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Abstract

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JEL Classification: D4, D7, L11, L15, M37, N72

Keywords: media, Local News, Television, newspapers, advertising, bundling, Split-Ticket Voting

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Media Competition and News Diets*

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May 10, 2021

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1 Introduction

A local newspaper's traditional economic model was to bundle its original local news content with different types of third-party content, such as wire national news, weather, and sports, into a single product to sell to consumers, and, in turn, to sell consumers's attention to advertisers. Over the past several decades, technological innovations such as television and the Internet have challenged local newspapers' once unique ability to monetize third-party content. In particular, there has been a fall in distribution costs and a proliferation of advertising-financed media outlets catering to specific types of content traditionally included in local media bundles: sports channels, classifieds websites, national cable news channels, etc. These new media outlets have affected both how information is produced (Cagé et al., 2020) and consumed (Boczkowski et al., 2017; Athey et al., 2018; Kennedy and Prat, 2019), and have weakened the traditional economic model of local print media. As a result, local newspapers are becoming smaller, lighter publications with fewer readers and advertisers, when they do not simply go out of business (see e.g. Abernathy, 2020). The resulting decline in the production and consumption of local news could have far-reaching political and social consequences, which we are only beginning to fully appreciate.

In this paper, we investigate how local newspapers adjust their production of local news when the market for national news becomes more competitive. We study whether the resulting changes in the amount of local versus national news individuals are exposed to affect voting behavior, particularly voters' propensity to engage in straight-ticket voting across elections. To study these issues, we use historical data to examine how the entry of television affected local newspapers in the United States from 1944 to 1964. We exploit the fact that technological constraints at the time meant that television stations offered mostly national news and general entertainment programming, whereas virtually all newspapers bundled original local news with syndicated national news.

To formalize this idea that a more competitive national news market may affect a local newspaper's ability to produce local news, we develop a simple model of newspaper content choice and pricing. In our model, an incumbent media outlet chooses how much local and national news to include in its bundle in order to maximize profits across both the readership and advertising sides of the market. We show that entry in the market for national news makes bundling less profitable by limiting the incumbent's ability to extract consumer surplus. This diminished ability to leverage bundling, in turn, decreases the incumbent's incentives to provide both local and national news. Although our model is special in several ways, it offers a cautionary tale regarding the production of local news in a more competitive environment.

The main empirical challenge we face in examining the effect of television stems from the non-exogenous nature of the roll-out of television: television entered larger and wealthier cities first. Our empirical strategy exploits exogenous variations in the timing of the introduction of

television in mid-sized markets in the United States. In particular, in the spirit of Gentzkow (2006) and Gentzkow and Shapiro (2008), we use the timing of the Federal Communications Commission (FCC) "freeze" that occurred between 1948 and 1952, primarily due to engineering difficulties. The freeze occurred as many mid-size markets were receiving licenses, and therefore we observe quasi-random variation in the entry date of television in a large set of television markets on opposite sides of the freeze. A typical television market covered several newspaper markets, offering a large set of treatment and control print news markets. These features allow us to isolate and measure the impact of television on local newspapers.

The empirical analysis required a significant data collection effort. We digitized annual circulation, cover price, advertising rates, and advertising quantity data for the universe of U.S. daily newspapers for 1944-1964.[1] We combine this with data we digitized regarding the first broadcast dates of all television stations in the U.S.. For each station, we observe the tower's location, height, channel, and broadcasting power. We use this data to construct reception contours to precisely determine which newspaper markets were exposed to television at a given point in time. For a subset of newspapers exposed to the freeze whose content have been digitized, we further gather data on the content of the newspaper itself. We focus on a sample of 102 newspapers that had full issues available from an online archive. We code the content of these newspapers for the third Tuesday and Saturday of March and the third Thursday and Saturday of September for each year from 1946 to 1955. We manually measure the quantity of news (categorized by type) versus advertising, photos, and editorials, noting any content sourced from a wire service. We additionally use machine learning techniques to identify the amount of article text on each page of each of these issues, giving us an objective measure of the amount of content contained within each issue.

We find that the entry of television led to a 3.1% decrease in circulation and a 3.3% decrease in subscription price. These effects are mostly concentrated among evening newspapers, which were the majority of newspapers at the time and which faced fiercer competition from TV. This suggests consumer substitution away from newspapers following the introduction of the new technology. Moreover, the entry of television represented the entry of a new competitor in the advertising side of the market: according to our estimates, it led to a 2% decrease in newspaper advertising rates and to a 3.9% decrease in evening newspapers' national advertising quantity. We do not find an effect on local advertising quantities; this is most likely due to the absence of local advertising on television at the time.[2] We confirm these results with a variety of matching estimators and robustness checks.

Next we investigate the extent to which the entry of television affected newspaper content,

[1] The data come from the *Editor & Publisher International Yearbook*. Advertising quantity data, or "lineage", come from a separate but related data source, and cover a majority, but not all, publications. While there is less coverage, the data are conveniently broken out by type of advertising, including local, national, classified, etc.

[2] We do not find an effect on classified advertising either.

and in particular, the provision of local news. We find that following the entry of television, the total number of stories published decreased by 6.6%. The decrease in the number of stories is driven mainly by a 10.1% drop in original local news stories. By contrast, the drop in the number of (wire) national news is small and not statistically significant. Consistent with this, we find limited evidence of lower reliance on subscriptions to news services.

Taken together, the introduction of television with its primarily national focus in news, the fall in local newspapers' readership, and the lower production of local news by newspapers point to a strong shift towards more national news diets. The resulting change in voters' news diets, in turn, offers a unique setting to test whether increasingly nationalized news diets lead to greater "nationalization" of local politics (Hopkins, 2018). We examine ticket splitting in Congressional and Presidential elections by collecting county-level election data for the period 1932-1964 and computing for each county the share of its territory covered by television. We document that the entry of television and the crowding out of local information led to less split-ticket voting, in particular for House elections (which, arguably, were more dependent on newspapers' coverage).

Our contribution is threefold. First, we build an entirely novel and comprehensive dataset on local newspapers and television stations. In particular, we collect detailed information on prices and quantities prevailing on both sides of the market from historical records available only in paper format. Our dataset covers $1,963$ newspapers, $1,537$ news markets, and $32,296$ newspaper-years. Moreover, to the extent of our knowledge, our paper is the first to provide detailed information on the evolution of the actual content of newspapers and, in particular, their provision of local news.[3] Second, we provide direct evidence of the effect of television's entry on the market for newspapers: we document a direct substitution effect towards television on both sides of the market. Third, we show that the entry of (national) news from television had compositional effects on the average news diets of consumers. On the one hand, it affected the quantity of news consumed – given the substitution away from newspapers. On the other hand, for those consumers still reading the same newspapers, it affected the news they were given to read on a daily basis. We take this, combined with our findings on ticket splitting, as evidence that shocks to ad-supported media can have significant real effects outside of the market for news.

Our findings have implications for the modern media landscape. A parallel can be drawn between the entry of television and the advent of the Internet, which, much like television, constituted a negative shock to the advertising side of the newspaper market (see e.g. Athey and Gans, 2010; Athey et al., 2018).[4] In addition to competing for advertising revenues, the

[3]There exists a growing empirical literature studying newspaper content, but its focus is on political bias rather than the nature or quantity of news produced (Groseclose and Milyo, 2005; Gentzkow and Shapiro, 2010; Puglisi and Snyder, 2015; Gentzkow et al., 2019). Cagé et al. (2020) investigate the quantity of news produced online, but only for one year (2013).

[4]Chandra and Kaiser (2014) show, however, that in the case of magazines, competition from the Internet

Internet is also modifying news companies' traditional bundles of diverse content. Because of the fall in distribution costs, local newspapers no longer represent the only channel to reach consumers. Classified ads have moved to specialized online outlets (e.g., craigslist.com or monster.com) and soft news about local communities is provided free of charge on social networks such as Facebook. Similarly, national and international news are now provided almost exclusively by a few of the largest news outlets. Whether local newspapers can profitably provide local journalism is an open question of policy relevance.

Literature review An important strand of literature has highlighted how changes in the market for news affect political outcomes (see e.g., Snyder and Strömberg, 2010; Gentzkow et al., 2011; Drago et al., 2014; Cagé, 2020). Analyzing the effect of the introduction of the Internet in, respectively, Germany and the United Kingdom, Falck et al. (2014) and Gavazza et al. (2019) show that the Internet decreased turnout, due to a substitution away from media with higher news content. Moreover, the provision of local news is key to both political participation and government accountability at the local level (see e.g., Strömberg, 2004b; Ferraz and Finan, 2008; Snyder and Strömberg, 2010; Mastrorocco and Ornaghi, 2020). The expansion of national media into local news markets may affect the consumption of local news and, therefore, political outcomes (Martin and McCrain, 2019). Gentzkow (2006) shows that the introduction of television led to lower Congressional election turnout, and provides aggregate evidence suggestive of a crowding-out of local political information.

Gentzkow (2006) is the first paper to exploit the FCC freeze as an exogenous source of variation of the entry of television (see also Gentzkow and Shapiro, 2008). Our paper is complementary to his: we explicitly investigate the effect of the introduction of television on newspapers' circulation and content choices. We depart in terms of identification with respect to this previous work as we have richer data: there are many newspaper markets per television market and we have annual data on outcomes of interest. Therefore, we are able to focus on the markets that saw entry of television precisely before and after the freeze, i.e., that were most clearly exogenously treated by the freeze. Further, our findings suggest that the decrease in turnout found by Gentzkow (2006) may be due not only to a substitution of readers away from local newspapers, but also to a reduction in the amount of local news offered to the consumers who carry on reading newspapers. Building on these findings, we document that voters' greater exposure to national versus local news following the introduction of television increased their propensity to engage in single-ticket voting in congressional elections (see additional references in Section 6).

Newspapers in our sample overwhelmingly engage in bundling, by selling national wire news alongside local news. Bundling allows companies to exploit complementarities in con-

has a positive effect on the value of targeted advertising in print media.

sumption and cost savings in production. Bundling also allows monopolists to extract higher consumer surplus (e.g., Stigler, 1968; Adams and Yellen, 1976; Schmalensee, 1982; McAfee et al., 1984; Bakos and Brynjolfsson, 1999; Chen and Riordan, 2013) and deter entry (e.g., Whinston, 1990; Nalebuff, 2004).[5] Innovations in content delivery, such as television or the Internet, have led to a proliferation of general-interest media outlets, thereby diminishing the once unique ability enjoyed by local newspapers in monetizing third-party content. Our theoretical model centers on this idea of the newspaper as a bundle: we contribute to the literature by embedding bundling in a two-sided model with endogenous quality.

In addition to challenging newspapers' ability to bundle content, television (and the Internet today) was also a direct and significant shock to advertising revenues. Accordingly, the model we build incorporates advertising and is thus related to the theoretical literature on two-sided markets (e.g., Caillaud and Jullien, 2001, 2003; Rochet and Tirole, 2003, 2006; Armstrong, 2006; Weyl, 2010),[6] as well as its empirical strand (e.g., Rysman, 2004; Jin and Rysman, 2015; Kaiser and Wright, 2006; Kaiser and Song, 2009; Song, 2015). Particularly related to our study are Seamans and Zhu (2014) and Angelucci and Cagé (2019). Seamans and Zhu (2014) analyze the impact of the entry of Craigslist on local U.S. newspapers. More recently, Angelucci and Cagé (2019) exploited the end of the prohibition against television advertising in France to show that national newspapers responded to lower advertising revenues by decreasing the size of their newsroom and lowering their subscription and advertising prices.[7] By contrast, this paper looks at the consequences of the introduction of television in the U.S., which constituted a direct shock not only to the advertising side of the daily newspaper market but also to the reader side. We exploit the fact that television at the time had mostly a national news focus to investigate how newspapers modified their provision of local versus national news, and to tie resulting changes in news diets to split-ticket voting in presidential and congressional elections. Unlike Angelucci and Cagé (2019), who, because of their focus on national newspapers, do not look at local news, we measure local content by analyzing newspaper articles.

Finally, our analysis is related to the literatures that study the relationships between market structure and content variety (e.g., Berry and Waldfogel, 2001; Seim, 2006; Sweeting, 2010, 2013; Jeziorski, 2014; Berry et al., 2016), as well as the relationship between market structure and content quality (e.g., Gentzkow et al., 2006; Berry and Waldfogel, 2010; Petrova, 2011).[8] In the daily newspaper market, George (2007) finds that greater market concentration

[5] For recent empirical work on bundling in media markets see Chu et al. (2011), Crawford and Yurukoglu (2012), and Ho et al. (2012). For more recent theoretical work see also Hurkens et al. (2019).

[6] A strand of this literature has modeled media markets specifically (e.g., Gabszewicz et al., 2001, 2004; Gal-Or and Dukes, 2003; Strömberg, 2004a; Anderson and Coate, 2005; Armstrong and Wright, 2007; Peitz and Valletti, 2008; Crampes et al., 2009; Esther Gal-Or et al., 2012).

[7] Relatedly, Shiller et al. (2017) show that the use of ad blocking leads to a decrease in the quality of websites.

[8] Further, de Corniere and Sarvary (2018) build a model to look at the impact of social media on newspapers' choice of quality. See also Jeon and Nasr (2016) on news aggregators and newspaper quality.

leads to more content variety. The closest papers to ours are George and Waldfogel (2006) and Fan (2013).[9] Among other newspaper characteristics, Fan (2013) looks at the provision of total content (the "news hole") and the local news ratio in the context of a simulated merger of local newspapers. She finds that ownership consolidation leads to a lower newshole and a lower local news ratio. We differ in that we examine how the entry of television, with its mostly national focus, affected local newspapers and their choices of sub-types of content. George and Waldfogel (2006) analyze how the expansion of *The New York Times* into local markets affected local newspapers' readerships and newsroom compositions. Unlike George and Waldfogel (2006) and Fan (2013), who mostly rely on newspaper reporters' topic assignments and job titles to proxy content, we measure content variety by directly analyzing the stories newspapers choose to print. Further, our findings on local news contrast with theirs; by all accounts, the entry of television was a stronger shock for local newspapers than the expansion of *The New York Times*. In particular, it decreased local newspapers' readerships and, ultimately, ability to provide local news. We also differ in that we explicitly investigate whether the observed changes in consumers' news diets affect local voting behavior.

The rest of the paper is organized as follows. In Section 2, we discuss the historical context of the introduction of the television in the United States, introduce the new dataset we build for this study, and provide descriptive statistics. Section 3 develops a model of the newspaper industry. In Section 4, we estimate the impact of the entry of television on both sides of the newspaper market, and in Section 5, we perform a content analysis and investigate how newspapers adjusted their editorial choices after the entry of television. Section 6 investigates the relationship between the change in the news diets and the nationalization of local politics. In Section 7, we perform a number of robustness checks. Finally, Section 8 concludes and discusses an epilogue case study of the current status of 10 of the papers in our analysis.

2 Background and Data

2.1 Newspapers

Our focus is on the 1944-1964 time period. During this period, newspapers were partisan (Gentzkow et al., 2015) and relied heavily on advertising (Hamilton, 2004; Schudson, 1981; Starr, 1982).[10] Newspapers were common even in very small towns (Gentzkow et al., 2011; McChesney and Nichols, 2010) and the majority of daily newspapers in this era produced

[9] Also related to our paper are Gentzkow et al. (2014), who estimate a model of newspaper entry and editorial choices in which newspapers compete to attract readers and advertisers, and George and Waldfogel (2003), who analyze the effects of preference externalities on news diets.

[10] In 1956, advertising revenues represented 70% of newspapers' total revenues. U.S. newspapers are still primarily ad-supported today, albeit to a lower extent (Cagé, 2016). Online Appendix Figure B.1 plots the long-run evolution of the advertising share in newspaper total revenues.

evening editions only (see online Appendix Figures B.2 and B.3). Most small towns – representing the vast majority of daily newspapers – had a single evening newspaper as their source of news. Larger towns had competing evening newspapers, or even morning newspapers.

Newspapers were widely circulated and constituted the primary source of news to most individuals before the introduction of television. While the vast majority of American households had radios at the time of the entry of television, radio broadcasting content was mainly devoted to general entertainment and newspapers covered a much wider range of news topics than radio news programs (Lazarsfeld, 1940).[11,12]

2.2 The Introduction of Television and the FCC "Freeze"

Television was first licensed for commercial broadcasting on July 1, 1941 and then quickly expanded in the 1950s.[13] Online Appendix Figure B.4 plots the evolution of the number of stations broadcasting from 1946 to 1961, as well as the associated total broadcasting revenues. During these initial years, television stations broadcast mostly national programming – due to the then excessively high cost of producing original local content – and relied heavily on network content (Hess, 1991).[14] The news television stations provided had a strong national focus. Moreover, most local and network programming was live as videotape recording had not yet been invented (Head and Sterling, 1994).[15] Some local stations developed their own news shows at the time but it was the exception rather than the rule. As highlighted by de Leon (2015), *"most local stations offered little more than brief summaries of wire-service headlines, and the expense of film technology led most to emphasize live entertainment programs instead of news."*

While the FCC licensed a few commercial broadcasters in 1941, the start of World War II led to a halt of commercial broadcasting. In 1945, the FCC decided to resume television licensing and by July 1946, it had issued twenty-four new licenses (Barnouw, 1990). The post-

[11] Lazarsfeld (1940) reports the broadcasting time of all the 700-odd stations in the United States in a typical week during April 1938: 52.5% of this time was devoted to music while only 9.8% was devoted to "news and sports." News broadcasts were large in the size of their listening audience, however.

[12] The 1952 American National Election Study provides information on media use: 79% of participants reported reading about the 1952 campaign in newspapers (21% did not), and 70% of them reported hearing about the campaign on radio. In the 1956 American National Election Study, the share of people who reported reading about the campaign in newspapers was 68% and the share who reported listening about the campaign on the radio was 45%. The 1952 American National Election Study is available at https://electionstudies.org/data-center/1952-time-series-study/. The 1956 American National Election Study is available at https://electionstudies.org/data-center/1956-time-series-study/.

