarter county information to define local newspaper markets,[5] Specifically, I define a market as the county, Metropolitan Statistical Area (MSA), or historical MSA equivalent in which a newspaper is headquartered. Table 1 summarizes characteristics by market for my study period. It shows that most market-years in my data with at least one active newspaper have only one or two newspapers during my study period, indicating that moving from one to two newspapers is plausibly the most relevant margin for news variety. Table 2 reports summary statistics for various newspaper-level variables across all market-years and for market-years with at most two papers. Subscription prices and ad rates appear similar across both groups. Markets with at most two newspapers are on average smaller in terms of total circulation than the full sample of local newspapers.

I supplement the U.S. Newspaper Panel with additional newspaper characteristics data on newspaper staff from *Editor and Publisher Yearbook* and construct a measure of newspaper quality based on the number of unique staff members per paper. Furthermore, I collect advertising linages from *Editor and Publisher Magazine* and (Angelucci et al., 2020), which I use to help estimate advertising revenues. I newly digitzed ad linages prior to 1948 and after 1964 for the purposes of this project. Data from 1948 to 1964 are from Angelucci et al. (2020). Since it was prohibitively time-consuming to digitize all the corresponding data for the intervening years, I collected all additional data used in this project only for election years during my study period. Table 2 indicates that the numbers of unique staff are similar for both the full and subsample of market-years with ≤ 2 firms but that newspapers in the subsample sell less ad linage.

[5] I was unable to obtain more detailed geographic circulation data.

3.2 Surveys

To help estimate reader demand and advertising revenues, I use newly digitized years of the *Inland Press Association Annual Cost and Revenue Study* corresponding to election years and the readership survey data assembled by Gentzkow et al. (2014).

In the *Inland Press Association Annual Cost and Revenue Study*, the number of participating daily newspapers per year ranges between 197 and 428 with a mean (SD) of 322 (94) papers. Participants belong to one of 9 regional associations and come from local markets across the U.S. The original purpose of the survey was to provide local daily papers a means of evaluating their own costs and revenues relative to those of similar sized papers across the country. The survey organizes its results by circulation group (e.g., 125,700 to 225,500 issues). While it reports results separately by paper, the survey does not identify individual papers under the premise that circulation groups provide adequate information for papers to identify others facing similar costs and revenues.

I extract the *Cost and Revenue Study* fields describing the cost of delivery per copy, the cost of paper and ink per copy, and the cost of advertising. I use these variables to construct variable cost shocks that vary by newspaper circulation group and year. Table 2 shows that paper and ink costs are on average slightly lower in markets with more newspapers while the cost of delivery and advertising are on average slightly higher. Additionally, Gentzkow et al. (2014) note that ad rates are often negotiated, indicating that the rates listed in *Editor and Publisher* may on average over- or understate realized advertising revenues. Therefore, I extract information on total advertising revenue to scale newspaper revenues calculated using ad linages and ad rates reported in *Editor and Publisher*.

The readership surveys from Gentzkow et al. (2014) provide information on readership overlap that I use to calibrate the disutility of consuming a second newspaper when readers choose to multihome.

3.3 Market Characteristics

I use county-level data from the U.S. Decennial Census and U.S. Presidential General County Election Results compiled by Dave Leip to construct market characteristics. For market size, I linearly interpolate between census years to calculate county populations corresponding to election years between 1932 and 1992 and aggregate county populations when counties are part of a MSA or historical predecessor of an MSA. I use county election results to estimate reader political affiliations corresponding to republican and democratic vote shares.

3.4 JOA Contract Characteristics

I assemble novel data on JOA contract characteristics from a number of industry reports. These characteristics include the revenue and loss division terms of 23 agreements and agreement start and end dates for all 28 JOAs ever in effect. Agreement terms are often stated in terms of newspapers' relative circulation shares. Notably, these agreements correspond to transfers made once a JOA is effective. While firms make side payments after agreeing to join a JOA but prior to starting a JOA, I do not observe these. Sources include reports and studies written about JOAs (Blanchard, ed, 2013; Busterna and Picard, 1993; Picard, 1987, 2007) as well as a number of historical newspaper articles.

JOA contracts are written for finite periods of time and can be seen as finite-term joint ventures between newspaper firms for advertising and circulation. However, as shown in table 3, the relevant time frames of JOAs are generally very long, with the average agreement lasting a total of 64.8 years from initial formation to contracted end after accounting for amendments, renegotiations, and extensions. Measuring duration in terms of only the current or latest iteration of each contract to the expiration date, contracts average 43.1 years. Moreover, JOAs are also quite flexible in addition to being long-lasting. Table 3 shows that many agreements are subject to amendments and changes over time. Busterna and Picard (1993) also note that many JOAs can be ended at any time when effective, subject to various constraints, ranging from no constraint to 15 years advanced notice, on how much advanced notice is required.

4 Descriptive Evidence

Using the full sample of newspapers in my data, I examine reduced form evidence on how newspaper exit affects the characteristics of the remaining products, how JOA participation impacts product characteristics and exit probability, and how newspapers select into JOAs. I find that increased market power is associated with higher subscription and advertising prices, heterogeneous impacts on newspaper quality, and that JOAs are associated with lower exit probabilities potentially partially due to selection on market and firm characteristics.

4.1 Firm Exit and Benefits of Entering into a JOA

The primary motivation behind allowing newspaper JOAs under an antitrust exemption is that they help preserve news variety by allowing multiple newspapers to survive for longer in the same local market. They extend newspaper survival by allowing newspapers to charge both readers and advertisers higher prices, thus increasing profits and reducing their incentives to exit. Columns 1 and 2 of Table 4 show that, controlling for various market characteristics (i.e., the number of active firms, and common annual shocks), being in a JOA correlates with charging higher subscription and advertising prices than firms not in JOAs charge. I also find evidence that non-price newspaper characteristics can also change with market structure. Column 3 indicates that newspapers in JOAs have higher quality, as measured by the number of unique staff members, than non-JOA newspapers. This suggests that being allowed to coordinate on prices may incentivize newspapers to compete more for market share in terms of quality. An increase in quality could offset some of the welfare losses to readers from increases in price.

Notably, firm exit can also harm readers through endogenous changes in prices or quality. As such, allowing for firm exit may have all the drawbacks to consumers of JOAs without the benefit of extending variety. This provides an additional reason for policymakers to sanction JOAs over firm exit. Table 5 displays how average subscription prices, advertising prices, and the number of unique staff hired in each market differ in the periods after a firm exits relative to periods without exit. I find that subscription and advertising prices set by the remaining firm(s) are higher than prior to competitor exit but that, unlike under JOAs, remaining firms may also choose less quality. Increased market power from exit potentially decreases consumer welfare through not only endogenous increases in prices and decreases in quality but also potential losses in available variety, increasing the appeal of JOAs as a policy alternative.

To examine if charging higher prices due to price coordination under JOAs did correlate with reduced firm exit, I compare exit rates of newspapers in JOAs to the exit rates of those in otherwise similar markets using the following linear probability model:

$$exit_{jt} = \alpha_0 + \alpha_{JOA} JOA_{jt} + \alpha_X X_{jt} + YR_t + \epsilon_{jt} \tag{1}$$

where $exit_{jt}$ is an indicator for whether firm j exited in year t, JOA_{jt} is an indicator variable for whether firm j was in a JOA in period t, X_{jt} is a matrix of control variables including city population, circulation share, whether the paper is an evening paper, and the number of daily newspapers in the market, YR_t are year fixed-effects, and ϵ_{jt} is an error term. I define similar markets as those with populations, total circulations, and total number of newspapers in the same ranges as those observed for JOA newspapers.

Column 4 of Table 4 shows that being in a JOA is significantly correlated with a lower probability of exit even when controlling for other firm and market characteristics.[6] While industry observers often noted that, at face value, JOAs did not seem to help prevent failing newspapers from exiting or to maintain higher levels of local news diversity, I find that, conditional on being in a JOA, firms do exhibit lower exit probabilities (Barwis, 1980; Kirchoff, 2010).

One reason for this conflict is that my linear probability model does not distinguish between firms with lower exit probabilities selecting into JOAs and JOAs causing lower exit rates. Theoretically, pairs of newspapers in which (i) one paper is stronger than the other (i.e., more financially sound and less likely to exit), or (ii) both newspapers are weak (i.e., less financially sound) are less likely to enter into JOAs. In a failing firms setting, I am interested in the following two mechanisms underlying these theoretical possibilities. First, when one firm is stronger than the other, the stronger firm may prefer not to join a JOA because it prefers to make monopoly profits sooner rather than help a competitor exit later. Second, mutually weak firms may be less likely to join a JOA because coordination in this scenario has a limited ability to increase long run profits. In the following section, I look for evidence that these mechanisms play a role.

4.2 Incentive Compatibility and Selection

Table 6 provides evidence for the role of selection into JOAs in the newspaper industry by looking at the correlation between the probability of entering into a JOA and measures of firm strength. Model 1 is a linear probability model relating the probability of entering a JOA to the ratio of the second largest JOA-eligible firm's circulation over the largest firm's circulation. By construction, this ratio is bounded above by 1. The closer the ratio is to 1, the more

[6]The sample counts may be higher than those in tables 1 and 2, because I include years through 2004 in this exercise.

similar firms are in their profits and consequently in exit probabilities. The significant positive correlation between circulation ratio and the probability of JOA entry provides evidence for mechanism (i) described above in section 4.1.

Model 2 is a linear probability model relating the probability of JOA entry to a measure of relative firm strength and other common determinants of reader demand and profits. These common determinants include the value of the outside option (i.e., choosing to purchase no paper) estimated as part of reader demand and market size as measured by population. For how I recover the firm strengths and the value of the outside option, see equations 4 and 5 specifying reader payoffs from buying a given newspaper and choosing the outside option, respectively. Firm strength can be interpreted as the value to readers from variety provided by a specific firm, controlling for differences in quality and price. Relative firm strength is how much more readers value one paper over the other. A greater gap in firm strength implies a bigger difference in firm exit probability. I find that the difference in firm strength is negatively correlated with the probability of entering a JOA, providing further evidence for mechanism (i). A higher value of the outside option means that readers find all newspapers relatively less valuable than other media such as radio and television and consequently implies lower profits and higher exit probabilities for both candidate JOA firms (i.e., a smaller "pie" to split under cooperation). I find that the value of the outside option is significantly negatively correlated with the probability of entering a JOA, providing support for mechanism (ii). Market size has the opposite effect of the value of the outside option, as a larger population indicates higher aggregate demand for newspapers (i.e., a larger "pie" to split under cooperation).

In the absence of a plausible random experiment, I decompose the causal effect of JOAs on exit from the selection effect using a structural model and counterfactual exercises. By explicitly modeling firm market exit decisions along with the determinants of JOA entry incentives, I can study what market exit rates would have been in the absence of JOAs. Moreover, the structure of the model further facilitates performing counterfactual exercises that look at the implications for firms and consumers of decreasing the legal and other contracting costs associated with JOAs as well as primitives under which JOAs are a more effective policy.

5 Static Stage Game

The purpose of the static stage game is to explain per-period static equilibrium newspaper profits and consumer surplus under different (i) ownership structures (i.e., competition, JOA, and monopoly) and (ii) relative values of the exogenous newspaper qualities (strengths) and alternative media sources (outside options) available to readers. The resulting differences in static profits motivates the newspaper market entry/exit and JOA entry decisions modeled in section 6. In particular, the static stage game captures how newspaper choices of subscription prices, advertising prices, and quality change with ownership structure and other primitives. The reduced form evidence described in the previous section indicates that endogenizing these characteristics may be important to capture changes in consumer welfare and firm profits, especially across different ownership structures. In particular, table 4 indicates that being in a JOA correlates with significantly higher values of all three characteristics and a lower probability of exit, which suggests that firms in a JOA can achieve higher profits through price coordination, and table 5 indicates that endogenous price and quality changes are also potentially important in comparing JOAs to monopolies.

5.1 Setup

The stage game model includes three types of agents: 1) newspapers, 2) readers, and 3) advertisers. Each period, newspapers endogenously choose reader prices, advertiser prices, and newspaper quality (defined as the number of unique staff producing content). Following Gentzkow et al. (2014), I assume that a newspaper is a firm.[7] Readers choose up to two newspapers to purchase each period. I further assume that a newspaper's declared political affiliation is either the same as or different from an individual reader's affiliation. Newspaper political affiliations are fixed over time, but the fraction of readers with aligning political affiliations changes exogenously over time. A unit mass of advertisers chooses whether to advertise in each newspaper and may value first reader views more than subsequent views.

The static game takes place in five stages. In the first stage, newspapers simultaneously choose quality r_{jt}.[8] Second, newspapers observe the current period's distribution of affiliation

[7] During my study period, most firms produced only one newspaper; 68.9% of newspapers in two-paper markets from 1932 to 1992 were always owned by distinct firms.

[8] I assume quality is set before other variables influencing profits are observed to reflect how it is easier for

alignments $\{A_{ijt}\}_{j\in\mathcal{J}}$, costs, and market size.[9] Third, newspapers observe all qualities chosen and simultaneously choose subscription prices p_{jt}. Fourth, newspapers observe subscription prices and choose advertising prices a_{jt}. Fifth, readers choose which newspapers, if any, to purchase, and advertisers choose in which newspapers to buy advertising space. Profits are realized at the end of the period.

5.2 Newspaper Supply

Firm j's profits are (omitting the market subscript m):

$$\pi_{jt}(\mathbf{p},\mathbf{r},\mathbf{a}) = \big(p_{jt} + a_{jt}\lambda_{jt}(\mathbf{p},\mathbf{r},\mathbf{a})\big)q_{jt}(\mathbf{p},\mathbf{r}) - C_{jt}(q_{jt}(\mathbf{p},\mathbf{r}), r_{jt}) \tag{2}$$

where $\mathbf{p},\mathbf{r},\mathbf{a}$ are vectors containing all firms' subscription prices, qualities, and advertising prices, respectively. $\lambda_{jt}(\cdot)$ is the fraction of the unit mass of advertisers purchasing space in paper j and depends on both characteristics influencing reader purchase decisions $\mathbf{p},\mathbf{r}$ and prices faced by advertisers $\mathbf{a}$. q_{jt} is the number of readers purchasing paper j and does not directly depend on ad prices. $C_{jt}(p_{jt}, r_{jt})$ is a cost function defined as

$$\begin{aligned} C_{jt}(p_{jt}, r_{jt}) &= FC(r_{jt}) + mc_{jt}q_{jt} \\ FC(r_{jt}) &= \gamma_0 + (\gamma_{x,1} + \gamma_{x,2}r_{jt})r_{jt} \end{aligned} \tag{3}$$

mc_{jt} is a per-period marginal cost. $FC(r_{jt})$ is a per-period fixed cost that is increasing in the amount of quality a firm chooses. I assume an increasing marginal cost of quality and that there is no cost to adding more advertising within a given newspaper for tractability.

This profit function reflects how declines in circulation decreased newspaper revenues from both readers and advertisers. In this specification, advertisers pay for each set of readers they can reach, and advertising rates act as a per-reader subsidy. As such, revenues on both sides of the market correlate directly with circulation, implying that decreases in circulation impact

newspapers to adjust prices each period than it is to alter the many steps involved with adjusting content.

[9] I assume that affiliation alignment is fixed after entry. This approach to affiliation alignment is consistent with the results in Gentzkow et al. (2011) that once set, newspaper political affiliation as measured by content does not seem to shift much over time and that partisan newspapers do not affect party vote shares. The latter does vary over time in my study period by market; the market-specific republican vote share has an average standard deviation of 11% over my study period.

both sides of the market.

5.3 Reader Demand

In my model, readers i may multihome and choose up to 2 newspapers or the outside option in each period. Reader i in period t receives the following utility from purchasing newspaper j if newspaper j is the first newspaper purchased (omitting market subscript m):

$$U_{ijt} = \underbrace{\beta_0 p_{jt} + log(1 + r_{jt})\beta_1 + A_{ijt}\beta_2 + \xi_{jt}}_{=\delta_{jt}+I_t} + \epsilon_{ijt} \tag{4}$$

and receives the following utility from choosing the outside option:

$$U_{i0t} = I_t + \epsilon_{i0t} \tag{5}$$

where p_{jt} is the annual subscription price, r_{jt} is the number of unique paper staff, $A_{ijt} \in \{0, 1\}$ is an indicator for whether a newspaper's political affiliation aligns with a reader's own affiliation. I_t is the common value of the outside option, ξ_{jt} is an unobserved (to the econometrician) newspaper- and period-specific characteristic (newspaper quality or "strength"), and $\epsilon_{ijt}, \epsilon_{i0t}$ are Type I EV errors drawn iid across individuals, papers, markets, and periods. These ϵ_{ijt} errors represent how much readers value variety. Along with A_{ijt}, they help capture horizontal differentiation. The other variables ultimately affect vertical differentiation as a part of $\delta_{jt}+I_t = \beta_0 p_{jt} + log(1 + r_{jt})\beta_1 + \xi_{jt}$. I assume that the value of the outside option I_t changes discretely for each market only in 1950 because this is when television became prevalent as an alternative. Thus, I_t takes on one value per market for all periods $t \leq 1950$ and another value for all periods $t > 1950$. The evolution of ξ_{jt} captures any gradual changes in the appeal of the outside option relative to a given paper.

Reader i experiences a marginal utility decrease of $\Gamma \geq 0$ from purchasing a second paper and purchases paper j with the following probability:

$$Pr(U_{ijt} \geq \max_{k \in \mathcal{J}_t} U_{ikt}) + \sum_{j' \neq j} Pr\left(U_{ij't} \geq U_{ijt} \geq \max_{k \in \mathcal{J}_t, k \neq j'} U_{ikt},\ U_{ijt} - \Gamma \geq U_{i0t}\right) \tag{6}$$

where $\mathcal{J}_t \subseteq \mathcal{J}$ is the set of active firms.

5.4 Advertiser Demand

I assume a unit mass of advertisers l who independently choose whether to purchase advertising space from each newspaper. Each advertiser earns the following revenue from each reader i:

$$\mathbb{1}_{n_{it}^l \geq 1} \times \left(\alpha_h + (n_{it}^l - 1)\alpha_l\right) \tag{7}$$

where $n_{it}^l \in \{0, 1, 2\}$ is the number of papers with advertiser l's ad that i has purchased, $\mathbb{1}_{n_{it}^l \geq 1}$ is an indicator function for whether a reader purchased any paper with l's advertisement, α_h is the value to the advertiser from the first time a reader sees its ad, and α_l, $0 \leq \alpha_l \leq \alpha_h$, is the value to the advertiser from each subsequent viewing. Advertisers maximize the sum of values over all ad views net the cost of advertising in each paper. See Gentzkow et al. (2014) for further details on this specification of advertiser demand.

5.5 Equilibrium

The equilibrium concept I use in the stage game is subgame perfect Nash equilibrium. I first derive the competitive equilibrium working backwards from the last stage of the game. I then discuss how a JOA changes these equilibrium decisions.

At the end of the period (last stage), reader demand is $q_{jt} = \mathcal{s}_{jt} M_t$ where $\mathcal{s}_{jmt}$ is the fraction of the market buying newspaper j ("market penetration"), and M_t is the market size. In the fourth stage, newspapers observe prices and qualities from the previous stages and choose advertising prices as in Gentzkow et al. (2014):

$$a_{jt}^*(\mathbf{p}, \mathbf{r}) = \alpha_h \mathscr{E}_{jt}(\mathbf{p}, \mathbf{r}) + \alpha_l (1 - \mathscr{E}_{jt}(\mathbf{p}, \mathbf{r})) \tag{8}$$

where $\mathscr{E}_{jt}(\mathbf{p}, \mathbf{r})$ is the fraction of newspaper j's readers who purchase only newspaper j. I focus on pure strategy equilibria for the advertising game, and it follows that all advertisers purchase from all newspapers in equilibrium and $\lambda_{jt} = 1$. Formulas for $\mathcal{s}_{jt}$ and $\mathscr{E}_{jt}(\mathbf{p}, \mathbf{r})$ are in Appendix B.

In the third stage, newspapers observe qualities chosen in the previous stage and choose subscription prices that satisfy, for all papers:

$$p^*_{jt}(\mathbf{r}) = arg \max_{p_{jt}} (p_{jt} + a_{jt}(\mathbf{p}^*, \mathbf{r}^*))q_{jt}(\mathbf{p}^*, \mathbf{r}^*) - C_t(q_{jt}(\mathbf{p}^*, \mathbf{r}^*), r^*_{jt}) \tag{9}$$

where $\mathbf{p}^*$ is the vector of prices where this condition is satisfied for all firms. I assume newspapers play pure strategies in the subscription price game.

In the second stage, newspapers choose qualities that satisfy for all papers:

$$r^*_{jt}(\mathbf{r}) = arg \max_{r_{jt}} (p_{jt}(\mathbf{r}^*) + a_{jt}(\mathbf{p}(\mathbf{r}^*), \mathbf{r}^*))q_{jt}(\mathbf{p}(\mathbf{r}^*), \mathbf{r}^*) - C_t(q_{jt}(\mathbf{p}(\mathbf{r}^*), \mathbf{r}^*), r_{jt}) \tag{10}$$

where $\mathbf{r}^*$ is the vector of qualities where this condition is satisfied for all firms.[10]

5.6 Joint Operating Agreements

Under a JOA, newspapers coordinate on advertising prices and subscription prices but not on quality. Papers in a JOA jointly set ad prices as:

$$a_{JOA,t} = a_{jt} = a_{-jt} = a_h \left(\frac{1 - \mathcal{s}_{0t}}{\sum_{j \in \mathcal{J}_t} \mathcal{s}_{jt}} \right) + a_l \left(1 - \frac{1 - \mathcal{s}_{0t}}{\sum_{j \in \mathcal{J}_t} \mathcal{s}_{jt}} \right) \tag{11}$$

where $\mathcal{s}_{0t}$ is the share of the market purchasing no newspapers:

$$\mathcal{s}_{0t} = \frac{1}{1 + \sum_{j \in \mathcal{J}_t} exp(\delta_{jt})} \tag{12}$$

and $\mathcal{s}_{jt}$ is the market penetration of paper j defined in Appendix B (equation 34).

