



HAL
open science

Media Competition and News Diets

Charles Angelucci, Julia Cage, Michael Sinkinson

► **To cite this version:**

Charles Angelucci, Julia Cage, Michael Sinkinson. Media Competition and News Diets. 2020. hal-03393063

HAL Id: hal-03393063

<https://sciencespo.hal.science/hal-03393063>

Preprint submitted on 21 Oct 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

NBER WORKING PAPER SERIES

MEDIA COMPETITION AND NEWS DIETS

Charles Angelucci
Julia Cagé
Michael Sinkinson

Working Paper 26782
<http://www.nber.org/papers/w26782>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA

The authors would like to acknowledge the valuable advice and suggestions provided by seminar audiences at the Berlin Applied Micro Seminar, Columbia University, the FCC, Imperial College, Harvard/MIT joint IO Workshop, INSEAD, London Business School, London School of Economics, the University of Mannheim, Microsoft, the NYC Media Workshop, Stanford University, the Toulouse School of Economics, the Universitat de Barcelona, and Wharton. We are also grateful to conference participants at the 19th CEPR-JIE Applied IO Conference, the HEC Montreal-CIRANO-RIIB Conference on Industrial Organization, the Petralia Workshop 2017, the 15th Annual Media Economics Workshop, the IAST Workshop on Information, Communication, and Knowledge in Historical Perspective, the 4th Rome Junior Conference on Applied Microeconomics, and the Social & Political Economics Conference at John Hopkins. This paper particularly benefited from discussions with Clement de Chaisemartin, Ruben Enikolopov, Lisa George, Doh-Shin Jeon, Sarah Laval, Simone Meraglia, Andrea Prat, Jonah Rockoff, and Ekaterina Zhuravskaya. We thank Luca Bassem Abdul Hay, Matteo Di Bernardo, Paul Berthe, Shelley Han, Jameson Lee, Ondre Padgett, Timothy Rickert, Arjuna Sakae Anday, and Rachel Tosney for excellent research assistance, and Yannick Guyonvarch for his precious help with the didmultipleGT analysis. We are particularly grateful to Jett Pettus for outstanding research support. Julia Cagé thanks the French National Research Agency (ANR) for funding (reference: ANR-17-CE26-0004-01), and the Sciences Po's Scientific advisory board (SAB). All errors remain our own. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2020 by Charles Angelucci, Julia Cagé, and Michael Sinkinson. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

Media Competition and News Diets
Charles Angelucci, Julia Cagé, and Michael Sinkinson
NBER Working Paper No. 26782
February 2020
JEL No. D4,L11,L15,M37,N72

ABSTRACT

News media operate in two-sided markets, offering bundles of content to readers as well as selling readers' attention to advertisers. Technological innovations in content delivery, such as the advent of broadcast television or of the Internet, affect both sides of the market, threatening the basic economic model of print news operations. We examine how the entry of television affected local newspapers as well as consumer media diets in the United States. We develop a model of print media and show that entry of national television news could adversely affect the provision of local news. We construct a novel dataset of U.S. newspapers' economic performance and content choices from 1944 to 1964. Our empirical strategy exploits quasi-random variation in the timing of the entry of television in different markets. We show that the entry of television was a negative shock for newspapers, particularly evening newspapers, in both the readership and advertising markets. Further, we find a drop in the total quantity of news printed, in particular original reporting, raising concerns about the provision of local news.

Charles Angelucci
Economics Division
Columbia Business School
3022 Broadway, Uris 602
New York, NY 10027
ca2630@columbia.edu

Michael Sinkinson
Yale School of Management
165 Whitney Ave, Suite 3473
New Haven, CT 06511
and NBER
michael.sinkinson@yale.edu

Julia Cagé
Sciences Po Paris
28 Rue des Saints-Pères
75007 Paris
France
julia.cage@sciencespo.fr

A data appendix is available at <http://www.nber.org/data-appendix/w26782>

1 Introduction

News media operate in two-sided markets where they attempt to attract consumers with their content offerings while also selling their consumers' attention to advertisers. In print media, the traditional economic model of a local newspaper was to bundle diverse types of content, such as local news, national news, weather, and sports, into a single product to sell to consumers. Over the past several decades, technological innovations such as television and the Internet have challenged this approach. In particular, there has been a fall in distribution costs and a proliferation of media outlets catering to specific types of content traditionally included in local media bundles: sports channels, classifieds websites, and national cable news channels. These new media outlets have affected both how information is produced (Cagé et al., 2019) 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, when they do not simply go out of business, which raises concerns about the provision and consumption of local information.

In this paper, we investigate the issue of competition between local newspapers and a new media technology on market outcomes such as prices and quantities in the readership and advertising markets, but also on the content of the newspaper itself. We use historical data to examine how the entry of television affected local newspapers and media consumption in the United States from 1944 to 1964. Our approach exploits an exogenous pause – the so-called FCC “freeze” – in the licensing of new television stations that meant that otherwise similar newspapers in different markets were exposed to the entry of television at different times.

The introduction of television affected both sides of the newspaper market and, in principle, television and print media could be complements or substitutes on either the readership or advertising market. Technological constraints at the time meant that television stations offered mostly *national* news and general programming, while providing some local entertainment programming. As a result, the entry of television represented an increase in competition for a newspaper's supply of national news stories – typically wire stories – and only an indirect shock to their production of local news. We exploit this feature to analyze how local newspapers adjusted their provision of both local and national news.

Inspired by the literature on two-sided markets and on bundling, we develop a model of newspaper content choice and pricing that centers on this idea of the newspaper as a bundle. In practice, the newspaper bundle elements included sports, weather, entertainment, classified ads, and more, although we will focus on the local and national news elements. In our model, an incumbent media outlet chooses how much of each element of the bundle to include in the product 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 introduction of television 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, due mostly 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. In addition, a typical television market covered several newspaper markets, offering a large set of treatment and control print news markets. This allows 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 103 newspapers that had full issues available from an online archive. We code the content of these newspapers for the third Tuesday of March and the third Thursday of September for each year from 1946 to 1955. We manually measure on each page the quantity of news (categorized by type) versus advertising, photos, and editorials, noting any content that is 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 drop in the circulation of local newspapers: the entry of television is associated with a 2.8% decrease in circulation and a 2.4% decrease in subscription price. These effects are concentrated among evening newspapers, which were the majority of newspapers at the time and which faced fiercer competition from TV. This

¹The 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.

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 1.6% decrease in newspaper advertising rates and to a 3.1% decrease in 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. The effects are again heterogeneous, with evening newspapers seeing a decrease in national advertising lineage of 5.0%, while morning newspapers were unaffected. We confirm these results with a variety of matching estimators and robustness checks.

Finally, we investigate the extent to which the entry of television affected newspaper content, and in particular the provision of local news. This is of particular interest given that – both historically and today – local newspapers are some of the most important providers of local journalism. The outcome is ex-ante uncertain: one possibility is that newspapers could have shifted their focus to more local coverage in an effort to differentiate from television and soften competition. Another possibility – in line with the model we develop – is that the loss of readership and advertising revenues that followed the introduction of television decreased newspapers’ incentives to provide all types of content.

We find that following the entry of television, there is a decrease in the total number of stories published, and of original content. The decrease in the number of stories is driven by a drop in the number of all types of stories, local and national. We examine subscriptions to news services and indeed find that the entry of television caused newspapers to subscribe to fewer wire services, consistent with the idea that national wire stories were of less value. To validate our manually categorized results, we analyze the machine learning data and find that newspapers exposed early to television print fewer pages and less content than those exogenously exposed to television at a later time. This decrease in supply across multiple types of content in response to increased competition along a single dimension of the newspaper bundle raises concerns about the provision and consumption of local information as new media outlets enter.