[13] Television was first successfully demonstrated in 1927; however, television penetration stayed very low until the end of the 1940's. Hence the development of television in the U.S. can be closely associated to that of commercial broadcasting. The first TV commercial aired was a very short spot for a watch and jewelry company, Bulova. Political advertising appeared a decade later on television, in 1952, with "Eisenhower Answers America", the first political spot ad campaign broadcast on television (Wood, 1990).

[14] The Prime Time Access Rule which required local television stations to broadcast a certain amount of non-network programs – in particular local news and documentaries – was instituted by the FCC in 1970 to limit the importance of network programming (see e.g. Prior, 2007).

[15] On local live entertainment programs, see Koenig (2018).

war roll-out of television was interrupted in the late 1940s by the so-called FCC "Freeze" that took place between September 30, 1948 and April 14, 1952 due to engineering problems. More precisely, on September 30, 1948, the FCC announced a freeze on the granting of new television licenses. Stations previously authorized were allowed to begin or continue operations – over 100 licenses had already been granted at the time – however, no new licenses were granted, even though over 700 applications had been received. The FCC implemented this drastic measure because it was unable to resolve several important interference, allocation, and other technical issues, which it anticipated would only grow more significant if it continued to grant licenses at the current speed. Moreover, while the freeze was originally planned to last only six months, it ended up lasting nearly four years.[16] We provide additional technical history in the online Appendix Section A.

From 1948 to 1952, 108 television stations were on the air and the number of television sets grew from a quarter million to 17 million (Head and Sterling, 1994). Only 24 cities had two or more stations, and many had only one. Most smaller and even some major cities – like Denver, Colorado and Austin, Texas – had none at all. Our empirical strategy exploits this interruption to TV expansion. We exploit the timing of the freeze, which occurred as many mid-size markets were receiving licenses. As highlighted above, this freeze has already been used by Gentzkow (2006) who documents the exogeneity of this shock. In particular, following Gentzkow (2006), we take advantage of three different historical facts. First, the freeze provides us with exogenous geographical variations in the introduction of television. Second, television adoption, once introduced, was extremely quick. This is of particular importance because it allows us to study its impact directly around the shock. Finally, the fact that a given television station broadcasts over a large area is helpful as the entry of a single television broadcaster typically affected multiple, separate newspaper markets. The reason for this is that at the time, newspaper distribution costs were strongly increasing in distance, while wireless waves propagate at no cost.

As we will show, the entry of television was a strong negative shock to both sides of the newspaper industry. Television quickly became an important source of national news. By the early 1960s, surveys indicated that the public thought of television as the most trustworthy and also their main source of news (Head and Sterling, 1994). On the advertising side, the top television advertisers were also among the top newspaper advertisers. The 1955 Television Factbook provides information on the 100 top network television advertisers (for the first six months of 1954). The main company to advertise, Procter & Gamble Co., spent more than 11 million dollars on network television, but also over 1 million dollars on newspaper advertising. For newspapers, Procter & Gamble was one of the main advertisers, together with General

[16]Much of this information comes from several sources that are detailed in the online Appendix, including an excellent overview at the Museum of TV, "Freeze of 1948" webpage, available at http://www.museum.tv/eotv/freezeof1.htm.

Motors Corp., Colgate-Palmolive Co., General Foods Corp. and Lever Bros. Co., all of which were among the top 10 television advertisers. As a consequence, while the total volume of advertising was expanding quickly in the United States in the 1950s, we observe an increase in the share of this volume captured by television (nearly 15% in 1961) and a drop in the share of newspapers (online Appendix Figure B.5).[17]

We will also document that the introduction of television led local newspapers to produce less local news. We exploit the resulting increased national focus in the information consumed by individuals to test whether it made local (congressional) elections' outcomes more correlated with presidential elections' outcomes. As we discuss in Section 6, split-ticket voting was relatively common and, if anything, growing during our time of interest. Even though they were affiliated with the Democratic or Republican parties, local politicians enjoyed their own "brand" and the extent to which national matters influenced local politics was low by today's standards (e.g., Jacobson, 2016; Hopkins, 2018). Nevertheless, if television shifted voters' attention to national matters, we expect their voting choices in local elections to become increasingly determined by candidates' party affiliations.

2.3 Data Sources and Descriptive Statistics

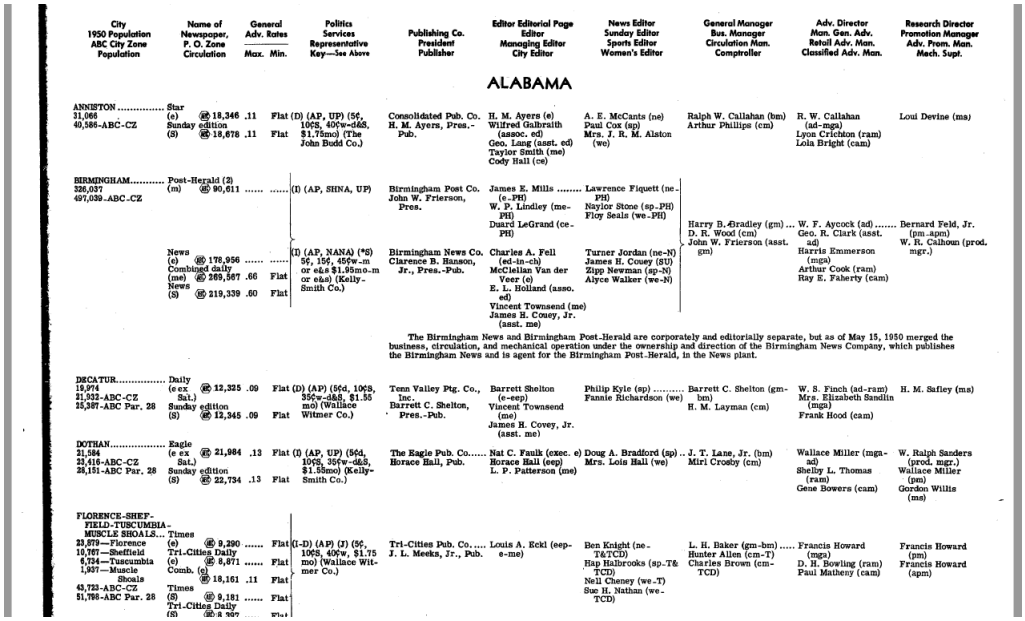
We use information from a number of different data sources to build our new dataset on the newspaper and television markets. Our dataset covers $1,963$ newspapers, $1,537$ news markets and $32,296$ newspaper-years for the period 1944-1964, as well as all television stations in the United States and their precise coverage. For our content analysis, we use scanned archives from newspapers.com and newspaperarchive.com for 102 local newspapers from the time period 1946-1955. Finally, we use county-level data on House, Senatorial, and Presidential Elections for the period 1932-1964.

Newspaper data We collect information from two different sources. All data were hand-coded by undergraduate students at the University of Pennsylvania, Columbia University, and Sciences Po Paris. First, we collect annual newspaper-level information on circulation, subscription prices, advertising prices, and wire news service subscriptions from the *Editor & Publisher International Yearbook*.[18] Figure 1 shows an example page from such a yearbook; for the *Decatur Daily*, we see a weekday circulation of $12,325$, and an advertising price of \$0.09 per line.[19]

[17] Note however that overall, in absolute terms, the advertising volume in newspapers continued to grow during this period.

[18] We use the 1945 to 1965 yearbooks, which cover the years 1944 to 1964.

[19] An "agate line" is a standard unit of measurement for print advertising. It is defined as one column of a paper wide, by one agate, or 1/14 of an inch. So, to place an ad in the *Decatur Daily* that spanned three columns and was 5 inches tall would cost an advertiser $(3 * 5 * 14 * 0.09) =$ \$18.90 in 1955.



City 1950 Population ABC City Zone Population	Name of Newspaper, P. O. Zone Circulation	General Adv. Rates Max.	 Min.	Politics Services Representative Key—See Above	Publishing Co. President Publisher	Editor Editorial Page Editor Managing Editor City Editor	News Editor Sunday Editor Sports Editor Women's Editor	General Manager Bus. Manager Circulation Man. Comptroller	Adv. Director Man. Gen. Adv. Retail Adv. Man. Classified Adv. Man.	Research Director Promotion Manager Adv. Prom. Man. Mech. Supt.
ALABAMA										
ANNISTON 31,066 40,586-ABC-CZ	Star (e) (M) 18,346 Sunday edition (S) (M) 18,678	.11 .11	Flat Flat	(D) (AP, UP) (5¢, 10¢S, 40¢w-d&S, $1.75mo) (The John Budd Co.)	Consolidated Pub. Co. H. M. Ayers, Pres.-Pub.	H. M. Ayers (e) Wilfred Galbraith (assoc. ed) Geo. Lang (asst. ed) Taylor Smith (me) Cody Hall (ce)	A. E. McCants (ne) Paul Cox (sp) Mrs. J. R. M. Alston (we)	Ralph W. Callahan (bm) Arthur Phillips (cm)	R. W. Callahan (ad-mgs) Lyon Crichton (ram) Lola Bright (cam)	Loui Devine (ms)
BIRMINGHAM 326,037 497,030-ABC-CZ	Post-Herald (2) (m) (M) 90,611	.....	.....	(I) (AP, SHNA, UP)	Birmingham Post Co. John W. Frierson, Pres.	James E. Mills (e-PH) W. P. Lindley (me-PH) Duard LeGrand (ce-PH)	Lawrence Fiquett (ne-PH) Naylor Stone (sp-PH) Flcy Seals (we-PH)	Harry B. Bradley (gm) D. R. Wood (cm) John W. Frierson (asst. gm)	W. F. Aycock (ad) Geo. R. Clark (asst. ad) Harris Emmerson (mga) Arthur Cook (ram) Ray E. Faherty (cam)	Bernard Feld, Jr. (pm-apm) W. R. Calhoun (prod. mgr.)
	News (e) (M) 178,956 Combined daily (me) (M) 269,567 News (S) (M) 219,339	.... .66 .60	.... Flat Flat	(I) (AP, NANA) (*S) 5¢, 15¢, 45¢w-m or e&s $1.95mo-m or e&s) (Kelly-Smith Co.)	Birmingham News Co. Clarence B. Hanson, Jr., Pres.-Pub.	Charles A. Fell (ed-in-ch) McClellan Van der Veer (e) E. L. Holland (asso. ed) Vincent Townsend (me) James H. Covey, Jr. (asst. me)	Turner Jordan (ne-N) James H. Couey (SU) Zipp Newman (sp-N) Alyce Walker (we-N)			
	The Birmingham News and Birmingham Post-Herald are corporately and editorially separate, but as of May 15, 1950 merged the business, circulation, and mechanical operation under the ownership and direction of the Birmingham News Company, which publishes the Birmingham News and is agent for the Birmingham Post-Herald, in the News plant.									
DECATUR 19,974 21,922-ABC-CZ 25,397-ABC Par. 28	Daily (e ex Sat.) (M) 12,325 Sunday edition (S) (M) 12,345	.09 .09	Flat Flat	(D) (AP) (5¢d, 10¢S, 35¢w-d&S, $1.55 mo) (Wallace Witmer Co.)	Tenn Valley Ptg. Co., Inc. Barrett C. Shelton, Pres.-Pub.	Barrett Shelton (e-eep) Vincent Townsend (me) James H. Covey, Jr. (asst. me)	Philip Kyle (sp) Fannie Richardson (we)	Barrett C. Shelton (gm-bm) R. M. Layman (cm)	W. S. Finch (ad-ram) Mrs. Elizabeth Sandlin (mgs) Frank Hood (cam)	H. M. Safley (ms)
DOTHAN 21,584 23,516-ABC-CZ 28,151-ABC Par. 28	Eagle (e ex Sat.) (M) 21,984 Sunday edition (S) (M) 22,734	.13 .13	Flat Flat	(D) (AP, UP) (5¢d, 10¢S, 35¢w-d&S, $1.53mo) (Kelly-Smith Co.)	The Eagle Pub. Co. Horace Hall, Pub.	Nat C. Faulk (exec. e) Horace Hall (eep) L. P. Patterson (me)	Doug A. Bradford (sp) Mrs. Lois Hall (we)	J. T. Lane, Jr. (bm) Miri Crosby (cm)	Wallace Miller (mga-ad) Shelby L. Thomas (ram) Gene Bowers (cam)	W. Ralph Sanders (prod. mgr.) Wallace Miller (pm) Gordon Willis (ms)
FLORENCE-SHEFFIELD-TUSCUMBIA-MUSCLE SHOALS 23,579—Florence 10,767—Sheffield 6,724—Tuscumbia 1,937—Muscle Shoals 43,723-ABC-CZ 51,786-ABC Par. 28	Times (e) (M) 9,290 Tri-Cities Daily (e) (M) 8,871 Comb. (e) (M) 18,161 Times (S) (M) 9,181 Tri-Cities Daily (S) (M) 8,807	.... .11	Flat Flat Flat Flat Flat	(I-D) (AP) (J) (5¢, 10¢S, 40¢w, $1.75 mo) (Wallace Witmer Co.)	Tri-Cities Pub. Co. J. L. Meeks, Jr., Pub.	Louis A. Eckl (eep-e-me)	Ben Knight (ne-T&TCD) Hap Halbrooks (sp-T&TCD) Nell Cheney (we-T) Sue H. Nathan (we-TCD)	L. H. Baker (gm-bm) Hunter Allen (cm-T) Charles Brown (cm-TCD)	Francis Howard (mga) D. H. Bowling (ram) Paul Matheny (cam)	Francis Howard (pm) Francis Howard (apm)

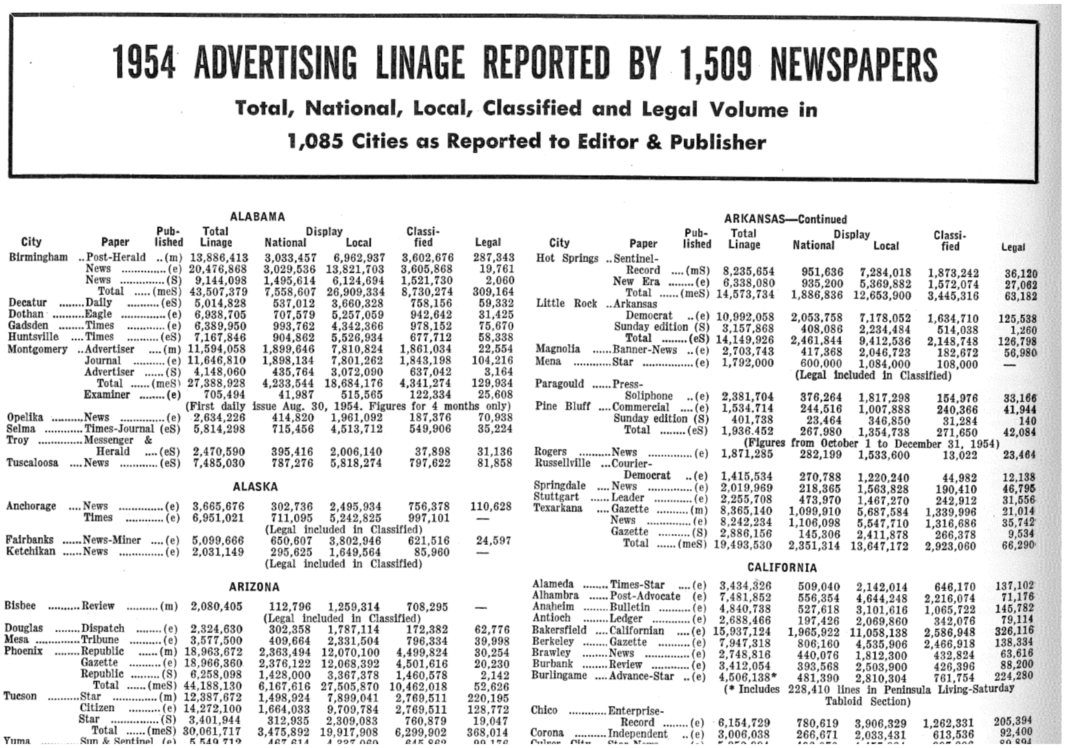
Notes: The figure reproduces a page of the *Editor & Publisher International Yearbook* .

Figure 1: Newspaper Raw Data: Illustration

The weekday price was $0.05, and $0.10 on Sunday ($0.05 would be approximately $0.42 in 2016 dollars), and the newspaper subscribed to the Associated Press (AP). Note also that each newspaper is associated with its main city of circulation as listed in the Editor & Publisher International Yearbooks. We code a newspaper's associated city as its *market*.[20]

Second, we digitize and merge information on annual newspaper-level advertising quantity (lineage) from the Editor & Publisher *Annual Lineage Supplement*. The information is available for a majority, but not for all, daily newspapers, and is broken out by national versus local advertisers for a very large part of our sample. We will henceforth refer to "national advertising" as advertising purchased by national advertisers, while "local advertising" refers to local advertisers. This is of particular importance because we plausibly expect the entry of television to have offered an alternative to national advertisers more than to local advertisers in print media, as television programming was national at the time and television advertising took the form of sponsored programming. To the extent of our knowledge, this paper is the first to exploit the detailed historical information on the quantity of advertising published in different categories in U.S. newspapers. Figure 2 shows an example of a page of the Lineage Supplement; the *Decatur Daily* sold 5,014,828 lines of advertising in 1955, with the majority going to local advertisers (3,660,628), and the balance to national advertisers (537,012), classifieds (758,156), and legal (59,332).

[20] In the relatively few cases in which multiple cities are grouped together, we code the largest listed city as the newspaper's market. In rare cases, newspapers circulated in multiple cities and, sometimes, in multiple counties. Unfortunately, no systematic data exist documenting newspapers' exact geographic markets.