Firms set prices (vector $\mathbf{p}$) to maximize:

$$\mathbf{p}^*_{\mathbf{JOA}} = \underset{\mathbf{p}}{argmax} \sum_{j \in \mathcal{J}_{JOA,t}} \Big((p_{jt} + a_{JOA,mt}(\mathbf{p}^*, \mathbf{r}^*))q_{jt}(\mathbf{p}^*, \mathbf{r}^*) - C_t(q_{jt}, r^*_{jt}) \Big) \tag{13}$$

where $\mathcal{J}_{JOA,t}$ is the set of firms in the JOA and $\mathbf{r}^*$ is the vector of competitively set qualities

[10] For computational tractability, I currently calculate equilibrium quality choices using the following discretized quality space: $r_{jt} \in \{0, 5, 10, \ldots, 110\}$ where the range of values is based on the max and min I observe across all periods in the data. In some states of the world, I find that this game leads to multiple pure-strategy equilibria. I currently assume that each equilibrium is chosen with equal probability and that firms base their expected payoffs taking expectations over which equilibrium they could be playing. In the absence of a pure strategy equilibrium, I calculate a mixed strategy equilibrium.

chosen in the previous stage.

These equations highlight how price coordination enables newspapers to extract more surplus from advertisers and readers. Newspapers now internalize the impact that subscription prices have on readership overlap and how this decreases advertiser valuations of ad space. They also internalize how subscription prices affect substitution across papers for readers who choose to only purchase a single paper.

Notably, allowing readers to purchase multiple newspapers ("multi-homing" readers) may lessen how much JOAs soften subscription price competition relative to a setting in which readers can purchase only a single newspaper ("single-homing" readers). Newspapers faced with multi-homing readers may already face softer subscription price competition absent a JOA (relative to the single-homing) because readers may still purchase a second paper even at a higher price. As such, under multi-homing readers, the loss in consumer surplus from higher JOA prices may be smaller, and the possibility that JOAs can improve consumer welfare may be higher. Moreover, assuming multi-homing readers in my model allows me to capture how JOAs soften price competition among newspapers on the advertiser side of the market. In a setting where readers only purchase one paper without additional assumptions about advertiser behavior, newspapers would always charge monopoly prices ($a_{jt} = \alpha_h$) to advertisers because every view by a reader would be the first and only view.

The difference between JOAs and tacit collusion is also implicit in the optimal firm decisions specified. In particular, this model focuses on optimal JOA prices and does not consider a newspaper's optimal deviation from these jointly set prices. I assume that unilateral deviations (i.e., "cheating") from JOA prices are not possible, because JOAs practically combine financial functions across newspapers (Picard, 2007). Consequently, a newspaper would be able to respond in the same period if its JOA partner deviated in price, and a deviation would be equivalent to dissolving the JOA completely.

5.7 Estimation and Identification

I use a Generalized Method of Moments approach to estimate the parameters characterizing reader and advertiser demand as well as newspapers' fixed and marginal costs. Using these estimated parameters, I then calculate equilibrium reader prices, advertiser prices, and qualities as specified in sections 5.5 and 5.6 and their corresponding profits.

For reader demand, I identify the price coefficient β_0, the value of quality β_1, and the value of affiliation alignment β_2 using variation in shares across all markets and cost shock instruments constructed from the *Inland Press Cost Survey data*. To account for the endogeneity of a firm's initial affiliation, I drop market-years with entry from the analysis. Subsequently, I identify the overlap term Γ using the remaining variation in shares across two-firm markets. I recover $\mathbf{I}_{mt} + \xi_{jmt}$ as the residual, where $\mathbf{I}_{mt}$ is the mean of the residuals of all firms in the same market pre- or post - 1950. I interpret $\mathbf{I}_{mt}$ as a common exogenous shock to both firms, and ξ_{jmt} as firm-specific, gradual deviations from this common shock. For further detail on how I estimate reader demand see Appendix C.1.1.

With respect to advertiser demand, I identify a_h using variation in revenues per reader across monopoly markets and a_l using variation across duopoly markets. For further detail on how I estimate advertiser demand see Appendix C.1.2.

I use the first order conditions implied by the firm's profit maximization problem with respect to prices and quantities in equations (9) and (10) to form moments identifying the cost parameters $\mathbf{mc}_{jmt}$ and $\gamma_{x,1}, \gamma_{x,2}$, respectively. $\mathbf{mc}_{jmt}$ is identified by differences in average prices across markets and periods not explained by other components of reader demand. $\gamma_{x,1}, \gamma_{x,2}$ are identified by variation in quality choice across all papers and periods. I use a measure of income per capita and vote shares over time as instruments, as firm quality choices are endogenous. I do not have a moment that separately identifies the constant component of fixed costs γ_0.

6 Dynamic Framework

In this section, I present a dynamic model of firm entry, exit, and JOA decisions that takes the profits resulting from the static stage game in section 5 as given. Firms that join a JOA or are currently in a JOA pay transfers negotiated over discounted stream payoffs. This model endogenizes changes in ownership structures and competition that lead firms to choose different product characteristics in the static stage game.

6.1 Environment

This is a discrete-time, infinite-horizon model. Assuming that the setting is finite-horizon as in Igami and Uetake (2020) imposes an exogenous "end date" on the industry, which runs contrary to the goal of studying policies that extend firm and industry survival.

In this section, I focus on newspapers (firms) j that choose per-period actions $\mathscr{A}_{jt}$ defined in section 5 and make long run decisions about market entry, market exit, and JOA status to maximize expected discounted long-run stream profits. They also bargain over discounted long-run payoffs to determine transfers when entering and currently in a JOA. For now, I also limit the analysis to markets with less than or equal to two firms (64% of all markets with any newspapers have ≤ 2 firms) for tractability. Table 2 indicates that these newspapers have similar characteristics to those in larger markets.

Newspapers in market m and period t need only keep track of state variables Ω_{mt} and Υ_{mt} to determine the expected equilibrium static payoffs from section 5. Ω_{mt} consists of the variables I believe are key to understanding the tension between predatory and collusive incentives in my model:

(i) the number of firms in the market n_{mt}.

(ii) variables evolving independently of firm decisions $\boldsymbol{\omega}_{mt} = \{I_{mt}, \{\xi_{kmt}\}_{k \in \mathscr{J}_m}, M_{mt}\}$, including the value of the outside option I_{mt}, a vector of firm-specific qualities (strengths) for each potential incumbent firm $\{\xi_{kmt}\}_{k \in \mathscr{J}_m}$ where $\xi_{kmt} = \emptyset$ if there is no incumbent firm k in period t and $\mathscr{J}_m$ is the maximal set of possible firms,[11] and market size M_{mt}.

(iii) the JOA status of the firms in the market joa_{mt}, which takes on value $joa_{mt} = 1$ if firms are currently in a JOA (i.e., coordinating on price and paying transfers) and value $joa_{mt} = 0$ otherwise.

Υ_{mt} includes the remaining variables (i.e., costs and the distribution of reader affiliations) firms need to compute expected static profits. I assume that the state space $(\boldsymbol{\Omega} \times \boldsymbol{\Upsilon})$ is discrete and finite.

To simplify the state space for computation, I further assume that current period t values of the variables in Ω_{mt} are correlated with their previous period $t-1$ values whereas the

[11] Generally, I_{mt} can be any variable(s) influencing aggregate demand, and ξ_{kmt} can be any variable(s) influencing firm-specific demand.

variables in Υ_{mt} are drawn i.i.d. per period. I allow the distribution of post-1950 values of I_{mt} to depend on its pre-1950 values. This allows for market access to television to be correlated with market access to radio. By assuming that I_{mt} evolves independent of local newspaper decisions, I assume that radio, television, and national newspaper firms do not take local newspapers into account when deciding on product provision; this is consistent with assumptions Fan (2013) makes about national newspapers. I also assume that firms do not forecast the change in the outside option. This implies that each technology regime (i.e., radio, television) is stationary. Assuming firms believed that technology was stationary is consistent with the strong skepticism about the scope each emergent technology could achieve before they actually became prevelant.[12] Firm strengths ξ_{kmt} evolve according to an exogenous first-order Markov process. As such, the firm-specific state variable provides me with a way to study the impacts of persistent asymmetries in firm strengths, as these firm-specific shocks generate asymmetric firm revenues (and profits).

In addition to static payoffs, firms also account for scrap values, entry costs, and JOA entry costs when calculating expected discounted stream payoffs. I assume that (i) newspapers have rational expectations over scrap values ϕ, entry costs γ, and JOA entry costs κ, (ii) these values and costs are drawn from independent distributions $F_\phi(\cdot)$, $F_\gamma(\cdot)$, and $F_\kappa(\cdot)$, respectively, and (iii) all these distributions have positive densities over connected supports and expectations that exist. In practice, I will assume all three variables are drawn independently from separate exponential distributions, which satisfies these properties. κ captures all present discounted costs of being in a JOA, including any costs of contracting and cooperating.

Taking as given the expected static profits determined by Ω_{mt} and Υ_{mt} and distributions $F_\phi(\cdot)$, $F_\gamma(\cdot)$, and $F_\kappa(\cdot)$, newspapers make decisions in two stages. In the first stage, newspapers receive state-specific per-period payoffs, and play a market entry and exit game similar to that described in Ericson and Pakes (1995) and Doraszelski and Satterthwaite (2010). The first stage deviates from typical entry/exit games in that the per-period payoff includes a transfer term endogenously determined by firms bargaining over how to split the expected gains from being in a JOA relative to competing. In the second stage, I add to the standard entry/exit game by giving firms the option of entering a JOA. Omitting the market subscript m and period

[12] See the discussion in section 2.1.1 for a more detailed description about skepticism regarding media technology spread.

subscript t, the timing of two stages of the dynamic game is as follows:

Dynamic Game Stage 1: Stage 1 captures the market entry and market exit game.

1. Each firm in the market draws a new firm strength ξ_j. Incumbents and potential entrants observe state variables Ω, Υ.
2. If $joa = 1$ and there are gains to trade from remaining in a JOA, firms efficient 50-50 Nash bargain to determine transfers $\tau_{J,j}(\Omega), \tau_{J,-j}(\Omega)$ and pay these transfers. If $joa = 1$ and there are no gains to trade,[13] the JOA immediately dissolves.
3. Firm per-period static profits are realized.
4. Firms observe their private scrap values ϕ and (bindingly) decide whether to exit permanently. Exit automatically ends any JOAs.
5. After x firms exit, if $n - x < 2$, there is one potential entrant who observes an iid private entry cost γ_e but *not* its strength ξ_e, and decides whether or not to enter. If the potential entrant enters, she pays γ_e and starts making profits in $t + 1$. If not, she disappears forever.

Dynamic Game Stage 2: Stage 2 only occurs if $joa = 0$ and $n = 2$ after exit and entry decisions are made in stage 1. When stage 2 does happen:

1. The 2 potential JOA firms observe the same individual cost of entering into a JOA $\kappa > 0$ and simultaneously decide whether or not to enter a JOA.[14]
2. If they enter, they each pay κ and then efficient 50-50 Nash bargain over dynamic payoffs to determine initial transfers $\tau_{0,j}(\Omega), \tau_{0,-j}(\Omega)$.
3. The JOA becomes effective in $t + 1$.

This model captures a dynamic game where firms endogenously choose whether to enter, whether to exit, and whether to join a JOA. I assume 50-50 Nash bargaining for simplicity, and

[13] Gains to trade are defined as the difference between discounted flow payoffs from being in a JOA this period and not being in a JOA this period.

[14] I assume that firms face the same JOA cost in each market-period, since I cannot identify individual firm costs. I only observe if the firms both found it profitable to enter a JOA or not.

this assumption implies that firms split the total additional surplus from joining a JOA 50-50. Once in a JOA, firms will continue to coordinate so long as expected aggregate discounted long-run profits are higher than under competition (i.e., there are "gains to trade"). However, firms may not join a JOA in the first place even if doing so increases expected discounted long-run aggregate profits because JOA costs are sunk prior to bargaining and may be larger than the expected discounted gains.

Given that variables in Υ_{mt} are drawn i.i.d. each period and the equilibrium concept I define later in section 6.2.4, all newspapers in state Ω_{mt} with strength ξ_{jmt} receive the same expected payoffs and play the same static and dynamic equilibrium strategies. I use this property to simplify notation throughout the rest of this section. Specifically, let j index that the firm's payoffs correspond to those of a firm with strength ξ_{jmt}. If $n = 2$, $-j$ indicates that firm j has a competitor whose payoffs correspond to having strength ξ_{-jmt}. I omit the market subscript m in the following discussion to simplify notation.

6.2 Firm Behavior

6.2.1 Incumbent Value Function

Incumbent firm j decides (i) whether to exit in stage 1, and (ii) whether to enter a JOA in stage 2 to maximize its expected discounted stream of profits conditional on Ω_t. These decisions do not also condition on state variable(s) Υ_t, because Υ_t is drawn iid across periods and independently of variables in Ω_t. This implies that values of Υ_t are not informative about values of Υ_{t+1} and future discounted stream profits. As such, to simplify notation, define firm j's expected static per-period payoffs Π^*_j in period t as a function of only state variables Ω_t:

$$\Pi^*_j(\Omega_t) = \sum_{\Upsilon_t} \pi_j\big(\mathscr{A}^*_j(\Omega_t, \Upsilon_t), \Omega_t, \Upsilon_t\big) F_\Upsilon(\Upsilon_t) \tag{14}$$

where $\mathscr{A}^*_j(\Omega_t, \Upsilon_t)$ represents firm j's equilibrium static stage game actions, $\pi_j\big(\mathscr{A}^*_j(\Omega_t, \Upsilon_t), \Omega_t, \Upsilon_t\big)$ the corresponding static stage game profits in state (Ω_t, Υ_t), and $F_\Upsilon(\Upsilon_t)$ the probability Υ_t is drawn each period.

Given these expected static per-period profits $\Pi^*_j(\Omega_t)$, the following Bellman Equation is incumbent j's expected value function at the start of stage 1 in period t:

$$V_j(\Omega_t) = \Pi_j^*(\Omega_t) - \tau_{J,j}(\Omega_t) + \mathbb{E}_\phi[max\{\phi, VC_j(\Omega_t)\}] \tag{15}$$

where ϕ is a firm's privately observed scrap value, drawn i.i.d. across markets, periods, and firms from distribution F_ϕ. $VC_j(\Omega_t)$ is firm j's continuation value conditional on remaining in the market which takes expectations over competitor exit, entry, and JOA state later in the period as well as discounted future stream profits given that a firm started the period in state Ω_t. For example, I define $VC_j(\cdot)$ for state $(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0)$ as follows:

$$\begin{aligned} VC_j(\underbrace{n_t = 2, \boldsymbol{\omega}_t, joa_t = 0}_{=\Omega_t}) =& P(\chi_{-jt} = 1|\Omega_t)\widetilde{VC}_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0|\chi_{-jt} = 1) \\ &+ P(\chi_{-jt} = 0, \chi_{et} = 1|\Omega_t)\widetilde{VC}_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0|\chi_{-jt} = 0, \chi_{et} = 1) \\ &+ P(\chi_{-jt} = 0, \chi_{et} = 0|\Omega_t)\widetilde{VC}_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0|\chi_{-jt} = 0, \chi_{et} = 0) \end{aligned} \tag{16}$$

where $\widetilde{VC}_j(\Omega_t|\cdot)$ is firm j's continuation value at the start of stage 2, $P(\cdot|\Omega_t)$ is the probability of an event occurring in state Ω_t, $\delta \in [0, 1)$ is the discount rate, χ_{-jt} is an indicator for if firm $-j$ remains in the market, and χ_{et} is an indicator for if a potential entrant enters during the current period. I define $VC_j(\cdot)$ for the remaining states in Appendix A.

Specifically, the continuation value evaluated at the start of stage 2 $\widetilde{VC}_j(\cdot)$ is conditional on the market entry and market exit decisions made in stage 1. If JOA entry is not possible (i.e., firms are already in a JOA at the end of the period or there are fewer than 2 firms in the market at the end of the period) at the start of stage 2, $\widetilde{VC}_j(\cdot)$ takes expectations over the evolution of the exogenous state variables $\boldsymbol{\omega}$ given the number of firms in the market and joa status at the end of the period.

$$\begin{aligned} \widetilde{VC}_j(\Omega_t|\text{JOA entry not possible}) &= \delta \sum_{\Omega_{t+1}} V_j(\Omega_{t+1}) P(\Omega_{t+1}|\Omega_t, \chi_{-jt}, \chi_{et}, \chi_{jt} = 1) \\ &= \delta \sum_{\boldsymbol{\omega}_{t+1}} V_j(n_{t+1}, \boldsymbol{\omega}_{t+1}, joa_{t+1}) P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t, \chi_{jt} = 1) \end{aligned} \tag{17}$$

The second equality comes from ω_t evolving independently of the number of firms and JOA status and allowing for incumbent and new entrant firm strengths to be drawn from different distributions.

When JOA entry is possible (i.e., there are 2 firms at the end of the period not already in a JOA) at the start of stage 2, $\widetilde{VC}_j(\cdot)$ also includes firm j's expectations over JOA entry.

$$\begin{aligned}
&\widetilde{VC}_j(\Omega_t|\text{JOA entry possible}) = \\
&\quad \mathbb{E}_\kappa\Big[max\{\underbrace{-\kappa - \tau_{0,j}(\Omega_t) + \delta\sum_{\boldsymbol{\omega}_{t+1}}(V_j(n_{t+1}=2,\boldsymbol{\omega}_{t+1}, joa_{t+1}=1))P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t,\chi_{jt}=1)}_{\text{Enter JOA}}, \\
&\qquad\qquad \underbrace{\delta\sum_{\boldsymbol{\omega}_{t+1}}(V_j(n_{t+1}=2,\boldsymbol{\omega}_{t+1}, joa_{t+1}=0))P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t,\chi_{jt}=1)}_{\text{Don't enter JOA}}\}\Big] \qquad (18)
\end{aligned}$$

Equation 18 highlights (i) how tensions between predatory and collusive incentives impact firm j's decision whether to join a JOA, and (ii) how considering transfers affects these tensions. Through $\widetilde{VC}_j(\cdot)$, the continuation value $VC_j(\cdot)$ reflects how joining a JOA in t decreases its competitor's probability of exit in $t+1$ and thus the probability of making monopoly profits in $t+2$, capturing predatory incentives against joining a JOA. It also captures collusive incentives in that firms make higher expected static profits $\Pi_j(n_{t+1}=2,\boldsymbol{\omega}_{t+1}, joa_{t+1}=1)$ in $t+1$ from joining a JOA. $V_j(\cdot)$ is also a function of within-JOA transfers $\tau_{J,j}(\Omega_t)$. Therefore, firm j's returns to entering a JOA depend on both $\tau_{0,j}(\Omega_t)$ and the expected present discounted sum of $\tau_{J,j}(\cdot)$. Depending on how the transfer is determined, the transfer can offset predatory incentives for firm j by allocating firm j more of the gains to trade.

In particular, I assume that newspapers determine transfers via 50-50 Nash bargaining and that transfers paid during a JOA $\tau_{J,j}(\Omega_t)$ and when entering a JOA $\tau_{0,j}(\Omega_t)$ by firm j to firm $-j$ in this game are functions of the value functions $V_j(\Omega_t)$ and $V_{-j}(\Omega_t)$. As in Lee and Fong (2013), I model bargaining over discounted stream payoffs because there is a cost to switching between the non-JOA and JOA states. The transfer paid by firm j when entering a JOA is:[15]

$$\begin{aligned}
\tau_{0,j}(\Omega_t) = \underset{\hat{\tau}}{argmax}&\Big[(\overline{VC}_{b,j}(n_{t+1}=2,\boldsymbol{\omega}_t, joa_{t+1}=1) - \overline{VC}_{b,j}(n_{t+1}=2,\boldsymbol{\omega}_t, joa_{t+1}=0)) - \hat{\tau}\Big]\times \\
&\Big[\overline{VC}_{b,-j}(n_{t+1}=2,\boldsymbol{\omega}_t, joa_{t+1}=1) - \overline{VC}_{b,-j}(n_{t+1}=2,\boldsymbol{\omega}_t, joa_{t+1}=0)) + \hat{\tau}\Big] \qquad (19)
\end{aligned}$$

[15]Both firms end up splitting the JOA entry cost evenly when I assume 50-50 efficient nash bargaining for any arbitrary initial split of the shared cost. For simplicity, I assume both firms draw the same entry cost κ.

where

$$\overline{VC}_{b,j}(n_{t+1}=2,\boldsymbol{\omega}_t, joa_{t+1}) = \delta \sum_{\boldsymbol{\omega}_{t+1}} (V_j(n_{t+1}=2,\boldsymbol{\omega}_{t+1}, joa_{t+1}))P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t,\chi_{jt}=1) \tag{20}$$

Firms also determine $\tau_{J,j}(\Omega_t)$ via 50-50 efficient Nash bargaining. The main distinction is that bargaining within a JOA happens at the start of the period and thus occurs instead over the sum of the expected static profits $\Pi_j(\Omega_t)$ and the expected max over firms' exit decisions $\mathbb{E}_\phi[max\{\phi, VC_j(\Omega_t)\}]$. See Appendix A for further details.

I model the transfers implied by the JOA revenue-loss splits as being determined by bargaining each period over continuation values, because of: (i) the long duration of these agreements as shown in table 3, and (ii) the general flexibility of these agreements to be ended or changed each year or period. Notably, these transfers are an approximation of the payments implied by long-term but finite contracts that can be changed, extended, or terminated almost at any time. I use this approximation to avoid explicitly modeling multiple endogenous contract characteristics such as duration, renewals, and other amendments. While this simplification does not directly capture continued payments made to a newspaper years post exit, the present-discounted value of these post-exit payments are reflected via endogenous transfers in the discounted expected flow payoffs that motivate firm long run decisions about market exit (as well as market and JOA entry). [16]

The bargaining equation 19 reflects how transfers do not maximize firms' joint probability of survival. Moreover, it highlights how a firm's predatory incentives enter into the gains to trade. Firm j's outside option to joining a JOA $\overline{VC}_{b,j}(n_{t+1}=2,\boldsymbol{\omega}_t, joa_{t+1}=0))$ includes expectations over becoming a monopolist in period $t+2$. The larger the probability and value of becoming a monopolist for either firm, the lower the gains to trade. As such, the predatory incentive decreases the gains to trade from joining a JOA and the ability of transfers to increase incentive compatibility and survival for both firms.