As an anecdote, we return at the very end of this paper to 10 of the newspapers whose content we analyze to see what these products look like today, when every aspect of the newspaper bundle now faces competition from specialized outlets. Consistent with our model, newspapers today contain little of the historic elements of the bundle that sustained the print news media for over a century.

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 1,965 newspapers, 1,538 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.² We also believe we are the first to use machine-learning techniques to classify the news page into article content versus non-article content. 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 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 clear 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).³ In addition to competing for advertising revenues, the 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 through which 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 now 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 newspaper companies can be profitable by providing local journalism only is an open question of policy relevance.

Literature review An important and growing strand of literature has highlighted how changes in the market for news affect political outcomes (Snyder and Stromberg, 2010; Gentzkow et al., 2011; Drago et al., 2014; Cagé, 2019). 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. The Internet also affected local government policies. Local news is key to both political participation and government accountability at the local level (see e.g., Stromberg (2004) on turnout in U.S. gubernatorial elections and Ferraz and

²There 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., 2016). Cagé et al. (2019) investigate the quantity of news produced online, but only for one year (2013).

³Chandra and Kaiser (2014) show, however, that in the case of magazines, competition from the Internet has a positive effect on the value of targeted advertising in print media.

Finan (2008) on corruption in Brazil), but the expansion of national media into local news markets may affect their provision (George and Waldfogel, 2006).⁴

Consistently, 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, we show 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.

Newspapers in our sample overwhelmingly engage in bundling, by selling national wire news alongside local news.⁵ The prevalence of this practice hints at significant benefits, and the literature indeed offers a variety of rationales. Bundling allows companies to exploit complementarities in consumption 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).⁶ 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. The extent to which bundling is key to newspapers' ability to produce local journalism remains an open question, and one contribution of our paper is to bring this policy issue to the fore.

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),⁷ as well as its empirical strand (e.g., Rysman, 2004; Jin and

⁴See also Martin and McCrain (2019), who show that ownership matters for the content of local news.

⁵Third-party content also included sports, entertainment, weather, and financial information.

⁶For 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).

⁷A strand of this literature has modeled media markets specifically (e.g., Gabszewicz et al., 2001, 2004; Gal-Or and Dukes, 2003; Strömberg, 2004; Anderson and Coate, 2005; Armstrong and Wright, 2007; Peitz and Valletti, 2008; Crampes et al., 2009; Esther Gal-Or et al., 2012).

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.⁸ More recently, Angelucci and Cagé (2019) exploited the introduction of advertising on French television to show that newspapers responded to lower advertising revenues by decreasing their production of content. By contrast, this paper looks at the consequences of the introduction of television in the U.S., which constituted a direct shock to both the reader and advertising sides of the daily newspaper market.⁹

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), as well as the relationship between market structure and content quality (e.g., Gentzkow et al., 2006; Berry and Waldfogel, 2010; Petrova, 2011).¹⁰ In the daily newspaper market, George (2007) finds that greater market concentration leads to more content variety. The closest paper to ours is Fan (2013), which looks at the provision of total content (the “news hole”), among other newspaper characteristics, in the context of a simulated merger of newspapers. 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.¹¹

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. We show that television had a heterogeneous impact: it only decreased the quantity of national (but not local) advertising and negatively affected evening newspapers. In Section 5, we perform a content analysis and investigate how newspapers adjusted their editorial choices after the entry of television. In Section 6, we perform a number of robustness checks. Section 7 concludes and discusses an epilogue case study of the current status of 10 of the papers in our analysis.

⁸Shiller et al. (2017) show that the use of ad blocking leads to a decrease in the quality of websites.

⁹Moreover, unlike Angelucci and Cagé (2019), we investigate how newspapers modified their bundle of content when faced with increased competition.

¹⁰Further, de Corniere and Sarvary (2018) build a model to look at the impact of social media on newspapers’ choice of quality. See also Esfahani and Jeon (2016) on news aggregators and newspaper quality.

¹¹Also, unlike George (2007) and Fan (2013), who mostly rely on newspaper reporters’ topic assignments, we measure content variety by analyzing the stories newspapers choose to print. 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.

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).¹² Newspapers were common even in very small towns (Gentzkow et al., 2011; McChesney and Nichols, 2010). One particular characteristic to note is that the majority of daily newspapers in this era produced 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 newspapers, or even morning newspapers, which entailed larger fixed costs to operate.

Newspapers were widely circulated and constituted the primary source of news to most individuals before the introduction of television. In particular, they represented a relatively more important source of news than radio for U.S. citizens of the time.¹³ While the very large majority of the American households had radios at the time of the entry of television, the broadcasting content of radio was mainly devoted to general entertainment (Lazarsfeld, 1940).¹⁴ Furthermore, newspapers covered a much wider range of topics than radio news programs (Lazarsfeld, 1940).

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.¹⁵ 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).¹⁶ The news television stations provided had a strong national

¹²In 1956, advertising revenues represented 70% of newspapers’ total revenues. Newspapers are still primarily ad-supported in the U.S. nowadays, 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.

¹³The 1952 “American National Election” provides information on media use: 79% of participants reported reading about the 1952 campaign in newspapers (21% did not), but only 70% of them reported hearing about the campaign on radio. In the 1956 Election Study, the share of people who respectively read (listened) about the campaign in newspapers (on radio) were 68% (45%).

¹⁴Lazarsfeld (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 the listening audience, however.

¹⁵Television 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).

¹⁶The 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

focus. Moreover, most local and network programming was live as videotape recording had not yet been invented (Sterling and Head, 1994).¹⁷ 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 so as to devote resources to the war effort. In 1945, the FCC decided to resume television licensing and by July 1946, it had issued twenty-four new licenses (Barnouw, 1990). The post-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.¹⁸ 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 (Sterling and Head, 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,

limit the importance of network programming (see e.g. Prior, 2007).

¹⁷On local live entertainment programs, see Koenig (2018).

¹⁸Much 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>.

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 the public thought of television as the most trustworthy and also their main source of news (Sterling and Head, 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 the main advertisers, together with General Motors Corp., Colgate-Palmolive Co., General Foods Corp. and Lever Bros. Co., all 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).¹⁹

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 1,965 newspapers, 1,538 news markets and 32,296 newspaper-years for the period 1944-1964, as well as all television stations in the United States. For our content analysis, we use scanned archives from newspapers.com and newspaperarchive.com for 103 local newspapers from the time period 1946-1955.

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*.²⁰ 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.²¹ 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).

Second, we digitize and merge information on annual newspaper-level advertising quantity (lineage) from the *Editor & Publisher Annual Lineage Supplement*. The information is avail-

¹⁹Note however that overall, in absolute terms, the advertising volume in newspapers continued to grow during this period.

²⁰We use the 1945 to 1965 yearbooks, which cover the years 1944 to 1964.