1954 ADVERTISING LINAGE REPORTED BY 1,509 NEWSPAPERS

Total, National, Local, Classified and Legal Volume in
1,085 Cities as Reported to Editor & Publisher

ALABAMA

City	Paper	Published	Total Linage	Display National	Display Local	Classified	Legal
Birmingham	Post-Herald	(m)	13,886,413	3,033,457	6,962,937	3,602,676	287,343
	News	(e)	20,476,868	3,029,536	13,821,703	3,605,868	19,761
	News	(S)	9,144,098	1,495,614	6,124,694	1,521,730	2,060
	Total	(meS)	43,507,379	7,558,607	26,909,334	8,730,274	309,164
Decatur	Daily	(eS)	5,014,828	537,012	3,660,328	758,156	59,332
Dothan	Eagle	(e)	6,938,705	707,579	5,257,059	942,642	31,425
Gadsden	Times	(e)	6,389,950	993,762	4,342,366	978,152	75,670
Huntsville	Times	(eS)	7,167,846	904,862	5,526,934	677,712	58,338
Montgomery	Advertiser	(m)	11,594,058	1,899,646	7,810,824	1,861,034	22,554
	Journal	(e)	11,646,810	1,898,134	7,801,262	1,843,198	104,216
	Advertiser	(S)	4,148,060	435,764	3,072,090	637,042	3,164
	Total	(meS)	27,388,928	4,233,544	18,684,176	4,341,274	129,934
	Examiner	(e)	705,494	41,987	515,565	122,334	25,608
			(First daily issue Aug. 30, 1954. Figures for 4 months only)				
Opelika	News	(e)	2,634,226	414,820	1,961,092	187,376	70,938
Selma	Times-Journal	(eS)	5,814,298	715,456	4,513,712	549,906	35,224
Troy	Messenger & Herald	(eS)	2,470,590	395,416	2,006,140	37,898	31,136
Tuscaloosa	News	(eS)	7,485,030	787,276	5,818,274	797,622	81,858

ALASKA

City	Paper	Published	Total Linage	Display National	Display Local	Classified	Legal
Anchorage	News	(e)	3,665,676	302,736	2,495,934	756,378	110,628
	Times	(e)	6,951,021	711,095	5,242,825	997,101	—
				(Legal included in Classified)			
Fairbanks	News-Miner	(e)	5,099,666	650,607	3,802,946	621,516	24,597
Ketchikan	News	(e)	2,031,149	295,625	1,649,564	85,960	—
				(Legal included in Classified)			

ARIZONA

City	Paper	Published	Total Linage	Display National	Display Local	Classified	Legal
Bisbee	Review	(m)	2,080,405	112,796	1,259,314	708,295	—
				(Legal included in Classified)			
Douglas	Dispatch	(e)	2,324,630	302,358	1,787,114	172,382	62,776
Mesa	Tribune	(e)	3,577,500	409,664	2,331,504	796,334	39,998
Phoenix	Republic	(m)	18,963,672	2,363,494	12,070,100	4,499,824	30,254
	Gazette	(e)	18,966,360	2,376,122	12,068,392	4,501,616	20,230
	Republic	(S)	6,258,098	1,428,000	3,367,378	1,460,578	2,142
	Total	(meS)	44,188,130	6,167,616	27,505,870	10,462,018	52,626
Tucson	Star	(m)	12,387,672	1,498,924	7,899,041	2,769,511	220,195
	Citizen	(e)	14,272,100	1,664,033	9,709,784	2,769,511	128,772
	Star	(S)	3,401,944	312,935	2,309,083	760,879	19,047
	Total	(meS)	30,061,717	3,475,892	19,917,908	6,299,902	368,014

ARKANSAS—Continued

City	Paper	Published	Total Linage	Display National	Display Local	Classified	Legal
Hot Springs	Sentinel-Record	(mS)	8,235,654	951,636	7,284,018	1,873,242	36,120
	New Era	(e)	6,338,080	935,200	5,369,882	1,572,074	27,062
	Total	(meS)	14,573,734	1,886,836	12,653,900	3,445,316	63,182
Little Rock	Arkansas Democrat	(e)	10,992,058	2,053,758	7,178,052	1,634,710	125,538
	Sunday edition	(S)	3,157,868	408,086	2,234,484	514,038	1,260
	Total	(eS)	14,149,926	2,461,844	9,412,536	2,148,748	126,798
Magnolia	Banner-News	(e)	2,703,743	417,368	2,046,723	182,672	56,980
Mena	Star	(e)	1,792,000	600,000	1,084,000	108,000	—
				(Legal included in Classified)			
Paragould	Press-Soliphone	(e)	2,381,704	376,264	1,817,298	154,976	33,166
Pine Bluff	Commercial	(e)	1,534,714	244,516	1,007,888	240,366	41,944
	Sunday edition	(S)	401,738	23,464	346,850	31,284	140
	Total	(eS)	1,936.452	267,980	1,354,738	271,650	42,084
			(Figures from October 1 to December 31, 1954)				
Rogers	News	(e)	1,871,285	282,199	1,533,600	13,022	23,464
Russellville	Courier-Democrat	(e)	1,415,534	270,788	1,220,240	44,982	12,138
Springdale	News	(e)	2,019,969	218,365	1,563,828	190,410	46,795
Stuttgart	Leader	(e)	2,255,708	473,970	1,467,270	242,912	31,556
Texarkana	Gazette	(m)	8,365,140	1,099,910	5,687,584	1,339,996	21,014
	News	(e)	8,242,234	1,106,098	5,547,710	1,316,686	35,742
	Gazette	(S)	2,886,156	145,306	2,411,878	266,378	9,534
	Total	(meS)	19,493,530	2,351,314	13,647,172	2,923,060	66,290

CALIFORNIA

City	Paper	Published	Total Linage	Display National	Display Local	Classified	Legal
Alameda	Times-Star	(e)	3,434,326	509,040	2,142,014	646,170	137,102
Alhambra	Post-Advocate	(e)	7,481,852	556,354	4,644,248	2,216,074	71,176
Anaheim	Bulletin	(e)	4,840,738	527,618	3,101,616	1,065,722	145,782
Antioch	Ledger	(e)	2,688,466	197,426	2,069,860	342,076	79,114
Bakersfield	Californian	(e)	15,937,124	1,965,922	11,058,138	2,586,948	326,116
Berkeley	Gazette	(e)	7,947,318	806,160	4,535,906	2,466,918	138,334
Brawley	News	(e)	2,748,816	440,076	1,812,300	432,824	63,616
Burbank	Review	(e)	3,412,054	393,568	2,503,900	426,396	88,200
Burlingame	Advance-Star	(e)	4,506,138*	481,390	2,810,304	761,754	224,280
			(* Includes 228,410 lines in Peninsula Living-Saturday Tabloid Section)				
Chico	Enterprise-Record	(e)	6,154,729	780,619	3,906,329	1,262,331	205,394
Corona	Independent	(e)	3,006,038	266,671	2,033,431	613,536	92,400

Notes: The figure reproduces a page of Editor & Publisher's *Annual Lineage Supplement.*

Figure 2: Advertising Raw Data: Illustration

Content data We identified all evening newspapers for which full-issue content had been scanned by newspapers.com and newspaperarchive.com between 1946 and 1955. We restricted our search to the subset of newspapers exposed to the freeze (i.e., newspapers in newspaper markets treated by television licenses that began operation after 1947 and before 1953 – see Section 4). There are 102 such newspapers (online Appendix Table C.1 presents summary statistics for these newspapers). We manually code the content of these newspapers for the third Tuesday and Saturday of March and the third Thursday and Saturday of September for each year. We restricted our attention to Tuesday/Saturday pairs and Thursday/Saturday pairs that belonged to the same two weeks to ensure that the dates of our manual content analysis were a subset of the dates used for our Matlab analysis (see below).

More precisely, for each issue, we first extract the number of pages. Then, we determine the number of wire articles versus original stories through manual counting of bylines. Similarly, we count the number of local, national, entertainment, weather, and editorial stories, as well

as the number of photos.[21,22] Finally, to validate our manual approach, we determine the space devoted to news content using Matlab's image processing machine learning capabilities. Matlab has built-in image processing functions to detect text regions that correspond to the text of news articles; moreover, it uses the size of the text to filter out headlines, photos, or advertising copy. We further specify text of a particular size to identify article content. Figure 3 shows the content highlighted for all 16 pages of the entire March 10, 1947 issue of the *Altoona Mirror*. We compute a total content score for that day's issue from those pages. We performed this exercise for all issues published in the third week of March and the third week of September for those newspapers present on newspapers.com.[23] Note that, not surprisingly, the Matlab score is positively correlated with the number of stories published in the paper that we collected manually: for the issues for which we have information on the two variables, we find a correlation of 0.47 statistically significant at the one percent level.

Summary Statistics Table 1 provides descriptive statistics on the newspaper markets for morning and evening newspapers. On average during our time period, around 80% of the newspapers are evening newspapers, and 8% morning ones. The remaining newspapers circulate editions both in the morning and in the evening. In 82% of the newspaper market-years, there is only one newspaper circulating (a monopolist). The average circulation of a newspaper during our period of interest was around $20,140$ copies a day for evening newspapers, and $97,887$ for morning newspapers.[24] The subscription price of evening newspapers was slightly lower than the price of morning newspapers. We also observe a lower advertising rate but this is likely mechanically related to having lower circulation. Our empirical analysis will highlight differential effects on morning versus evening newspapers.

Turning to newspaper content, Table 2 shows summary statistics for the different types of content that we measure. On average, newspapers are 16.2 pages long. They include 120.3 news stories, of which 28.3 are national wire stories and 61.1 are local original stories.

[21] To approximate local newspapers' content following *The New York Times*' geographic expansion, George and Waldfogel (2006) use information on journalists' assignment to topical beats. We are unable to implement a similar strategy for our period of interest because journalist directories such as the *Burelle's Media Directory* were not available at the time. However, we measure the relative amount of local news produced by directly categorizing stories for a sample of newspapers.

[22] Throughout, we refer to both national and international stories as 'national' stories. Also, a picture is counted both as a picture and a story if it has a caption. Online Appendix Figure B.6 illustrates our strategy for *The Courier-Express*, a local daily newspaper published in Dubois (Pennsylvania), on September 14 1953.

[23] For the newspaper issues we obtained from newspaperarchive.com, we limited ourselves to the third Tuesday of March and the third Thursday of September for each year (i.e., the same dates as those for our manual analysis).

[24] A decent number of newspapers circulated both in the morning and in the evening, we do not treat those as evening newspapers for the purpose of this analysis. However, doing so does not affect our main results, as discussed in the robustness checks section.

Figure 3: Content Analysis Example: *Altoona Mirror*'s entire issue

Notes: The Figure shows an example of using Matlab image processing features to determine a content score. Each page is examined to determine what percent of pixels are used to display news text content and these are summed across the issue to determine a total score. The example here is an entire issue of *Altoona Mirror*, March 10, 1947. There are 16 pages and the content score of 159.78 implies an average of about 10% of pixels per page were used to display article content.

	Mean	St.Dev	P25	Median	P75	Obs
Morning Newspapers						
Subscription price	0.44	0.13	0.36	0.42	0.47	6,245
Daily Circulation	97,887	179,971	15,218	40,690	96,611	6,245
Advertising Rate	2.0	1.8	0.8	1.4	2.3	5,844
National Lineage	1.5	1.3	0.5	1.3	2.2	2,422
Local Lineage	7.9	5.8	3.7	6.5	11.0	2,451
Classified Lineage	2.1	2.0	0.7	1.6	3.0	2,432

	Mean	St.Dev	P25	Median	P75	Obs
Evening Newspapers						
Subscription price	0.43	0.10	0.36	0.40	0.46	25,586
Daily Circulation	20,140	53,565	4,260	7,021	14,044	25,586
Advertising Rate	0.8	1.0	0.4	0.5	0.8	24,238
National Lineage	0.5	0.4	0.3	0.4	0.6	14,724
Local Lineage	3.8	2.8	2.1	3.1	4.7	14,739
Classified Lineage	0.8	0.9	0.3	0.5	1.0	14,646

Table 1: Summary Statistics for Market Outcomes

Notes: The table provides summary statistics. An observation is a newspaper-year. The time period is 1944-1964. Subscription price and advertising rates are in constant (2016) dollars. Advertising lineage is in millions of agate lines.

	Mean	St.Dev	P25	Median	P75	Obs
Total text	120.3	65.8	73.0	107.0	154.0	3,232
National wire	28.3	18.6	16.0	24.0	36.0	3,232
Local original	61.1	39.8	34.0	51.0	78.0	3,232
Local wire	10.1	12.2	3.0	7.0	13.0	3,232
Photos	12.5	11.5	5.0	10.0	17.0	3,232
Editorials	7.6	7.3	3.0	7.0	10.0	3,232

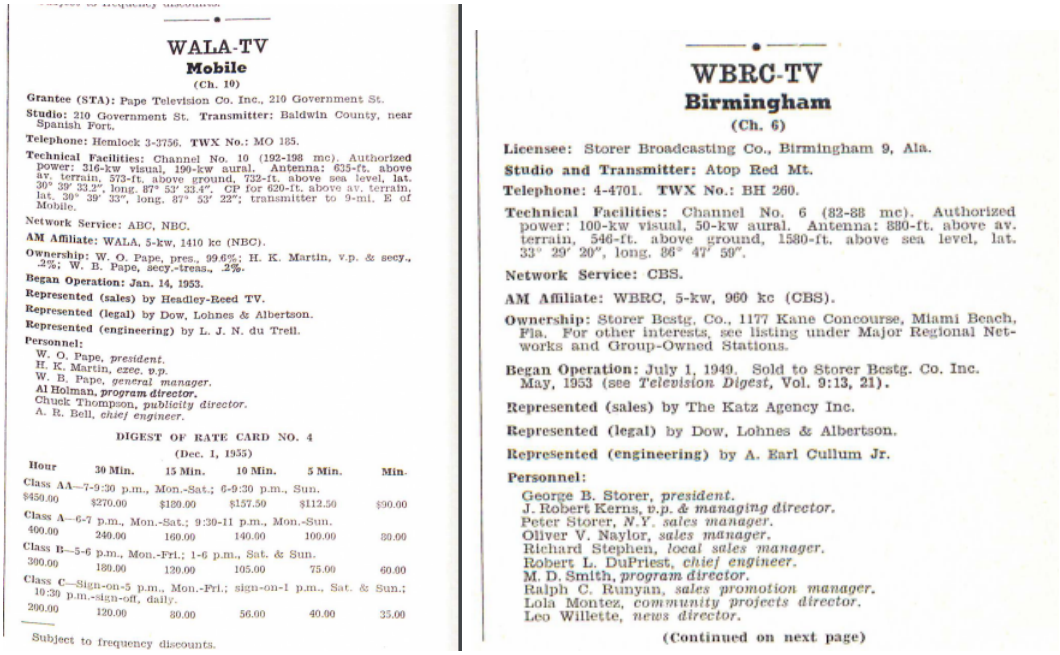
(a) **Manual Coding**

	Mean	St.Dev	P25	Median	P75	Obs
Nb pages	16.2	11.7	8.0	12.0	20.0	6,829
Matlab total score	114.7	118.4	26.1	82.4	153.5	6,829
Matlab mean score	7.6	6.0	2.2	6.9	10.8	6,829

(b) **Machine Learning Approach**

Table 2: Summary Statistics for Newspaper Content

Notes: The table provides summary statistics. An observation is a newspaper-date. The time period is 1946-1955. There are a total of 102 different newspapers analyzed. All papers are evening newspapers that circulated in markets affected by the FCC's "freeze" on licensing. In the upper Table 2a, data are average counts of a variable across all issues analyzed. "Total text" includes additional content types beyond the ones listed, such as weather forecasts and entertainment news. Wire and original stories are identified by their bylines. In the bottom Table 2b, we report the summary statistics for Matlab's image processing analysis.



WALA-TV
Mobile
(Ch. 10)

Grantee (STA): Pape Television Co. Inc., 210 Government St.
Studio: 210 Government St. **Transmitter:** Baldwin County, near Spanish Fort.
Telephone: Hemlock 3-3756. **TWX No.:** MO 185.
Technical Facilities: Channel No. 10 (192-198 mc). Authorized power: 316-kw visual, 199-kw aural. Antenna: 635-ft. above av. terrain, 573-ft. above ground, 732-ft. above sea level, lat. 30° 39' 33.2", long. 87° 53' 33.4". CP for 620-ft. above av. terrain, lat. 30° 39' 33", long. 87° 53' 22"; transmitter to 9-mi. E of Mobile.
Network Service: ABC, NBC.
AM Affiliate: WALA, 5-kw, 1410 kc (NBC).
Ownership: W. O. Pape, pres., 99.6%; H. K. Martin, v.p. & secy., .2%; W. B. Pape, secy.-treas., .2%.
Began Operation: Jan. 14, 1953.
Represented (sales) by Headley-Reed TV.
Represented (legal) by Dow, Lohnes & Albertson.
Represented (engineering) by L. J. N. du Treil.
Personnel:
W. O. Pape, *president.*
H. K. Martin, *exec. v.p.*
W. B. Pape, *general manager.*
Al Holman, *program director.*
Chuck Thompson, *publicity director.*
A. R. Bell, *chief engineer.*

DIGEST OF RATE CARD NO. 4
(Dec. 1, 1955)

Hour	30 Min.	15 Min.	10 Min.	5 Min.	Min.
Class AA—7-9:30 p.m., Mon.-Sat.; 6-9:30 p.m., Sun.					
$450.00	$270.00	$180.00	$157.50	$112.50	$90.00
Class A—6-7 p.m., Mon.-Sat.; 9:30-11 p.m., Mon.-Sun.					
400.00	240.00	160.00	140.00	100.00	80.00
Class B—5-6 p.m., Mon.-Fri.; 1-6 p.m., Sat. & Sun.					
300.00	180.00	120.00	105.00	75.00	60.00
Class C—Sign-on-5 p.m., Mon.-Fri.; sign-on-1 p.m., Sat. & Sun.; 10:30 p.m.-sign-off, daily.					
200.00	120.00	80.00	56.00	40.00	35.00

Subject to frequency discounts.