[16] Furthermore, explicitly modeling post-exit profit sharing adds considerable complexity to the model, since it depends on the number of years left on a JOA contract. As table 3 shows, there is considerable heterogeneity in the amount of time for which contracts are written, ranging from 12 to 101 years, and renewals are not always made for the same lengths of time. As such, it would be difficult to assume the same initial contract durations across different states of the world.

6.2.2 Entrant Value Function

A potential entrant e compares the following value of entry to its observed entry cost γ_e in stage 1:

$$
\begin{aligned}
&VE(\Omega_t, x_t) = \\
&\qquad \mathbb{1}(n_t - x_t = 1)\times \\
&\mathbb{E}_\kappa\Bigg[max\{\underbrace{-\kappa - \tau_{0,e} + \delta\sum_{\boldsymbol{\omega}_{t+1}}(V_j(n_{t+1}=2, \boldsymbol{\omega}_{t+1}, joa_{t+1}=1))P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t, \chi_{et}=1)}_{\text{Enter JOA}}, \\
&\qquad \underbrace{\delta\sum_{\boldsymbol{\omega}_{t+1}}(V_j(n_{t+1}=2, \boldsymbol{\omega}_{t+1}, joa_{t+1}=0))P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t, \chi_{et}=1)}_{\text{Don't enter JOA}}\}\Bigg] \\
&\qquad + \mathbb{1}(n_t - x_t = 0)\times \\
&\qquad \delta\sum_{\boldsymbol{\omega}_{t+1}}(V_j(n_{t+1}=1, \boldsymbol{\omega}_{t+1}, joa_{t+1}=0))P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t, \chi_{et}=1)
\end{aligned} \tag{21}
$$

where I allow the entrant type in the first period after entry to be drawn from a different distribution (i.e., I allow for $P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t, \chi_{et}=1) \neq P(\boldsymbol{\omega}_{t+1}|\boldsymbol{\omega}_t, \chi_{jt}=1)$). I assume that the initial entrant type ξ_{et} is drawn independently with probability $f_e(\xi_{et})$ at the end of the period from distribution $F_{\xi_e}(\cdot)$. Equation (21) reflects how a potential entrant observes exit decisions made by incumbents earlier in stage 1. It also captures how a potential entrant will have the option of joining a JOA if it will be the second firm in the market $(n_t - x_t = 1)$ and how this option does not exist if it becomes a monopolist right after entry $(n_t - x_t = 0)$.

Since bargaining with a new entrant occurs before the entrant draws its individual strength ξ_{et}, JOA entry transfers $\tau_{0,e}, \tau_{0,-e}$ between a new entrant and incumbent can take on different values from transfers between two incumbents:

$$
\begin{aligned}
\tau_{0,e}(\Omega) = \underset{\hat{\tau}}{argmax}\Bigg[&(\sum_{\xi_{et}}\overline{VC}_{b,e}(n_{t+1}=2, \boldsymbol{\omega}_t, joa_{t+1}=1)f_e(\xi_{et}) - \\
&\sum_{\xi_{et}}\overline{VC}_{b,e}(n_{t+1}=2, \boldsymbol{\omega}_t, joa_{t+1}=0))f_e(\xi_{et}) - \hat{\tau}\Bigg] \\
&\times\Bigg[(\sum_{\xi_{et}}\overline{VC}_{b,-e}(n_{t+1}=2, \boldsymbol{\omega}_t, joa_{t+1}=1)f_e(\xi_{et}) - \\
&\sum_{\xi_{et}}\overline{VC}_{b,-e}(n_{t+1}=2, \boldsymbol{\omega}_t, joa_{t+1}=0))f_e(\xi_{et}) + \hat{\tau}\Bigg]
\end{aligned} \tag{22}
$$

I allow new entrants in stage 1 to join a JOA in stage 2, because I observe this once in the data and do not rule this possibility out in the timing of the model. I assume that entrant strengths are unknown until the start of the next period to reflect how it takes time for a new paper's popularity to be observed or realized.

6.2.3 State Transition Probabilities

Assume that firm strength ξ_{jt} evolves according to transition probabilities $P_\xi(\xi_{jt+1}|\xi_{jt})$ and that market size M_t evolves according to transition probabilities $P_M(M_{t+1}|M_t)$. Further assume that I_t transitions post 1950 according to transition probabilities $P_I(I_{\text{post}}|I_{\text{pre}})$ and otherwise continues to take on the same value ($I_{t+1} = I_t$). Given that I_t, M_t, ξ_{jt} evolve independently and that market entry cost, scrap value, and JOA entry cost are drawn independently each period, the state space transition function is:

$$P_\Omega(\Omega_{t+1}|\Omega_t) = P_I(I_{t+1}|I_t) \times P_M(M_{t+1}|M_t) \times \prod_{j \in \mathcal{J}} P_\xi(\xi_{jt+1}|n_t, \xi_{jt}) \times P_{n,joa}(n_{t+1}, joa_{t+1}|\Omega_t) \quad (23)$$

By the above assumptions, $P_\Omega(\cdot)$ is continuous in n_t, joa_t, I_t, M_t, and $\{\xi_{jt}\}_{j\in\mathcal{J}}$. The number of firms and JOA status evolve jointly, because $joa_{t+1} = 1$ is possible only when $n_{t+1} = 2$.

6.2.4 Markov Perfect Equilibrium

The equilibrium concept I use is Markov Perfect Equilibrium (MPE) as defined by Maskin and Tirole (1988a,b). When firms are symmetric, I assume that the equilibrium is symmetric. Under MPE, agents' beliefs over the evolution of Ω_t match the true evolution of Ω_t. Furthermore, firms choose optimal exit, entry, and JOA strategies given their beliefs over the evolution of Ω_t. This implies that:

- Firm j chooses to exit according the following cutoff rule: exit if $\phi > VC_j(\Omega_t)$.
- A potential entrant enters if $\gamma_e < VE(\Omega_t, x_t)$.
- Firm j agrees to *join* a JOA agreement if

$$\underbrace{-\kappa - \tau_{0,j}(\Omega_t) + \overline{VC}_{b,j}(n_{t+1} = 2, \boldsymbol{\omega}_t, joa_{t+1} = 1)}_{\text{Enter JOA}} \geq \underbrace{\overline{VC}_{b,j}(n_{t+1} = 2, \boldsymbol{\omega}_t, joa_{t+1} = 0)}_{\text{Don't enter JOA}}$$

A JOA only occurs if both candidate firms agree to join.

As discussed by Doraszelski and Satterthwaite (2010), these strategies can be described by exit, entry , and JOA entry probabilities, respectively. Let $\mathbf{\Omega}$ be the (finite) set of all possible values of Ω_t. Then, I can define the exit probability as $pr_x : \mathbf{\Omega} \to [0, 1]$, the entry probability as $pr_e : \mathbf{\Omega} \to [0, 1]$, and the JOA entry probability as $pr_J : \mathbf{\Omega} \to [0, 1]$.

Equilibrium existence in this setting comes from a slight modification to the existence proof in Doraszelski and Satterthwaite (2010). My setting differs from Doraszelski and Satterthwaite (2010) in that I: (i) do not have firm investment, (ii) allow for an aggregate states I_t, M_t, (iii) allow for JOA entry costs that are drawn i.i.d. over periods, and (iv) allow for efficient transfers that are functions of the value function. Kalouptsidi (2014) discusses how (i) and (ii) preserve equilibrium existence. Under (iii), equilibrium existence still holds, because JOA entry and JOA dissolution both have unique cutoff strategies. Transfers in my setting satisfy the properties listed in Lee and Fong (2013) that are sufficient to preserve the continuity and single-valued conditions that the firm best-response correspondence function needs to satisfy for Brouwer's fixed point theorem to guarantee equilibrium existence. For further detail on how (iii) and (iv) preserve equilibrium existence, see Appendix A

Similar to other dynamic games with entry and exit, I cannot rule out that multiple equilibria may exist in this game. In simulations both using arbitrarily chosen parameters and estimates from my newspaper application, I have found that the Pakes and McGuire (1994) algorithm consistently finds the same equilibrium regardless of initial starting values.

7 Estimation

In the spirit of other two-step dynamic games estimators (e.g., Bajari et al. 2007; Pakes et al. 2007), I divide estimation into two steps: 1) "offline" policy functions, within-JOA transfers, and Markov state transition matrices, and 2) dynamic game parameters characterizing the scrap value, entry cost, and JOA entry cost distributions that require me to recover continuation values using the "offline" objects from step 1. I take the static profits estimated in section 5.7 as given.

7.1 Step 1: Offline Parameters

I discretize the state space and parametrically estimate the exit, entry, and JOA entry policy functions $(\hat{pr}_x, \hat{pr}_e, \hat{pr}_J)$.[17] In particular, following Kalouptsidi (2014), I use low order polynomials to approximate how each policy function and within-JOA transfers[18] vary with the state space. My specifications are sufficiently predictive and reflect the expected relationships with the state variables.

For example, I find that firm j's exit probability is decreasing in its own strength, lower if it is in a JOA, and increasing in the number of competitors it has. This is consistent with the probability of exit decreasing if the current state implies lower static profits and increasing if the current state implies higher static profits. Additionally, I parametrize the within-JOA transfer a firm j pays as a function of how much stronger that firm is than its competitor (i.e., $\xi_j - \xi_{-j}$) and find that this transfer is decreasing in firm j's relative strength.

Using the estimated binomial entry and exit probabilities $\hat{pr}_x, \hat{pr}_e$, JOA entry probabilities $\hat{pr}_J$, and nonparametrically estimated transition probabilities for the value of the outside option I, firm strengths ξ_j, and market size M, I then estimate a state transition matrix $\hat{M}^\iota$ for the incumbent conditional on firm j remaining in the market based off of equation 23. I generate the entrant Markov matrix $\hat{M}^e$ by multiplying $\hat{M}^\iota$ by an estimated distribution of possible entrant types $\hat{F}_{\xi_e}(\cdot)$ from which entrant types are drawn iid and independently of all other state variables conditional on entry.

For further detail on how I discretize the state space, parametrize $\hat{pr}_x, \hat{pr}_e, \hat{pr}_J$, the results of these parametizations, and formulas for how I estimate the state transition matrix, see Appendix C.2.

7.2 Step 2: Dynamic Parameters

Given my offline estimates of the policy functions, within-JOA transfers, Markov transition matrices, and profits, I can: (i) recover continuation values, (ii) use these continuation values to calculate model-implied policy functions, and (iii) use these policy functions to form moments for estimation. I assume that $\delta = 0.815$ and that scrap values, entry costs, and JOA entry

[17] While these policy functions would be preferably estimated non-parametrically as in Pakes et al. (2007), data limitations in the form of unevenly distributed observations across the state space necessitate parametrization.

[18] I parametrize within-JOA transfers because I observe few active JOAs ($n < 20$) for which contract details are available in my estimation sample

costs are all drawn from exponential distributions with mean parameters $\mu_\phi M_t$, μ_e, and μ_κ, respectively. Define $\theta = \{\mu_\phi, \mu_e, \mu_\kappa\}$.[19] That the mean of the scrap value distribution is $\mu_\phi M_t$ implies that firm scrap value draws are correlated with market size M_t.

7.2.1 Continuation Value

Define $V_j(\Omega;\theta)$ and $VC_j(\Omega;\theta)$ as the value function and continuation value specified in equation 15 for state Ω and firm j, evaluated at parameters θ. For a given set of parameters θ, I derive the Bellman equation expressed as a continuation value by working backwards from the stage 2 payoffs of the dynamic game. In stage 2, firms only have the option of joining a JOA if there are 2 firms in the market that are not already in a JOA. Letting $x_t = x$ and $x_{t+1} = x'$ for some variable x, firm j will agree to join a JOA if the returns to joining a JOA net initial JOA transfers $\tau_{0,j}(VC_j(\Omega;\theta))$ and JOA entry costs κ exceed returns to not joining:

$$\begin{aligned} &-\tau_{0,j}(VC_j(\Omega;\theta)) - \kappa + \delta \sum_{\boldsymbol{\omega}'} V_j(n'=2, \boldsymbol{\omega}', joa'=1) P(\boldsymbol{\omega}'|n'=2, \boldsymbol{\omega}, joa'=1, \chi_j=1) \\ &\qquad\qquad \geq \delta \sum_{\boldsymbol{\omega}'} V_j(n'=2, \boldsymbol{\omega}', joa'=0) P(\boldsymbol{\omega}'|n'=2, \boldsymbol{\omega}, joa'=0, \chi_j=1) \end{aligned} \tag{24}$$

where the transfer $\tau_{0,j}(VC_j(\Omega;\theta))$ is determined by efficient Nash bargaining over the non-cost (and non-transfer) payoff terms from equation 24.[20]

If firm j is either a monopolist or already in a JOA in stage 2, firm j receives:

$$\delta \sum_{\boldsymbol{\omega}'} V_j(n', \boldsymbol{\omega}', joa') P(\boldsymbol{\omega}'|n', \boldsymbol{\omega}, joa', \chi_j=1) \tag{25}$$

which does not include the option of joining a JOA, a transfer term, or a JOA cost term.

Combining these stage 2 payoffs with the estimated policy functions $(\hat{pr}_x, \hat{pr}_e, \hat{pr}_J)$, within-JOA transfers $(\hat{\tau}_{J,j})$, Markov transition matrices $(\hat{M}^\iota)$, and profits $(\hat{\Pi}_j)$, I can now write the Bellman equation for firm j from stage 1 of the dynamic game in terms of estimated continuation

[19]Note, $\mu^*_\phi = \mu_\phi - \frac{\gamma_0}{1-\delta}$ is the true mean of the scrap value distribution. However, I estimate μ_ϕ, as γ_0 cannot be separately identified. The same applies to μ_e, μ_κ. I assume $\delta = 0.95^4 = 0.815$, as each period in this game lasts four years. Market and time subscripts are omitted in this subsection.

[20]See Appendix C.3 for the equation defining this transfer.

values:

$$\widehat{VC}_j(\theta) = \delta \hat{M}^\iota \Bigg(\underbrace{(\hat{\Pi}_j - \hat{\tau}_{J,j})}_{\text{Period payoff}} + \hat{pr}_x \underbrace{\mathbb{E}[\phi | \phi \geq \widehat{VC}_j(\theta)]}_{\text{Expected payoff if exit}} + (1 - \hat{pr}_x)(\widehat{VC}_j(\theta)) \Bigg) - g_j\big(\widehat{VC}_j(\theta)\big) \quad (26)$$

where $g_j(\cdot)$ is a function of $\widehat{VC}_j(\theta)$ that accounts for how firms now also take expectations over: (i) the probability of joining a JOA and having to pay the associated costs and transfers in stage 2 of the dynamic game, as well as (ii) competitor market exit and entry behavior in stage 1. If $g_j(\widehat{VC}_j(\theta)) = 0$ or a constant, I arrive back at the standard Pakes et al. (2007) estimation procedure. I provide the full formula for $g_j(\cdot)$ in Appendix C.3.

Including transfers makes the incumbent continuation value a non-linear operator. A fixed point to equation 26 still exists, since it is a continuous function on a closed and bounded space. However, without additional restrictions, I am not guaranteed a unique $\widehat{VC}_j(\theta)$ for a given set of previously estimated policy functions, within JOA transfers, and profits. I derive sufficient conditions on $\hat{pr}_J, \hat{pr}_x, \hat{pr}_e$, and δ in Appendix D for which equation 26 is a contraction mapping. Whether a unique solution exists depends on the chosen discount factor δ and the probabilities, estimated "offline" in step 1, that the unobserved transfer occurs in a given state (Ω). Since I estimate the relevant probabilities prior to the continuation values, I can evaluate whether the conditions hold before implementing a fixed point algorithm in step 2. The smaller the value of δ, the larger the estimated step 1 probabilities under which a contraction mapping is guaranteed. I also find in my Monte Carlo simulations that a unique solution may still exist even when my derived sufficient conditions are not satisfied.

Given $\widehat{VC}_j(\theta)$, I can estimate a potential entrant's expected returns to entry $\widehat{VE}(\theta)$. Since entry happens after exit decisions are made but before firms decide whether to enter into a JOA, the potential entrant's expected returns to entering at the end of stage 1 include expectations over whether it joins a JOA in stage 2.[21]

7.2.2 Moments

For a given θ, I can recover estimated model-implied policy functions using the estimated continuation value vector $\widehat{VC}_j(\theta)$ from equation 26 and entrant continuation value vector $\widehat{VE}(\theta)$

[21] See Appendix C.3 for the equation defining the expected value of entry $\widehat{VE}(\theta)$.

from equation 43. Define the model-implied policy functions for exit, entry , and JOA entry in state i as $pr_x(\widehat{VC}_j(\Omega_i;\theta))$, $pr_e(\widehat{VE}(\Omega_i;\theta))$, and $pr_J(\widehat{VC}_j(\Omega_i;\theta))$, respectively. Let their empirical counterparts estimated in step 1 be $\hat{pr}_x(\Omega_i)$, $\hat{pr}_e(\Omega_i)$, $\hat{pr}_J(\Omega_i)$.

Then, to estimate θ, I can form the following vector of moments matching the model-implied policy functions for market exit, market entry, and JOA entry with their empirical counterparts:

$$\boldsymbol{\psi}_7(\theta) = \begin{pmatrix} \frac{1}{L}\sum_{i=1}^{L}[pr_x(\widehat{VC}_j(\Omega_i;\theta)) - \hat{pr}_x(\Omega_i)] \\ \frac{1}{L}\sum_{i=1}^{L}[(pr_e(\widehat{VE}(\Omega_i;\theta)) - \hat{pr}_e(\Omega_i)] \\ \frac{1}{L}\sum_{i=1}^{L}[(pr_J(\widehat{VC}_j(\Omega_i;\theta)) - \hat{pr}_J(\Omega_i)] \end{pmatrix}$$

where $L = 2,205$ is the total number of states in Ω. Since I have three parameters and three moments, this system is just-identified.

8 Results

In this section, I first present my estimated model primitives and then discuss the reader and newspaper per-period payoffs implied by these estimates. Reader surplus across states demonstrates how under a JOA, consumers and policymakers give up additional consumer surplus now to hopefully avoid even larger decreases in consumer surplus if the market becomes a monopoly market in the future. Comparing period payoffs across JOA, non-JOA, and monopoly states motivates why the stronger newspaper faces predatory incentives even after transfers are made when the firms are more asymmetric, because the increase in payoff from becoming a monopolist in $t+2$ can still exceed the increase from JOA payoffs in $t+1$.

8.1 Model Primitives

Table 7 shows my static parameter estimates corresponding to reader demand, advertiser demand, and supply-side costs. I display the distributions of the outside option pre- and post-1950 in figure 2a. For both single- and two-firm markets, the outside option value distribution, converted to dollar terms, shifts to the right after 1950. As such, my estimates account for how expanded access to television in 1950 hurt newspaper profits by providing readers with another valuable outside option in addition to radio. Figures 2b and 2c show how the distribution of annual newspaper strengths evolve in the radio era pre-1950 and the television era post-1950, respectively. Within both eras, the distribution of firm strengths shifts downwards, reflecting potential quality improvements or increased appeal of radio and television relative to individual papers over time that would have led consumers to increasingly substitute towards these outside options after the initial technologies became available.

I translate these parameters into average revenues, consumer surplus, prices, and number of unique staff (quality), weighting over all possible states Ω equally, in table 8. The static payoffs reflect how static profits increase and consumer surplus decreases in the amount of firm market power. Beneath the reported expected consumer surplus under each market structure I decompose how changes in endogenous product characteristics contribute to changes in expected consumer (reader) surplus. Moving from competition to JOA, consumer surplus decreases due to higher prices and decreased quality in states where consumers value marginal increases in quality more. The latter compositional effect is why expected consumer surplus, averaged across all states also decreases due to quality even though mean quality increases slightly.

Going from JOA to monopoly, firms have incentives to slightly decrease prices and increase qualities in order to increase the number of readers they attract and make higher advertising revenues. However, I find that the expected consumer welfare increase from lower prices and higher quality under monopoly is offset by the welfare loss from decreased access to variety. Notably, loss in consumer surplus when going from a JOA to a single-paper monopoly works through two channels when consumers can purchase multiple newspapers. First, consumer surplus decreases because they have fewer options. Second, consumer surplus decreases because consumers who would purchase multiple papers can no longer do so.

Tables 9 and 10 display average product characteristics weighted to reflect how often each non-JOA state[22] appears in my estimation sample of firms from market-years with ≤ 2 firms. In table 9, I find that the predicted average subscription and advertising prices for my sample increase with observed market power and that quality drops, on average, in states with monopolies. This is qualitatively consistent with the reduced form descriptives in table 5. Note, the monopoly numbers are not direct counterfactuals for the competition and JOA values, since I do not account for how firms select into becoming monopoly markets from competition

[22] I use the same weights to calculate the average product characteristics under competition and under JOA to get comparable characteristics

and JOA states in this table. Consumers in markets with monopolist newspapers have higher expected surplus due to exogenous components such as firm strength leading to a monopoly firm that provides high value to consumers relative to the outside option. Table 10 shows that my model-predicted median characteristics are similar to the median characteristics in my data and that the predicted and observed distributions overlap substantially. However, that my model-predicted means are higher indicates that my model jointly overpredicts price and quality in some states Ω.

Using these static payoffs, I then recover the primitives of the dynamic game. Table 11 shows the point estimates for the means of the scrap value, entry cost, and JOA entry cost distributions. As a validation exercise, I compare the observed average number of firms per market in the 208 markets starting with 2 firms in 1932 to what the model primitives predict in figure 3, since one of the main goals of the model is to rationalize the decrease in the average number of firms per market over time. I find that the model generally predicts the evolution of average firms per market from 1932 to 1992, with a slight underprediction of exit in the latter periods. Furthermore, I look at how the revenue/loss shares implied by my model match those observed in my data in figure 4. The model-predicted revenue-loss shares fit the observed shares on average, and the best fit line mapping predicted and observed shares to one another has a slope of 1.330 with 99% confidence interval (0.962, 1.698).[23]

8.2 Payoffs

8.2.1 Readers

Figure 5 displays static expected reader surplus under competition (panel 5a), the change in surplus comparing competition and JOA (panel 5b), and the change in surplus comparing competition and monopoly (panel 5c) by pairs of firm strengths. Since readers choose newspapers independently each period, comparing the static losses in reader surplus relative to competition under (i) monopoly and (ii) JOA reflects the tradeoff faced by policymakers when evaluating the impacts of JOAs on discounted flow reader surplus.