²¹An “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. City Editor Publisher | Editor Managing Editor City Editor | Editorial Page 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. Press. Man. Mach. Supt. |
|--|---|------------------------------------|--|--|--|---|---|--|--|---|
| ALABAMA | | | | | | | | | | |
| ANNISTON..... | Star | | | Consolidated Pub. Co. H. M. Ayers, Pres.- Pub. | H. M. Ayers (e) Willard Oulbush (assoc. ed) Geo. Long (asst. ed) Taylor Smith (ms) Cody Hall (cs) | | A. E. McCants (ne) Paul Cox (sp) | Ralph W. Callahan (bm) Arthur Phillips (cm) | R. W. Callahan (ad-mgr) Lyon Critchton (ram) Lola Bright (cam) | Lou Devine (ms) |
| BERMINGHAM..... | Post-Herald (2) 457,639-ABC-CZ | | (D) (AP, SEN, 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) Floy 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 (mgs) Arthur Cook (ram) Ray E. Faherty (cam) | Bernard Field, Jr. (m. appn) W. R. Calhoun (prod. mgr.) |
| | News (e) @ 179,956 Combined daily (me) @ 289,587 .66 Flat News (S) @ 219,339 .60 Flat | | (D) (AP, NANA) (NS) | Birmingham News Co. Clarence B. Hanson, Jr., Pres.-Pub. Smith Co. | Charles A. Fell (ed-in-eh) James H. Cooney (SU) McClain Van der Veer (e) E. L. Holland (asso. ed) Vincent Townsend (ms) James E. Cooney, Jr. (asst. ms) | Turner Jordan (ne-N) (ed-in-eh) James H. Cooney (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..... | Daily 19,971 21,923-ABC-CZ Sundays edition 25,397-ABC Par. 28 (S) @ 12,945 .09 | | Flat (D) (AP) (66d, 106S, 25c-odd \$1.55 mo) (Wallace Witmer Co.) | Tenn Valley Ptg. Co., Inc. Barrett C. Shelton, Pres.-Pub. | Barrett Shelton (e-esp) Vincent Townsend (ms) James H. Cooney, Jr. (asst. ms) | Philip Kyle (sp) Fannie Richardson (we) | Barrett C. Shelton (gm- bm) H. M. Layman (cm) | W. S. Finch (ad-ram) Mrs. Elizabeth Sandlin (mgs) Frank Hood (cam) | | H. M. Saffley (ms) |
| DOTHAN..... | Eagle 21,584 21,614-ABC-CZ Sundays edition 21,151-ABC Par. 28 (S) @ 22,734 .13 | | Flat (D) (AP, UP) (66d, 106S, 30c-odd \$1.55 mo) (Wallace Witmer Co.) | The Eagle Pub. Co..... Horne Hall (esp) | Nat C. Faulk (exec. e) Horne Hall (esp) L. P. Patterson (ms) | Doug A. Bradford (sp) .. Mrs. Lois Hall (we) | J. T. Lane, Jr. (bm) Miri Crosby (cm) | Wallace Miller (mgs- ad) Shelley L. Thomas (ram) Gene Bowers (cam) | | W. Ralph Sanders (prod. mgr.) Wallace Miller (gm) Gordon Willis (ms) |
| FLORENCE-SHEP- FIELD-TUSCUMBIA- MUSCLE SHOALS..... | Times 23,879—Florence (e) 10,767—Sheffield 4,034—Tusculmbia 1,997—Muscle Comb. (e) 43,722-ABC-CZ Times (S) @ 9,181 Flat Tri-Cities Daily (S) @ 2,987 Flat | | Flat (D) (AP) (3) (95, 106S, 40c, \$1.75 mo) (Wallace Wit- mer Co.) | Tri-Cities Pub. Co..... J. L. Meeks, Jr., Pub. e-me) | Louis A. Eckl (esp- e-me) | Ben Knight (e- T&CD) Ray Hildebrooks (sp-T& CD) Neil Chesney (we-T) Doe H. Nathan (we- TCD) | L. H. Baker (gm-bm)..... Hunter Allen (cm-T) Charles Brown (cm- TCD) | Francis Howard (mgs) D. H. Bowling (ram) Paul Matheny (cam) | | Francis Howard (gm) Francis Howard (spn) |

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

Figure 1: Newspaper Raw Data: Illustration

able 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).

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. There are 103 such newspapers (online Appendix Table C.1 presents summary statistics for these newspapers). We code the content of these newspapers for the third Tuesday of March and the third Thursday of September for each year.

More precisely, for each issue, we first extract the number of pages. Then to estimate



Issue content score:
159.78

Notes: The Figure shows an example of using Matlab image processing features to determine a content score (roughly what percent of pixels are used to display news text content). The example here is an entire issue of *Altoona Mirror*, March 10, 1947.

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

Table 1: Summary Statistics for Market Outcomes

| | 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 | 1.9 | 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 |
| 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 |

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.

Summary Statistics Table 1 provides descriptive statistics on the newspaper markets for both 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, but 97,887 for morning newspapers.²⁴ The subscription price of evening newspapers was slightly lower compared to 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 several different types of content that we measure. One interesting fact from this is that of the “news” content (original and wire stories) in a typical issue, approximately 64% was original over the time horizon we examine. On average, newspapers were 19.6 pages long.

²⁴A 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.

Table 2: Summary Statistics for Newspaper Content

| (a) Manual Coding | | | | | | |
|------------------------|-------|--------|------|--------|-------|-------|
| | Mean | St.Dev | P25 | Median | P75 | Obs |
| Total Text Stories | 152.3 | 73.0 | 98.0 | 139.0 | 199.0 | 1,829 |
| National Wire Stories | 31.1 | 20.4 | 16.0 | 27.0 | 41.0 | 1,829 |
| Local Original Stories | 81.2 | 48.1 | 47.0 | 69.0 | 105.0 | 1,829 |
| Photos | 13.7 | 11.4 | 5.0 | 10.0 | 18.0 | 1,829 |
| Editorials | 9.9 | 9.3 | 4.0 | 8.0 | 13.0 | 1,829 |

| (b) Machine Learning Approach | | | | | | |
|-------------------------------|-------|--------|------|--------|-------|-------|
| | Mean | St.Dev | P25 | Median | P75 | Obs |
| Number of Pages | 19.6 | 13.1 | 10.0 | 16.0 | 24.0 | 1,040 |
| Content Score | 134.5 | 108.7 | 40.8 | 120.9 | 197.7 | 1,040 |

Notes: The table provides summary statistics. An observation is a newspaper-date. The time period is 1946-1955. There are a total of 103 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. “Stories” 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 the Matlab’s image processing analysis.

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*). For each television station, the Factbook provides information on the precise location of the broadcasting tower (latitude and longitude), the tower’s height (meters above average terrain), the tower’s channel, and the broadcast power of the tower (kW). This data has been collected since the advent of television.²⁵ From this, we are able to construct the “Grade B” signal contours that define the area in which a television signal could be received using the FCC’s TV signal propagation tools. The average radius of a television station’s signal reach is 76.54km, with a median of 75.18km and a standard deviation of 28.26km. We assign a newspaper to be treated by a television station if the centroid of the newspaper market falls within this “Grade B” reception contour. We follow the FCC’s guidelines on computing “Grade B” contours based on the channel of the station since VHF waves in different bands (channels 2-6 vs 7-13) propagate differently.

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

²⁵The 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.

WALA-TV
Mobile
(Ch. 10)

Grantee (STA): Pape Television Co. Inc., 210 Government St. Spanish Port.

Studio: 210 Government St. **Transmitter:** Baldwin County, near Spanish Port.

Telephone: Hemlock 3-2756. **TWX No.:** MO 185.

Technical Facilities: Channel No. 10 (192-198 mc). Authorized power: 316-kw visual, 190-kw aural. Antenna: 635-ft. above av. terrain, 573-ft. above ground, 732-ft. above sea level, lat. 30° 29' 33", long. 87° 53' 53". CP for 620-ft. above av. terrain, lat. 30° 29' 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 Trel.

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. H. 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 Bcastg. 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 Bcastg. 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).