(a) WALA (Mobile, AL)

WBRC-TV
Birmingham
(Ch. 6)

Licensee: Storer Broadcasting Co., Birmingham 9, Ala.
Studio and Transmitter: Atop Red Mt.
Telephone: 4-4701. **TWX No.:** BH 260.
Technical Facilities: Channel No. 6 (82-88 mc). Authorized power: 100-kw visual, 50-kw aural. Antenna: 880-ft. above av. terrain, 546-ft. above ground, 1580-ft. above sea level, lat. 33° 29' 20", long. 86° 47' 59".
Network Service: CBS.
AM Affiliate: WBRC, 5-kw, 960 kc (CBS).
Ownership: Storer Bcstg. Co., 1177 Kane Concourse, Miami Beach, Fla. For other interests, see listing under Major Regional Networks and Group-Owned Stations.
Began Operation: July 1, 1949. Sold to Storer Bcstg. Co. Inc. May, 1953 (see *Television Digest*, Vol. 9:13, 21).
Represented (sales) by The Katz Agency Inc.
Represented (legal) by Dow, Lohnes & Albertson.
Represented (engineering) by A. Earl Cullum Jr.
Personnel:
George B. Storer, *president.*
J. Robert Kerns, *v.p. & managing director.*
Peter Storer, *N.Y. sales manager.*
Oliver V. Naylor, *sales manager.*
Richard Stephen, *local sales manager.*
Robert L. DuPriest, *chief engineer.*
M. D. Smith, *program director.*
Ralph C. Runyan, *sales promotion manager.*
Lola Montez, *community projects director.*
Leo Willette, *news director.*
(Continued on next page)

(b) WBRC (Birmingham, AL)

Notes: The figures reproduce two pages of the 1955 edition of the *Advanced Television Factbook* (published by *Warner Communications*).

Figure 4: Television Raw Data: Illustration

Television data We obtain the date of the initial broadcast for all commercial and non-commercial licensed television stations from the Advanced Television Factbook (published by Warner Communications). We use five different Factbooks of compiled station information (1951, 1953, 1956, 1960, and 1966).[25] For each station, the Factbook provides information on the precise location of the broadcasting tower (latitude and longitude), the tower's height (feet above ground), the tower's channel, and the visual broadcast power of the tower (kW). This data has been collected since the advent of television.[26] Figure 4 shows examples of entries in the 1955 book for WBRC (Birmingham, AL) and WALA (Mobile, AL). The dates of first broadcasts are listed, which happen to be July 1, 1949 (WBRC) and Jan 14, 1953 (WALA). This is an informative example, as WBRC happened to be licensed prior to the "freeze", while WALA was licensed afterward. We account for eventual changes in the antennas' characteristics that occur during our time period. For each year, we use the information provided by the most recent Factbook.

With this data, we can construct the "Grade B" and "Grade A" signal contours that define the area in which a television signal could be received using the FCC's TV signal propagation

[25]Television factbooks can be downloaded at https://worldradiohistory.com/Television_Factbook_Page.htm.
[26]The Factbook stopped reporting precise location in 1956. For stations that begin operation in 1956 or later, we use the centroid of the city of license for that TV station.

tools. We use the Irregular Terrain Model (ITM) (Hufford et al., 1982), which is a modified version of the Longley-Rice model (Longley and Rice, 1968) which gives the propagation of electromagnetic waves over the Earth's surface. This model allows us to compute the received signal strength for each emitter-receiver pair, depending on the topographical conditions the signal had to go through. We assign a newspaper to be treated by a television station if the newspaper market's centroid falls within this Grade's reception contour. We follow the FCC's guidelines in computing the Grade A and B contours based on the station's channel, since VHF waves in different bands (channels 2-6 vs 7-13) propagate differently. Grade B contours are larger than and encompass Grade A contours because they specify a lower quality of signal reception (and the quality of signal reception decreases with the distance from the antenna).[27] In our main analysis, we focus on Grade B contours. Focusing on Grade A contours does not affect our main results, as discussed in the robustness checks section. Figure 5 illustrates our approach by focusing on the State of Illinois in 1952 and plotting the contours of several television stations and the locations of the state's newspaper markets.

To visualize the impact of the freeze on the roll-out of television, we first count the number of newspaper markets treated by television over time. Figure 6 shows this for the 1938-1964 period. The impact of the "freeze" is obvious: while television spread rapidly in 1947-1949, it greatly slowed in 1950 and stopped entirely in 1951, before a slew of new broadcasting in 1952 and 1953. We show the precise evolution around the freeze graphically in Figure 7. Each map is a snapshot of active television stations as of September 1 of that year. The maps for 1950 and 1951 are nearly identical, and the maps for 1952 and 1953 show a rapid development of new stations after the lifting of the freeze.

Election data Our analysis focuses on House, Senatorial, and Presidential Elections. We collect county-level data on all three types of elections for the period 1932-1964.[28] The data – which contain the number of votes for each party and the total number of votes – come from the "United States Historical Election Returns, 1824-1968" and is available online on the Inter-University Consortium for Political and Social Research's website.[29] We investigate whether the changes in news diets brought about by the introduction of television led local elections' outcomes to become more correlated with presidential elections' outcomes.

We look at Senate and House elections that correspond to presidential election years. The advantage of this approach is that we (arguably) hold constant turnout, voters' information,

[27] The thresholds for Grade B are: -70.78dBm for channels 2-6, 61.78dBm for channels 7-13 and -53.78dBm for channels 14-69.

[28] For a seminal analysis of voting behavior in presidential elections during our time period see Campbell et al. (1960).

[29] Inter-university Consortium for Political and Social Research. United States Historical Election Returns, 1824-1968. Inter-university Consortium for Political and Social Research [distributor], 1999-04-26. https://doi.org/10.3886/ICPSR00001.v3.

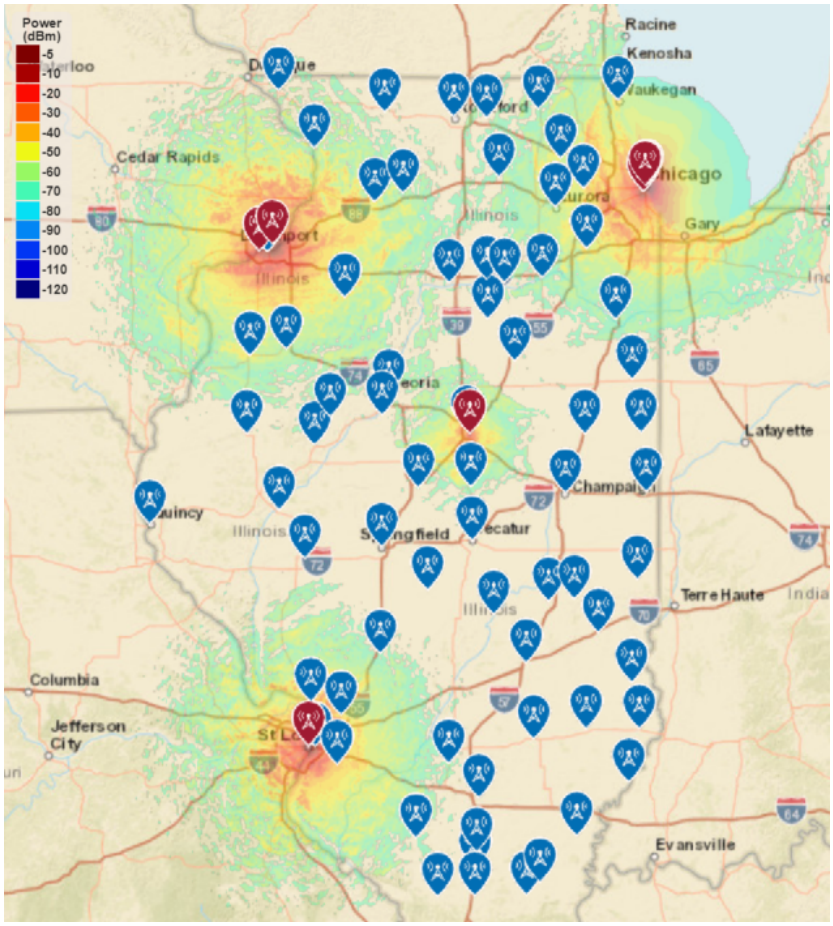


Figure 5: Newspaper markets covered by television in Illinois in 1952

Notes: Every red marker represents the location of a television antenna ("emitter") and every blue marker represents the center of a newspaper market ("receiver'). Both Grade A contours (in yellow) and Grade B contours (in green) are shown. They are constructed taking into account topographic conditions.

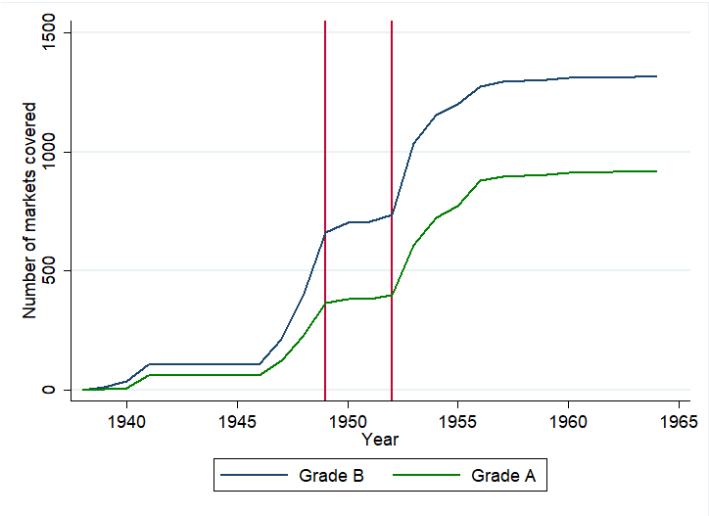


Figure 6: Evolution of the number of newspaper markets covered by TV

Notes: There are 1,539 newspaper markets in total. The freeze occurred between September 30, 1948 and April 14, 1952.

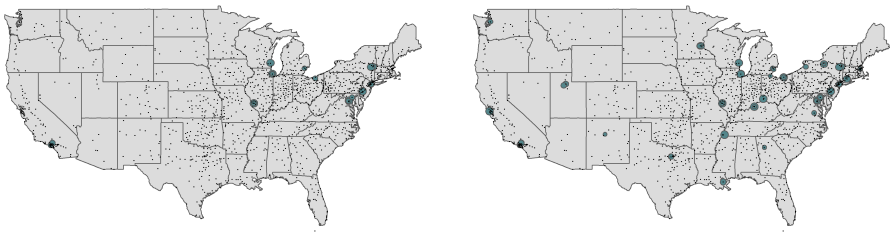
etc., across both the local and the national election. For each election, we compute the share of votes going to the Democratic Party candidate. We then compute the difference (in absolute value) between the share of votes going to the Democratic candidate in the local election (House and Senatorial) and the share of votes going to the Democratic candidate in the Presidential election. We expect this difference to shrink in the counties where news diets became more 'nationalized' following the introduction of television.

Lastly, for the analysis on voting, we build a grid covering the continental United States. This grid has points at every 0.1 degrees of latitudes and longitudes (approximately 10km depending on the location). We then compute, using an Irregular Terrain Model, the signal strength received at each point of this grid. We consider a county as treated depending on the share of points within the county that receive a signal above the Grade B threshold and compute results for different thresholds.

Other data Finally, to compute our control variables, we combine several datasets from the Historical, Demographic, Economic, and Social Data: The United States, 1790-2002 (ICPSR 2896).[30] First, the census data for 1930, 1940, 1950, 1960 and 1970 provide us with information on population per county, median income per county (1950 only), median school year for those above 25 years per county (1940 and 1950 only), the percentage of church members per county (1950 only), the percentage of foreigners per county (all years[31]), the percentage

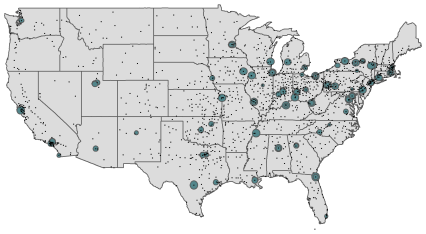
[30] Haines, Michael R., and Inter-university Consortium for Political and Social Research. Historical, Demographic, Economic, and Social Data: The United States, 1790-2002. Inter-university Consortium for Political and Social Research [distributor], 2010-05-21.

[31] Note that for 1930, this is only the percentage of white foreigners.

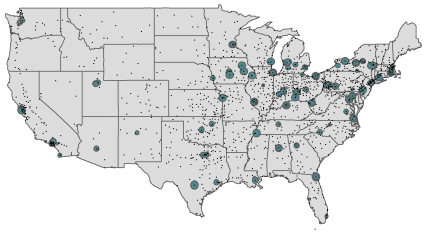


(a) 1947

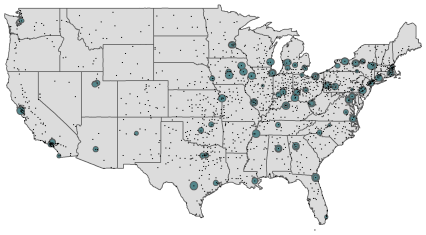
(b) 1948



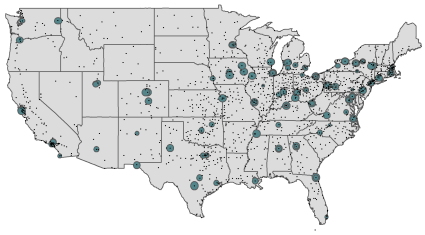
(c) 1949



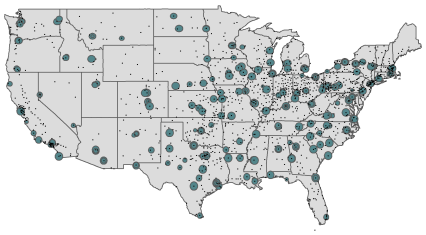
(d) 1950



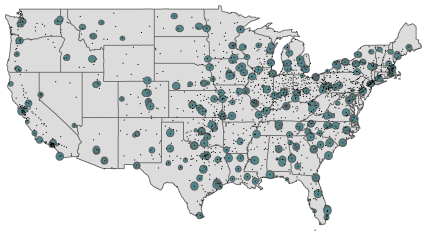
(e) 1951



(f) 1952



(g) 1953



(h) 1954

Figure 7: Timing of Television Entry, 1947-1954

Notes: Each television broadcast tower is represented by a circle once it is active. Circles show the reception area based on 47 dBu (ignoring topographic conditions), which the FCC defines as the "Grade B" service contour for analog television reception. Points indicate centroids of newspaper markets. Prior to 1947, the only licensed broadcast towers were in New York, Philadelphia, and Chicago.

of black population (all years) and the percentage of urban population per county (missing for 1960 and 1970). For periods pre-1950, we use $(1 - \%$ illiterate$) \times 10$ as a proxy for the median school years.[32] Second, the County data book for 1952, 1956, 1962 and 1967 give us the median school years, the median income, and the urban population for post-1950 years. Information on post-1950 percentage of church members comes from the Religious Study. For all these variables, we interpolate the results for each year using a natural cubic spline interpolation. Finally, we use the newspaper market population data from Gentzkow et al. (2011), which is imputed for non-census years.

3 Model of Newspaper Content Choices

Virtually all newspapers in our dataset bundle local and national news. Because we are interested in changes in news diets, in what follows we treat local and national news as distinct products and, inspired by the literatures on two-sided markets and bundling, we write a simple model of newspaper content choice and pricing which centers on this idea of the newspaper as a bundle. We show that the entry of a pure national news media outlet decreases the incumbent's incentives to provide *both* local and national news. We also show that the incumbent's decrease in content is especially pronounced if bundling is used as a price-discrimination device (as suggested by its widespread use in our data). Although our model is special in several ways, it offers a cautionary tale regarding the production of local news in a more competitive national news market.

3.1 Setting

There are 2 media outlets – an incumbent ($z = I$) and an entrant ($z = E$) – and 2 products – local news ($k = L$) and national news ($k = N$). I produces $q_{I,L} \in \left\{\underline{q}, \overline{q}\right\}$ local news and $q_{I,N} \in \left\{\underline{q}, \overline{q}\right\}$ national news, where $\Delta q \equiv \overline{q} - \underline{q} > 0$, and it incurs a fixed cost $F\left(q_{I,k}\right)$ per product k (where $F\left(\underline{q}\right) = 0 \leq F\left(\overline{q}\right) = F$). E specializes in national news by supplying an exogenous amount $q_{E,N}$. We refer to consumers of content as 'readers,' although I and E may well rely on distinct media technologies. Both outlets sell their content to readers at zero marginal cost. In addition, they sell readers' attention to advertisers (also at zero marginal cost). We denote by p_z^R and p_z^A the prices media outlet z charges readers and advertisers.

Readers There exists a mass 1 of readers, each of whom has taste for news determined by $u_i \sim \mathrm{U}\left[0, 1\right]$. For simplicity, we assume that reader preferences are independent of advertising. Readers' tastes for local and national news are perfectly negatively correlated. Reader i

[32] Because the average number of years of schooling is not included in the 1940 decennial census, we use $(1 - \%$ illiterate$) \times 10$ as a proxy. For example, this gives, for a county with a 50% illiteracy rate, an average number of years of schooling of 5 (approximately the number of years needed to develop literacy).

enjoys gross payoffs $q_{z,L} + \frac{1}{2}(1 - u_i)$ and $q_{z,N} + \frac{1}{2}u_i$ from consuming local and national news, respectively. Reader i's total payoff from consuming I's bundle is thus equal to $\sum_{k\in\{L,N\}} q_{I,k} + \frac{1}{2} - p_I^R$. Similarly, reader i's payoff from consuming E's national news product is equal to $q_{E,N} + \frac{1}{2}u_i - p_E^R$. We suppose readers can purchase from one media outlet at most and set their outside option equal to zero.

Advertisers There exists a mass 1 of advertisers, each of whom has a valuation for reader attention determined by $v_j \sim \mathrm{U}[0,1]$. Advertisers' valuations for readers' attention across the local and national news products are perfectly negatively correlated. Let d_z^R denote media outlet z's readership. Advertiser j enjoys payoff $\frac{1}{2}\left(\beta d_z^R + 1 - v_j\right)$ when reaching d_z^R readers consuming local news and payoff $\frac{1}{2}\left(\beta d_z^R + v_j\right)$ when reaching d_z^R readers consuming national news (where $\beta > 0$).[33] Overall, advertiser j's payoff from placing an ad in I's bundle is thus equal to $\beta d_I^R + \frac{1}{2} - p_I^A$. Similarly, advertiser j's payoff from placing an ad in E's product is equal to $\frac{1}{2}\beta d_E^R + \frac{1}{2}v_j - p_E^A$. We suppose advertisers can place ads with one outlet at most and set their outside option to zero. We let d_z^A denote outlet z's quantity of ads.