The figure shows that the decreases in reader surplus under a JOA are often much smaller than the decreases under a firm 1 monopoly. These differences illustrate how readers can

[23]The y-intercept is -0.159, 99% CI (-.353, .036)

benefit from JOAs in the long run if JOAs can sustain variety. By giving up some reader surplus now under a JOA, policymakers and readers can avoid even greater future surplus decreases when firm exit leads to monopoly. Whether this improves reader surplus in the long run depends on how much JOAs postpone firm exit in the dynamic game. The exception to JOAs being better for readers than monopoly markets is when the surviving monopolist is of higher quality/strength than the exiting firm. This exception highlights the importance of allowing for prices and qualities to be endogenous to market structure. For example, I find that when the monopolist is of strength 3, firm 2 with strength 1 exiting leads to an increase in reader surplus relative to competition. Table 8's decomposition of changes in consumer surplus implies that in these states newspapers would rather give up more surplus to readers in terms of lower prices and higher qualities in return for being able to extract more for advertisers.

8.2.2 Newspapers

While ownership structure helps determine reader surplus, firm payoffs are also endogenous to long-run firm decisions. In figure 6, I describe the firm static and per-period payoffs for the dynamic game. Though competitive and monopoly per-period payoffs in the dynamic game are equivalent to the static profits earned in each state, the JOA payoffs include a transfer term determined by bargaining over discounted stream payoffs. Panels (6a), (6c), and (6d) show firm 1's static profits under different ownership structures without including transfers. Panel 6b displays the transfers paid by firm 1 to firm 2.[24] Panels (6e) and (6f) show firm 1's incremental payoffs, including transfers, from moving from competition to JOA and JOA to monopoly respectively.

Comparing payoffs under these three possible ownership structures highlights how a repeated games framework changes the usual static intuition about price coordination. Even though JOA payoffs are generally higher than competitive payoffs, the monopoly gains in panel 6d are even higher than the JOA gains in panel 6c. Moreover, panels (6e) and (6f) reveal this holds even post-transfer. This highlights that even after allowing for transfers, firms may still experience predatory incentives when deciding whether or not to enter into a JOA with a competitor because they cannot contract over future realized increases in competitor strength. Gains from monopoly payoffs in the more distant future can dominate gains from joining a JOA now if a

[24] A negative number means firm 1 receives a net positive amount in transfers.

firm is patient and continuing to compete instead of entering a JOA increases its rival's exit probability sufficiently.

However, the transfers shown in panel 6b reveal that, conditional on the initial allocation of static JOA profits, the stronger firm does not always receive (positive) transfers from the weaker firm to offset its predatory incentives. In particular, the increase in firm 1's continuation value from *not* entering a JOA and increasing firm 2's probability of exit may not be enough to offset firm 1's pre-transfer increase in static payoffs from entering into a JOA being larger that of firm 2. As such, firm 1 may still have to pay transfers to firm 2 to offset this discrepancy in initial allocation of JOA static profits.

Given these firm payoffs and the parameters in table 11, I examine the conditional expected values in figure 7 to see if the estimated payoffs, continuation values, and parameters yield values consistent with observed newspaper firm valuations taken from separate sources. These conditional expected values are the values that firms are expected to pay or receive, given that they find choosing a certain action (i.e., entry, exit, joining JOA) optimal. I collected a series of newspaper firm valuations reported in *Editor and Publisher Magazine* as firm sales values. These valuations are shown in table 12 and are on the magnitude of between \$100 million and \$300 million. The ranges of the conditional expected scrap value and entry cost distributions shown in figures 7a, 7b cover similar magnitudes. Panel 7a shows the distribution of conditional expected entry costs weighted by how often each state appears in the data. In other words, panel 7a describes the distribution of expected entry costs firms would have found it optimal pay across different states of the world observed in the data. Panels 7b and 7c conduct similar exercises, describing expected scrap values at which firms will find it optimal to exit and costs at which firms will find it optimal to join a JOA, respectively. That the distribution of conditional expected entry costs and JOA costs are so low in magnitude reflects that the probability of market entry and joining a JOA are low according to the exponential distribution parameters shown in Table 11. The generally low JOA entry costs are plausibly consistent with legal fees required to draw up and sign the agreement and potentially some moving costs of setting up a joint financial office.

9 Counterfactuals

I use the model and estimates to assess the welfare implications of different ways of implementing JOAs as a policy. First, I calculate the impact of JOAs as implemented historically, allowing price coordination and with a positive expected cost of JOA entry relative to banning JOAs completely. Second, I calculate a counterfactual making joining JOAs costless to newspapers. Third, I examine what could occur when JOAs are costless and allow quality coordination in addition to price coordination (also relative to banning JOAs). Given that I observe that the impact of JOAs is quite heterogeneous across markets in the daily newspaper industry, I also use the estimates and model to explore conditions under which JOAs as a policy could have a larger effect.

9.1 Motivating Alternative JOA Implementations

In addition to allowing me to evaluate the historical welfare implications of JOAs, the model and estimates also suggest alternative implementations that could improve the efficacy of JOAs in sustaining multiproduct markets. Specifically, I find a wedge between when JOAs are more effective at sustaining variety and when newspapers are most likely to enter into JOAs. I show a comparison between the two scenarios in figure 8.

Panel 8a measures the impact of JOAs on variety as the percentage point increase in number of 2-firm markets. I compare the percentage of 2-firm markets remaining in 1992 when all firms are forced into JOAs to when firms are never allowed to enter into JOAs. This exercise looks at how much JOAs could increase variety if the decision whether to enter a JOA were not available. Panel 8b shows the corresponding probabilities of firms joining a JOA when I allow for endogenous JOA entry decisions. That these two panels are different emphasizes that states in which JOAs increase product variety more are not always the same as states in which firms have stronger incentives to enter into JOAs. Specifically, I find that the probability two firms enter a JOA is monotonically increasing in both firm strengths but that the same relationship does not hold for how much JOAs increase joint firm survival probabilities. In particular, joint survival probabilities can sometimes increase as one firm becomes weaker than the other.

This wedge between when firms want to enter into JOAs and how effective JOAs are at increasing the joint survival probabilities occurs in part because the transfers negotiated help incentivize firms to enter into JOAs but do not take into account the JOAs impact on joint firm survival. The former depends only on the firms' joint increase in total discounted flow payoffs from entering into a JOA. The latter depends on the percentage increase in per-period payoffs each firm experiences from entering into a JOA. Figure 6 shows that the weaker firm generally experiences a greater fraction (or percentage) increase in per-period payoffs (including transfers) from entering a JOA, motivating why, conditional on entering, JOAs can increase the joint survival probabilities of relatively asymmetric firms more. Intuitively, the weaker firm benefits (when exit probabilities are not "too" high[25]) from the possibility of becoming stronger in the future.

I discuss how considering whether or not firms have the same or different political alignment (i.e., an observable and persistent source of horizontal differentiation) affects this analysis in Appendix E. Generally, I find that the wedge looks similar across both affiliation alignments. I also find an additional wedge in the sense that newspapers that chose the same affiliation have higher probabilities of entering into JOAs but smaller decreases in exit probabilities relative to newspapers that chose different affiliations.

One way to increase incentives for relatively asymmetric firms to enter JOAs is to significantly reduce the cost of JOA entry. In practice, such a reduction could take the form of diminished legal requirements or government subsidies covering any initial contracting or capital costs of implementing a JOA. Given this potentially straightforward policy application, I focus on the welfare implications of eliminating costs to JOA entry in the counterfactual exercises.

9.2 Comparing Alternative JOA Implementations

Table 13 reports the results of the counterfactual policy simulations.[26] Column 1 compares allowing JOAs with price coordination and the estimated JOA entry costs to banning JOAs. Columns 2 and 3 make the same comparison for costless JOAs (with price coordination) and costless JOAs that allow quality coordination in addition to price coordination. Row 1 reports how much each policy could have increased the number of remaining markets with two firms in 1992. These results indicate that policymakers were overly optimistic about the degree to

[25] I discuss what I mean by "too high" in section 9.4

[26] See Appendix F for further detail on how I set up these simulations.

which JOAs could help sustain multifirm markets. I find that JOAs as historically implemented increased the percentage of 2-firm markets remaining in 1992 by only 0.04% (< 1 market). Through incentivizing more asymmetric firms to join JOAs, eliminating most of the costs associated with JOA entry (e.g., legal) could have produced a 2.54% (approx. 33 markets out of my 1,324 market sample) increase in the number of remaining 2-firm markets in 1992.

Row 2 of table 13 shows the average change in consumer surplus per person across all markets (and all periods within each market) corresponding to each policy. This average change in consumer surplus can be negative because: (i) there are markets in which firms enter into JOAs but JOAs do not increase firm survival, and (ii) there are markets in which firms enter into JOAs and consumers do not value the additional periods of variety enough to offset higher JOA prices. The change in consumer surplus is increasingly negative as JOAs become increasingly appealing because firms in markets with lower increases in total surplus from JOAs start selecting into JOAs. The average in consumer surplus can be positive when the reader valuation of continued access to variety dominates. These results show that policymakers originally opposed to JOAs were potentially overly pessimistic about their negative effects, given that the resulting decreases in (internalized) reader surplus are small.

While as the "fourth estate," newspapers plausibly have a social welfare benefit uninternalized by consumers (readers), table 13 captures only the internalized value of news variety to consumers. However, row 2 provides how much a social planner maximizing consumer surplus would have to value a variety externality per reader, per period in order to implement each policy. In order for a social planner to sanction firms freely entering into JOAs, they would have to value the variety externality at minimally $4.81 per reader. A social planner would require a higher externality to justify increasing amounts of market power short of merger.

9.3 Robustness: Bargaining Parameter

Since the bargaining parameter affects equilibrium transfers and consequently when firms choose to enter into JOAs and their JOA per-period payoffs, I separately estimate a bargaining parameter that allows the stronger firm in an agreement to have more bargaining power than the weaker firm. I find similar results to when I estimate the model and calculate counterfactuals assuming 50-50 Nash bargaining. Even under a weaker bargaining power for the weaker firm, I find a wedge between when firms want to enter JOAs and when JOAs most extend joint survival probabilities.

To allow for bargaining power that deviates from 50-50, I parameterize firm j's bargaining parameter in period t as:

$$\nu_{jt} = \frac{1}{1 + exp(-\bar{\nu}(\xi_{jt} - \xi_{-jt}))} \quad \in [0, 1] \tag{27}$$

where $\bar{\nu} \geq 0$. Note, for $\bar{\nu} = 0$ this parametrization implies 50-50 bargaining. I estimate $\bar{\nu}$ by forming an additional moment matching the transfers implied by my model to those implied by the JOA contract revenue shares I observe in the data and find $\hat{\bar{\nu}} \approx 0$.[27] This is consistent with figure 4, which implies that a 50-50 Nash bargaining parameter fits the profit splits I observe in my data quite well.

Figure 9 displays how deviating from 50-50 Nash bargaining could affect the wedge between JOA entry incentives and how much JOAs extend joint firm survival. In particular, I redo the counterfactual calculation and simulation for $\bar{\nu} = 0.25$, which produces bargaining parameters ranging between 0.21 and 0.79. This gives the stronger firm (higher ξ_{jt} firm) more bargaining power and the weaker firm less.

Though the levels of changes to joint survival probabilities are slightly higher in a couple states of the world,[28] panel (9a) is qualitatively similar to panel (8a) with asymmetric firms sometimes experiencing greater increases in joint survival probability than relatively more symmetric firms. This indicates that even with transfers allocating less of the long-run gains from entering a JOA to the weaker firm, the resulting per-period payoff is still proportionately large enough to further delay both firms' exit probabilities. However, incentives to enter a JOA are qualitatively different under this parameterization. In particular, asymmetric firm pairs now have much lower probabilities of entering into JOAs. This is consistent with each firm drawing from the same JOA cost distribution and sinking these costs ahead of time. Allowing for firms to bargain over JOA costs would lead panel (9b) to further resemble panel (8b).[29]

[27] I match the raw values and not the values smoothed over the state variable space.

[28] This occurs because the additional payoffs allocated to the stronger firm increase the stronger firm's survival probability by more than enough to offset the impact of the corresponding slight decrease in the weaker firm's survival probability on the joint survival probability of both firms (relative to the transfers implied by 50-50 nash bargaining). Higher values of $\bar{\nu}$ lead to similar patterns but lower increases in joint survival.

[29] Allowing for bargaining over unobserved costs in my model would also substantially complicate estimation and computation.

9.4 When Could JOAs Matter More?

In the newspaper setting, I find heterogeneity across markets that has implications for the efficacy of JOAs in sustaining variety. Consequently, I use the model and estimates to explore circumstances under which the policy could have a larger effect on variety (via increasing the number of surviving 2-firm markets after 16 periods). In figure 10, I show that as the value of the available outside option increases, exit rates increase and changes in variety sustained are mostly decreasing (and somewhat non-monotonic). On one hand, JOAs are ineffective when the outside option and exit rates are too low because there is little scope to decrease exit probabilities. On the other hand, JOAs are also less effective when the value of the outside option is very high and the probability of exit is high, because a high outside option limits how much static profits can increase under JOAs. As such, under a high outside option, profits cannot increase enough to significantly reduce exit rates. Thus, figure 10 indicates that the distinction between failing and flailing is practically important. If firms are truly failing and exit is imminent in the next period, as opposed to likely occur sometime in the next 20 years, JOAs as a policy have a limited effectiveness, and policymakers should consider alternative interventions.

Consequently, consumers in industries and markets experiencing moderate declines could potentially benefit from JOAs. On one hand, hospitals and airlines are potential examples if they face lower exit rates compared to newspapers as a result of more moderate changes in average profits and consumers highly value the variety from location and routes, respectively. On the other hand, even though variety in location is valuable in the Northwest timber industry, persistently expanding production in the Southwest may generate profits and exit rates under which JOAs have little effect for this industry.

10 Conclusion and Discussion

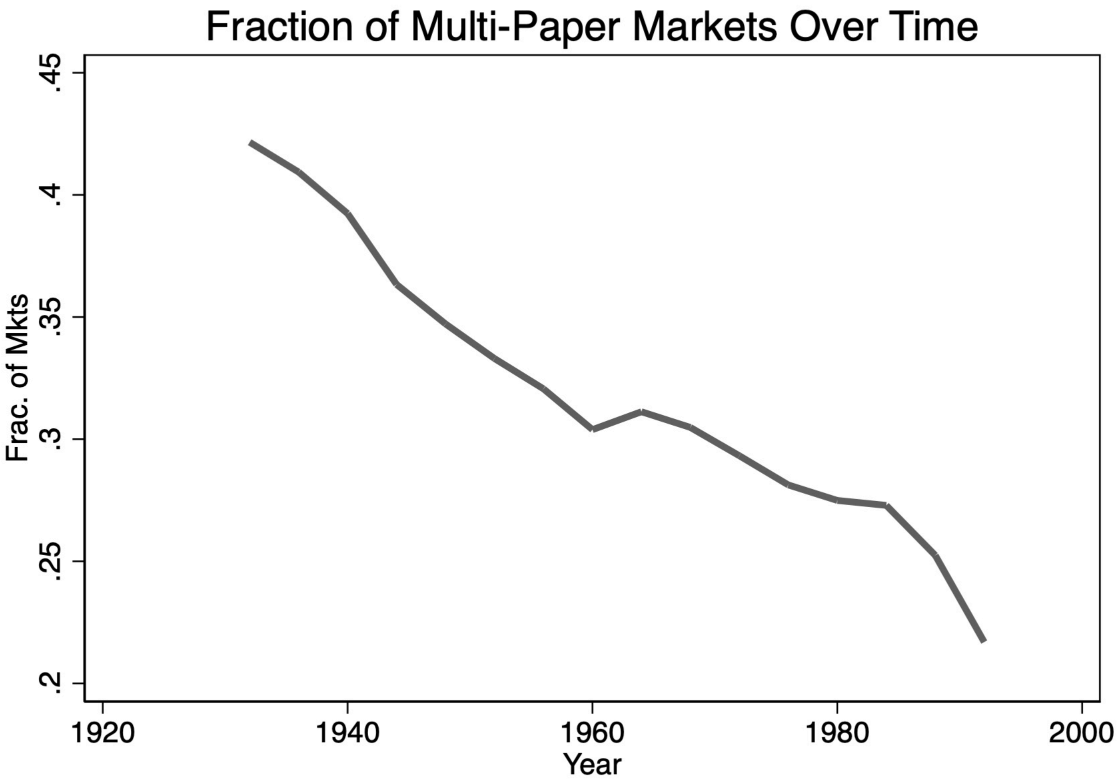
In settings where firm exit is prevalent, allowing firm coordination on price or other product characteristics may improve consumer or social surplus in a repeated games setting. I focus on how price coordination in the daily newspaper industry can reduce firm exit by increasing static profits. The main mechanism driving potential increases in consumer surplus I capture comes from the surplus created by access to a greater variety of goods for more periods being greater than the decrease in surplus from higher prices in each of those periods. I find that, as implemented historically, allowing newspaper joint operating agreements led to only a 0.04% increase in the number of multi-paper markets after 60 years.

Within this framework, part of the ineffectiveness of this policy comes from the wedge between when firms want to enter into JOAs and when JOAs most increase joint survival. Firms have too little incentive to enter into JOAs in states of the world where JOAs reduce exit more. As such, I find that eliminating JOA costs increases the effect of the policy to 2.54%. If the main costs associated with JOA entry are legal and contracting fees or capital costs of combining financial functions, reducing JOA costs could take the form of some combination of loosened legal restrictions and government subsidies. However, if these costs come in the form of deep ideological differences between asymmetric papers that prevent them from working together, a practical policy solution is less straightforward. Additionally, transfers may contribute to the wedge between JOA attractiveness and JOA effectiveness, as they only improve incentives for firms to enter these agreements in the first place. This implies that policies in the form of additional restrictions on how firms in JOAs split payoffs could be used in tandem with a reduction in JOA entry costs to improve JOA efficacy.

While I focus on the historical daily newspaper industry, the model and empirical strategy have potential broader applications. First, my results suggest that allowing for coordination decreases firm exit most when firms are flailing rather than failing (i.e., when exit probabilities are mild or moderate). Second, the model of dynamic entry/exit, coordination, and transfers as well as the corresponding estimation procedure can be applied to other settings. Applying this empirical exercise to other settings is of policy interest, because one of the goals of the latest DoJ/FTC merger guidelines revision is to more seriously consider the implications of non-price competition (see for example: Feiner 2022; Cowie and Fishkin 2022). Allowing partial coordination such as JOAs is a potentially appealing alternative to merger, because firms cannot commit to maintaining variety (or quality) post merger. They may find it optimal to end one product to reduce cannibalization (or reduce quality to reduce total fixed costs). When variety is measured in terms of political affiliation, Gentzkow et al. (2014) find that mergers lead to a large reduction in variety relative to when ownership remains separate. Consequently, further research exploring the welfare implications of coordination in other settings could be valuable to forming more nuanced antitrust policies.

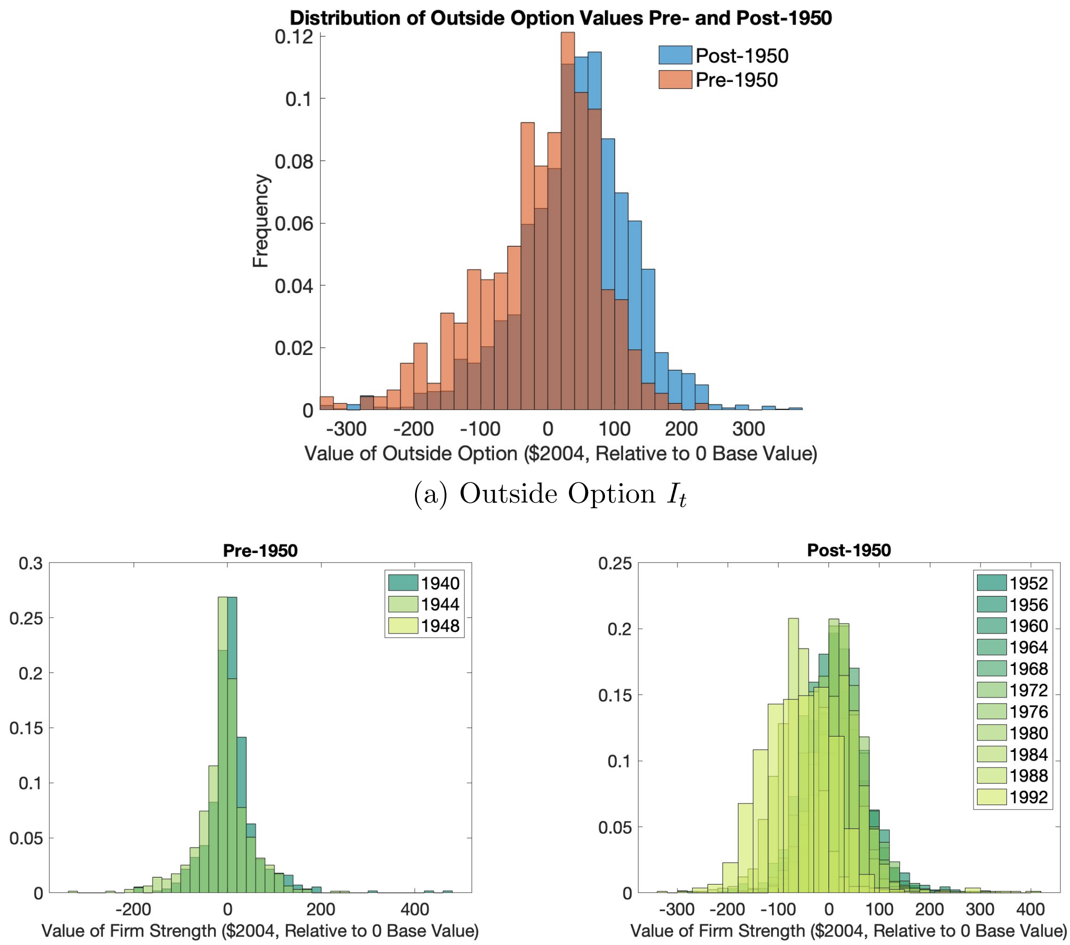
11 Figures

Figure 1: Decline in Multi-Paper Markets Over Time



Source: Data from ICPSR Newspaper Panel.