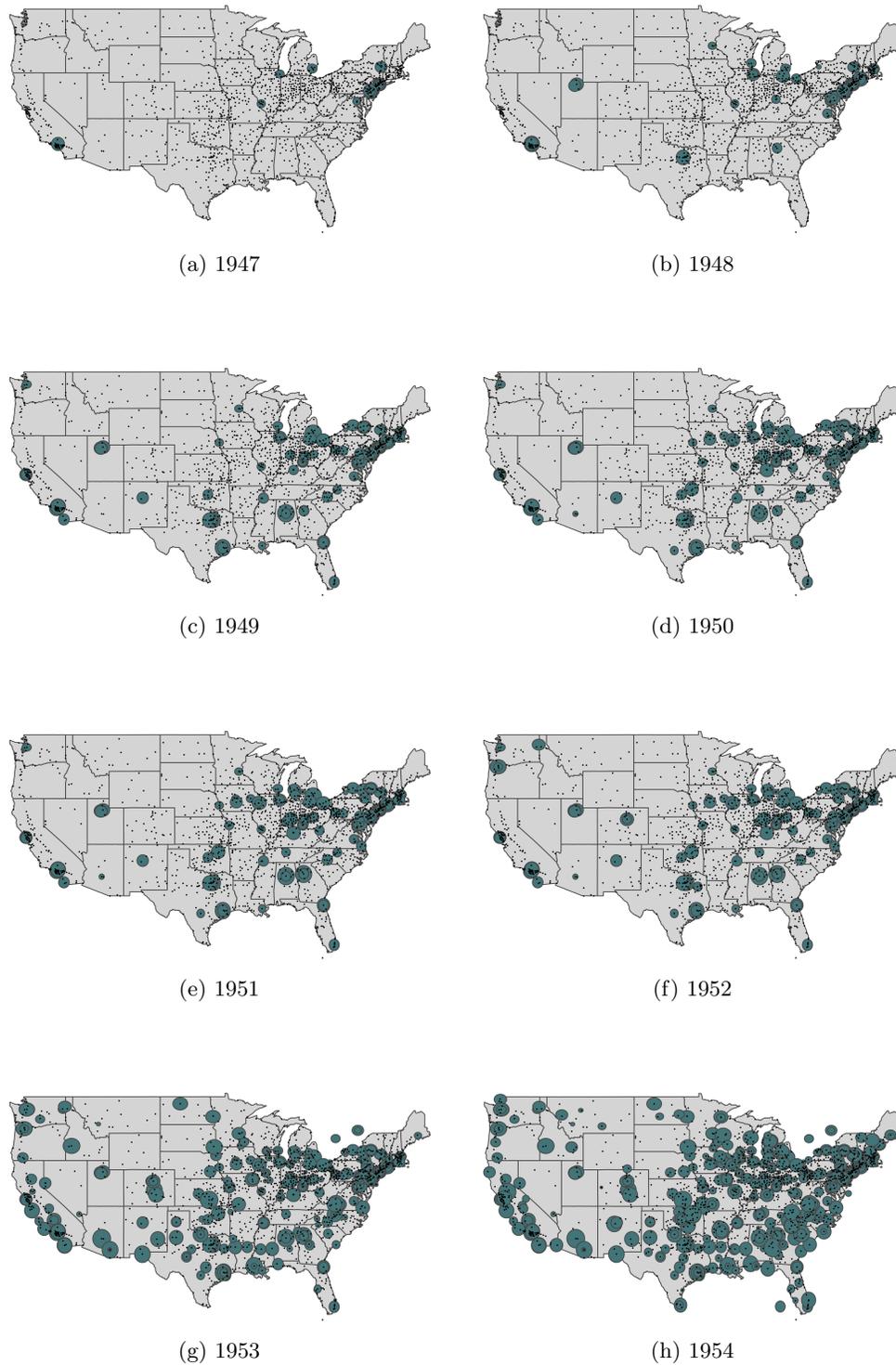
Figure 4: Television Raw Data: Illustration

to be licensed prior to the “freeze”, while WALA was licensed afterwards. To visualize the roll-out of television, Figure 5 shows maps for 1947-1954 that plot signal reception contours for active TV stations (active prior to September 1st of each year) as well as newspaper markets. 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. These figures also show that the reception areas were large, covering multiple newspaper markets.

Other data We use the newspaper market population data from Gentzkow et al. (2011), which is imputed for non-census years. We also use county-level data from the 1950 U.S. census in our matching analysis.

3 Model of Newspaper Content Choices

Virtually all newspapers in our sample engage in bundling, by selling original local news alongside wire national news and various other types of content. The prevalence of this practice hints at significant benefits for newspapers. To rationalize our main empirical findings, we develop a model in which an incumbent media outlet chooses how much local and national news



Notes: Each television broadcast tower is represented by a circle once it is active. Circles show the reception area based on 47 dBu , 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.

Figure 5: Timing of Television Entry, 1947-1954

to include in its bundle, as well as which prices to charge in the readership and advertising markets. We show that the entry of a pure national news media outlet 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.

3.1 Setting

There are two media outlets – an incumbent ($z = I$) and an entrant ($z = E$) – and two products – local news ($k = L$) and national news ($k = N$). I produces a quantity $q_{I,L} \in \{\underline{q}, \bar{q}\}$ of local news and a quantity $q_{I,N} \in \{\underline{q}, \bar{q}\}$ of national news, where $\Delta q \equiv \bar{q} - \underline{q} \geq 0$. I incurs a fixed cost $F(q_{I,k})$ to provide $q_{I,k}$ stories – e.g., it must hire journalists or subscribe to a news agency – where $F(\underline{q}) = 0 \leq F(\bar{q}) = F$. In contrast, E specializes in national news by supplying an exogenous amount $q_{E,N}$.²⁶ Both media outlets sell their content to readers at zero marginal cost.²⁷ I sells its products as a bundle: readers can purchase local and national news in a single transaction, but cannot make separate purchases. In addition, media outlets 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 $u_i \sim U[0, 1]$. Readers’ tastes for local and national news are either perfectly positively correlated or perfectly negatively correlated. In the positive correlation case, reader i enjoys gross payoff $q_{I,k} + \frac{1}{2}(1 - u_i)$ per-product $k = L, N$ when reading I ’s bundle. In the negative correlation case, reader i instead enjoys gross payoffs $q_{I,L} + \frac{1}{2}(1 - u_i)$ and $q_{I,N} + \frac{1}{2}u_i$ from local and national news, respectively. Reader i ’s total payoff from consuming I ’s bundle is thus equal to $\sum_{k \in \{L, N\}} q_{I,k} + (1 - u_i) - p_I^R$ in the positive correlation case and $\sum_{k \in \{L, N\}} q_{I,k} + \frac{1}{2} - p_I^R$ in the negative correlation case. Similarly, reader i ’s payoff from consuming E ’s national news product is equal to either $q_{E,N} + \frac{1}{2}(1 - u_i) - p_E^R$ or $q_{E,N} + \frac{1}{2}u_i - p_E^R$, depending on the correlation in readers’ tastes for local and national news.²⁸ Finally, we suppose readers can purchase from one media outlet at most and set their outside option equal to zero.

²⁶Below we discuss the fact that our findings would not be affected if we relax the exogeneity assumption.

²⁷For simplicity we refer to consumers of content as ‘readers,’ although incumbent and entrant may well rely on distinct media technologies (e.g., TV and print newspapers).

²⁸Notice that readers’ valuations for I and E ’s national news products are always perfectly positively correlated (i.e., independently of the correlation in readers’ valuations for local and national news). This feature will imply a vertical differentiation setting in the reader side of the duopoly case. Notice also that reader preferences are independent of advertising. This choice is made for simplicity.