3.2 Monopoly

Suppose I is a monopolist on both sides of the local news and national news markets. We impose $\beta < 1$ and $\overline{q} \leq \frac{1}{4}(2+\beta)(1-\beta)$ to ensure that $0 < d_I^A(\cdot), d_I^R(\cdot) \leq 1$ in equilibrium. All readers' and advertisers' valuations for the bundle are homogeneous. As a result, I is able to serve all consumers and extract the entire consumer surplus on both sides of the market.

Lemma 1 *The incumbent finds it optimal to set* $p_I^R = \sum_{k\in\{L,N\}} q_k + \frac{1}{2}$ *and* $p_I^A = \beta + \frac{1}{2}$*, and its revenues are equal to* $\pi_I^M = \sum_{k\in\{L,N\}} q_k + 1 + \beta$*. Finally, the incumbent sets* $(q_{I,L}, q_{I,N}) = (\overline{q}, \overline{q})$ *if* $F \leq \tilde{F}^M \equiv \triangle q$ *and otherwise* $(q_{I,L}, q_{I,N}) = \left(\underline{q}, \underline{q}\right)$*.*

Raising one product's quantity increases reader surplus by an amount equal to $\triangle q$. Because I serves all readers and extracts the entirety of reader surplus, it thus sets $q_{I,k} = \overline{q}$ if and only if $F \leq \tilde{F}^M = \triangle q$. We now show that entry in the market for national news lowers the incumbent's incentives to produce content.

3.3 Entry

E enters the market for national news. I chooses its content $(q_{I,L}, q_{I,N})$ in a first stage and I and E set their prices $\left(p_z^R, p_z^A\right)$ simultaneously in a second stage. We focus on outcomes such that (i) both media outlets are active on both sides of the market and (ii) all readers and advertisers make a purchase. To this end, we impose $\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N} \in$

[33] Advertising exhibits constant returns: The benefit from reaching a reader twice (i.e., when she reads local and national news) is twice the benefit from reaching a consumer once (e.g., when she reads local news only).

$\left(\frac{1}{2}\left(-2-\beta+2\beta^2\right), \frac{1}{2}\left(1-\beta-4\beta^2\right)\right)$; that is, we limit the superiority in content any outlet can achieve relative to its rival. We also impose $\beta < \frac{1}{5}$, which ensures positive profits.[34]

We now compute the demand functions. The marginal reader $\tilde{u}$ is given by:

$$\begin{aligned} &\sum_{k\in\{L,N\}} q_{I,k} + \frac{1}{2} - p_I^R = q_{E,N} + \frac{1}{2}\tilde{u} - p_E^R \quad \Rightarrow \\ &d_I^R\left(p_I^R, p_E^R, q_{I,L}, q_{I,N}\right) = \tilde{u} = 2\left(\frac{1}{2} + \sum_{k\in\{L,N\}} q_{I,k} - q_{E,N} + p_E^R - p_I^R\right). \end{aligned} \tag{1}$$

Similarly, the marginal advertiser $\tilde{v}$ is found using condition:

$$\begin{aligned} &\beta d_I^R + \frac{1}{2} - p_I^A = \frac{1}{2}\beta\left(1-d_I^R\right) + \frac{1}{2}\tilde{v} - p_E^A \quad \Rightarrow \\ &d_I^A\left(p_I^A, p_E^A, d_I^R\right) = \tilde{v} = 2\left(\frac{1}{2} + \beta\left(\frac{3}{2}d_I^R - \frac{1}{2}\right) + p_E^A - p_I^A\right). \end{aligned} \tag{2}$$

Consumers differ in the extent to which they prefer one outlet over the other by an amount equal to a random variable uniformly distributed over the $\left[0, \frac{1}{2}\right]$ interval. As a result, our duopoly setting amounts to a vertical differentiation environment in which the value taken by $\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N}$ determines the identity of the 'high quality' firm (c.f. Whinston, 1990).

In the pricing stage, I chooses $\left(p_I^R, p_I^A\right)$ to maximize $\pi_I^D = p_I^R d_I^R(\cdot) + p_I^A d_I^A(\cdot)$ and E chooses $\left(p_E^R, p_E^A\right)$ to maximize $\pi_E^D = p_E^R\left(1-d_I^R(\cdot)\right) + p_E^A\left(1-d_I^A(\cdot)\right)$. The next lemma states I's solution. Its proof, as well as the expressions for all the listed thresholds and E's prices and revenues, can be found in Appendix A.2. In what follows, let $\Delta\tilde{q} \equiv \sum_{k\in\{L,N\}} q_{I,k} - q_{E,N}$.

Lemma 2 *In the equilibrium of the pricing game, the incumbent finds it optimal to set:*

$$p_I^R = \frac{\gamma_I + 2\left(1-3\beta^2\right)\Delta\tilde{q}}{6\left(1-2\beta^2\right)}, \quad p_I^A = \frac{\mu_I + 2\beta\Delta\tilde{q}}{6\left(1-2\beta^2\right)}, \tag{3}$$

where γ_I, μ_I are positive constants. The incumbent's revenues are equal to:

$$\pi_I^D = \frac{\kappa_I + \left(4-3\beta^2\right)\Delta\tilde{q} + 2\Delta\tilde{q}^2}{9\left(1-2\beta^2\right)}, \tag{4}$$

where κ_I is a positive constant.

I's prices are increasing in its own provision of local and national news and decreasing in E's offering of national news. The following lemma analyzes I's incentives to produce content.

[34] These restrictions guarantee both (i) that E finds it optimal to enter and (ii) that I finds it optimal not to exit following E's entry. This region of parameter values is a subset of that considered in the monopoly case. To ensure nonnegative prices, the condition above is replaced by the tighter condition $\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N} \in \left(\frac{5\beta(1+\beta)-9\beta^3-2}{2\left(1-3\beta^2\right)}, \frac{1+12\beta^3-4\beta(1+\beta)}{2\left(1-3\beta^2\right)}\right)$.

Its proof can be found in Appendix A.2.

Lemma 3 *The incumbent chooses* $(q_{I,L}, q_{I,N}) = (\overline{q}, \overline{q})$ *if:*

$$F \leq \tilde{F}^D \equiv \frac{\left(4 - 3\beta^2\right)\Delta q + 4\left(\overline{q}^2 - \underline{q}^2 - q_{E,N}\Delta q\right)}{9\left(1 - 2\beta^2\right)}. \tag{5}$$

Otherwise, it chooses $(q_{I,L}, q_{I,N}) = \left(\underline{q}, \underline{q}\right)$.

The higher the amount of national news supplied by E is, the lower the prices I is able to charge readers and advertisers, and thus the lower are its incentives to produce local and national news. The following proposition summarizes the impact of E's entry on I's prices and content, helping us rationalize the empirical findings presented in Sections 4 and 5.[35] Its proof (as well as the proof of Corollary 2 below) can be found in Appendix A.3.

Proposition 1 *In the equilibrium of the duopoly game, the incumbent (i) produces a weakly lower amount of local and national news* $q_{I,L}$ *and* $q_{I,N}$ *(i.e.,* $\tilde{F}^M - \tilde{F}^D > 0$*) and (ii) charges lower reader and advertising prices compared to the equilibrium of the monopoly game.*

Entry in the market for national news reduces both reader and advertising prices. This effect, in turn, lowers I's incentives to expand demand by producing either type of content.

We assumed that I is better off selling local and national news as a pure bundle. Lemma E.2 in Online Appendix E.2 shows that bundling is strictly optimal in the monopoly case because consumers' valuations for the local and national news products are perfectly negatively correlated. Bundling is especially profitable given the two-sided nature of the newspaper industry: it allows I (i) to reduce the dispersion in readers' valuations for content and (ii) to sell a 'bundle of readers' to advertisers, thereby reducing the dispersion in their valuations also. Overall, bundling allows I to extract the whole consumer surplus and, therefore, creates strong incentives to produce content. In Appendix A.1, we solve for the polar case of perfect positive correlation in which the local and national news products are effectively no longer distinct products. Bundling under monopoly becomes only weakly optimal and does not raise I's incentives to produce content. By contrast, the duopoly case is identical independently of the correlation in consumers' tastes for both products, because competition removes I's ability to use bundling as a price discrimination device.[36] Thus, although we find that E's entry

[35] Predictions regarding the impact of E's entry on I's readership and quantity of advertising are ambiguous. Intuitively, E's entry leads to a fall in I's readership and advertising if $\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N}$ is sufficiently low, that is, if E's content is sufficiently superior. We do not report the exact conditions for the sake of brevity.

[36] Under bundling, the dispersion in consumers' valuations for the bundle relative to E's product is determined by a random variable uniformly distributed over the $\left[0, \frac{1}{2}\right]$ interval (see (10) and (11)). If it was to sell local and national news independently, I would enjoy monopoly profits in the market for local news and engage in Bertrand pricing in the market for national news. The dispersion in consumers' valuations over its local news product would again be determined by a random variable uniformly distributed over $\left[0, \frac{1}{2}\right]$. Bundling

reduces I's incentives to produce content in both cases, the effect is stronger if valuations are negatively correlated.[37]

To summarize, we find that increased competition for readers and advertisers in the market for national news decreases the incumbent's incentives to produce local news. This negative effect is especially pronounced if the bundling of local and national news is strictly optimal under monopoly, which, although we cannot directly test empirically, is indirectly suggested by its widespread use by the newspapers in our data.

Corollary 2 *The difference $\tilde{F}^M - \tilde{F}^D$ is higher when the values attached to the local and national news products are perfectly negatively correlated.*

We conclude this section with two remarks and by relating the model to the broader literature. We have assumed identical production technologies for local and national news. In our empirical context, producing local news was much more expensive than printing wire national stories. Modifying the setting to allow for higher costs of producing local news would lead I to reduce local news by a weakly greater amount following entry in the market for national news. In the extreme, if the cost of printing extra national news is independent of the total number of stories (e.g., because the newspaper relies entirely on its subscription to a wire service for its national news), the entry of a national news outlet may have only a very limited effect on the incumbent's provision of national news. In addition, we endowed incumbent and entrant with identical advertising technologies. Television was likely a far superior advertising platform. Not surprisingly, generalizing the model in this direction would make the fall in the incumbent's production of content even more pronounced. Similarly, improving E's content offering (e.g., by assuming it bundles national news with entertainment) can only worsen the impact of competition on I's incentive to produce local news.

There exists a large literature analyzing the determinants of products' characteristics. Models of horizontal differentiation would predict local newspapers to increase their share of local news stories following the entry of television (Hotelling, 1929). In principle, there exists no technological or physical constraint forcing the newspaper to produce more of one type of content when it reduces the other (unlike, for instance, a radio station with 24 hours of content). For this reason, and because we are able to directly measure newspapers' content, we instead build a model in which the newspaper chooses how much of each type of content

local and national news, therefore, cannot help I extract greater consumer surplus by reducing the per-product dispersion in valuations. Nevertheless, bundling is optimal when it allows I to soften competition in the market for national news by vertically differentiating itself from E (Whinston, 1990; Nalebuff, 2004). Sufficient conditions that ensure the optimality of bundling under competition are $2\underline{q} > \frac{2}{5} + \overline{q}$ and $\beta < \frac{1}{10}$.

[37] Note that, as is standard, bundling is profitable as long as valuations are not too positively correlated. Thus, our finding that the fall in local news should be particularly severe in case bundling serves a price-discrimination motive holds more generally than the extreme case of perfect negative correlation assumed here.

to produce. Further, models of vertical differentiation would treat local and national news as a single product ("news") and predict that newspapers – if television is assumed to provide more, or better, content – decrease their provision of news (Gabszewicz and Thisse, 1980; Shaked and Sutton, 1982). Our model exhibits strong elements of vertical differentiation but, importantly given our empirical setting, it treats local and national news as distinct products. This distinction allows us to make the observation that newspapers' reliance on bundling (if driven by a price discrimination motive) may exacerbate the drop in local newspapers' content.

Lastly, our setting is closely related to the strand of literature that centers on "preference externalities" in media markets (see Anderson and Waldfogel, 2015, for a review). If the consumers who switch to television have a preference for a product that focuses on national news, their departure may induce newspapers to target the remaining consumers by producing content with a strong local focus (George and Waldfogel, 2003, 2006). As mentioned above, it isn't obvious that a newspaper that produces more of one type of content must produce less of the other. Similarly, readers who prefer national over local news may still benefit from the inclusion of additional local news stories (which they can always choose not to read). For these reasons, because of scale effects, the consumers who switch to television may actually lower newspapers' incentive to produce local news. In our setting, consumers always prefer more of either type of content but they are heterogeneous in which type of content they prefer.

4 Empirical Results for Market Outcomes

This section examines the effect of the entry of television on prices and quantities in both the readership and advertising markets for newspapers. The primary challenge in identification is that the entry of television was not entirely random. Large markets with more commercial potential were the first to see firms pursue broadcast licenses. We proceed in two parts: first, a difference-in-differences approach based on a narrow window around the freeze, when variation in exposure to television is most likely to be exogenous. Second, a nearest-neighbor matching estimator using variables from the census, matched to newspaper markets. Our most stringent matching estimator examines only outcomes in 1951, when the FCC freeze was most salient, matching on demographics and newspaper characteristics from the era prior to television. All approaches show a consistent result: television was a negative shock to both readership and advertising, concentrated among evening newspapers.

4.1 Difference-in-Differences Identification Strategy

Our difference-in-differences approach focuses on the exact timing of the FCC freeze to isolate the impact of television on newspapers. By focusing only on markets that saw entry of television exactly before and after the freeze, we can isolate the impact of television by exploiting

the random variation in which particular markets received television earlier or later. Online Appendix Table C.2 shows the last twenty television markets to receive TV after the freeze began[38], as well as the first twenty to receive TV after the freeze ended. Looking at the list, the idea is that newspapers in markets near cities on either side should be comparable.[39]

The entry of TV stations may have been anticipated by the newspapers located in cities where no TV stations were granted before the freeze. In particular, the freeze was at first expected to last only six months. Hence, newspapers may have reacted preemptively to the entry, e.g. by adjusting their prices or changing their content. If this were the case, our estimates should then be considered as lower bounds of the true effect of TV entry. Note also that during this time period there was very little cross-ownership of newspapers and broadcast stations.[40] Hence, there were effectively few applicants for a broadcast license that were also local newspaper owners anticipating the effects of their own application.

Furthermore, to ensure the validity of our empirical strategy, we follow de Chaisemartin and D'Haultfœuille (2020) and compute, for our main outcome of interests, the long-difference placebos. Doing so allows us to test whether the treated and the control groups follow parallel trends prior to entry. Reassuringly, Figure 8 shows that the common trends hold over several periods.

Our main specifications use as a sample all newspaper markets that were impacted by newly active television broadcasts starting just "before" and just "after" the freeze, which took place from September 30, 1948 until April 14, 1952. In particular, we include newspaper markets treated by television licenses that began operation after 1947 and before 1953. The sample includes 136 TV licenses and $1,291$ newspapers out of the $1,965$ newspapers included in our database.[41] We designate this sample as the set of "freeze" markets. Thanks to the rich data on newspaper markets, we can ignore all other markets to isolate purely exogenous variation through running regressions that only include these markets.

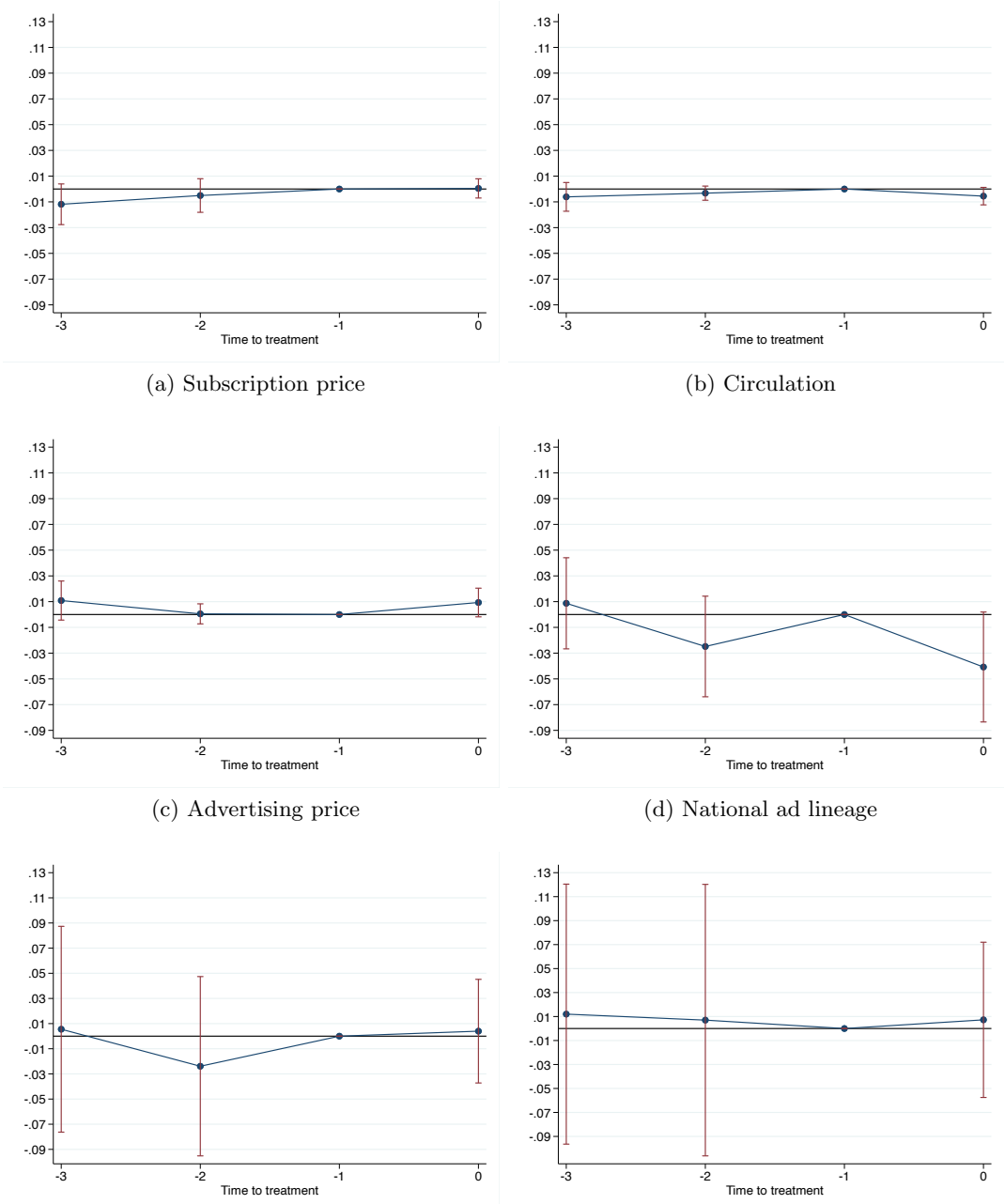
Our difference-in-differences empirical approach estimates, for this set of newspapers most

[38] Note that because one needs time to begin broadcasting after the licensing, the first commercial broadcast for the markets that were licensed prior to the freeze took place during the freeze period (e.g. in July 10, 1949 in Providence, Rhode Island).