Figure 2: Outside Option I_t and Firm Strengths ξ_{jt} Pre- and Post- 1950



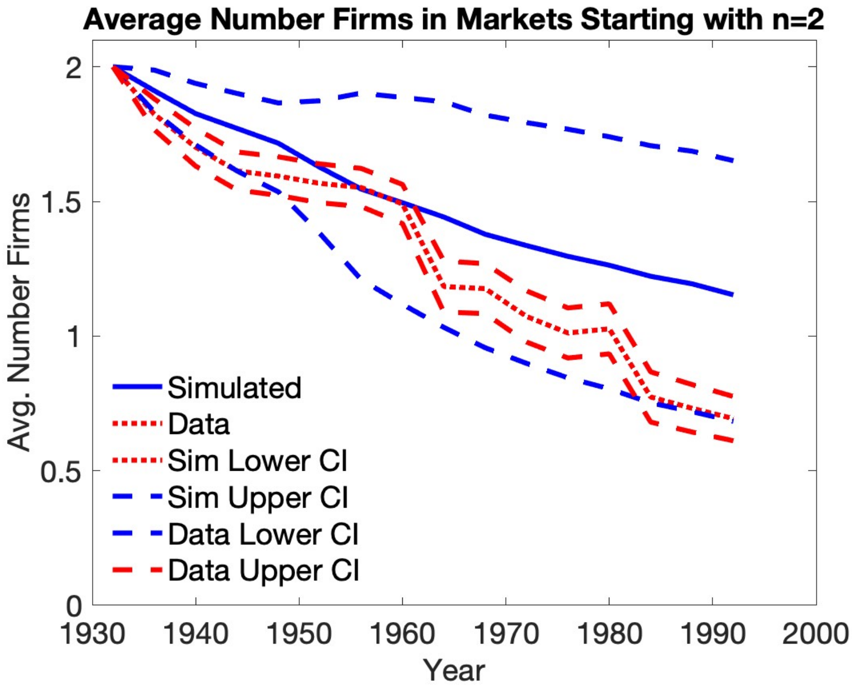
(a) Outside Option I_t

(b) Firm Strengths ξ_{jt} Pre-1950

(c) Firm Strengths ξ_{jt} Post-1950

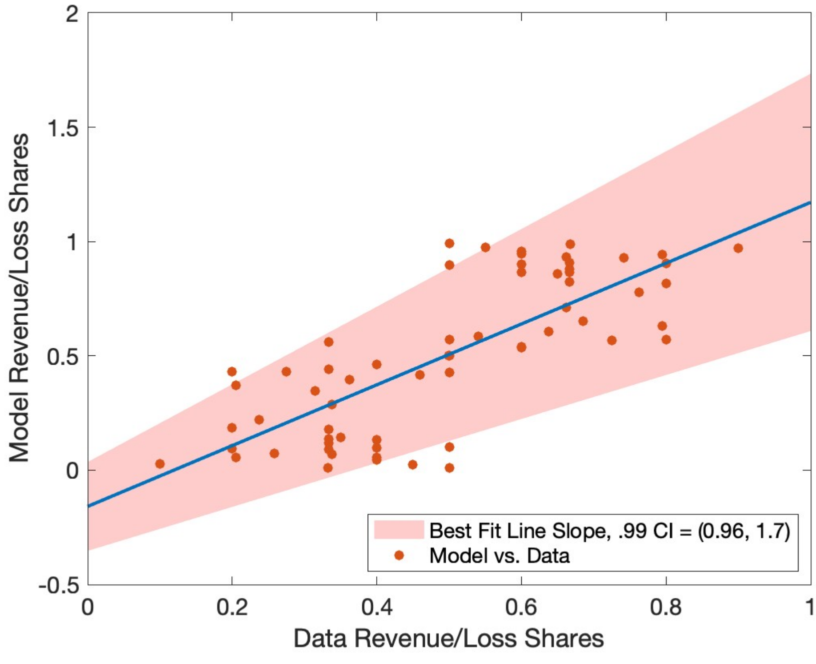
Note: Distributions are probability distributions.

Figure 3: Data vs. Model: Average Number of Firms per Market



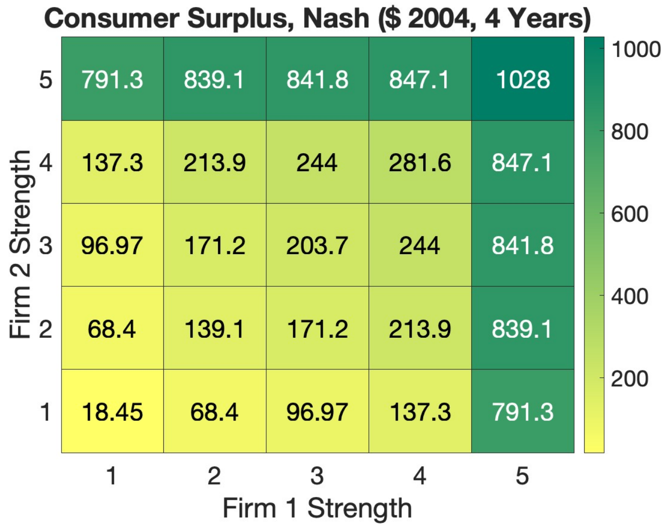
Note: Confidence intervals are 95% confidence intervals and do not account from error in estimating the static parameters, nor error from estimating the JOA entry costs. They do account for simulation error and bootstrap standard errors for the scrap value and market entry cost distributions.

Figure 4: Data vs. Model: JOA Revenue Shares

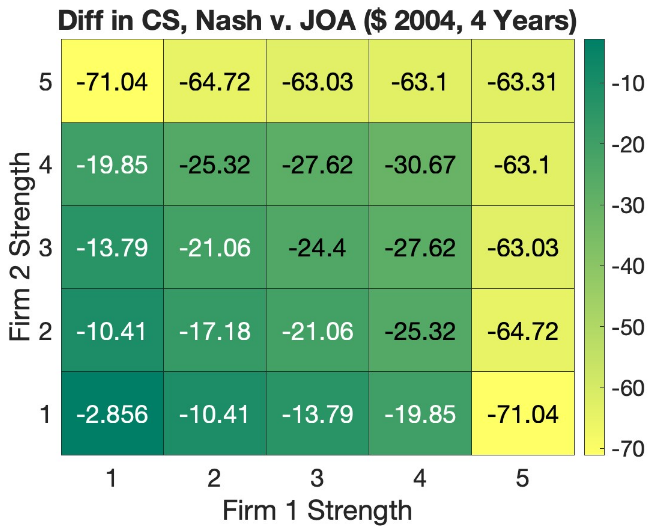


Note: Data values represent the average revenue contract observed for a given state in the state space. The minimum data revenue share is 0.1. Data values are non-smoothed.

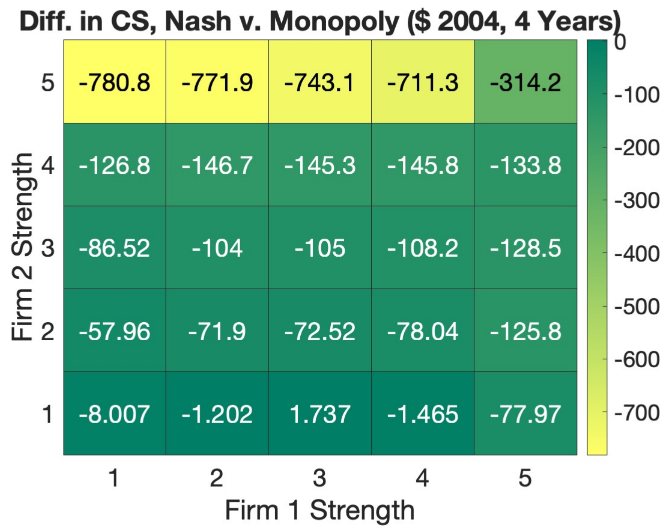
Fig. 5: Differences in Expected Consumer Surplus by Firm Strength



(a) Nash Bertrand Competition



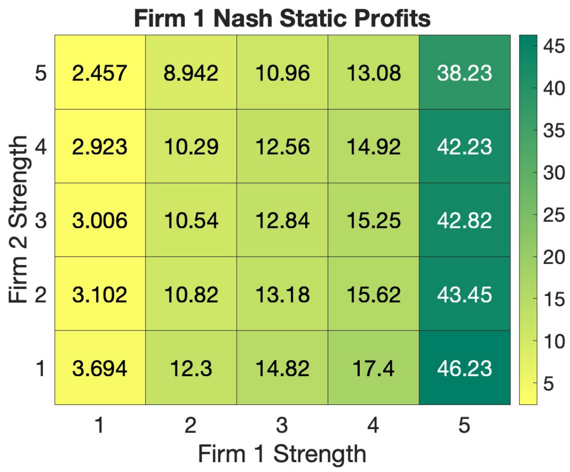
(b) Nash vs. JOA



(c) Nash vs Monopoly

Note: Consumer surplus is reported per reader, per 4-year period. Panel 5c assumes that firm 1 is the remaining monopolist to calculate consumer welfare under monopoly.

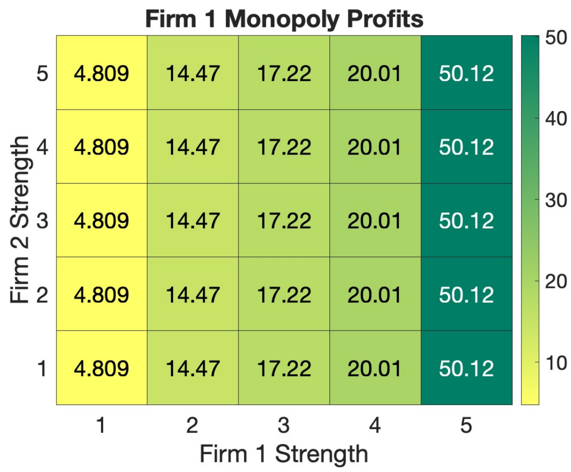
Fig. 6: Comparison of Firm 1 Per-Period Annual Payoffs by Firm Strength ($ Millions)



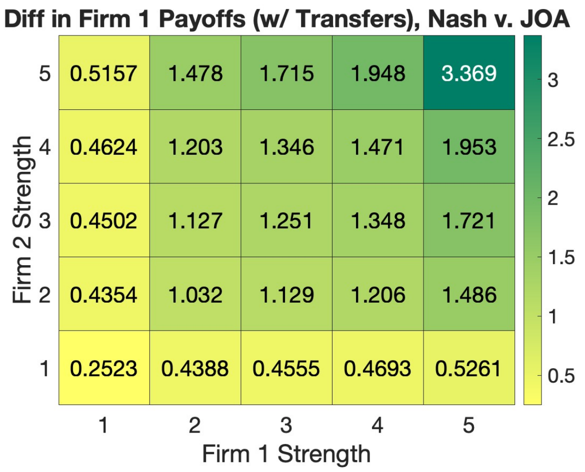
(a) Static Nash Profits

(b) Firm 1 JOA Transfer Paid

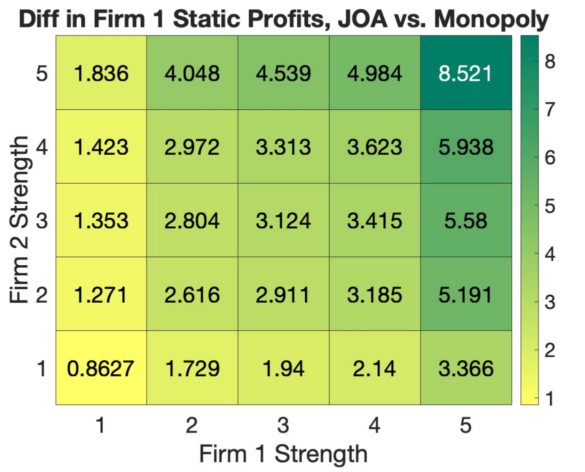
(c) Firm 1 JOA Profits Pre-Transfer



(d) Firm 1 Monopoly Profits



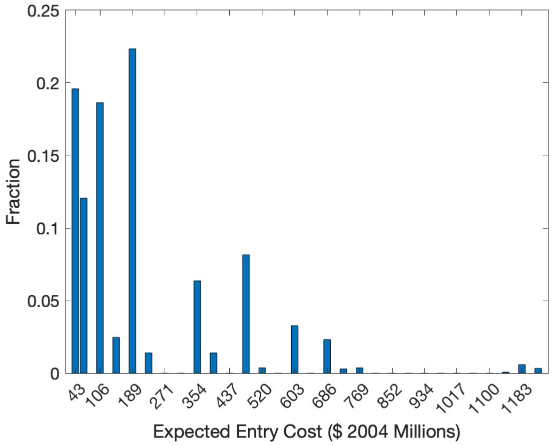
(e) Gains from Nash to JOA Post-Transfer



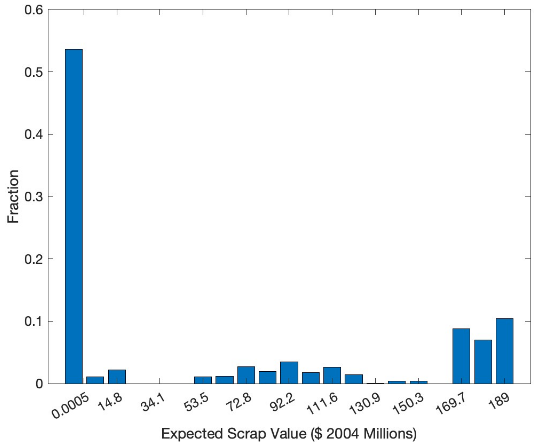
(f) Gains from JOA to Monopoly Post-Transfer

Note: Panels 6e and 6f include the within-JOA transfers $\tau_{J,j}$ shown in panel 6b paid each period. Panel 6e takes the per-period firm 1 payoffs from JOA and and subtracts the competitive payoffs from panel 6a. Panel 6f takes the per-period firm 1 payoffs from monopoly and subtracts the JOA payoffs from panel 6e.

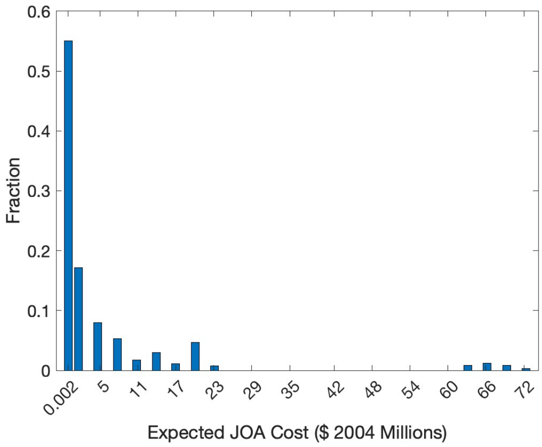
Fig. 7: Distributions of Conditional Parameter Expectations



(a) Entry Cost



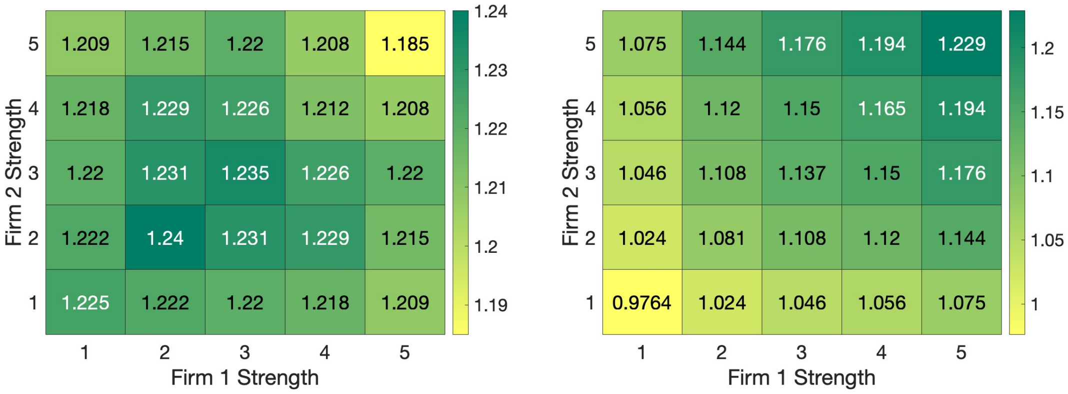
(b) Scrap Value



(c) JOA Entry Cost

Note: Expectations are conditional on a firm finding a given action optimal. Distributions are weighted by how often each state occurs in the data.

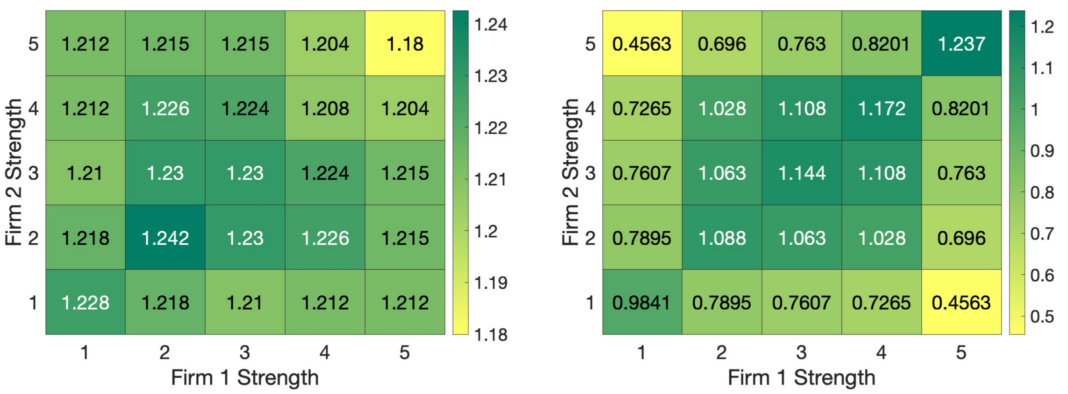
Fig. 8: Gains in Variety vs. Incentive to Coordinate, 50-50 Nash Bargaining Parameter



(a) Δ Pct. Points of 2-Firm Markets (b) Probability of Entering into a JOA

Note: Percentage point changes are based off of exit policy functions for each state starting with $n = 2$, barring entry, and holding independently evolving state variables $\boldsymbol{\omega}$ constant. Firms can only exit JOAs via market exit. JOA entry probabilities come from model-generated policy functions. Reported numbers average across all values of the outside option. Changes in joint survival rates are for 60 years.

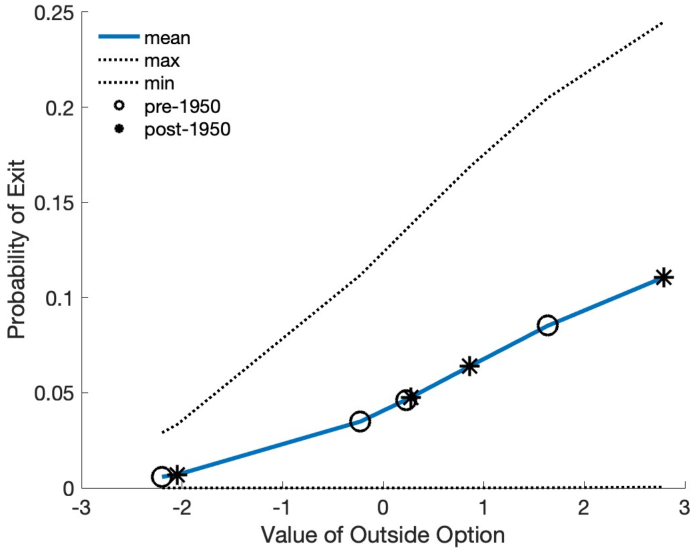
Fig. 9: Gains in Variety vs. Incentive to Coordinate, Robustness



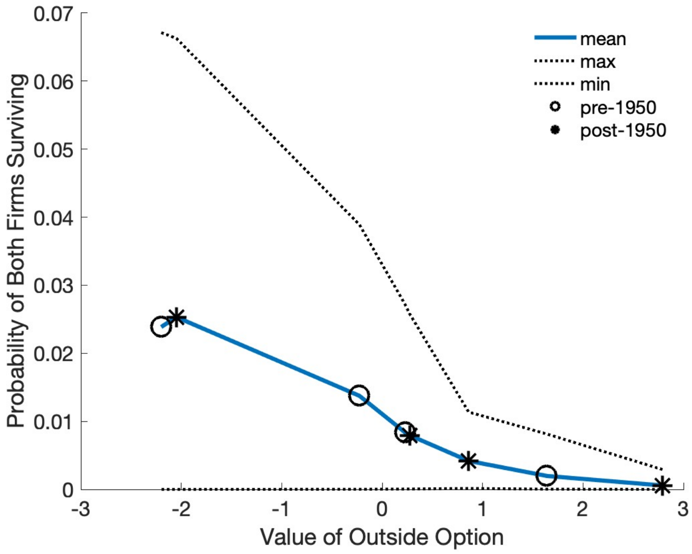
(a) Δ Pct. Points of 2-Firm Markets (b) Probability of Entering into a JOA

Note: Parameter value used in simulation is 0.25. Bargaining parameters range between 0.21 and 0.79. Percentage point changes are based off of exit policy functions for each state starting with $n = 2$, barring entry, and holding independently evolving state variables $\boldsymbol{\omega}$ constant. Firms can only exit JOAs via market exit. JOA entry probabilities come from model-generated policy functions. Reported numbers average across all values of the outside option. Changes in joint survival rates are for 60 years.

Fig. 10: JOA Efficacy - Flailing vs. Failing Firms



(a) Probability of Exit, Non-JOA 2-Firm Markets



(b) Δ Survival 2-Firm Markets from Reduced Exit under JOA

Note: Points average across values of (ξ_{jmt}, ξ_{-jmt}) and M_t. Survival probabilities assume no entry and is the probability that, in a market starting with 2 incumbents, neither firm has exited after 16 periods.