Advertisers The setup of advertisers mostly mirrors that of readers. Advertisers place ads that readers are exposed to. There exists a mass 1 of advertisers, each of whom has a valuation for reader attention determined by $v_j \sim U[0, 1]$. Advertisers' valuations for readers' attention across the local and national news products are either perfectly positively or perfectly negatively correlated. Let d_z^R denote media outlet z 's readership. In the positive correlation case, advertiser j enjoys payoff $2 \times \frac{1}{2} (\beta d_I^R + 1 - v_j) - p_I^A$ when placing an ad in I 's bundle, where $\frac{1}{2} (\beta d_I^R + 1 - v_j)$ represents the per-product k payoff and $\beta > 0$ the importance attached to readership.²⁹ In the negative correlation case, advertiser j instead enjoys payoff $2 \times \frac{1}{2} \beta d_I^R + \frac{1}{2} (1 - v_j) + \frac{1}{2} v_j - p_I^A = \beta d_I^R + \frac{1}{2} - p_I^A$. Similarly, advertiser j 's payoff from placing an ad in E 's product is equal to either $\frac{1}{2} \beta d_E^R + \frac{1}{2} (1 - v_j) - p_E^A$ or $\frac{1}{2} \beta d_E^R + \frac{1}{2} v_j - p_E^A$, depending on the correlation in valuations.³⁰ We suppose advertisers can place ads with one outlet at most and set their outside option to zero. Finally, we let d_z^A denote outlet z 's quantity of ads.

Remarks Consistent with our empirical analysis, we suppose I bundles its local news and national products in both the monopoly and duopoly cases (as opposed to selling them separately).³¹ By distinguishing between the cases of perfect negative and perfect positive correlation, we can turn on and off – albeit in a stark way – the traditional justification for bundling the literature has focused on (i.e., price discrimination). This, in turn, allows us to isolate the distinct consequences of bundling regarding the effects of E 's entry in the market for national news on I 's provision of national and local news.³²

3.2 Monopoly

We first suppose I is a monopolist on both sides of the local news and national news markets. We impose $\beta < 1$ and $\bar{q} \leq \frac{1}{4} (2 + \beta) (1 - \beta)$ to ensure that $0 < d_I^A(\cdot), d_I^R(\cdot) \leq 1$ in equilibrium.

Case 1. Suppose that the valuations attached to the local and national news products are perfectly positively correlated on both sides of the market. I chooses $(q_{I,L}, q_{I,N}, p_I^A, p_I^R)$ to

²⁹We thus assume that advertising exhibits constant returns across products, that is, 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).

³⁰As for readers, advertisers' valuations for I and E 's national products are perfectly positively correlated. This feature will imply a vertical differentiation setting in the advertising market of the duopoly case.

³¹Bundling is optimal when I enjoys a monopoly in the both the local news and national news markets (see Online Appendix E.1 and E.2). Bundling may or may not be optimal following E 's entry in the market for national news. Sufficient conditions ensuring the optimality of bundling are provided in Footnote 37.

³²We consider the two extreme cases of perfect correlation – as opposed to, for instance, the case of independent valuations – for simplicity.

maximize its profits:

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

The next lemma states the solution. Its proof can be found in Appendix A.1.

Lemma 1 (Positive Correlation) *Take $(q_{I,L}, q_{I,N})$ as given. The incumbent finds it optimal to set:*

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

and its revenues are equal to:

$$\pi_I^M = \frac{1}{4 - \beta^2} \left((2 + \beta) \left(1 + \sum_{k \in \{L, N\}} q_{I,k} \right) + \left(\sum_{k \in \{L, N\}} q_{I,k} \right)^2 \right). \quad (3)$$

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

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.³³ 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 . In line with the literature, 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. As a result, I 's pricing problem is unchanged by the bundling of local and national news, and so are its incentives to produce content.

Case 2. Suppose now that the valuations attached to the local and national news products are perfectly negatively correlated on both sides of the market. In this setting, all readers'

³³For mathematical simplicity, we focus on preferences which are linear in q_k . This choice leads to I 's profits being increasing and convex in q . This feature would create difficulties if q_k were a continuous variable, in which case one would have to modify the model to incorporate either diminishing marginal utility from reading stories and/or convex costs of producing stories.

valuations for the bundle are homogeneous, and so are all advertisers'. As a result, I is able to serve all consumers and extract the entire consumer surplus on both sides of the market. The next lemma states the solution to I 's problem.

Lemma 2 (Negative Correlation) *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 $(q_{I,L}, q_{I,N}) = (\bar{q}, \bar{q})$ if $F \leq \tilde{F}^M \equiv \Delta q$ and otherwise $(q_{I,L}, q_{I,N}) = (\underline{q}, \underline{q})$.*

Raising one product's quantity increases reader surplus by an amount equal to Δq . Because I serves all readers and extracts the entirety of reader surplus, it thus sets $q_{I,k} = \bar{q}$ if and only if $F \leq \tilde{F}^M = \Delta q$. Further, in line with the existing literature, Lemma E.2 in Online Appendix E.2 shows that bundling is strictly optimal when valuations are perfectly negatively correlated. This strict optimality follows from I 's ability to drastically reduce the per-product dispersion in consumers' valuations, which, in turn, allows for the whole consumer surplus to be extracted. Lemma E.2 also shows that bundling has a quality-enhancing effect; that is, that bundling leads I to produce weakly more content. This positive effect follows directly from I 's ability to capture the full "social" returns to investing in content (i.e., Δq).³⁴ Below, we build on this insight to argue that entry in the market for national news has a particularly negative impact on I 's content offering when bundling is optimal under monopoly.

3.3 Entry

Suppose E enters the market for national news. I chooses its content $(q_{I,L}, q_{I,N})$ in a first stage – these choices are publicly observable – and I and E set their prices (p_z^R, p_z^A) simultaneously in a second stage. As before, we take it as given that I engages in bundling. Further, we focus on market 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 $\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \in (\frac{1}{2}(-2 - \beta + 2\beta^2), \frac{1}{2}(1 - \beta - 4\beta^2))$; that is, we impose bounds on the superiority in content any media outlet can achieve relative to its rival. Finally, we also impose $\beta < \frac{1}{5}$, a sufficient condition to ensure positive profits for both media outlets.³⁵ Notice reader and advertiser preferences for I and E 's national news products are always perfectly positively correlated (see Section 3.1). As a result, our duopoly setting amounts to a vertical

³⁴Our model is special along several dimensions and, therefore, we do not claim bundling to be quality-enhancing in all circumstances. In fact, our own model exhibits one force – dominated by that described underneath Lemma 2 – working against the positive impact of bundling on content: selling local and national news jointly makes the reader and advertiser demand functions *less* sensitive to content.

³⁵These 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 $\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \in \left(\frac{5\beta(1+\beta) - 9\beta^3 - 2}{2(1-3\beta^2)}, \frac{1+12\beta^3 - 4\beta(1+\beta)}{2(1-3\beta^2)} \right)$.

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.³⁶

To compute demand functions, we characterize the consumers indifferent between the two outlets. In the case of perfect positive correlation, the marginal reader \tilde{u} is given by:

$$\begin{aligned} \sum_{k \in \{L, N\}} q_{I, k} + 1 - \tilde{u} - p_I^R &= q_{E, N} + \frac{1}{2} (1 - \tilde{u}) - p_E^R \quad \Rightarrow \\ d_I^R(p_I^R, p_E^R, q_{I, L}, q_{I, N}) &= \tilde{u} = 2 \left(\frac{1}{2} + \sum_{k \in \{L, N\}} q_{I, k} - q_{E, N} + p_E^R - p_I^R \right). \end{aligned} \quad (4)$$

The case of perfect negative correlation yields an identical expression for \tilde{u} . Similarly, the marginal advertiser in the case of perfect positive correlation is found using condition:

$$\begin{aligned} \beta d_I^R + 1 - \tilde{v} - p_I^A &= \frac{1}{2} \beta (1 - d_I^R) + \frac{1}{2} (1 - \tilde{v}) - p_E^A \quad \Rightarrow \\ d_I^A(p_I^A, p_E^A, d_I^R) &= \tilde{v} = 2 \left(\frac{1}{2} + \beta \left(\frac{3}{2} d_I^R - \frac{1}{2} \right) + p_E^A - p_I^A \right), \end{aligned} \quad (5)$$

and again the expression for \tilde{v} is identical in the case of perfect negative correlation. Unlike the monopoly setting, therefore, we do not need to distinguish between two separate cases. This equivalence is driven by the vertical differentiation nature of our setting, in which consumers – independently of whether their tastes for local and national news are negatively or positively correlated – 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 $[0, \frac{1}{2}]$ interval.³⁷

In the pricing stage, I chooses (p_I^R, p_I^A) to maximize $\pi_I^D = p_I^R d_I^R(\cdot) + p_I^A d_I^A(\cdot)$. Similarly, E chooses (p_E^R, p_E^A) to maximize $\pi_E^D = p_E^R (1 - d_I^R(\cdot)) + p_E^A (1 - d_I^A(\cdot))$. The next lemma states I ’s solution to the pricing game. 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.