[39] Alternatively, one may use the list of pending applications (at the onset of the freeze) to determine the list of control newspaper markets. While the information exists, we have not digitized it. First, to the best of our understanding, it was common for pending applications to be denied. Second, for the pending applications, antenna information is not as complete as in our dataset and therefore cannot be used to compute reception areas. Third, restricting attention to the list of pending applications would mean that we cannot vary the window of months used to define our sample. A qualitative review of the pending applications at the time suggests that the markets with applications pending mirrors the set of markets that we use as controls.

[40] The newspaper-broadcast cross-ownership rule was initiated by the FCC in 1975. This rule banned cross-ownership of a newspaper and broadcast station in the same market. However, during our period of interest (1944-1964, i.e. before the ban), we observe very few occurrences of cross-ownership. In 1975, at the time of the FCC ban, only 16 cities had companies that owned both a newspaper and a television station which were required to sell at least one of the properties.

[41] Online Appendix Table C.3 presents summary statistics for these newspapers. In the robustness checks section, we show that our results are robust to using different windows around the freeze.



(a) Subscription price

(b) Circulation

(c) Advertising price

(d) National ad lineage

(e) Total Text Stories

(f) Local Original Stories

Figure 8: Assessing the plausibility of the common trends assumption: Long-difference placebos

Notes: The figures plot the estimates and 95% confidence intervals, using the de Chaisemartin and D'Haultfœuille (2020) method, based on the Stata command did_multipleGT, available from the SSC repository. Standard errors are clustered at the television station level. Dependent variables are in natural logs. All specifications include year and newspaper fixed effects. We use the same scale on all the plots for the sake of comparison.

directly impacted by the freeze, a regression of the form:

$$y_{it} = \alpha + \sigma \cdot TV_{it} + \mathbf{X_{it}}\beta + \gamma_t + \delta_i + \epsilon_{it} \tag{6}$$

where i index the newspapers and t the years. y_{it} is an outcome of interest for newspaper i in time period t (e.g. its circulation) in natural logarithm. We construct TV_{it} as an indicator variable for whether or not newspaper i is in the range of an active television broadcast in year t. Following Gentzkow (2006), we assume that any broadcasts that begin in the final four months of a year only affect the following year. $\mathbf{X_{it}}$ is a vector that includes the newspaper market population (in log), an indicator for the population not being observed, as well as categorical variables for the number of newspapers in the market. Finally, our specification includes year and newspaper fixed effects. We cluster standard errors at the television station level as regional shocks may be correlated across newspaper markets, even when there is no competition across markets among newspapers.

Focusing only on the markets that were most clearly exogenously treated by the freeze is a departure in terms of identification with respect to the existing literature using this shock. Gentzkow (2006) includes all the media markets in the analysis, controlling for fourth-order polynomials in time interacted with county-level observable characteristics. Similarly, to identify the effect of television on test scores, Gentzkow and Shapiro (2008) use variation across local markets in the timing of the introduction of television. They divide DMAs into three groups according to the year in which they began receiving television broadcasts. By contrast, we identify the impact of television by using variations in adoption within the 1947-1953 time period where the impact of television can clearly be considered as being more plausibly exogenous.

4.2 Results

Results are presented in Table 3 and Table 4. The first table looks at the readership side, and finds negative effects on prices and quantities. According to our estimates, the introduction of television led to a 3.3% decrease in the subscription price of newspapers and to a 3.1% decrease in circulation. The negative circulation effect is consistent with previous findings in the literature that point toward the crowding out of newspapers when television (or later the Internet) is introduced (see e.g., Gentzkow, 2006; Gavazza et al., 2019). This effect is concentrated among evening newspapers, for which we observe a 3.4% decrease in circulation. Interestingly, morning newspapers see little impact, possibly because very few stations came in the air before noon at the time.[42]

[42] See, for instance, the Advanced Television Factbook of 1956 which also reports that in 1955 about 10% of sets were turned on between 7am and 4pm and about 60% between 7pm and 9pm.

	Subscription price			Circulation		
	(1)	(2)	(3)	(4)	(5)	(6)
TV	-0.033**	-0.039**	-0.031**	-0.031*	0.005	-0.034**
	(0.015)	(0.019)	(0.015)	(0.016)	(0.017)	(0.016)
Year & Newspaper FEs	X	X	X	X	X	X
Sample	All	Morning	Evening	All	Morning	Evening
R-sq	0.53	0.58	0.53	0.99	0.99	0.98
R-sq (within)	0.16	0.20	0.16	0.44	0.40	0.45
Observations	19,159	3,884	15,267	19,159	3,884	15,267
Clusters (TVStation)	197	130	181	197	130	181

Table 3: Readership: Difference-in-Differences Analysis

Notes: * p<0.10, ** p<0.05, *** p<0.01. The time period is 1944-1964. Models are estimated using OLS. Standard errors are clustered at the television station level. Dependent variables are in natural logs. All specifications include city population as a control, an indicator for city population missing, categorical variables for the number of newspapers in the market, and year and newspaper fixed effects.

Table 4 presents the results for the advertising side of the market. According to our estimates, the introduction of television led to a 2.2% decrease in the advertising rate, where the effect is concentrated primarily among evening newspapers (Columns 1 to 3). The advertising price effect may be due in part to the decreased circulation, which would mechanically lead to lower prices in advertising. It may also be driven by the fact that the introduction of an alternative advertising platform (television) decreased advertisers' willingness to pay for newspaper readers' attention.

Looking at advertising quantities, the negative impact of television is primarily in national advertising for evening newspapers. For those newspapers, we observe a 3.9% decrease in the amount of national advertising following the introduction of television. We find no impact on local advertising or classified advertising. This is probably because television programming was mostly national during this time period due to the excessively high cost of producing original local content at the time. National television advertising took the form of sponsored programs (Lichty and Topping, 1975), unlike "spot" advertising that developed in the late 1960s and 1970s as the cost of program development exceeded the value to a single advertiser.

The decreases in subscription and advertising prices are consistent with the model developed in Section 3.[43] Television entered both the readership and advertising sides of the news market, and the resulting competition for readers and advertisers put significant downward pressure on prices.[44] Moreover, as we document below, newspapers reacted to the intro-

[43] We do not find any evidence of an effect of television on the extensive margin of newspapers. It is possible that the shock we exploit was too short relative to the decision to shut down or merge. Additionally, newspaper readership was generally on an upward trajectory during this era, and so the negative shock might not have been sufficient to push firms to shut down.

[44] Other models of platform competition instead produce ambiguous predictions regarding subscription prices.

	Ad Prices			Local Advertising			National Advertising			Classified Advertising		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
TV	-0.020*	0.007	-0.023**	0.004	0.071	-0.003	-0.020	0.088	-0.039*	0.005	0.050	0.005
	(0.011)	(0.022)	(0.009)	(0.018)	(0.044)	(0.019)	(0.021)	(0.061)	(0.021)	(0.026)	(0.060)	(0.027)
Year & Newspaper FEs	X	X	X	X	X	X	X	X	X	X	X	X
Sample	All	Morning	Evening	All	Morning	Evening	All	Morning	Evening	All	Morning	Evening
R-sq	0.97	0.96	0.96	0.76	0.82	0.72	0.85	0.86	0.79	0.84	0.85	0.82
R-sq (within)	0.34	0.23	0.39	0.19	0.25	0.19	0.32	0.29	0.33	0.20	0.20	0.20
Observations	18,360	3,714	14,638	10,457	1,351	9,098	10,456	1,349	9,099	10,381	1,340	9,033
Clusters (TVStation)	196	129	180	183	84	169	183	84	169	183	83	169

Table 4: Advertising: Difference-in-Differences Analysis

Notes: * p<0.10, ** p<0.05, *** p<0.01. The time period is 1944-1964. Models are estimated using OLS. Standard errors are clustered at the television station level. Dependent variables are in natural logs. All specifications include city population as a control, an indicator for city population missing, categorical variables for the number of newspapers in the market, and year and newspaper fixed effects.

duction of television by decreasing their news content; a decrease in content may also have negatively affected prices.

4.3 Matching Estimators

Our second empirical approach employs a nearest-neighbor matching estimator (Abadie and Imbens, 2006) to assess the impact of television. This approach estimates a sample average treatment effect in our data. We link demographics about a newspaper's home county to each newspaper. The first matching estimator matches observations with replacement on year (exact), city population, median family income, median schooling, and percent urban. In some specifications, we also match on the number of newspapers in the market. In all cases, we estimate the bias-corrected treatment effect of Abadie and Imbens (2011).

Table 5 reproduces our main results for the readership and advertising markets. In both cases, the matching estimator qualitatively aligns with our main results, and if anything, produces much larger estimates in magnitude for some variables, including circulation.

In Table 6, we limit outcome variables to only the year 1951, when the "freeze" is most salient. This greatly reduces the effective size of our dataset. We further match newspapers based on their average circulation for the years 1945–1947. This matching estimator is therefore directly comparing the 1951 outcome variables for papers that had similar circulation in 1945–1947, in similarly sized cities, with similar demographics. We view this specification as the most stringent. The results again mirror the quantitative results from our earlier analysis, although with more modest circulation and advertising effects than obtained in Table 5. Taken together, the results from these two matching estimator approaches provide additional reassurance of the main effects we document.

5 Newspaper Content Analysis

While typical studies of shocks to product markets focus mostly on prices and quantities, the market for print newspapers features a far more complex product, whose quality and content can be adjusted over time. This section of the paper analyses how newspapers responded to the entry of television in terms of the product they offered to readers.

5.1 Intuition

As reviewed in Section 3, it is not clear what one should expect to occur to a local media outlet's offering of local vs. national news once faced with competition from television in

In particular, as advertising revenues drop, a news company may well find it optimal to increase its subscription price (i.e., the well-known "waterbed effect"). See e.g. Seamans and Zhu (2014) who analyze the impact of the entry of Craigslist on U.S. local newspapers for evidence in support of the waterbed effect.

	Subscription price			Circulation			Advertising price			National Advertising		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
TV	-0.05***	-0.05***	-0.05***	-0.40***	-0.40***	-0.21***	-0.16***	-0.16***	-0.12***	-0.13***	-0.13***	-0.04*
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Match on Year and Census	X	X	X	X	X	X	X	X	X	X	X	X
Match on #papers		X	X		X	X		X	X		X	X
Sample	All	All	Evening	All	All	Evening	All	All	Evening	All	All	Evening
Observations	20,814	20,814	16,406	20,814	20,814	16,406	19,791	19,791	15,694	11,846	11,846	10,047

Table 5: Nearest-Neighbor Matching Estimators

Notes: * p<0.10, ** p<0.05, *** p<0.01. The time period is 1944-1964. Dependent variables are in natural logs. All specifications match on year (exact), city population, and from the 1950: median family income, median schooling, and percent urban. Estimates are bias-adjusted.

	Subscription price	Circulation	Ad price	National Ad
	(1)	(2)	(3)	(4)
TV	0.001	-0.038***	-0.043***	-0.091**
	(0.010)	(0.012)	(0.015)	(0.038)
Match on Year & Census	X	X	X	X
Match on #papers	X	X	X	X
Observations	826	826	797	566

Table 6: Nearest-Neighbor Matching Estimators, 1951 Outcomes Only

Notes: * p<0.10, ** p<0.05, *** p<0.01. Models are estimated using OLS estimations. Dependent variables are in natural logs. All specifications match on year (exact), city population, and from the 1950 census: median family income, median schooling, and percent urban. Estimates are bias-adjusted.

both the readership and advertising sides of the industry. For example, one line of Industrial Organization theory suggests we should see newspapers devote more space to local content in order to differentiate themselves from national television news.[45] Or, in line with our model, entry in the market for national news could lower newspapers' incentives to incur the fixed costs necessary to produce both local and national news because competition reduces newspapers' ability to extract consumer surplus. As we noted in Section 3, this effect would be particularly strong if the bundling of local and national news is used by newspapers to engage in price discrimination. Moreover, because national wire stories were more economical for print media, we might expect a higher reliance on wire stories over original local reporting. It is also possible that we see more national news in newspapers if national print and national television news are complements.

5.2 Results

To study the extent to which newspapers adjusted their content after the introduction of television, we study the evolution of the actual stories printed in newspapers, as described in Section 2.3. Since our data are counts of different types of content, we first use a Poisson regression model with two-way fixed effects for dates and newspapers. Table 7 presents the results. In Columns (1) to (5) we report the results we obtain when manually studying the content of the newspapers. Overall, we find a reduction of 6.6% in the total number of news stories (Column 1), driven by a drop of 10.1% in the number of local original stories (Column 3). The estimated marginal effects point to 7.99 fewer stories, including 6.15 fewer local news stories, due to the introduction of television. The drop in the number of local original stories is statistically significant at the 1% level. It is robust to the use of an OLS specification similar

[45] Similarly, if the drop in readership were driven by readers who were mostly interested in national news, it is possible that newspapers would react by providing more local news so as to cater to the new marginal readers.

to the one presented in the market outcomes part of the paper (online Appendix Table D.1), and to the use of a negative binomial regression (online Appendix Table D.2). Looking at the other types of content (Columns (2), (4), and (5)), the coefficients are negative but not statistically significant at conventional levels. Unlike original local news, therefore, we find no clear evidence of changes in local newspapers' provision of national news. Similarly, we find no clear evidence of a drop in newspapers' reliance on wire local stories (which covered mostly state-level affairs). These findings are consistent with the fact that wire stories were free to print (see next section for an analysis of subscriptions to wire services).

Further, Column (6) to (8) present the results for the number of pages and the machine-learning content score measure. As described in the data section, the number of observations is higher because the Matlab processing capabilities allow us to handle a large number of issues compared to what can be done manually. While the coefficient for the number of pages is negative, it is not statistically significant at conventional levels (Column (6)). Interestingly, we obtain a drop in the Matlab content score (Columns (7) and (8)), consistent with there being less article text in the newspaper; this result holds whether we consider the total Matlab score of the issue or the average quantity of content per page.

Comparing these findings with those present in George and Waldfogel (2006) and Fan (2013) is informative. Fan (2013) simulates a merger between two local newspapers and shows that common ownership leads both newspapers to reduce their "news hole" and their local news ratio. Our setting is different in that we look at a change in the number of outlets rather than changes in ownership. Closer to our setting, George and Waldfogel (2006) look at the impact of the expansion of *The New York Times* into local markets using a fixed-effects approach on a short panel dataset. They find that increased competition in the market for national news leads newspapers to increase the share of journalists assigned to local news assignments, which is interpreted as a greater focus on local news. In contrast, increased competition in the market for national news in our setting leads local newspapers to decrease their news hole (i.e., the matlab score content) and the overall number of local news stories they print. What might explain these differences? First, our setting involves the entry of a new mass media technology. Conceivably, the entry of television was more disruptive to local newspapers than the entry of a national newspaper. Consistent with this view, we showed in Section 4 that television led to a significant drop in newspapers' readerships. Instead, George and Waldfogel (2006) find that the entry of *The New York Times* did not reduce local newspapers' readerships.[46] Second, the method employed to proxy newspapers' local news

[46]However, George and Waldfogel (2006) document that the composition of local newspapers' readerships did change following the entry of *The New York Times*. Specifically, college-educated readers switched to *The New York Times* and local newspapers started attracting more readers without a degree. Unfortunately, we do not have data on the composition of local newspapers' readerships. Nevertheless, because television offered not only national news but also various types of live entertainment and programming, the types of individuals and households who switched to television was likely much more heterogeneous.