12 Tables

Table 1: Market Characteristics, 1932-1992

Market Size	0	1	2	1+
Total Markets	6,383	11,314	3,342	16,753
Total Markets w/ JOAs	0	0	14	28
Total Newspapers	0	11,314	6,684	27,337
Mean Population	42,341	45,802	127,573	132,009

Note: Market size is the number of newspapers active in a given market in a given period (election year). Total markets is the number of market-years in each market size. Total newspapers is the number of newspaper-years in markets of each size. I calculate the number of markets with 0 newspapers by counting the number of periods for which no newspapers are active in markets with any entry during my study period.

Table 2: Summary Statistics of Newspaper Characteristics, 1932-1992

	Mean	*Median*	*SD*	*Min*	*Max*	*Obs.*
All Markets						
Total Circulation	25,608	9,242	52,192	122	771,303	26,980
Annual Ad Linage (Col. In.)	7,403,634	4,884,807	12,440,021	3,947	792,384,320	10,809
Annual Subscription Price ($)	87.64	91.89	42.44	3.22	732.40	17,725
Ad Rate ($/Col. In.)	15.18	8.79	21.15	0.05	602.14	24,470
Unique Staff	11.33	9.00	10.49	0.5	135	23,639
Market Penetration	0.17	0.20	0.12	<0.01	0.99	26,924
Paper & Ink Cost*	6.04	5.76	4.74	<0.01	381.96	20,071
Cost of Delivery per Copy*	29.86	26.86	17.35	0.01	156.78	20,102
Ad Cost Per Inch*	2.06	0.91	16.10	<0.01	1,123.52	19,887
Ad Revenue per Copy*	828.81	264.31	1,595.47	20.76	13,894.46	19,442
Markets with ≤ 2 Firms						
Total Circulation	15,150	7,615	23,964	300	641,363	17,776
Annual Ad Linage (Col. In.)	6,252,600	4,137,659	13,588,981	6,132	792,384,320	7,108
Annual Subscription Price ($)	85.15	89.41	40.5	3.22	732.40	11,861
Ad Rate ($/Col. In.)	10.97	7.96	12.46	0.05	259.92	16,207
Unique Staff	9.97	8.00	7.73	0.5	111	16,133
Market Penetration	0.21	0.20	0.12	0.01	0.99	17,735
Paper & Ink Cost*	6.22	5.90	2.85	<0.01	61.46	13,363
Cost of Delivery per Copy*	27.76	25.25	15.61	0.01	156.78	13,383
Ad Cost Per Inch*	1.86	0.85	17.02	<0.01	1,123.52	13,215
Ad Revenue per Copy*	822.39	254.13	1,631.14	20.76	13,894.46	12,908

Note: I define a newspaper as a firm. Unique staff are unique staff listed in the *Editor & Publisher Yearbook*; this includes mostly editors and columnists. Prices, cost, and revenues are annual. (*) indicates that summary statistics are for values approximated using cost and revenue surveys. Ad linage and rates are for display advertising. Paper and ink costs are per page per 1,000 copies. Each observation is a newspaper for a specific (election) year.

Table 3: JOA Amendments and Durations

City	Start (Year)	# Amendments*	Last Amended (Year)	Expiry (Year)	Duration Current	Duration Total
Albuquerque, NM	1933	9	1982	2022	40	89
Birmingham, AL	1950	3	1988	2015	27	65
Charleston, WV	1958	4	1986	2036	50	78
Chattanooga, TN	1942	2	1980	2000	20	20
Cincinnati, OH	1977	-	-	2007	30	30
Detroit, MI	1989	-	-	2086	97	97
El Paso, TX	1936	3	1989	2015	26	79
Evansville, IN	1938	1	1986	1998	12	60
Fort Wayne, IN	1950	4	1980	2020	40	70
Honolulu, HI	1962	6	1981	2042	61	80
Las Vegas, NV	1989	-	-	2049	60	60
Nashville, TN	1937	3	1986	2022	36	85
Pittsburgh, PA	1961	-	-	1999	38	38
Salt Lake City, UT	1952	1	1982	2012	30	60
San Francisco, CA	1965	-	-	1995	30	30
Seattle, WA	1983	-	-	2032	50	50
Tuscon, AZ	1940	4	1988	2015	27	75
York, PA	1989	-	-	2090	101	101
Mean (SD)	-	-	-	-	43.1 (24.1)	64.8 (23.7)

Note: (*) Also includes other changes such as supplementing and renewing. Chattanooga, TN was dissolved in 1966 and reestablished in 1980 (these are the events counted under amendments). Current Duration reflects how long the most recent version of the JOA contract, as of 1993, was written for. Total Duration is the total length of the contract from the first start date to end date. This table is a modified version of Table 1.1 in Busterna and Picard (1993) and contains all JOAs for which contract duration information is available.

Table 4: JOA Paper Characteristics and Probability of Exit

	(1) Sub. Price	(2) Ad Price	(3) Unique Staff	(4) Exit
JOA	3.177*	29.64***	6.015***	-0.0340***
	(1.364)	(2.791)	(0.609)	(0.00554)
Total Pop. (1000)	0.0111***	0.0415***	0.0162***	0.00000951
	(0.00114)	(0.00149)	(0.000577)	(0.00000642)
Mkt. Share	10.36***	30.54***	12.32***	-0.206***
	(2.185)	(1.669)	(0.533)	(0.0126)
Pop. Buying Any Paper	9.547***	0.264	-2.473***	0.0845***
	(2.084)	(1.232)	(0.418)	(0.0118)
N. Firms	0.462***	-0.120***	-0.122***	-0.000488*
	(0.0396)	(0.0337)	(0.0123)	(0.000244)
Frac. Diff. Pol. Affil. Voters	-0.163	1.585*	-0.342	0.0482***
	(1.589)	(0.732)	(0.287)	(0.00821)
Constant	83.68***	31.74***	21.15***	0.0107
	(5.291)	(5.289)	(1.495)	(0.0116)
Mean	87.53	15.23	11.41	0.0359
N	17533	23963	23308	26772

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Observations are at the firm-year level. Huber-White (robust) standard errors reported. Specifications include year and time-of-day (i.e., whether the paper is a morning or evening paper) fixed effects. Sample includes observations from all papers in the data from 1932 to 1992. Mean refers to the mean of the dependent variable. Prices are adjusted for inflation. Quality is measured as the number of unique staff per firm.

Table 5: Firm Exit and Newspaper Characteristics

	(1) Sub. Price	(2) Ad Price	(3) Unique Staff
Exit in t-1	1.166	0.586	-0.704*
	(0.835)	(0.748)	(0.281)
Total Pop. (1000)	0.0123***	0.0393***	0.0150***
	(0.00113)	(0.00155)	(0.000552)
Mkt. Share	27.29***	84.31***	32.73***
	(3.782)	(2.766)	(1.102)
Pop. Buying Any Paper	-5.846*	-1.745	-7.191***
	(2.882)	(1.662)	(0.614)
Frac. Diff. Pol. Affil. Voters	-4.277	7.174***	0.659
	(2.522)	(1.673)	(0.581)
Constant	88.06***	19.64***	20.60***
	(6.785)	(5.515)	(2.066)
Mean	92.14	20.16	13.48
N	8826	11686	11645

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Observations are at the firm-year level. Huber-White (robust) standard errors reported. Specifications include year fixed effects. Sample includes observations from all papers in the data from 1932 to 1992 with at least two active papers in the previous period. Mean refers to the mean of the dependent variable. Prices are adjusted for inflation.

Table 6: Probability of JOA Entry and Characteristics of 2 Firm Markets

Model	*Characteristic*	*Est.*	*SE*
1	Circulation Ratio	0.353	0.163
2	Firm 1 Strength	0.0010	0.0010
	Diff. in Firm Strength	-0.0019	0.0011
	Value of Outside Option	-0.0020	0.0013
	Market Size (Population)	5.42×10^{-9}	3.15×10^{-9}

Note: N=1117 markets in model 1. N=855 markets in model 2. Model 1 includes market fixed effects, and the circulation ratio is the ratio of second largest JOA eligible firm's circulation to largest firm's circulation (max. value of 1). Model 2 uses values from estimated reader demand. Firm strength is the firm-period residual - value to readers from variety provided by a specific firm. Outside option is an interaction between market fixed effects and indicators for whether a period is before or after 1950.

Table 7: Stage Game Parameter Estimates

	Parameter	*Est.*	*SE*	*$ 2004 Value*
Price	β_0	-0.012	0.004	-1
log(Quality +1)	β_1	0.550	0.161	45
Affil. Dist.	β_2	-3.296	0.895	-247.67
2nd Paper Disutility	Γ	0.709	0.149	59
Adv. 1st Impression Value	a_h	128.95	2.66	128.95
Adv. 2nd Impression Value	a_l	100.49	.118	100.49
Avg. MC per Copy	$\overline{mc}_{mt}$	112.47	0.793	112.47
Marginal Cost of Quality	$\gamma_{x,1}$	15,707	4,768.2	15,707
	$\gamma_{x,2}$	1,410	451.48	1,410

Note: Amounts are for annual subscriptions per reader ($\sim$ 365 issues). The standard errors for $\beta_0, \beta_1, \beta_2, \Gamma$ are calculated jointly. The gradients for β_2, γ are calculated numerically. The standard errors for $a_h, a_l, \bar{mc}_{mt}, \gamma_{x,1}, \gamma_{x,2}$ do not currently take into account estimation error from other variables.

Table 8: Average Stage Game Equilibrium Payoffs and Characteristics

	Competition	JOA	Monopoly
Revenue Net Variable and Quality Fixed Cost	16.87 Mil.	18.02 Mil.	21.33 Mil.
Consumer Surplus (CS)	101.72	92.74	51.27
Δ CS from Price	-	-7.71	3.34$^{(b)}$
Δ CS from Quality	-	$-1.28^{(a)}$	1.44$^{(c)}$
Δ CS from Variety	-	-	$-46.25^{(d)}$
Annual Subscription Price	121.60	136.74	125.47
Annual Ad. Price	121.86	126.50	128.95
Quality	20.06	20.55	21.4
Avg. Firm Share	0.237	0.228	0.309

Note: Averages are across all states Ω and weight each state equally. This weighting does not account for selection across states. Consumer surplus is in dollars per reader and only includes reader surplus. Except for unique staff averages, all values are reported in 2004 dollars. (a): This change is the change between Nash and JOA consumer surplus not accounted for by subscription price changes. (b): This change in consumer (reader) surplus is calculated by changing firm 1's subscription prices from JOA to monopoly prices and holding firm 2's JOA characteristics constant (as well as firm 1's other characteristics). (c): This change in consumer surplus is calculated by changing firm 1's JOA subscription prices and qualities to monopoly ones and holding firm 2's JOA characteristics constant (as well as firm 1's other characteristics). (d): This change is calculated by netting out the differences in consumer surplus between JOA and monopoly, taking the surplus increases from the decrease in price and increase in quality into account.

Table 9: Stage Game Model Predicted Characteristics, Weighted

	Competition	JOA	Monopoly
Annual Subscription Price	116.43	130.63	145.61
Annual Ad. Price	122.71	127.35	128.95
Quality	30.66	31.13	26.77
Outside Share	0.55	0.56	0.59
Consumer Surplus (CS)	79.12	47.71	57.67

Note: Statistics are weighted by how often observations in different states appear in the data. Data sample statistics are for only markets with ≤ 2 firms.

Table 10: Stage Game Model vs. Data Characteristics

	Subscription Price		**Quality**	
	Model	*Data*	*Model*	*Data*
Mean	116.43	85.15	30.67	9.97
Median	96.67	89.41	15.00	8
90% CI	(68.77, 209.14)	(14.13, 136.57)	(0,98.5)	(2, 25)

Note: Statistics are weighted by how often observations in different states appear in the data. Data sample statistics are for only markets with ≤ 2 firms.

Table 11: Dynamic Model Parameter Estimates

	Parameter	*Estimate ($ 2004 millions)*	(SE)
Scrap Value Mean	$\mu_\phi M_t$	$0.0005 \times M_t$	$(0.00017 \times M_t)$
Entry Cost Mean	μ_e	14,928	(6,656)
JOA Cost Mean	μ_κ	1,308	

Note: My sample includes 1,342 markets across 16 periods (election years from 1932 to 1992). I include only periods with monopoly or two-firm markets. Parameters are the means of exponential distributions. $M_t \in [11300, 1.35 \text{ Million}]$. Reported standard errors do not currently account for additional error from also estimating the static stage game parameters or μ_κ.

Table 12: Observed Firm Values

Observed Daily Newspaper Sales

Year	*Firm*	*Amount ($ 2004 Millions)*	*Circ.*
1975	Cincinnati Enquirer	193	200K
1977	Kansas City Star Co.	125	294K
1988	Bridgeport Post Holding Company	225	80K
1997	6 Dailies, Scripps	119 per paper	235K

Source: Various articles from *Editor and Publisher Magazine*

Table 13: Firm Survival and Consumer Welfare under Alternative Policies

	Policy		
	(1)	(2)	(3)
	Allowing JOAs	*Costless JOAs*	*Costless JOAs. Quality Coord.*
% Increase in $n = 2$	0.04%	2.54%	2.59%
Avg. ΔCS	-$0.43	-$4.81	-$5.58

Note: % Increase in $n = 2$ is measured after 16 4-year periods. Avg. ΔCS is an average across markets and periods.

A Additional Dynamic Model Specifications

I define $VC_j(\cdot)$ in the remaining states as:

$$\begin{aligned} VC_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1) =& P(\chi_{-jt} = 1|\Omega_t)\widetilde{VC}_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1|\chi_{-jt} = 1) \\ &+ P(\chi_{-jt} = 0, \chi_{et} = 1|\Omega_t)\widetilde{VC}_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0|\chi_{-jt} = 0, \chi_{et} = 1) \\ &+ P(\chi_{-jt} = 0, \chi_{et} = 0|\Omega_t)\widetilde{VC}_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0|\chi_{-jt} = 0, \chi_{et} = 0) \end{aligned} \tag{28}$$

$$\begin{aligned} VC_j(n_t = 1, \boldsymbol{\omega}_t, joa_t = 0) =& P(\chi_{et} = 1|\Omega_t)\widetilde{VC}_j(n_t = 1, \boldsymbol{\omega}_t, joa_t = 0|\chi_{et} = 1) \\ &+ P(\chi_{et} = 0|\Omega_t)\widetilde{VC}_j(n_t = 1, \boldsymbol{\omega}_t, joa_t = 0|\chi_{et} = 0) \end{aligned} \tag{29}$$

The within-JOA transfer $\tau_{J,j}(\Omega_t)$ is determined by the following 50-50 Nash bargaining equation where $\overline{VC}_{a,j}(\Omega_t) = \mathbb{E}_\phi[max\{\phi, VC_j(\Omega_t)\}]$:

$$\begin{aligned} \tau_{J,j}(\Omega_t) = \underset{\hat{\tau}}{argmax}\Big[&(\Pi_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1) + \overline{VC}_{a,j}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1)) - \\ &(\Pi_j(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0) + \overline{VC}_{a,j}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0)) - \hat{\tau}\Big] \times \\ \Big[&(\Pi_{-j}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1) + \overline{VC}_{a,-j}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1)) - \\ &(\Pi_{-j}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0) + \overline{VC}_{a,-j}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0)) + \hat{\tau}\Big] \end{aligned} \tag{30}$$

Note, if the following does not hold in state Ω_t, there are no potential gains from trade, the JOA dissolves immediately, and firms pay no transfer $\tau_{J,j} = \tau_{J,-j} = 0$:

$$\begin{aligned} \sum_{k\in\{j,-j\}} &\Big(\Pi_k(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1) + \overline{VC}_{a,k}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 1)\Big) \\ &\geq \sum_{k\in\{j,-j\}} \Big(\Pi_k(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0) + \overline{VC}_{a,k}(n_t = 2, \boldsymbol{\omega}_t, joa_t = 0)\Big) \end{aligned}$$

More on Equilibrium Existence: Under (iii), equilibrium existence still holds, because JOA entry and JOA dissolution both have unique cutoff strategies. Since JOA entry only occurs (and κ is paid) when both firms agree to enter a JOA and I only consider $n \leq 2$, there is a single cutoff condition that needs to be met for a JOA to be formed:

$$\kappa \leq min\{\overline{VC}_{b,j}(n_{t+1} = 2, \boldsymbol{\omega}_t, joa_{t+1} = 1) - \overline{VC}_{b,j}(n_{t+1} = 2, \boldsymbol{\omega}_t, joa_{t+1} = 0 - \tau_{0,j}(\Omega_t)),$$
$$\overline{VC}_{b,-j}(n_{t+1} = 2, \boldsymbol{\omega}_t, joa_{t+1} = 1) - \overline{VC}_{b,-j}(n_{t+1} = 2, \boldsymbol{\omega}_t, joa_{t+1} = 0 - \tau_{0,-j}(\Omega_t)\}$$

For any state Ω_t, this condition is unique, as the $min(\cdot)$ operator returns a unique value. Similarly, since transfers within a JOA are efficient and JOAs dissolve only when there are no gains to trade, JOA dissolution is effectively a single-agent problem, and a unique equilibrium cutoff strategy exists.

Transfers under my model assumptions satisfy the following properties for all continuation values: (i) there are unique solutions[30] to equations 30 and 19, (ii) transfers are continuous[31] in pr_x, pr_e, and pr_J, and (iii) transfers are additively separable in the value function $V_j(\cdot)$. Following Lee and Fong (2013), these properties preserve the continuity and single-valued conditions that the firm best-response correspondence function needs to satisfy for Brouwer's fixed point theorem to guarantee equilibrium existence.

[30]For this to hold, I define $\tau_{0,j} = 0$ and $\tau_{J,j} = 0$ when there are no gains trade. Note, this does not violate continuity, since the continuation values are continuous in pr_x, pr_e, and pr_J, which implies that the gains to trade are also continuous in pr_x, pr_e, and pr_J. As the gains to trade approach 0, transfers approach 0, and the continuation value in the corresponding $joa = 1$ approaches its $joa = 0$ value from above. Value functions in states where $joa = 1$ are bounded below by the value function in the $joa = 0$ state with the same value of $\boldsymbol{\omega}$ (and $n = 2$). Intuitively, allowing for efficient transfers turn JOA dissolution into a single-agent problem, and I no longer have the issue that equilibrium JOA actions in pure strategies may not exist.

[31]To be completely correct, the model needs to include some iid exogenous shock $\epsilon_{JOA,t}$ to the value of being in a JOA that smooths out the probability of a JOA ending in any given period and such that there exists $\bar{\epsilon}_{JOA}$ in the support where there are always gains to trade when $\epsilon_{JOA,t} > \bar{\epsilon}_{JOA}$. See Lee and Fong (2013) for further details. I do not write this in explicitly, since this does not prevent me from finding equilibria in my application.

B Additional Static Model Specifications

As in Fan (2013), I define market penetration $\mathcal{s}_{jt}$ as:

$$\Psi^{(1)}_{jt} = \frac{exp(\delta_{jt})}{1 + \sum_{k\in\mathcal{J}_t} exp(\delta_{kt})} \tag{31}$$

$$\Psi^{(2)}_{j,j't} = \frac{exp(\delta_{jt})}{exp(\Gamma) + \sum_{k\in\mathcal{J}_t, k\neq j'} exp(\delta_{kt})} \tag{32}$$

$$\Psi^{(3)}_{jt} = \frac{exp(\delta_{jt})}{exp(\Gamma) + \sum_{k\in\mathcal{J}_t} exp(\delta_{kt})} \tag{33}$$

$$\mathcal{s}_{jt} = \Psi^{(1)}_{jt} + \sum_{j'\neq j} \left(\Psi^{(2)}_{j,j't} - \Psi^{(3)}_{jt}\right) \tag{34}$$

I define the fraction of a newspaper j's readers who read only newspaper j as:

$$\mathcal{E}_{jt}(\mathbf{p}, \mathbf{r}) = \frac{\Psi^{(1)}_{jt} - \sum_{j'\in\mathcal{J}_t, j'\neq j}(\Psi^{(2)}_{j',jt} - \Psi^{(3)}_{j't})}{\Psi^{(1)}_{jt} + \sum_{j'\in\mathcal{J}_t, j'\neq j}(\Psi^{(2)}_{j,j't} - \Psi^{(3)}_{jt})} \tag{35}$$

C Estimation Details

C.1 Static Demand Estimation Details

C.1.1 Reader Demand Moments

Using variation across monopoly markets in years without entry ($n = 5,209$), I estimate the price coefficient β_0, the interaction between quality and affiliation alignment β_1, the value of affiliation alignment β_2, and the (relative) value of the outside option $\mathbf{I_t}$. Using instruments $\mathbf{Z}_{jmt}$, I form the following vector of moments:

$$\boldsymbol{\psi}_1(\theta) = \underbrace{(\delta_{jmt} - (log(1 + x_{jmt})\beta_1 + p_{jmt}\beta_0 + A_{jmt}\hat{\beta}_2 + \tilde{\mathbf{I}}_{m,t}))}_{=\tilde{\xi}_{jmt}} \times [\mathbf{Z}_{jmt}, \tilde{\mathbf{I}}_{m,t}] \tag{36}$$

$$\delta_{jmt} = \ln(s_{jmt}) - \ln(s_{0mt}) \tag{37}$$

$\mathbf{Z}_{jmt}$ includes affiliation distance and two different possible sources of cost shocks: (i) paper and ink costs and (ii) printing costs specific to advertising[32]. To create shock measures, I average

[32] Many of the improvements in printing technology went to producing more image and color-based advertisements in newspapers. Maintaining and operating these technologies would have contributed to marginal costs, as labor, repairs, and parts would be needed to continue to print ads in additional copies.

the costs corresponding to each source reported by all newspapers in the same circulation group reported by *Inland Press*. I assume that cost shocks in each period are exogenous and that newspapers in different circulation groups have exogenously different exposure to cost shocks in each period. I also include pre-post 1950 fixed effects interacted with market fixed effects $\tilde{I}_{m,t}$ as controls.

Circulation groups correlate with the exposure to and intensity of cost shocks through several channels. First, smaller newspapers are generally more geographically isolated; this results in different input supply networks and delivery costs relative to larger newspapers in more urban areas. Second, newspapers with low circulation might have less bargaining power with input suppliers, implying that any upstream shocks are passed along differentially by circulation group. I show first stage results in the table below.