³⁶See Whinston (1990) for a similar reasoning.

³⁷This last observation implies that bundling cannot be optimal because of a price discrimination motive (i.e., to reduce the dispersion in consumers’ valuations). We have just established that, under bundling, the dispersion in consumers’ effective valuations is determined by a random variable uniformly distributed over the $[0, \frac{1}{2}]$ interval. 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 be determined by a random variable uniformly distributed over the $[0, \frac{1}{2}]$ interval. Bundling local and national news, therefore, cannot help I extract greater consumer surplus by reducing the per-product dispersion in valuations. Nevertheless, bundling can constitute an optimal pricing strategy under duopoly 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, for instance, $2q > \frac{2}{5} + \bar{q}$ and $\beta < \frac{1}{10}$. Our results would remain identical if we were to impose these conditions throughout.

Lemma 3 *In the equilibrium of the pricing game, the incumbent finds it optimal to set:*

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

$$p_I^A = \frac{\mu_I + 2\beta \left(\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \right)}{6(1 - 2\beta^2)}, \quad (7)$$

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

$$\pi_I^D = \frac{\kappa_I + (4 - 3\beta^2) (q_{I,L} + q_{I,N} - q_{E,N}) + 2(q_{I,L} + q_{I,N} - q_{E,N})^2}{9(1 - 2\beta^2)}, \quad (8)$$

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. Its proof can be found in Appendix A.2.

Lemma 4 *The incumbent chooses $(q_{I,L}, q_{I,N}) = (\bar{q}, \bar{q})$ if:*

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

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

As in the monopoly case, I chooses the same quantity of local and national news and its incentives to produce content are increasing in advertisers' willingness-to-pay (i.e., \tilde{F}^D is increasing β). Notice also that I 's production of content is decreasing in the entrant's supply of national news (i.e., \tilde{F}^D is decreasing in $q_{E,N}$). 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, 5, and 6.³⁸ Its proof (as well as the proof of Corollary 1 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.*

³⁸The model makes ambiguous predictions regarding the impact of E 's entry on I 's readership and quantity of advertising. 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.

Although models of two-sided markets often predict increases in prices following the entry of a platform, we find that entry in the market for national news puts significant downward pressure on both reader and advertising prices. This effect, in turn, lowers I 's incentives to expand demand by providing greater content, despite the greater sensitivity of the demand functions to content choices. A consequence of bundling local and national news is thus that both products are equally and negatively affected by greater competition.³⁹

Corollary 1 *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.*

In the monopoly case, bundling translates into relatively strong incentives to produce content when the valuations attached to the local and national news products are perfectly negatively correlated. Entry in the market for national news removes I 's ability to use bundling as a price discrimination device regardless of the correlation in consumers' valuations. It follows that E 's entry has a particularly large negative effect on the provision of local news when valuations are perfectly negatively correlated.

Corollary 2 *The difference $\tilde{F}^M - \tilde{F}^D$ is decreasing in (resp. ambiguous with respect to) β when the values attached to the local and national news products are perfectly negatively correlated (resp. perfectly positively correlated).*

Corollary 1 stated that the decline in the incumbent's production of information due to entry in the market for national news was largest when bundling was most profitable under monopoly. Corollary 2 states that higher willingness-to-pay by advertisers softens this negative effect. As a result, the fall in the incumbent's content will be the largest in markets where advertising revenues are relatively low.

To summarize our main findings, 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, as suggested by its widespread use by the newspapers in our data.

We conclude with three remarks. We have assumed identical production technologies for local and national news. However, in our empirical context, producing local news was much more expensive than printing wire national stories. Intuitively, modifying the setting to allow for higher costs of producing local news would lead I to reduce local news by a weakly

³⁹This finding does not depend on our assumption whereby E 's content $q_{E,N}$ is exogenous. In a model in which E chooses how much national news $q_{E,N}$ to supply, expression (9) represents I 's best-reply function. Comparing (9) to \tilde{F}^M yields that I has lower incentives to produce content for any $q_{E,N}$. In other words, in any equilibrium of the duopoly game in which both I and E choose how much news to produce, I has weakly lower incentives to produce content compared to the unique equilibrium of the monopoly game.

greater amount following entry in the market for national news, consistent with our empirical findings. Finally, 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.

4 Empirical Results for Market Outcomes

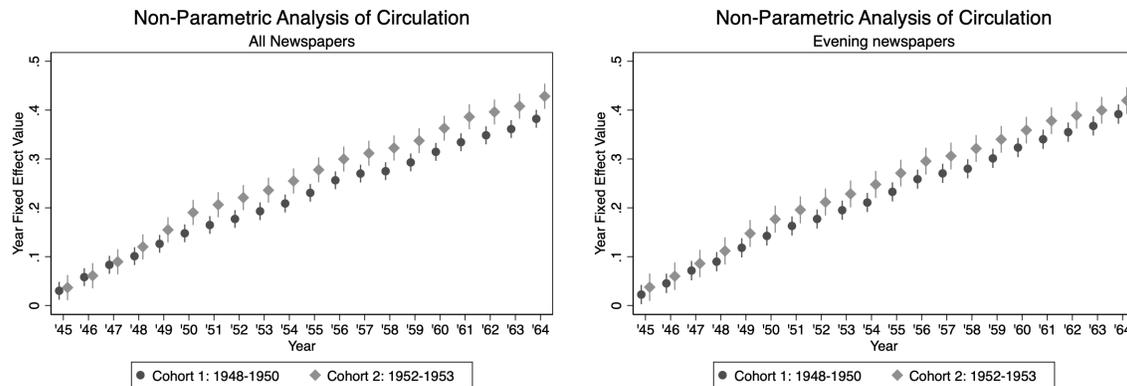
This section examines the effect of the entry of television on prices and quantities in both the readership and advertising markets for newspapers. The primary challenge in identification is that the entry of television was not entirely random. Large markets with more commercial potential were first 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 1950 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. Further, in Section 6.1 we use the time-corrected Wald ratio estimand proposed by de Chaisemartin and D’Haultfoeulle (2018) to take into account heterogeneity in treatment effects. 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 began⁴⁰, 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.

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

⁴⁰Note 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).



Notes: The figure plots the year fixed effects from a two-way fixed effects model (year and newspaper), for two “cohorts” of newspapers: those that saw the entry of television sometime in 1948-1950, and those that saw the entry of television in 1952-1953. The left figure includes all newspapers, while the right figure includes only evening newspapers.

Figure 6: Non-Parametric Evidence from Circulation

entry, e.g. by decreasing 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. Moreover, in the robustness Section 6.1, we allow for flexible time-varying effects of the negative shock due to the entry of television and show that there is no statistically significant impact of the pre-introduction of television time period on our outcomes of interest. Note also that during this time period there was very little cross-ownership of newspapers and broadcast stations.⁴¹ Hence, there were effectively no applicants for a broadcast license that were also local newspaper owners anticipating the effects of their own application.