	(1) Total text	(2) National wire	(3) Local original	(4) Local wire	(5) Photos	(6) Editorials	(7) Nb pages	(8) Matlab total	(9) Matlab mean
TV	-0.066**	-0.061	-0.101***	-0.041	-0.053	-0.056	-0.024	-0.147**	-0.085**
	(0.030)	(0.048)	(0.030)	(0.067)	(0.058)	(0.055)	(0.027)	(0.062)	(0.043)
Date FEs	✓	✓	✓	✓	✓	✓	✓	✓	✓
Newspaper FEs	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	3,196	3,196	3,196	3,196	3,196	3,196	6,829	6,829	6,829
Clusters (TVStation)	61	61	61	61	61	61	48	48	48
Marginal Effect	-7.99	-1.72	-6.15	-0.42	-0.67	-0.43	-0.39	-16.85	-0.64

Table 7: Newspaper content: Poisson Regression

Notes: * p<0.10, ** p<0.05, *** p<0.01. The time period is 1946-1955. Models are estimated using a Poisson regression. An observation is a newspaper-date. Standard errors are clustered at the television station level. All specifications include city population as a control, an indicator for city population missing, categorical variables for the number of newspapers in the market, and date and newspaper fixed effects.

focus is different in our paper compared to George and Waldfogel (2006) and Fan (2013). While they rely on journalists' titles and assigned beats to proxy newspapers' local news provision (i.e., newspapers' "input"), we measure newspapers' content by directly counting the types of stories they chose to print (i.e., newspapers' "outputs"). Lastly, we note that our findings may not be perfectly comparable with George and Waldfogel (2006)'s because they proxy local news production with the *share* of journalists assigned to local news topics, whereas we look at the *absolute* number of local news stories printed.[47]

To summarize, the implications of the content results are significant. While the entry of television was a shock to both the readership and advertising markets, newspapers further responded by reducing the amount of content they provided. With television, the bundle of the local newspaper faced direct competition on only a single dimension – national news – and yet we see a decrease in the provision of mostly original, local news. Note that the amount of local information consumed unambiguously decreased: some newspaper customers stopped reading the newspaper, while those who continued to read received a lower amount of content. We exploit this shift in "news diets" in Section 6, where we analyze whether the lower exposure to local news results in more nationalized local elections.

News services During our time period, newspapers relied on news agencies for their national and international news. In return for the subscription fee, newspapers were allowed to print as many wire stories as they wished. For the time period 1946-1960, we collected annual information on the news services to which each of the newspapers subscribe (i.e. AP, UP, etc.). We have information for 18 different news agencies.[48] However, only the following news services can be considered "of importance" (with on average more than 1% of the newspapers subscribing to them): AP, UP, INS, NANA, CTNYN, NYT, CDN, DJ, NYHT, and RN. Online Appendix Figure B.7 plots the share of the newspapers which subscribe each year to each of these news services. While the vast majority of the newspapers subscribe to at least one news service – only 6% of the newspaper-year in our sample have no subscription to a news service – less than a third of the newspapers subscribe to more than two news services (online Appendix Figure B.8).

In Table 8, we investigate how the number of news services to which the newspapers subscribe varies following the entry of television. In Column (1), we use an ordered probit and report the results for the total number of news services to which the newspaper subscribes: the coefficient estimate is negative but not statistically significant at conventional levels. If

[47] Naturally, an increase in the share of journalists assigned to local news topics is consistent with an increase, a decrease, or no change in the total number of journalists assigned to local news topics (and thus possibly an increase, a decrease, or no change in the number of local news stories). Because we are interested in changes in news diets and consumers' information, we prefer to report our content findings for each category separately.

[48] In alphabetical order, AP, CanP, CDN, CS, CTNYN, DJ, INS, McNS, NANA, NYHT, NYT, ONA, RN, SHNA, TP, TS, UP, and WCN. These are the abbreviations used by Editor & Publisher.

we consider each of the major news services separately (dependent variables in Columns (2) to (7) are indicator variables equal to one if the newspaper subscribes to a given news agency and to zero otherwise), we find a decrease in the probability to subscribe to the AP (Column (2)) as well as to the Dow Jones (Column (7)). Overall, the substitution away from wire services seems limited, which is consistent with our earlier finding whereby newspapers did not react to the introduction of television by significantly reducing their provision of national news.

6 Nationalization of Local Politics

Voters often choose between the same political parties in the various local and national elections they participate in. Many scholars have documented a sharp tendency for local politics to become increasingly "nationalized" (e.g., Jacobson, 2015; Abramowitz and Webster, 2016; Hopkins, 2018).[49] Vote choices become nationalized when *"voters use the same criteria to choose candidates across the federal system"* or *"when voters are engaged with and knowledgeable about national politics to the exclusion of state or local politics"* (Hopkins, 2018, p. 3). As Jacobson (2016) observes: *"Whereas in earlier decades, American voters were open to presidential and congressional candidates from the other political party, fewer and fewer voters are now willing to back out-party candidates."* This trend is not inherently good or bad, but it raises some serious questions about electoral institutions. In particular, the extent to which local politics are nationalized may influence political accountability at the local level. If voters are no longer informed about local politics, local officials' alignment with national politics may matter more than their performance in office.[50,51]

Hopkins (2018) hypothesizes that changes in media market structures are key drivers of these trends. Older media, such as local newspapers, had audiences that were "geographically bounded." These outlets had relatively strong incentives to produce local content. With recent decreases in distributions costs and increased competition from national outlets, voters' attention has drifted away from local content towards national politics (see also Martin and McCrain, 2019).

In the previous sections, we exploited the unique setting provided by the FCC freeze to show that the introduction of television led to a strong shift away from local content, with fewer individuals reading newspapers and with newspapers producing less local content. We thus expect the average voter to have become less informed about local elections and to have

[49] For earlier work shedding light on nationalization trends see also Stokes (1967).

[50] See Mayhew (1974) for a seminal analysis of congressmen and congresswomen activities and election concerns when the nationalization of local politics was relatively limited and local politicians could develop their own "brand". On the behavior of representatives in the US electoral system, see also Cain et al. (1990).

[51] A growing nationalization of local politics is also directly related to the debate about polarization, with voters' opinions and behaviors increasingly predicted by the party they support during presidential elections.

	Ordered probit	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Number of News Services	AP	UP/INS	NANA	CTNYN	NYT	DJ
TV	-0.111	-0.018*	0.004	-0.000	-0.004	-0.005	-0.014***
	(0.079)	(0.010)	(0.014)	(0.005)	(0.006)	(0.003)	(0.005)
Year & News FEs	X	X	X	X	X	X	X
ME	All	All	All	All	All	All	All
R-sq		0.84	0.76	0.71	0.65	0.74	0.44
Observations	13,297	13,297	13,297	13,297	13,297	13,297	13,297
Clusters (TVStation)	197	197	197	197	197	197	197

Table 8: Subscription to news services

Notes: * p<0.10, ** p<0.05, *** p<0.01. The time period is 1946-1960. An observation is a newspaper-year. Models are estimated using OLS estimations in Columns (2) to (7) and an ordered probit in Column (1). Standard errors are clustered at the closest TV station level. All specifications include city population and the number of newspapers circulating as a control, and year and newspaper fixed effects. In Columns (2) to (7) the dependent variables are indicator variables equal to one if the newspaper subscribes to the given news service (e.g. AP in Column (2)), and to zero otherwise.

relied more on her national election preferences to determine her vote.[52]

6.1 Empirical Approach

To test Hopkins (2018)'s hypothesis, we use county-level voting returns for House, Senatorial, and Presidential elections for the period 1936-1964.[53] For both types of congressional elections, we investigate whether their congruence with Presidential elections increased for those counties that were exposed earlier to television. We restrict our attention to on-cycle elections (as opposed to mid-term elections). The advantage of this approach is that turnout, voters, and information are presumably the same across both congressional and Presidential elections.

We develop a measure of congruence between congressional and Presidential elections. First, for each election, we compute the share of votes for the Democratic candidate. Online Appendix Figure B.10 provides summary statistics on this variable. Second, for each local election, we compute the difference between this share and the corresponding share at the Presidential election in the same electoral year (in absolute terms).

Our empirical specification is the same as before (equation (6)), except that the observations are at the level of county. We first make sure that our difference-in-differences approach is valid. As in Section 4.1, we follow de Chaisemartin and D'Haultfœuille (2020) and compute the long-difference placebos for our congruence measures. Doing so allows us to test whether the treated and the control groups follow parallel trends prior to entry. Reassuringly, online Appendix Figure B.11 shows that the common trends hold over several periods. Our vector of controls includes the log of the county population, the share of Blacks, the share of urban population, and the share of foreigners. We also control for county and year fixed effects. As before, we only focus on the counties exposed to the freeze.

Because the analysis in this part is at the county level, we use a grid approach to approximate the share of the county covered by TV: our TV explanatory variable is not a binary variable as in the previous two sections. We compute for each year the share of the county that is covered by a signal of quality Grade B using a grid of points. Hence, the TV variable here is this share which varies between zero and one. As in the rest of the analysis, our main specification uses as a sample all counties that were impacted by newly active television broadcasts starting just before and just after the freeze, which took place from September 30,

[52] This logic can easily be formalized. Suppose voters participate in a local and in a national election. Suppose also that candidates from the same two parties are running in both elections and that a candidate's relative quality depends additively on the quality of her party as well as her intrinsic quality. Suppose finally that voters observe one signal per election, where each signal conveys information about the sum of the party's relative quality and the candidate's relative intrinsic quality. Voters optimally use both signals in both elections. Moreover, if the precision of the signal associated to the local election decreases, voters rely increasingly on the signal associated to the national election and the likelihood that a voter votes for the same party in both election increases.

[53] Unfortunately, the voting data is not available at the news market nor at the city level. See Key (1966) for a canonical study of voters' behavior in presidential elections in the 1936-1960 period.

1948 until April 14, 1952. We designate this sample as the set of "freeze" counties. Because the treatment variable in this analysis is continuous, the sample of freeze counties is sensitive not only to the dates used to define the window but also to the threshold we specify above which a county is considered to be treated.

One challenge we face is that populations are not uniformly distributed and we do not observe within-counties' spatial distributions of population. Thus, a given share of a county's surface treated by television may not translate into the same share of that counties' voters treated by television. As a result, if we specify a very low threshold, we risk including many false positives. By contrast, if we specify a very high threshold, we risk including relatively few false positives but may run into power issues. In Table 9, we report our preferred specification, with thresholds of 60% and 70% of the county's area receiving a Grade B signal. Figure D.3 in the Online Appendix reports our estimated coefficient of interest for all possible thresholds between 0% and 100% in steps of 5%. Last, because our measure of congruence can be equal to zero, we report the results of the estimation both with the dependent variable in level and with the inverse hyperbolic sine transformation of congruence.[54]

6.2 Results

Table 9 presents the results of the empirical estimation. In Columns (1) to (4), we report the results with the 60% threshold, and in Columns (5) to (8) with the 70% one. As hypothesized, we find a negative and statistically significant decrease in the difference between the local and the national votes following the introduction of television. Regarding the magnitude of the effects, we find that TV penetration led to a decrease by around 2 percentage points in the absolute difference in the relative vote share for Democrats between the House of Representatives and the Presidential elections (Column 1), i.e. roughly 12% of a standard deviation. In other words, in the median county where the absolute vote difference is equal to 6.8 percentage points, an increase by one standard deviation, i.e. by 0.36, in TV penetration – e.g. from 0 to 36% of the county covered –, leads to a change in the vote difference from 6.8 to 6.06 percentage points, a 11% decrease. The magnitude of the effect is of the same order for the Senate elections but not statistically significant in most specifications. In Figure D.3 in the Online Appendix, we show that our coefficient estimate are robust to using various thresholds to construct the sample of freeze counties.

Conceivably, the sharper results for House elections may be due to the fact that local newspapers' coverage was likely more important for House than Senatorial elections. Because senators represent larger geographical areas than congressmen and congresswomen (and thus multiple newspaper markets), wire agencies to which newspapers subscribed were more likely to offer coverage. By contrast, producing information on House elections was likely not

[54] A log transformation would indeed truncate the zero observations.

economical for wire agencies and thus depended more directly on local newspapers' original reporting. Finally, note that Gentzkow (2006) shows that the introduction of television did not reduce turnout for congressional elections that coincided with presidential years. This observation makes it more likely that changes in information (as opposed to changes in the composition of voter turnout) led to increased nationalization of local elections.

Moskowitz (2021), following Snyder and Strömberg (2010), exploits geographical mismatches between media markets and electoral areas as sources of variation in voters' knowledge about local politics. Using individual survey data, he finds that higher exposure to local news increases (i) voters' knowledge about local officials and (ii) voters' probability of casting a split president-local official ticket vote in the 2012 and 2016 elections. Our analysis complements his in important ways. We focus on a time period that predates rising nationalization trends and during which split-ticket voting was relatively frequent (see e.g., Hopkins, 2018). This appears clearly in online Appendix Figure B.12 where we plot the evolution of the absolute difference in the relative vote share for the Democrats between the Presidential elections and the House elections during our period of interest. In contrast to Moskowitz (2021)'s preference-externality argument, we exploit exogenous timing in the entry of a national news media outlet as a source of variation in news diets. Despite the distinct underlying mechanisms and time periods, our results line up remarkably. Taken together, they constitute strong evidence that shifts in news diets away from local content are a key driver of the nationalization of local politics.

7 Robustness Checks

Finally, we perform a number of additional robustness checks. This section briefly describes them; the detailed results for these tests are available in the online Appendix (Section D).

Changing the size of the window to define the "freeze" period In our preferred empirical strategy, we have focused on all the newspaper markets affected by television between 1947 and 1953. Online Appendix Figure D.1 shows that our results are robust to using different windows around the freeze. Each sub-figure reports the $\sigma\cdot$ coefficient associated with the TV indicator variable in the different specifications depending on the number of months we use to define the window. For example, if one considers the subscription price (sub-Figure D.1a for all newspapers and D.1b for evening newspapers), it appears clearly that whether our "freeze" sample is defined using simply 8 months before and 8 months after the freeze, or 20 months before and 20 months after, the entry of television has led to a statistically significant decrease in the subscription price. From an empirical point of view, there is a clear trade-off in the choice of the optimal window: the smaller the window, the more similar the

	60% coverage				70% coverage			
	(1) House (level)	(2) House (IHS)	(3) Senate (level)	(4) Senate (IHS)	(5) House (level)	(6) House (IHS)	(7) Senate (level)	(8) Senate (IHS)
TV	-2.01**	-0.02**	-1.98*	-0.02*	-1.85**	-0.02**	-1.38	-0.01
	(0.86)	(0.01)	(1.07)	(0.01)	(0.90)	(0.01)	(1.13)	(0.01)
Year & County FEs	X	X	X	X	X	X	X	X
R-sq	0.49	0.50	0.50	0.51	0.49	0.50	0.51	0.51
R-sq (within)	0.02	0.02	0.00	0.00	0.02	0.02	0.00	0.00
Observations	10,041	10,041	6,717	6,717	8,737	8,737	5,846	5,846
Mean DepVar	13.57	0.13	10.83	0.11	13.37	0.13	10.66	0.10
Sd DepVar	17.31	0.16	14.94	0.14	17.05	0.16	14.65	0.14

Table 9: Absolute difference in the vote share for the Democrats between "Local" and Presidential Elections: Difference-in-Differences analysis

Notes: * p<0.10, ** p<0.05, *** p<0.01. The time period is 1932-1964 and an year is a Presidential election year. Models are estimated using OLS. Standard errors are clustered at the county level and observations are at the year-county level. The dependent variable is the absolute difference in the relative vote share for the Democrats between the Presidential elections and the House of Representative elections in Columns (1), (2), (5) and (6), and between the Presidential elections and the Senate elections in Columns (3), (4), (7), and (8). In the odd columns, the dependent variable is the level of the absolute vote difference (in percentage points). In even columns, we report the results when using the inverse hyperbolic sine transformation. All specifications include the logarithm of the county population, the share of Blacks, the share of urban population, and the share of foreigners as controls, and year and county fixed effects.

news markets, but the lower the number of observations (as illustrated in the online Appendix Figure D.2) and so the lower the statistical power for the empirical estimations.

Further, in the online Appendix Tables D.3 and D.4, we perform a similar analysis as before but this time we include all the newspapers in our sample, effectively allowing for an unlimited window around the "freeze." Hence, we now have a larger number of observations (around 29,000 compared to around 21,000). The main qualitative results remain unchanged, but we note many quantitative differences from using the entire sample.

Next, we similarly investigate what happens in terms of content when we include all the newspapers for which we have collected content in our sample (i.e. 159 newspapers rather than 102 when we focus on freeze evening newspapers). Online Appendix Table D.5 reports the results. We see that the results of the manual content analysis are not affected if we do so. The negative coefficient on the number of photos is now negative and statistically significant.

Considering "all day" newspapers as evening newspapers As noted in Section 2.3, 11% of the newspapers in our sample are "all day" newspapers, i.e. newspapers circulating both in the morning and in the evening. In the main specification, we do not consider these newspapers as evening newspapers (nor as morning) when we consider evening and morning newspapers separately to investigate the heterogeneity of the effects. As an additional robustness check, we verify that our results regarding evening newspapers are not driven by this exclusion, i.e. we consider the "all day" newspapers as evening newspapers. Online Appendix Table D.6 presents the results. The magnitude and statistical significance of the results for subscription price and circulation are unaffected, as well as for advertising price. When we do so, the decrease in the quantity of national advertising is no longer statistically significant, however. This is not surprising given that newspapers circulating both in the morning and in the evening may face no change or a slight increase in the quantity of national advertising published in their morning editions, therefore mitigating the effect observed for the evening ones.

Alternative controls In our preferred empirical specification, we control for city population, an indicator for city population missing, and categorical variables for the number of newspapers in the market. However, the market structure can be considered as a "bad" control in the sense of Angrist and Pischke (2009). Online Appendix Tables D.7 and D.8 present the results of the estimation of equation 6 without the number of newspapers as a control. The results are very similar to those presented in Tables 3 and 4.

Monopoly markets Next, in the only Appendix Tables D.9 and D.10, we verify that our results are robust to including only monopoly newspaper markets (markets with more than one newspaper could in principle have reacted differently to the introduction of television,

since they were more competitive to begin with). Our findings are robust to reducing our sample to monopoly newspaper markets; if anything, the magnitude of the effects on the advertising side is slightly larger, while there are no differences on the reader side. This also holds for the content analysis: our main findings are not affected either quantitatively nor qualitatively when focusing on monopoly newspaper markets (Table D.11).

Next, we adopt a less conservative approach and define as monopoly all those markets that have at most one newspaper per frequency (i.e., markets with one morning newspaper, markets with one evening newspaper, and markets with one morning newspaper and one evening newspaper). These represent 89.39% of all newspaper markets in the entire dataset (and 89.50% in the freeze dataset). Online Appendix Tables D.12 and D.13 show that our results are also robust to restricting our attention to these markets.[55]

Timing of television entry Finally, we show that our results are robust to using the Grade A signal contours – rather than the Grade B as in our preferred specification – to define the area in which a television signal could be received using the FCC's TV signal propagation tools (see Section 2.3 for details). Online Appendix Table D.14 and D.15 present the results respectively for readership and advertising. Despite the different number of observations, our findings are robust to this alternative definition of the TV signal.