The validity of these instruments relies on the assumption that newspapers cannot manipulate their circulation groups each period to influence their exposure to cost shocks. I believe this assumption is plausible because local newspapers rarely, if ever, change which local geographic market they serve. As such, cost determinants correlated with circulation group such as location and potential suppliers are generally fixed before shocks are realized. I also assume that my constructed cost shocks are not correlated with specific demand, as they are averages across many different papers in different markets.

IV First Stage

	(1)	(2)
	Price	log(1+Quality)
adv_cost_per_inch	0.821**	-0.102**
	(0.194)	(0.00351)
paper_ink_cost_per_page_1kcirc	0.336*	-0.0491**
	(0.147)	(0.00463)
_cons	81.35**	2.814**
	(1.193)	(0.0304)
N	9335	12169
fs	9.944	431.7

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Note: Huber-White (robust) standard errors reported. Prices are adjusted for inflation.

After recovering $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2$ I estimate $\hat{\Gamma}$ using two-paper markets in years without entry ($n = 1,204$) and the following vector of moments:

$$\boldsymbol{\psi}_2(\theta) = \underbrace{(\delta_{jmt} - (\hat{\beta}_0 p_{jmt} + log(1 + x_{jmt})\hat{\beta}_1 + A_{jmt}\hat{\beta}_2 + \tilde{\mathbf{I}}_{\mathbf{m,t}}))}_{=\tilde{\xi}_{jmt}} \tag{38}$$

Lastly, I recover $\tilde{\xi}_{jmt} - \tilde{\mathbf{I}}_{m,t} = -\hat{\mathbf{I}}_{\mathbf{m,t}} + \xi_{jmt}$ where ξ_{jmt} is now centered around 0, and $-\hat{\mathbf{I}}_{\mathbf{m,t}}$ are the market and pre or post 1950 means of $\tilde{\xi}_{jmt} - \tilde{\mathbf{I}}_{m,t}$.

C.1.2 Advertiser Demand Moments

Define $\hat{a}_{jmt} = a_{jmt} + \eta_{jmt}$ where η_{jmt} is measurement error with mean 0 and a_{jmt} is the equilibrium advertising rate defined according to equation 8. To arrive at my measure of total advertising revenues per paper $\hat{a}_{jmt}$, I calculate total advertising revenues per paper by multiplying the reported ad-linage rate by observed total linage sold. I then use the *Inland Press* revenue survey to scale these amounts because actual ad rates are determined via bargaining processes with different advertisers. This can lead the reported ad rates to overstate (or understate) the actual ad linage rate. The revenues reported in the survey reflect realized revenues from these bargaining processes. I assume that the relationship between posted rates and average bargained rates is constant over time and across papers and find that realized ad revenues are, on average, only 3% of revenues calculated using posted rates and linages. To convert total ad revenues to per-reader ad revenues, I divide the scaled value by total circulation.

I estimate the value of first views to advertisers a_h using variation across monopoly markets ($n = 4,113$). Using my assumption about measurement error in $\hat{a}_{jmt}$, I form the following moment:

$$\psi_3(\theta) = \hat{a}_{jmt} - a_h \tag{39}$$

In monopoly markets, $\mathscr{E}_{jmt} = 1$, as all readers are exclusive. Again, my underlying assumption is that advertisers in monopoly and multi-paper markets are homogeneous.

Next, taking $\hat{\beta}_0, \hat{\beta}_1, \hat{\Gamma}, \hat{\Gamma}_s, \hat{a}_h, \hat{\mathbf{I}}_{\mathbf{m,t}}, \boldsymbol{\xi}_{m,t}$ as given, I estimate the value of subsequent views to advertisers $\hat{a}_l$ using the following moment and variation across two-paper markets ($n = 2,379$):

$$\psi_4(\theta) = \hat{a}_{jmt} - (\hat{a}_h \hat{\mathscr{E}}_{jmt} + a_l(1 - \hat{\mathscr{E}}_{jmt})) \tag{40}$$

where $\hat{\mathscr{E}}_{jmt}$ is calculated using data and $\hat{\beta}_0, \hat{\beta}_1, \hat{\Gamma}, \hat{\mathbf{I}}_{m,t}, \boldsymbol{\xi}_{m,t}$.

C.2 Policy Function and State Transition Estimation Details

C.2.1 Policy Functions and JOA Transfers $\tau_{J,j}$

To estimate policy functions and within-JOA transfers, I first discretize the state space and then estimate how the policy functions vary across the state space. State variables $\boldsymbol{\omega} = (I, \{\xi_j\}_{j\in\mathscr{J}})$ come from estimating reader demand. During estimation of the static game, these variables are treated as continuous. However, to make computing and estimating the dynamic game more tractable, I assume a discrete state space. Thus, I discretize I into four quartile buckets and ξ_j into five quintile buckets. Percentiles are based off of the distributions recovered from the data, and each bucket takes on the value of its midpoint.

With respect to the parametric assumptions used to estimate the policy functions, I assume that the probability of exit is given by $pr_x(\Omega_t) = \mathbf{\Phi}(\iota_{x,0}+\iota_{x,1}\xi_{jt}+\iota_{x,2}\xi_{-jt}+\iota_{x,3}joa_t+\iota_{x,4}n_t+\iota_{x,5}I_t+$

$\iota_{x,6} I_t n_t + \iota_{x,7} M_t n_t + \iota_{x,8} M_t I_t)$, the probability of entry[33] is given by $pr_e(\Omega_t) = exp(\iota_{e,0} + \iota_{e,1} I_t)$, and the probability of entering a JOA is given by $pr_J(\Omega_t) = \mathbf{\Phi}(\iota_{J,0} + \iota_{J,1}\xi_{jt} + \iota_{J,2}\xi_{-jt} + \iota_{J,3}\xi_{jt}\xi_{-jt} - \iota_{J,4} I_t)$ where $\mathbf{\Phi}(\cdot)$ is the standard normal CDF. I estimate $\boldsymbol{\iota}_x$ and $\boldsymbol{\iota}_J$ using maximum likelihood and $\boldsymbol{\iota}_e$ using a log linear regression.

Table 14 below reports the resulting parameter estimates. Firm j's exit probability is decreasing in its own strength, lower if it is in a JOA, and increasing in the number of competitors it has. The appropriate sign on competitor strength is ambiguous; in the short run, this should increase exit probability, but, given the possibility of entering into a JOA in the future, firm j could benefit from coordinating with a relatively strong competitor. The interaction between competitor strength and the value of the outside option increases the exit probability, as a higher outside option implies that both firms have lower long run profits, and firm j can benefit from a JOA with a relatively stronger competitor for fewer periods. Firm j's entry probability is decreasing in the strength of the incumbent. The JOA entry probability is increasing in competitor strength as well as the interaction between own and competitor strength, because these increase the gains from cooperation. It is decreasing in the value of the outside option, as this decreases the gains to trade by shrinking overall profits. Theoretically, the impact of a firm's own strength is ambiguous and depends on whether market expansion under coordination or future monopoly profits dominate; I find a positive relationship, indicating that market expansion under coordination dominates.

[33] Competitor strength is currently omitted from this specification, as this yields the wrong signs on the state variables. I believe this is due to an endogenous selection issue.

Table 14: Policy Function Parameters

	State Variable	*Prob. Exit*	*Prob. Entry*	*Prob. JOA Entry*
Own Strength	ξ_{jt}	-0.130	-	0.053
Competitor Strength	ξ_{-jt}	-0.023	-	0.053
Outside Option Value	I_t	.281	-0.059	-0.229
In JOA	joa_t	-0.56	-	-
# Firms	n_t	0.844	-	-
Market Size	M_t	-6.62×10^{-7}	-	.059
	$I_t \times n_t$	-.203	-	-
	$M_t \times n_t$	-2.42×10^{-7}	-	-
	$M_t \times I_t$	-9.10×10^{-8}	-	-
	$\xi_{jt} \times \xi_{-jt}$	-	-	0.078
# Obs.		10,048	11	2,234
Unit of Obs.		Market-Periods	States	Market-Periods

Note: All specifications also include a constant term.

C.2.2 Conditional Markov Transition Matrices

I estimate a state transition matrix $\hat{M}^{\iota}$ for the incumbent conditional on firm j remaining in the market based off of equation 23:

$$\hat{M}^{\iota}_{ik} = \hat{P}_I(I_k|I_i) \times \left(\prod_{j \in \mathcal{J}} \hat{P}_\xi(\xi_{j,k}|\xi_{j,i}) \right) \times \hat{P}_{n,joa}(n_k, joa_n|n_i, joa_i, \chi_{j,t} = 1)$$

where i is a value of the state variable in the current period t and k is a possible value in the next period

$$\hat{P}_I(I_k|I_i) = \frac{\sum_{t \in T(I_i)} \mathbb{1}\big(I_{t+1} = I_k, I_t = I_i, \chi_{j,t} = 1\big)}{\sum_{t \in T(I_i)} \mathbb{1}\big(\chi_{j,t} = 1\big)}$$

$$\hat{P}_\xi(\xi_{j,k}|\xi_{j,i}) = \frac{\sum_{t \in T(\xi_{j,i})} \mathbb{1}\big(\xi_{j,t+1} = \xi_k, \xi_{j,t} = \xi_i, \chi_{j,t} = 1\big)}{\sum_{t \in T(\xi_{j,i})} \mathbb{1}\big(\chi_{j,t} = 1\big)}$$

I calculate $\hat{P}_{n,joa}(n_k, joa_n|n_i, joa_i, \chi_{j,t} = 1)$ using the estimated binomial entry and exit probabilities $\hat{pr}_x, \hat{pr}_e$, and JOA entry probabilities $\hat{pr}_J$.

C.3 Continuation Value Estimation Details

Define the unobserved (to the econometrician) paid by firms that have just agreed to join a JOA as:

$$\begin{aligned}
&\tau_{0,j}(VC_j(\Omega;\theta)) = \\
&\quad \underset{\hat{\tau}}{argmax}\Big[(\delta \sum_{\omega'}(V_j(n'=2,\omega',joa'=1))P(\omega'|n'=2,\omega,joa'=1,\chi_j=1) \\
&\quad -\delta \sum_{\omega'}(V_j(n'=2,\omega',joa'=0))P(\omega'|n'=2,\omega,joa'=0,\chi_j=1))-\hat{\tau}\Big]\times \\
&\quad \Big[(\delta \sum_{\omega'}(V_{-j}(n'=2,\omega',joa'=1))P(\omega'|n'=2,\omega,joa'=1,\chi_{-j}=1) \\
&\quad -\delta \sum_{\omega'}(V_{-j}(n'=2,\omega',joa'=0))P(\omega'|n'=2,\omega,joa'=0,\chi_{-j}=1))+\hat{\tau}\Big]
\end{aligned} \tag{41}$$

Define $g_j(\cdot)$ for each state Ω as:

$$g_j(VC_j(\Omega;\theta)) = \begin{cases}
(1-\hat{pr}'_x)\times \hat{pr}_J\big(\tau_{0,j}(VC_j(\Omega;\theta))+ \\
\quad \mathbb{E}[\kappa|\kappa \le min\{f_J(VC_j(\Omega;\theta))-f_{\neg J}(VC_j(\Omega;\theta))-\tau_{0,j}(VC_j(\Omega;\theta)), & \text{if } n=2,\ joa=0 \\
\quad\quad f_J(VC_{-j}(\Omega;\theta))-f_{\neg J}(VC_{-j}(\Omega;\theta))-\tau_{0,-j}(VC_{-j}(\Omega;\theta))\}]\big) \\
\\
\hat{pr}'_x \times \hat{pr}_e \times \hat{pr}_J\big(\tau_{0,j}(VC_j(\Omega;\theta)F_{\xi_e})+ \\
\quad \mathbb{E}[\kappa|\kappa \le min\{f_J(VC_j(\Omega;\theta)F_{\xi_e})-f_{\neg J}(VC_j(\Omega;\theta)F_{\xi_e})-\tau_{0,j}(VC_j(\Omega;\theta)F_{\xi_e}), & \text{if } n=2,\ joa=1 \\
\quad\quad f_J(VC_{-j}(\Omega;\theta)F_{\xi_e})-f_{\neg J}(VC_{-j}(\Omega;\theta)F_{\xi_e})-\tau_{0,-j}(VC_{-j}(\Omega;\theta)F_{\xi_e})\}]\big) \\
\\
\hat{pr}_e \times \hat{pr}_J\big(\tau_{0,j}(VC_j(\Omega;\theta)F_{\xi_e})+ \\
\quad \mathbb{E}[\kappa|\kappa \le min\{f_J(VC_j(\Omega;\theta)F_{\xi_e})-f_{\neg J}(VC_j(\Omega;\theta)F_{\xi_e})-\tau_{0,j}(VC_j(\Omega;\theta)F_{\xi_e}), & \text{if } n=1 \\
\quad\quad f_J(VC_{-j}(\Omega;\theta)F_{\xi_e})-f_{\neg J}(VC_{-j}(\Omega;\theta)F_{\xi_e})-\tau_{0,-j}(VC_{-j}(\Omega;\theta)F_{\xi_e})\}]\big)
\end{cases} \tag{42}$$

where $\hat{pr}'_x$ is the probability of a competitor or rival exiting, $f_J(\cdot)$ is a function that finds elements of the vector $\widehat{VC}_j(\theta)$ with the same values of $n, \boldsymbol{\omega}$ and $joa = 1$, and $f_{\neg J}(\cdot)$ is a similar function to $f_J(\cdot)$ that finds corresponding elements for which $joa = 0$. The function differs by state, because, conditional on the number of firms and JOA status at the start of the period (stage 1), the sequence of actions required for possible JOA entry later in the period is different. For instance, if $n = 1$, conditional on j remaining in the market, a potential entrant must enter in order for a JOA to be possible.

The expected value of entry for a potential entrant is:

$$\widehat{VE}(\theta) = \begin{cases} (1-\hat{pr}_J)f_{\neg J}(\hat{F}_{\xi_e}\widehat{VC}_j(\theta)) + \hat{pr}_J(f_J(\hat{F}_{\xi_e}\widehat{VC}_j(\theta)) - \tau_{0,j}(\hat{F}_{\xi_e}\hat{VC}_j(\theta)) \\ \quad -\mathbb{E}[\kappa|\kappa \leq min\{f_J(\hat{F}_{\xi_e}\widehat{VC}_j(\theta)) - f_{\neg J}(\hat{F}_{\xi_e}\widehat{VC}_j(\theta)) - \tau_{0,j}(\hat{F}_{\xi_e}\widehat{VC}_j(\theta)), & \text{if } n-x=1 \\ \quad\quad f_J(\widehat{VC}_{-j}(\theta)) - f_{\neg J}(\hat{F}_{\xi_e}\widehat{VC}_{-j}(\theta)) + \tau_{0,j}(\hat{F}_{\xi_e})\widehat{VC}_{-j}(\theta)\}]) \\ \\ \hat{F}_{\xi_e}\widehat{VC}_j(\theta) & \text{if } n-x=0 \end{cases} \tag{43}$$

where

$$\hat{F}_{\xi_e}\hat{VC}_j(\theta) = \beta\widehat{M}^e(\hat{\Pi} - \hat{\tau} + \widehat{VC}_j(\theta))$$

indicates that the entrant takes expectations over its initial strength draw and starts the next period with strength ξ_j. $F_{\xi_e}VC_{-j}(\theta)$ reflects the incumbent firm's payoffs, taking expectations over the entrant's strength. That the potential entrant and incumbent firm take expectations over the entrant strength reflects how it may take time for a new entrant's strength to become apparent. The expected returns to entry reflect that new entrants have the option of entering into a JOA after entry but before they realize their type.

D Conditions for Contraction Mapping with observed τ, unobserved $\tau_{0,j}$

D.1 Existence

By Brouwer's fixed point theorem, a fixed point to equation 26 exists:

- Condition 1: Equation 26 is a continuous function of $VC_j(\theta)$.
  - As defined by equation 19, the transfer is a continuous function of $VC_j(\theta)$.

- The min operator defined in the function $g_j(\cdot)$ is a continuous function of $VC_j(\theta)$.
- Since I assume that the scrap values and JOA entry costs are drawn from exponential distributions, their expected conditional means are also continuous functions of $VC_j(\theta)$.
- The gains to trade are a continuous function of $VC(\theta)$. Thus there is no discontinuity in the function value when a JOA dissolves.
- The sum and compositions of continuous functions are continuous.

- Condition 2: Fixing θ and all of he "offline" objects estimated in step 1, the space of continuation values $VC_j(\theta)$ is bounded and closed.
  - Each element $VC(\Omega;\theta)$ is bounded below by 0 because the scrap value distribution is bounded below by 0. Each element $VC(\Omega;\theta)$ is bounded above by $\frac{\Pi_j^{JOA}(\Omega^{max})+\Pi_{-j}^{JOA}(\Omega^{max})}{1-\delta}+\mu_\phi$ where Ω^{max} is the state that yields the highest possible total joint JOA profits, and $\frac{\Pi_j^{JOA}(\Omega^{max})+\Pi_{-j}^{JOA}(\Omega^{max})}{1-\delta}$ is the infinite discounted sum of these total static joint profits. This expression also takes into account the corresponding conditional expected scrap value and an exit probability of 1 (as a lower exit probability would only yield a lower value).
  - Even with a transfer, the function maps back into the space as defined above, because post-transfer, a single firm cannot receive more than the maximum possible total joint value from cooperation, which I have defined as the "upper bound" of the space.
  - The Markov transition matrix $\hat{M}^i$ and policy functions all take weighted averages of the various elements of $VC_j(\theta)$, yielding an interior point.

D.2 Contraction Mapping

adjust equation 26 to make the exposition easier:

$$VC_j(\theta) = \delta\hat{M}^\iota\Big((\hat{\Pi}_j - \hat{\tau}_{J,j}) + \hat{pr}_x\mathbb{E}[\phi|\phi \geq VC_j(\theta)] + (1-\hat{pr}_x)(VC_j(\theta))\Big) - \tilde{pr}_J\Big(\tilde{\tau}_{0,j}(VC_j(\theta)) + \mathbb{E}_\kappa[\kappa|\kappa \leq h_j(VC_j(\theta))]\Big) \quad (44)$$

$$\tilde{\tau}_{0,j}(VC_j(\Omega;\theta)) = \begin{cases} \tau_{0,j}(VC_j(\Omega;\theta)) & \text{if } n=2,\ joa=0 \\ \tau_{0,j}(VC_j(\Omega;\theta)F_{\xi_e}) & \text{if } n=1 \text{ or } \ joa=1 \end{cases}$$

$$h_j(VC_j(\Omega;\theta)) = \begin{cases} min\{f_J(VC_j(\Omega;\theta)) - f_{\neg J}(VC_j(\Omega;\theta)) - \tilde{\tau}_{0,j}(VC_j(\Omega;\theta)), & \\ \quad f_J(VC_{-j}(\Omega;\theta)) - f_{\neg J}(VC_{-j}(\Omega;\theta)) - \tilde{\tau}_{0,-j}(VC_{-j}(\Omega;\theta))\} & \text{if } n=2,\ joa=0 \\ min\{f_J(VC_j(\Omega;\theta)F_{\xi_e}) - f_{\neg J}(VC_j(\Omega;\theta)F_{\xi_e}) - \tilde{\tau}_{0,j}(VC_j(\Omega;\theta)), & \\ \quad f_J(VC_{-j}(\Omega;\theta)F_{\xi_e}) - f_{\neg J}(VC_{-j}(\Omega;\theta)F_{\xi_e}) - \tilde{\tau}_{0,-j}(VC_{-j}(\Omega;\theta))\} & \text{if } n=1 \text{ or } \ joa=1 \end{cases}$$

where $f_J(\cdot)$ is a function that finds elements of the vector $VC_j(\theta)$ with the same values of $n, \boldsymbol{\omega}$ and $joa = 1$. $f_{\neg J}(\cdot)$ is a similar function that finds the corresponding elements for which $joa = 0$.

$$\tilde{pr}_J = \begin{cases} (1 - \hat{pr}'_x) \times \hat{pr}_J & \text{if } n=2,\ joa=0 \\ \hat{pr}'_x \times \hat{pr}_e \times \hat{pr}_J & \text{if } n=2,\ joa=1 \\ \hat{pr}_e \times \hat{pr}_J & \text{if } n=1 \end{cases}$$

where $\hat{pr}'_x$ is a rival's probability of exit.

Let $B(x) = \delta \hat{M}^{\iota}((\hat{\Pi}_j - \hat{\tau}_{J,j}) + \hat{pr}_x \mathbb{E}[\phi|\phi \geq x] + (1-\hat{pr}_x)x)$ be an operator producing the first term on the right of equation (44) and x_1, x_2 be two possible vectors of continuation values for a given θ. Define $||\cdot||$ as the sup metric. Then, since $B(x)$ is a contraction mapping as proven in Pakes et al. (2007),

$$\begin{aligned} &||B(x_1) - B(x_2)|| + \\ &\qquad ||-\tilde{pr}_J\Big(\tau_{0,j}(x_1) - \tau_{0,j}(x_2) + (\mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_1)] - \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_2)]\Big)|| \\ &\qquad\qquad \leq \delta||x_1 - x_2|| + \\ &\qquad\qquad ||-\tilde{pr}_J\Big(\tau_{0,j}(x_1) - \tau_{0,j}(x_2) + (\mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_1)] - \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_2)]\Big)|| \end{aligned} \tag{45}$$

So, it remains to find conditions that bound $||d_1 - d_2||$ where for $i = 1, 2$, $d_i = -\tilde{pr}_J(\tau_{0,j}(x_i) + \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_i)])]$:

$$||d_1 - d_2|| = ||-\tilde{pr}_J\big(\tau_{0,j}(x_1) - \tau_{0,j}(x_2) + \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_1)] - \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_2)]\big)||$$

As in Pakes et al. (2005), using Heckman and Honore (1990) proposition 1, I also have that for a log concave random variable D:

$$0 \leq \frac{\partial E[D|D \leq d]}{\partial d} \leq 1$$

Consequently, as κ is drawn from a log-concave distribution (e.g., exponential, logistic), it follows that

$$0 \leq \frac{\partial \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x)]}{\partial h_j(x)} \leq 1$$

However, in order to bound $\mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_1)] - \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_2)]$, I need (via the chain rule):

$$\frac{\partial \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x)]}{\partial x} = \frac{\partial \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x)]}{\partial h_j(x)} \times \frac{\partial h_j(x)}{\partial x}$$

To bound $\frac{\partial h_j(x)}{\partial x}$, first note that $h_j(x)$ is how much a firm makes post-transfer calculated from 4 elements of vector x. Let be a be firm 1's continuation payoff under a JOA and b be firm 1's continuation payoff not under a JOA when there are 2 firms in the market. Define a' and b' similarly for firm 2. a, a', b, b' are all elements of vector x. Then, since I assume 50-50 efficient Nash bargaining with lump-sum transfers over expected future gains to the JOA:

$$||\frac{\partial h_j(x)}{\partial x}|| \leq 2\delta \tag{46}$$

where δ comes from the gains to trade being in terms of discounted payoffs starting the next period (see equation 24). I now need to perform the same exercise with $\tau_{0,j}(x)$:

$$||\frac{\partial \tau_{0,j}(x)}{\partial x}|| \leq 2\delta \tag{47}$$

Thus in order for the following to hold

$$\delta||x_1 - x_2|| + ||\tilde{pr}_J\Big(\tau_{0,j}(x_1) - \tau_{0,j}(x_2) + \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_1) - \mathbb{E}_{\kappa}[\kappa|\kappa \leq h_j(x_2)]\Big)|| \leq ||x_1 - x_2|| \tag{48}$$

I need (using the triangle inequality)

$$\delta + \delta \tilde{pr}_J |2 + 2| < 1 \tag{49}$$

$$0 \leq \tilde{pr}_J < \frac{\frac{1}{\delta} - 1}{4} \tag{50}$$

For $\delta = 0.815$, this implies I need $\tilde{pr}_J \leq .0569$ across all states for the sufficient condition for a contraction mapping to be satisfied. This holds in my setting.