Furthermore, if we compare non-parametrically how circulation evolved among the “cohort” of newspapers that saw television enter sometime in 1948-1950 and the “cohort” of those that saw television enter in 1952-1953, we find identical trends prior to entry. Figure 6 shows the result we obtain when we regress the log of daily circulation on newspaper and year fixed effects, and plot the year fixed effects separately for the two cohorts. The left panel shows the results for all newspapers, and the right panel only for evening newspapers. We see that this was a time of growth for daily newspapers in the United States. Importantly, in both panels, the trends prior to 1948 seem identical for the two groups. It appears as though the group that is exposed to TV earlier sees a break in the increase in circulation relative to the group that is exposed later.

Our main specifications use as a sample all newspaper markets that were impacted by

⁴¹The 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.

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.⁴² We designate this sample as the set of “freeze” markets. Due 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 directly impacted by the freeze, a regression of the form:

$$y_{it} = \alpha + \sigma \cdot TV_{it} + \mathbf{X}_{it}\beta + \gamma_t + \delta_i + \epsilon_{it} \quad (10)$$

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.⁴³ 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.⁴⁴

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. To do so, 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

⁴²Online 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.

⁴³Given newspaper fixed effects, any other controls would have to vary at the newspaper-year level and so the 1950 census is of little use.

⁴⁴A recent paper (de Chaisemartin and D’Haultfoeuille, 2019) has called into question the validity of estimates from two-way fixed effects models such as ours. The concern is that the estimated treatment effect is a weighted average of heterogeneous effects across the cells of fixed effects, and since some weights may be negative, this could lead to potential bias in the estimates. To address this concern, in Section 6.1 we apply the estimator proposed in that paper (Wald-TC estimates) and also show their recommended diagnostic plots which confirm our results and the validity of our empirical strategy.

Table 3: Readership: Difference-in-Differences Analysis

| | Subscription price | | | Circulation | | |
|----------------------|---------------------|-------------------|---------------------|---------------------|-------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| TV | -0.024** (0.012) | -0.020 (0.022) | -0.025** (0.011) | -0.028** (0.013) | -0.001 (0.014) | -0.030** (0.013) |
| Year & Newspaper FEs | X | X | X | X | X | X |
| Sample | All | Morning | Evening | All | Morning | Evening |
| R-sq | 0.53 | 0.56 | 0.53 | 0.99 | 0.99 | 0.98 |
| R-sq (within) | 0.16 | 0.18 | 0.15 | 0.44 | 0.40 | 0.46 |
| Observations | 21,094 | 4,473 | 16,612 | 21,094 | 4,473 | 16,612 |
| Clusters (TVStation) | 203 | 144 | 191 | 203 | 144 | 191 |

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.

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 leads to 2.4% decrease in the subscription price of newspapers, and to a 2.8% 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. This effect is concentrated among evening newspapers for which we observe a 3% decrease in circulation. Interestingly, morning newspapers see little impact, possibly because there was no news on television in the morning at the time.

Table 4 presents the results for the advertising side of the market. We find a weakly negative effect of television on advertising rates (1.6% decrease), although this seems to be due to 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 at evening newspapers. For those newspapers, we indeed observe a 5% decrease in the amount of national advertising following the introduction of television. We find no impact on local advertising. This is most probably due to the fact that television programming was mostly national during this time period due to the then excessively high cost of producing

original local content. 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. Finally, we obtain a 2.3% decrease in classified ads. Similarly to national advertising, this effect is driven by evening newspapers. However, it is not statistically significant.

The decreases in subscription and advertising prices are consistent with the model developed in Section 3. 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.⁴⁵ Moreover, as we document below, newspapers reacted to the introduction of television by decreasing their news content and number of pages; a decrease in content may also have led to a negative effect on prices.⁴⁶

Taken together, our results suggest that television was a substitute for newspapers in both the advertising and consumer markets. The negative effect of television on newspapers was primarily borne by evening newspapers, which tended to be smaller and more local newspapers, while morning newspapers may have possibly benefited in the short run. The equilibrium implications of this are that either evening monopoly newspapers should have paid an (unknown) fixed cost to switch to a morning format, or we should have seen higher survival rates for morning versus evening newspapers in the later decades. We are unable to provide any evidence of such effects as the empirical strategy in this paper exploits a short term shock, and so we do not have the power to measure effects far beyond the freeze.

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. One convenient fact is that the 1950 U.S. Census occurred during the freeze, and so we are able to use data from that census in matching newspaper markets. We therefore link demographics about a newspaper’s home county to each newspaper.⁴⁷ 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).

⁴⁵Other models of platform competition instead produce ambiguous predictions regarding subscription prices. 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.

⁴⁶See e.g. Angelucci and Cagé (2019) who document a drop in newspapers’ provision of content driven by increased competition for advertisers.

⁴⁷As highlighted above, since we only observe one year’s census, there is no sense in including these controls in the differences-in-differences estimates; newspaper fixed effects account for any variation.

Table 4: Advertising: Difference-in-Differences Analysis

| | Ad Prices | | | Local Advertising | | | National Advertising | | | Classified Advertising | | |
|-----------------------|--------------------|-------------------|--------------------|-------------------|-------------------|-------------------|----------------------|------------------|---------------------|------------------------|------------------|-------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| TV | -0.016* (0.008) | -0.005 (0.019) | -0.015* (0.008) | 0.004 (0.017) | 0.070* (0.041) | -0.003 (0.017) | -0.031 (0.019) | 0.041 (0.051) | -0.050** (0.019) | -0.023 (0.020) | 0.019 (0.054) | -0.022 (0.022) |
| 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 | 0.77 | 0.84 | 0.72 | 0.85 | 0.87 | 0.79 | 0.85 | 0.86 | 0.82 |
| R-sq (within) | 0.36 | 0.25 | 0.40 | 0.19 | 0.25 | 0.19 | 0.32 | 0.30 | 0.33 | 0.23 | 0.18 | 0.24 |
| Observations | 20,130 | 4,283 | 15,838 | 11,113 | 1,631 | 9,474 | 11,095 | 1,618 | 9,469 | 11,049 | 1,612 | 9,429 |
| Clusters (TV/Station) | 202 | 142 | 189 | 196 | 101 | 179 | 196 | 100 | 179 | 196 | 101 | 179 |

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 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

The model developed in Section 3 predicts a decrease in newspapers’ content offering following the introduction of television. According to the model’s logic, competition for readers and advertisers makes bundling less profitable, by limiting newspapers’ ability to extract consumer surplus. This diminished ability to leverage bundling, in turn, decreases newspapers’ incentives to provide content. Consistent with the model, in Section 4 we showed that the introduction of television lowered newspapers’ prices in both the readership and advertising markets. We now investigate whether newspapers adjusted their bundle of content by lowering their provision of local and national news.

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. Given that television news content is mostly national during this time period, one may expect newspapers to devote more space to local content, over which they still enjoy a virtual monopoly.⁴⁸ The introduction of television may also have affected newspaper content through a different channel. Television led to a decrease in newspapers’ revenues on both sides of the market: this reduction in

⁴⁸Similarly, 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.

Table 5: Nearest-Neighbor Matching Estimators

| | Subscription price | | | Circulation | | | Advertising price | | | National Advertising | | |
|--------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------------------|--------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| TV | -0.03*** (0.01) | -0.03*** (0.01) | -0.04*** (0.01) | -0.29*** (0.03) | -0.29*** (0.03) | -0.14*** (0.02) | -0.11*** (0.01) | -0.11*** (0.01) | -0.09*** (0.01) | -0.11*** (0.03) | -0.11*** (0.03) | -0.08*** (0.03) |
| 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 | 28,140 | 28,140 | 22,511 | 28,140 | 28,140 | 22,511 | 26,717 | 26,717 | 21,430 | 16,014 | 16,014 | 13,807 |

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 census: median family income, median schooling, and percent urban. Estimates are bias-adjusted.