Finally, online Appendix Table D.16 shows that the content results are also unaffected when we use Grade A rather than Grade B.

8 Conclusion

The introduction of a new media technology affects both incumbent media outlets and the news individuals are exposed to. Some individuals switch to the new media technology and incumbent media outlets also adjust their content in response to the new competitive landscape. The existing literature has documented that the advent of television in the 1940s and 1950s and, more recently, that of the Internet have led to a crowding out of local political information. The decline of local news provision may in turn affect local government policies and political accountability (Snyder and Strömberg, 2010).

In this paper, we highlight two different channels through which the entry of a new technology may impact news consumption. First, we find that the entry of television led to a drop in newspapers' circulation and advertising revenues, as consumers and advertisers substituted away. Second, we show that the entry of television led to an adjustment in newspapers' content. In particular, newspapers reacted to the introduction of television by printing fewer

[55] Note that we do not replicate our findings for the remaining roughly 10% of markets because there are too few observations.

local news stories. As a result, it is clear the news diets of individuals – both those who continued to read newspapers and those who started watching television exclusively – changed significantly as a result of the technological innovation. We show that television also led to a decrease in ticket splitting in elections, which is consistent with the idea that individuals have less local information to inform their voting decisions. This change in news diets may have other important consequences regarding the quality of the democratic debate and of government accountability given that local newspapers – even today – are still playing an important role in holding local governments accountable.[56]

Epilogue This paper has focused on a historical setting. However, entry on different dimensions of the television bundle have occurred in the intervening years: cable sports channels, Craigslist, and the Internet have introduced competition to sports news, classified ads, weather news, horoscopes, etc. We therefore sought to examine the newspapers whose historical content we had analyzed to see what they looked like today. Of the 102 newspapers whose content we analyzed, 10 were still operating in print format with full issues available online as of 2017. We repeated our manual content coding for these 10 newspapers, by focusing on an arbitrary date: Tuesday the 7th of March 2017. Our findings are simple: the average total number of stories was 95, compared to an average of 152 during the historical era we studied (for the same 10 newspapers), a drop of 37.5%. Moreover, we found that the content was 50 original local news (53% of all articles), compared to 86 (57%) during the historical era, which represents a large decrease in the amount of original reporting in the newspaper. While only anecdotal, this suggests that the predictions of our theory model have been borne out, as entry along singular dimensions of content has weakened the value of bundling to the newspaper, leading to a reduction in all types of content, especially local news. Online Appendix Figure B.9 shows the cover of the Altoona Mirror for Tuesday, March 7, 2017.

[56] Consistently, Gao et al. (2020) have shown that municipal borrowing costs increase by 5 to 11 basis points in the long run following a newspaper closure. Their data cover the 1996-2015 period, suggesting that the Internet is not providing adequate substitutes for local journalism.

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A Theory Appendix

A.1 Perfect Positive Correlation

We solve the version of the model in which readers and advertisers' valuations for the local news and national news products are perfectly positively correlated. Reader i enjoys gross payoff $q_{I,k} + \frac{1}{2}(1-u_i)$ per-product $k = L, N$ when reading I's bundle. Reader i's total payoff from consuming I's bundle is thus equal to $\sum_{k\in\{L,N\}} q_{I,k} + (1-u_i) - p_I^R$. Similarly, reader i's payoff from consuming E's national news product is equal to $q_{E,N} + \frac{1}{2}(1-u_i) - p_E^R$. Similarly, advertiser j enjoys payoff $2 \times \frac{1}{2}\left(\beta d_I^R + 1 - v_j\right) - p_I^A$ when placing an ad in I's bundle, where $\frac{1}{2}\left(\beta d_I^R + 1 - v_j\right)$ represents the per-product k payoff and $\beta > 0$ the importance attached to readership. Further, advertiser j's payoff from placing an ad in E's product is equal to $\frac{1}{2}\beta d_E^R + \frac{1}{2}(1-v_j) - p_E^A$. The setting is otherwise identical to that described in Section 3.

Monopoly. I chooses $\left(q_{I,L}, q_{I,N}, p_I^A, p_I^R\right)$ to maximize its profits:

$$\begin{aligned}\pi_I^M &= p_I^R d_I^R\left(q_{I,L}, q_{I,N}, p_I^R\right) + p_I^A d_I^A\left(q_{I,L}, q_{I,N}, p_I^R, p_I^A\right) - \sum_{k\in\{L,N\}} F\left(q_{I,k}\right) \qquad (7)\\ &= p_I^R\left(1 + q_{I,L} + q_{I,N} - p_I^R\right) + p_I^A\left(1 + \beta\left(1 + q_{I,L} + q_{I,N} - p_I^R\right) - p_I^A\right) - \sum_{k\in\{L,N\}} F\left(q_{I,k}\right).\end{aligned}$$

The next lemma states the solution. Its proof follows.

Lemma 4 *Take $(q_{I,L}, q_{I,N})$ as given. The incumbent finds it optimal to set:*

$$p_I^R = \frac{2 - \beta(1+\beta) + \left(2-\beta^2\right)\sum_{k\in\{L,N\}} q_{I,k}}{4-\beta^2}, \quad p_I^A = \frac{2 + \beta + \beta\sum_{k\in\{L,N\}} q_{I,k}}{4-\beta^2}, \qquad (8)$$

and its revenues are equal to:

$$\pi_I^M = \frac{1}{4-\beta^2}\left((2+\beta)\left(1 + \sum_{k\in\{L,N\}} q_{I,k}\right) + \left(\sum_{k\in\{L,N\}} q_{I,k}\right)^2\right). \qquad (9)$$

Finally, the incumbent sets $(q_{I,L}, q_{I,N}) = (\overline{q}, \overline{q})$ if $F \leq \tilde{F}^M \equiv \frac{(2+\beta)\triangle q + 2\left(\overline{q}^2 - \underline{q}^2\right)}{4-\beta^2}$ and otherwise $(q_{I,L}, q_{I,N}) = \left(\underline{q}, \underline{q}\right)$.

Producing more news raises revenues through two channels. First, it raises readers' demand for the bundle, and thus also the number of advertisers willing to place ads in it. Second, it allows I to charge higher prices on both sides of the market. Notice that I chooses the same quantity of local and national news. This symmetry occurs because the two products exhibit complementarities, so that raising one product's quantity makes it more profitable to raise

the other's. Finally, notice also that I's incentives to produce content are increasing in the weight advertisers put on the size of the readership, captured by β.[57]

Proof of Lemma 4 Condition $\beta < 1$ ensures objective function (7) is strictly concave in $\left(p_I^R, p_I^A\right)$. Differentiating (7) with respect to p_I^R and p_I^A, setting both first-order derivatives equal to zero, and solving the resulting system of equations for $\left(p_I^R, p_I^A\right)$ yields the expressions stated in Lemma 4. Last, setting $(q_L, q_N) = (\overline{q}, \overline{q})$ yields higher profits than $(q_L, q_N) = \left(\underline{q}, \underline{q}\right)$ if and only if $F \leq \tilde{F}_1 \equiv \frac{(2+\beta)\triangle q + 2\left(\overline{q}^2 - \underline{q}^2\right)}{4-\beta^2}$. Similarly, setting $(q_L, q_N) = (\overline{q}, \overline{q})$ yields higher profits than $(q_L, q_N) = \left(\underline{q}, \overline{q}\right), \left(\overline{q}, \underline{q}\right)$ if and only if $F \leq \tilde{F}_2 \equiv \frac{(2+\beta)\triangle q + 3\overline{q}^2 - 2\underline{q}\overline{q} - \underline{q}^2}{4-\beta^2}$. Finally, setting $(q_L, q_N) = \left(\underline{q}, \overline{q}\right), \left(\overline{q}, \underline{q}\right)$ yields higher profits than $(q_L, q_N) = \left(\underline{q}, \underline{q}\right)$ if and only if $F \leq \tilde{F}_3 \equiv \frac{(2+\beta)\triangle q + \overline{q}^2 + 2\underline{q}\overline{q} - 3\underline{q}^2}{4-\beta^2}$. Further, $\overline{q} > \underline{q}$ implies that $\tilde{F}_3 < \tilde{F}_1 < \tilde{F}_2$. It follows that setting $(q_L, q_N) = (\overline{q}, \overline{q})$ (resp. $(q_L, q_N) = \left(\underline{q}, \underline{q}\right)$) when $F \leq \tilde{F}_1$ (resp. $F > \tilde{F}_1$) is optimal. Threshold $\tilde{F}_1$ is labeled as '$\tilde{F}^M$' in Lemma 4. ■

Duopoly To compute demand functions, we characterize the readers and advertisers who are indifferent between the two outlets. The marginal reader $\tilde{u}$ is given by:

$$\begin{aligned} \sum_{k \in \{L,N\}} q_{I,k} + 1 - \tilde{u} - p_I^R = q_{E,N} + \frac{1}{2}(1 - \tilde{u}) - p_E^R \quad \Rightarrow \\ d_I^R\left(p_I^R, p_E^R, q_{I,L}, q_{I,N}\right) = \tilde{u} = 2\left(\frac{1}{2} + \sum_{k \in \{L,N\}} q_{I,k} - q_{E,N} + p_E^R - p_I^R\right). \end{aligned} \tag{10}$$

Similarly, the marginal advertiser is found using condition:

$$\begin{aligned} \beta d_I^R + 1 - \tilde{v} - p_I^A = \frac{1}{2}\beta\left(1 - d_I^R\right) + \frac{1}{2}(1 - \tilde{v}) - p_E^A \quad \Rightarrow \\ d_I^A\left(p_I^A, p_E^A, d_I^R\right) = \tilde{v} = 2\left(\frac{1}{2} + \beta\left(\frac{3}{2}d_I^R - \frac{1}{2}\right) + p_E^A - p_I^A\right). \end{aligned} \tag{11}$$

Both demand functions are identical to those derived in the perfect negative correlation case. The solution to I's problem is thus described in Lemma 3 (proven in Appendix A.2). The next proposition corresponds to Proposition 1 for the case of perfect positive correlation.

Proposition 3 *Suppose consumers' valuations for the local and national news products are perfectly positively correlated. In the equilibrium of the duopoly game, the incumbent (i) produces a weakly lower amount of local and national news $q_{I,L}$ and $q_{I,N}$ and (ii) charges lower reader and advertising prices compared to the equilibrium of the monopoly game.*

[57] Lemma E.1 in Online Appendix E.1 shows that bundling is only weakly optimal when valuations are perfectly positively correlated. Because all consumers value the local and national news products identically, I is unable to reduce the per-product dispersion in consumers' valuations through bundling. I's pricing problem is thus unchanged by the bundling of local and national news, and so are its incentives to produce content.

Proof of Proposition 3 Using Lemma 2 and Lemma 4, I charges lower reader prices under duopoly than monopoly if and only if the following inequality holds:

$$\begin{aligned} &\frac{2-\beta\left(1+\beta\right)+\left(2-\beta^{2}\right)\sum_{k\in\{L,N\}}q_{I,k}}{4-\beta^{2}} \\ &\geq\frac{2+9\beta^{3}-5\beta-5\beta^{2}+2\left(1-3\beta^{2}\right)\left(\sum_{k\in\{L,N\}}q_{I,k}-q_{E,N}\right)}{6\left(1-2\beta^{2}\right)}. \end{aligned} \tag{12}$$

Anticipating the fact that I chooses weakly lower values of $(q_{I,L},q_{I,N})$ under duopoly than monopoly (see below), inequality (12) is verified because both (i) $\frac{2-\beta(1+\beta)}{4-\beta^{2}}>\frac{2+9\beta^{3}-5\beta-5\beta^{2}}{6(1-2\beta^{2})}$ and (ii) $\frac{2-\beta^{2}}{4-\beta^{2}}>\frac{1\left(1-3\beta^{2}\right)}{3(1-2\beta^{2})}$ hold when $\beta\leq\frac{1}{5}$. Similarly, I charges lower advertising prices under duopoly than monopoly if and only if:

$$\frac{2+\beta+\beta\sum_{k\in\{L,N\}}q_{I,k}}{4-\beta^{2}}\geq\frac{2+\beta-3\beta^{2}+2\beta\left(\sum_{k\in\{L,N\}}q_{I,k}-q_{E,N}\right)}{6\left(1-2\beta^{2}\right)}. \tag{13}$$

Again anticipating the fact that I chooses weakly lower values of $(q_{I,L},q_{I,N})$ under duopoly than monopoly, conditions $\sum_{k\in\{L,N\}}q_{I,k}-q_{E,N}\in\left(\frac{1}{2}\left(-2-\beta+2\beta^{2}\right),\frac{1}{2}\left(1-\beta-4\beta^{2}\right)\right)$ and $\beta\leq\frac{1}{5}$ ensure that inequality (13) always holds.

Finally, I chooses a weakly lower value of $(q_{I,L},q_{I,N})$ under duopoly if and only if:

$$\tilde{F}^{M}=\frac{\left(2+\beta\right)\triangle q+2\left(\overline{q}^{2}-\underline{q}^{2}\right)}{4-\beta^{2}}>\tilde{F}^{D}=\frac{\left(4-3\beta^{2}\right)\Delta q+4\left(\overline{q}^{2}-\underline{q}^{2}-q_{E,N}\Delta q\right)}{9\left(1-2\beta^{2}\right)}. \tag{14}$$

Inequality (14) always holds because (i) $\frac{2+\beta}{4-\beta^{2}}>\frac{4-3\beta^{2}}{9(1-2\beta^{2})}$ and (ii) $\frac{2}{4-\beta^{2}}>\frac{4}{9(1-2\beta^{2})}$ when $\beta\leq\frac{1}{5}$.

A.2 Proofs of Lemma 2 and Lemma 3

We begin by stating the expressions for the thresholds listed in Lemma 2 and below:

$$\begin{aligned} \gamma_{I}&=2+9\beta^{3}-5\beta-5\beta^{2}, & \mu_{E}&=1-\beta-3\beta^{2}, \\ \gamma_{E}&=1+12\beta^{3}-4\beta-4\beta^{2}, & \kappa_{I}&=\frac{1}{2}\left(8+9\beta^{3}-14\beta^{2}-4\beta\right), \\ \mu_{I}&=2+\beta-3\beta^{2}, & \kappa_{E}&=\frac{1}{2}\left(2+18\beta^{3}-2\beta^{2}-7\beta\right). \end{aligned}$$

Condition $\beta\leq\frac{1}{5}$ ensures these thresholds are positive. Also, E's equilibrium prices are:

$$p_E^R = \frac{\gamma_E + 2\left(1-3\beta^2\right)\left(q_{E,N} - \sum_{k\in\{L,N\}} q_{I,k}\right)}{6\left(1-2\beta^2\right)}, \tag{15}$$

$$p_E^A = \frac{\mu_E + 2\beta\left(q_{E,N} - \sum_{k\in\{L,N\}} q_{I,k}\right)}{6\left(1-2\beta^2\right)}, \tag{16}$$

where $\gamma_E, \mu_E > 0$.

Further, E's profits are equal to:

$$\pi_E^M = \frac{\kappa_E + \left(2-3\beta-6\beta^2\right)\left(q_{E,N} - q_{I,L} - q_{I,N}\right) + 2\left(q_{E,N} - q_{I,L} - q_{I,N}\right)^2}{9\left(1-2\beta^2\right)}. \tag{17}$$

Conditions $\beta \leq \frac{1}{5}$ and $\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N} \in \left(\frac{1}{2}\left(-2-\beta+2\beta^2\right), \frac{1}{2}\left(1-\beta-4\beta^2\right)\right)$ ensure that $\pi_E^M > 0$, that is, that entry by E is rational.

Condition $\beta \leq \frac{1}{5}$ also ensures that both media outlets' objective functions are strictly concave in prices. Differentiating I's profit function with respect to p_I^R and p_I^A, differentiating E's profit function with respect to p_E^R and p_E^A, setting all four first-order derivatives equal to zero, and solving the resulting system of equations for $\left(p_I^R, p_I^A, p_E^R, p_E^A\right)$ yields the expressions stated in Lemma 2 as well as expressions (3), (16), and (17).

Finally, one verifies that $\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N} \in \left(\frac{1}{2}\left(-2-\beta+2\beta^2\right), \frac{1}{2}\left(1-\beta-4\beta^2\right)\right)$ and $\beta \leq \frac{1}{5}$ ensure that:

$$\begin{aligned} d_I^R &= \frac{2+\beta-2\beta^2+2\left(\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N}\right)}{3-6\beta^2} \in (0,1), \\ d_I^A &= \frac{2+\beta-3\beta^2+2\beta\left(\sum_{k\in\{L,N\}} q_{I,k} - q_{E,N}\right)}{3-6\beta^2} \in (0,1). \end{aligned} \tag{18}$$

The proof for the derivation of $\tilde{F}^D$ (Lemma 3) is almost identical to that for $\tilde{F}^M$ provided above in the proof of Lemma 4 (using expression (4) instead of (9)).

A.3 Proofs of Proposition 1 and Corollary 2

Comparing the expressions stated in Lemma 4 and Lemma 1, one shows – using condition $\overline{q} \leq \frac{1}{4}(2+\beta)(1-\beta)$ – that I charges higher advertising and reader prices in the case of perfectly negative correlation compared to the case of perfectly positive correlation (under monopoly). Given Proposition 3, it follows that I charges higher prices under monopoly than duopoly also in the perfectly negative correlation case. Finally, we prove the statement whereby I chooses a weakly lower value of $(q_{I,L}, q_{I,N})$ under duopoly than monopoly. Lemma E.2 establishes that $\triangle q$ is higher than the left-hand side of (14). It follows that I's incentives

to produce content are higher under monopoly than duopoly also in the case of perfect negative correlation. It also follows from Lemma E.2 that the difference between $\tilde{F}^M$ and $\tilde{F}^D$ is in fact higher in the case of perfect negative correlation, thereby establishing Corollary 2.