E Allowing Newspapers to Have Same or Different Political Affiliation

Whether or not two newspapers in the same market share the same political affiliation is another persistent source of asymmetry between two competing newspapers. In the main specification of my model, I do not keep track of newspaper affiliations to simplify the number of state variables predictive of flow payoffs. As such, I make the simplifying assumption that while different readers can value the same paper differently by either having an aligned or opposite affiliation, the fraction of readers with aligned affiliations is drawn randomly across periods, markets, and firms. However, realistically, 66.31% of the markets in my sample with two newspapers have papers with the same fixed declared political affiliation (Democrat, Republican, or Independent), and the remaining newspapers have different fixed declared affiliations. A such, the evolution of share of aligned readers may not be independent across papers in the same market. I find that, conditional on having the same affiliation, newspapers are more likely to enter into JOAs and experience smaller resulting decreases in exit rates relative to those with different affiliations. Moreover, qualitatively, the wedge between when newspapers choose to enter into JOAs and when JOAs help most also still exists across different pairs of firm strengths when allowing for endogenous political affiliation differences.

The implications of whether two newspapers have persistently the same or different political affiliations for the wedge between when newspapers choose to join JOAs and how much these JOAs extend joint paper survival are ambiguous. On one hand, two newspapers with the same affiliation may experience a greater increase in stage game static profits for price coordination because having the same affiliation implies potentially tougher price competition and lower non-JOA prices. On the other hand, newspapers with the same affiliation may also face stronger long-run predatory incentives to wait for a competitor's exit because lower non-JOA prices could imply higher exit probabilities.

In this appendix section, I use my estimated static stage game supply and demand parameters and my estimated scrap value, market entry, and JOA entry parameters to explore how whether or not firms have the same affiliation affects the wedge between JOA entry incentives and effectiveness. Note, to limit the dimensions of the relevant state space, I adjust how I treat individual firm strengths ξ_{jt} and the value of the outside option I_t. I reduce the number of categories of ξ_{jt} from 5 to 3. I also allow I_t to evolve following an AR(1) process, with a jump in value when television arrives in 1950. Furthermore, even if newspaper affiliations are stable post-entry, whether an entrant into a market that already has an incumbent chooses the same affiliation is endogenous. I assume an entrant chooses its affiliation after entry but before it observes its entrant-specific strength ξ_e (and before stage 2 of the dynamic game period when it decides whether or not to enter a JOA with the incumbent). In particular, it chooses:

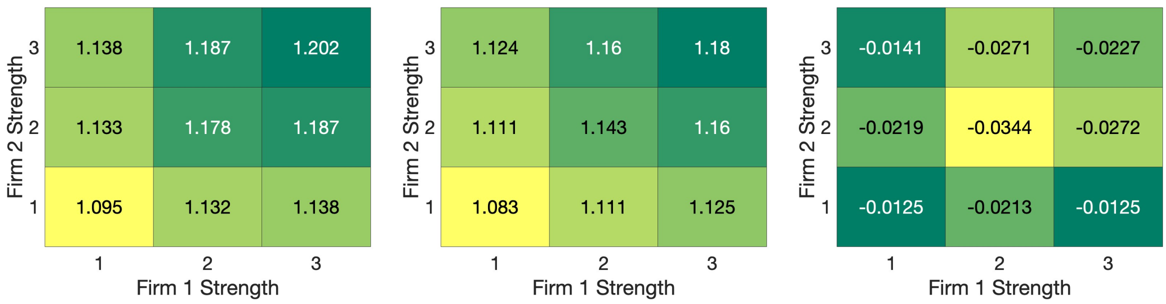
$$\text{affil}^*_{jt} = \underset{\text{affil}_{jt}}{argmax} \left\{ VE(\Omega_t, \text{vote}_t, \text{affil}_{jt} = 1) + \zeta_{1,jt}, \quad VE(\Omega_t, \text{vote}_t, \text{affil}_{jt} = 0) + \zeta_{0,jt} \right\} \tag{51}$$

where $\text{affil}_{jt} = 1$ if the entrant chooses the same affiliation as the incumbent and 0 otherwise. Whether two firms have the same affiliation is fixed so long as those two same firms remain active. $\zeta_{1,jt}, \zeta_{0,jt}$ are Type I EV error terms drawn from a distribution with mean 0 and scale parameter σ_{affil} independently of entrant, period, and affiliation choice. These errors can be interpreted as an idiosyncratic taste component for whether the entrant newspaper wants to have the same affiliation as the incumbent. vote_t determines what fraction of readers in the market align with the incumbent's affiliation in a given period. In contrast to my main specification, here I assume it evolves according to an $AR(1)$ process. I calibrate $\sigma_{\text{affil}} = 45.44$ by taking my original estimates as given and adjusting my two-step estimation routine to include matching affiliation choice probabilities (conditional on an entrant choosing to enter).

With this calibrated parameter and equilibrium static stage payoffs corresponding to the adjusted state space, I use Pakes and McGuire (1994) to solve for the equilibrium policy functions of this new game with affiliation choice. Since whether two incumbents are of the same or different affiliations are now included in the dynamic state space, I can now calculate separate policy functions for firms of the same and different affiliations in periods after entry decisions and types are realized. Since my model implies some states in which an entrant is more likely to choose the same affiliation and other, distinct, states in which an entrant is more likely to choose a different affiliation, I consider only states in which it is on average optimal to choose the same (a different) affiliation when calculating policy functions for same (different) affiliation states. Figure 11 displays JOA entry probabilities. It shows that firms, for which choosing the same affiliation is optimal, have higher JOA entry probabilities, on average, across all pairs of firm strengths. Figure 12 provides evidence that weaker predatory incentives, conditional on firms choosing the same affiliation, play a role in making JOAs more appealing to firms that entered the same market with the same political affiliation.

Furthermore, figures 11 and 12 imply that a similar wedge exists for pairs of firms with the same and different affiliations. As in my main analysis, figure 11 shows that mutually strong firms across both types of pairs are the most likely to enter JOAs. Moreover, figure 12 shows that the weaker firm experiences a greater decrease in exit probability from being part of a JOA when paired with a stronger firm than two stronger firms paired together. Compare, for example when firm 1 is of strength 1 and firm 2 of strength 3 to when both firms are of strength 3. This relationship holds across both firms having the same and different alignments.

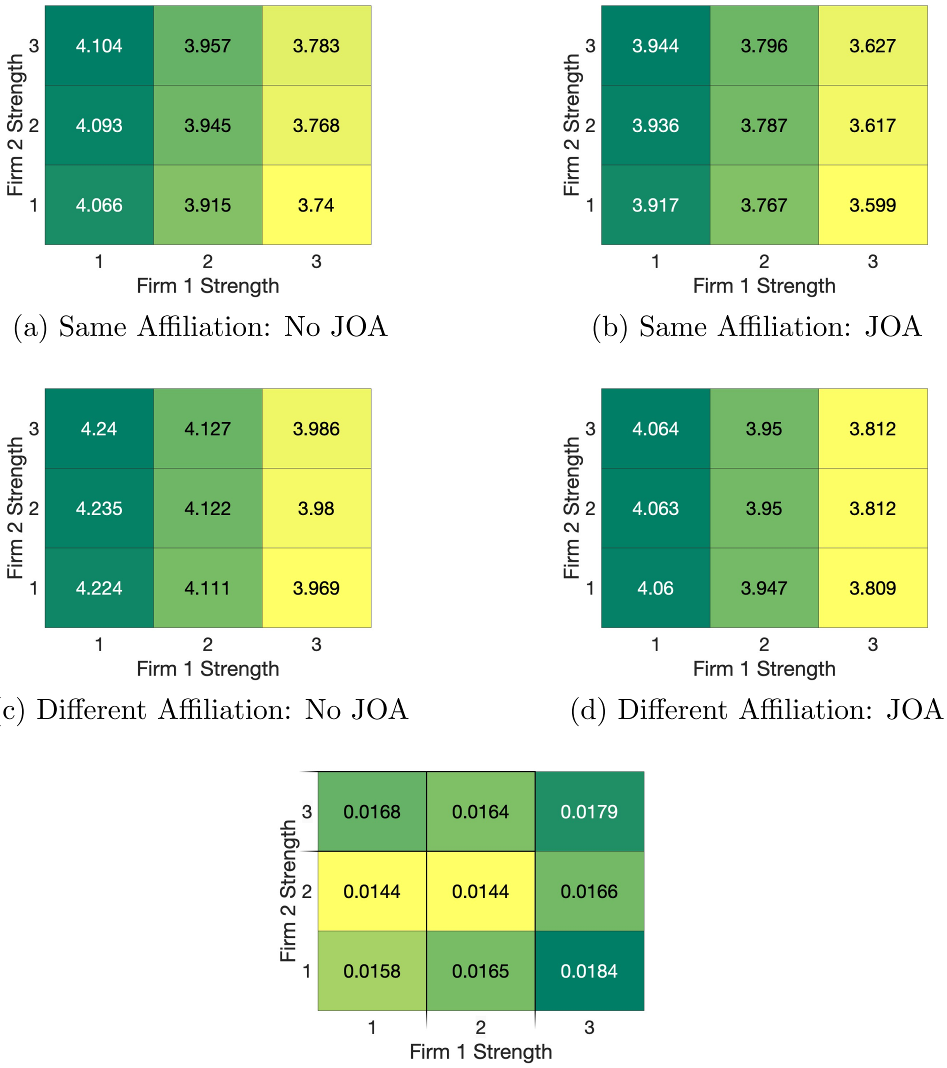
Fig. 11: JOA Entry Probabilities, Same vs. Different Affiliation (Pct. Points)



(a) Same Affiliation (b) Different Affiliation (c) Difference

Note: Same affiliation JOA entry probabilities average across all other states in which firms are more likely to choose the same affiliation. This occurs when the share of votes aligning with the incumbents affiliation is < 0.5. Different affiliation JOA entry probabilities average across all other states in which firms are more likely to choose different affiliations. The difference is the different affiliation probabilities net the same affiliation probabilities.

Fig. 12: Exit probabilities with and without JOAs, Same vs. Different Affiliation (Pct. Points)



(a) Same Affiliation: No JOA

(b) Same Affiliation: JOA

(c) Different Affiliation: No JOA

(d) Different Affiliation: JOA

(e) (Δ Different Affil.) − (Δ Same Affil.)

Note: Same affiliation exit probabilities average across all other states in which firms are more likely to choose the same affiliation. This occurs when the share of votes aligning with the incumbents affiliation is < 0.5. Different affiliation exit probabilities average across all other states in which firms are more likely to choose different affiliations. (Δ Different Affil.) − (Δ Same Affil.) corresponds to the probability without JOA net the probability first within affiliation alignments and then across.

E.1 Monte Carlo

In this section, I provide Monte Carlo evidence that the conditions derived in section D.2 are sufficient but not necessary. I choose $\delta = 0.925$, which implies that my sufficient condition is that $\tilde{pr}_J \leq .02$. As in the main estimation exercise, I assume exponential distributions for the scrap value, entry cot, and JOA entry cost distributions. Fixing $\mu_\phi = 25$, and $\mu_e = 888$, I find

- $\mu_\kappa = 20$ corresponds to $\tilde{pr}_J$ of 4%-8%.

- $\mu_\kappa = 10$ corresponds to $\tilde{pr}_J$ of 8%-16%.

The Monte Carlos yield the following confidence intervals, all of which cover the original parameter values. The confidence intervals also reflect that as the mean of an exponential distribution gets largwe, so does the variance.

95% Confidence Interval

θ	$M = 300, T = 16$	$M = 1K, T = 16$	$M = 10K, T = 20$
$\mu_\kappa = 10$	(0.42, 115.55)	(0.51, 37.06)	(4.92, 18.19)
$\mu_\phi = 25$	(4.13, 60.26)	(9.69, 32.27)	(21.93, 26.27)
$\mu_e = 888$	(279.74, 2284.7)	(428.24, 1231.4)	(808.76, 976.10)
$\mu_\kappa = 20$	(0.28, 313.99)	(0.68, 121.43)	(4.18, 39.79)
$\mu_\phi = 25$	(3.67, 158.85)	(7.71, 37.75)	(21.162, 26.61)
$\mu_e = 888$	(278.39, 4465.3)	(392.22, 1374.8)	(793.57,978.1)

Note: Timing for model underlying the Monte Carlo puts entry at the end of the period. I do not believe this changes the results substantively.

F Counterfactual Simulation

- Since I_{mt} and ξ_{jmt} cannot be recovered for all relevant firms and markets in every period of my sample, I estimate a starting distribution of these values using the observed distribution in 1932.
- Similarly, since I focus on markets with at most 2 firms, I estimate a starting distribution over the number of firms $\{0, 1, 2\}$ using the observed distribution in 1932.
- I then draw starting values of I_{mt}, ξ_{jmt}, and n_{mt} using these distributions.
- I assume no markets start with active JOAs, which is consistent with the number of active JOAs in 1932.
- I simulate 100,000 markets, holding all random draws fixed across counterfactuals, and calculate percentage changes.

References

Anderson, Simon P. and Joel Waldfogel, "Chapter 1 - Preference Externalities in Media Markets," in Simon P. Anderson, Joel Waldfogel, and David Strmberg, eds., *Handbook of Media Economics*, Vol. 1 of *Handbook of Media Economics*, North-Holland, 2015, pp. 3 – 40.

Angelucci, Charles, Julia Cagé, and Michael Sinkinson, "Media Competition and News Diets," 2020, (NBER Working Paper 26782).

Bajari, Patrick, C. Lanier Benkard, and Jonathan Levin, "Estimating Dynamic Models of Imperfect Competition," *Econometrica*, 2007, *75* (5), 1331–1370.

Barringer, Felicity, "A 1970's act to preserve falteriong newspapers seems only to del;ay the inevitable end," *NY Times*, August 1999.

Barwis, Gail Lund, "The Newspaper Preservation Act: A Restrospective Analysis," *Newspaper Research Journal*, Winter 1980.

Bilotkach, Volodymyr, "Airline Partnerships, Antitrust Immunity, and Joint Ventures: What We Know and What I Think We Would Like to Know," *Review of Industrial Organization*, June 2018, (54), 37–60.

Blanchard, Margaret A., ed., "Newspaper Preservation Act," in Margaret A. Blanchard, ed., *History of the Mass Media in the United States: An Encyclopedia*, Routledge, 2013, p. 449.

Busterna, John C. and Robert G. Picard, *Joint Operating Agreements: the Newspaper Preservation Act and Its Application*, Ablex Publishing, 1993.

Carlson, John H., "Newspaper Preservation Act: A Critique," *Indiana Law Journal*, 1971, *46* (3).

Cook, Gerald N., "A Review of History, Structure, and Competition in the U.S. Airline Industry," *Journal of Aviation/Aerospace Education & Research*, 1996, *7* (1).

Cowie, Mike and James A. Fishkin, "Back to the drawing board: FTC and DOJ rethink merger guidelines," *Reuters*, March 2022.

Crolius, Ali, "For Some People the Only Good TV is No TV," *Daily Hampshire Gazette*, June 1993, p. 44.

Doraszelski, Ulrich and Marj Satterthwaite, "Computable Markov-Perfect Industry Dynamics," *RAND Journal of Economics*, 2010, *41* (2), 215–243.

Ericson, Richard and Ariel Pakes, "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," *Review of Economic Studies*, 1995, *62* (1), 325–77.

Fan, Ying, "Ownership Consolidation and Product Characteristics: A Study of the U.S. Daily Newspaper Market," *American Economics Review*, 2013, *103* (5), 15981628.

Feiner, Lauren, "FTC, DOJ seek to rewrite merger guidelines, signaling a tougher look at large deals," January 2022.

Fershtman, Chaim and Ariel Pakes, "A Dynamic Oligopoly with Collusion and Price Wars," *RAND Journal of Economics*, Summer 2000, *31* (2), 207–236.

Gentzkow, Matthew, Edward L. Glaeser, and Claudia Goldin, "The Rise of the Fourth Estate: How Newspapers Became Informative and Why it Mattered," 2004, (NBER Working Paper 10791).

_ , Jesse M. Shapiro, and Michael Sinkinson, "The Effect of Newspaper Entry and Exit on Electoral Politics," *American Economic Review*, December 2011, *101* (7), 2980–3018.

_ , _ , and _ , "Competition and Ideological Diversity: Historical Evidence from US Newspapers," *American Economic Review*, 2014, *104* (10), 3073–3114.

Heckman, James T. and Bo E. Honore, "The Empirical Content of the Roy Model," *Econometrica*, 1990, *58* (5), 1121–1149.

Igami, Mitsuru and Kosuke Uetake, "Mergers, Innovation, and Entry-Exit Dynamics: Consolidation of the Hard Disk Drive Industry, 1996-2016," *Review of Economic Studies*, 2020, *87*, 2672–2702.

_ and Takuo Sugaya, "Measuring the Incentive to Collude: The Vitamin Cartels, 1990-99," *Review of Economic Studies*, May 2022, *89* (3), 1460–1494.

Justice Department File Suit to Block ECHOSTAR's Acquisition of Hughes Electronics

Justice Department File Suit to Block ECHOSTAR's Acquisition of Hughes Electronics*, Technical Report, U.S. Department of Justice October 2002.*

Kalouptsidi, Myrto*, "Time to Build and Fluctuations in Bulk Shipping," American Economic Review, 2014, 104 (2), 564–608.*

Kirchoff, Suzanne M.*, The U.S. Newspaper Industry in Transition, Congressional Research Service, 2010.*

Lee, Robin and Kyna Fong*, "Markov-Perfect Network Formation: An Applied Framework for Bilateral Oligopoly and Bargaining in Buyer-Seller Markets," 2013.*

Mahone, Jessica, Qun Wang, Philip Napoli, Matthew Weber, and Katie Mccollough*, "Who's Producing Local Journalism? Assessing Journalistic Ouput Across Different Outlet Types," Technical Report, Duke DeWitt Wallace Center for Media and Democracy August 2019.*

Maskin, Eric and Jean Tirole*, "A Theory of Dynamic Oligopoly, I: Overview and Quantity Competition with Large Fixed Costs," Econometrica, 1988a, 18 (1), 549–569.*

_ **and** _ *, "A Theory of Dynamic Oligopoly II: A Theory of Dynamic Oligopoly, II: Price Competition, Kinked Demand Curves, and Edgeworth Cycles," Econometrica, 1988b, 56 (3), 571–9.*

Mcardle, Megan*, "The Media Death Spiral," The Atlantic, Oct 2009.*

McGuireWoods*, "Three Things to Know About Joint Operating Agreement Transactions," Technical Report, McGuireWoods June 2013.*

Mermelstein, Ben, Volker Nocke, and Michael D. Whinston Mark A. Sattherwaite*, "Internal versus External Growth in Industries with Scale Economies: A computational Model of Optimal Merger Policy," Journal of Political Economy, January 2020, 128 (1).*

p. 772; Congress, Almanac, the Nation Vol. I p. 443; Congress, and the Nation Vol. II p. 293; 1967 Almanac p. 382; 1968 Almanac p. 527;, eds*, "action," Research Reports, 1963, I, 3.*

Pakes, Ariel and Paul McGuire, *"Computing Markov-Perfect Nash Equilibria: Numerical Implications of a Dynamic Differentiated Product Model," RAND Journal of Economics, Winter 1994, 25 (4), 555–589.*

_ , Michael Ostrovsky, and Steven Berry, *"Simple Estimators for the Parameters of Discrete Dynamic Games (with Entry/Exit Examples)," June 2005.*

_ , _ , and _ , *"Simple Estimators for the Parameters of Discrete Dynamic Games (with Entry/Exit Examples)," RAND Journal of Economics, 2007, 38 (2), 373–399.*

Picard, Robert G., *"Evidence of a Failing Newspaper under the Newspaper Preservation Act," Newspaper Research Journal, 1987, 9 (1), 73–82.*

Picard, Robert G, *"Natural Death, Euthanasia, and Suicide: The Demise of Joint Operating Agreements," Journal of Media Business Studies, 2007, 4 (2), 41–64.*

Price, Sydney, *"A DISH/DIRECTV merger: To be, or not to be," S&P Global Market Intelligence, January 2022.*

Randolph, Eleanor and Peter Behr, *"Newspaper Preservation Law Produces Windfalls," Washington Post, July 1986.*

Romeo, Charles, Russell Pittman, and Norman Familant, *"Do newspaper JOAs charge monopoly advertising rates?," Review of industrial organization, 03 2003, 22 (2), 121–138.*

Shulkin, David, *"Hospitals were struggling before the pandemic. Now they face financial disaster.," CNN Business Perspectives, April 2020.*

Yarow, Jay, *"Paul Krugman Responds To All The People Throwing Around His Old Internet Quote," December 2013.*