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

| | Subscription price | Circulation | Advertising price | National Advertising |
|--------------------------|----------------------|---------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| TV | -0.026*** (0.009) | -0.022** (0.011) | -0.038*** (0.014) | -0.139*** (0.032) |
| Match on Year and Census | X | X | X | X |
| Match on #papers | X | X | X | X |
| Observations | 1,059 | 1,059 | 1,016 | 732 |

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.

Table 7: Total Number of Stories: Negative Binomial Estimation

| | (1) | (2) | (3) | (4) | (5) |
|----------------------|--------------|--------------|------------------|---------|------------|
| | Total | National | Local | | |
| | Text Stories | Wire Stories | Original Stories | Photos | Editorials |
| TV | -0.036* | -0.026 | -0.059** | -0.043 | -0.006 |
| | (0.022) | (0.047) | (0.026) | (0.056) | (0.050) |
| Date & Newspaper FEs | X | X | X | X | X |
| Observations | 1,829 | 1,829 | 1,829 | 1,829 | 1,829 |
| Clusters (TVStation) | 65 | 65 | 65 | 65 | 65 |
| Marginal Effect | -5.46 | -0.81 | -4.81 | -0.58 | -0.06 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The time period is 1946-1955. Models are estimated using a negative binomial estimation. 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.

revenues may make national wire stories more economical for print media. In this case, we should expect a higher reliance on wire stories over original reporting or a higher proportion of pictures on pages given that pictures require a lower investment in journalism.

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 use a negative binomial regression framework with two-way fixed effects for dates and newspapers. Table 7 presents the results we obtain when manually studying the content of the newspapers. Overall, we see a reduction in content, with estimated marginal effects pointing to a 5.46 drop in the total number of stories (Column 1) due to the entry of television. This drop comes from a 0.81 decrease in the number of national wire stories (Column 2), and 4.81 fewer local original stories (Column 3). The drop in the number of local original stories is statistically significant at the 5% level. We find no statistically significant effects on the number of editorials or photos, although point estimates are negative and these make up small parts of the newspaper (as shown earlier in Table 2). Since there were more local original stories than national wire stories in the baseline, these results imply that as a percentage of total stories, local original stories now represent a smaller fraction of the newspaper.

In the online Appendix Table D.1, we show that these results are robust to using our matching estimator. As with the negative binomial, we find a statistically significant decrease in the total number of stories and the number of local original stories; furthermore, the coefficient for the number of national wire stories is statistically significant at the 10% level.

Table 8: Number of Pages and Machine-Learning Content Score

(a) **Difference-in-differences approach**

| | Number of pages | | | Content score |
|----------------------|---------------------|--------------------|---------------------|-------------------|
| | (1) | (2) | (3) | (4) |
| TV | -0.224** (0.093) | -0.258* (0.157) | -0.049** (0.019) | -0.032 (0.052) |
| Date & Newspaper FEs | X | X | X | X |
| Empirical model | Ordered probit | Ordered logit | OLS (log) | OLS (log) |
| Observations | 1,040 | 1,040 | 1,040 | 1,040 |
| Clusters (TVStation) | 39 | 39 | 39 | 39 |

(b) **Nearest-neighbor matching estimators**

| | Number of pages | | Content score | |
|--------------------------|----------------------|----------------------|---------------------|--------------------|
| | (1) | (2) | (3) | (4) |
| TV | -7.712*** (2.688) | -7.057*** (2.679) | -18.966* (9.813) | -10.811 (9.702) |
| Match on Year and Census | X | X | X | X |
| Match on #papers | | X | | X |
| Sample | All | All | All | All |
| Observations | 1,040 | 1,040 | 1,040 | 1,040 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The time period is 1946-1955. An observation is a newspaper-date. Standard errors are clustered at the television station level. In the upper Table 8a, we perform a difference-in-differences analysis. The 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. The bottom Table 8b reports the results of the nearest-neighbor matching estimation. The specifications match on year (exact), city population, and from the 1950 census: median family income, median schooling, and percent urban. Estimates are bias-adjusted.

Table 8 presents the results for the number of pages and the machine-learning content score measure. The upper Table 8a shows the results we obtain when using the difference-in-differences approach. In Columns (1) to (3), we show that the introduction of television is associated with a decrease in the total number of pages published by the newspaper; the result is robust to the use of different empirical specifications and is statistically significant at the 5% level. We also obtain a 3.2% decrease in the content score. While this drop is not statistically significant here, we do obtain a statistically significant decrease both in the number of pages and in the content score when we perform the matching analysis (see the lower panel of Table 8b). Overall, these additional findings confirm that the introduction of television is associated with a significant drop in total text content in a newspaper.

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 new competition on only a single dimension – national news – and yet we see a decrease in the provision of all types of news, and in particular, original, local news. Note that the amount of local information consumed in a market unambiguously decreased: some newspaper customers stopped reading the newspaper, while those who continued to read received a lower amount of content. This shift in “news diets” away from local information raises concerns about political engagement, community engagement, and the viability of the local newspaper in the “watchdog” role in politics.

News services We documented a drop in newspapers’ provision of national news. During our time period, most newspapers relied on news agencies for their national 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.⁴⁹ 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 9, 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 number of news services to which the newspaper subscribes: we see that this number decreases following the entry of television. If we consider each of the 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 that the decrease in news service subscriptions mainly comes from a decline in the probability to subscribe to NYT (Column (6)) as well as to DJ (Column (7)). Anecdotally, those were seen as more expensive subscriptions, although pricing of the subscriptions at the time was complex.

Overall, the decreased reliance on wire agencies is consistent with our earlier finding whereby newspapers printed fewer national news following the introduction of television.

⁴⁹In 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.

Table 9: Subscription to news services

| | Ordered probit | | | | | | |
|-------------------------|---------------------|-------------------|-------------------|------------------|-------------------|--------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Number of News Services | AP | UP/INS | NANA | CTNYN | NYT | DJ | |
| main | | | | | | | |
| TV | -0.143** (0.072) | -0.000 (0.009) | -0.014 (0.012) | 0.003 (0.005) | -0.006 (0.005) | -0.004* (0.002) | -0.016*** (0.004) |
| Year & News FEs | X | X | X | X | X | X | X |
| ME | All | All | All | All | All | All | All |
| R-sq | 14,675 | 14,625 | 14,625 | 14,625 | 14,625 | 14,625 | 14,625 |
| Observations | 203 | 203 | 203 | 203 | 203 | 203 | 203 |
| Clusters (TVStation) | | | | | | | |

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. 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. "Number of NS" stands for the number of news services to which the newspaper subscribes. 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 (4)), and to zero otherwise.

6 Robustness Checks

6.1 Heterogeneity in Treatment Effects

Recent research has questioned the validity of staggered differences-in-differences analyses. In particular, it has been noted that in such a research design, the estimated treatment effect is an average of treatment effects across groups, but with some groups potentially having negative weights. The implication is that it is possible for these negative weights to bias or even change the sign of the overall estimated effect.

In this section, we follow de Chaisemartin and D’Haultfoeuille (2018) who first highlight the limits of two-way fixed effects regressions in our empirical context – the estimation of the effect of the “TV treatment” on newspapers’ outcomes – with newspapers experiencing the entry of TV at different points in time. The two-way FE regressions rely on the assumption that the treatment effect is constant across groups and over time; but this assumption may not hold if, for example, the effect of TV changes over time. They propose a new estimand that is valid even if the treatment effect is heterogeneous over time or across groups. We use their `fuzzydid` Stata package (de Chaisemartin et al., 2018) to show that our results are robust to using this alternative estimand.

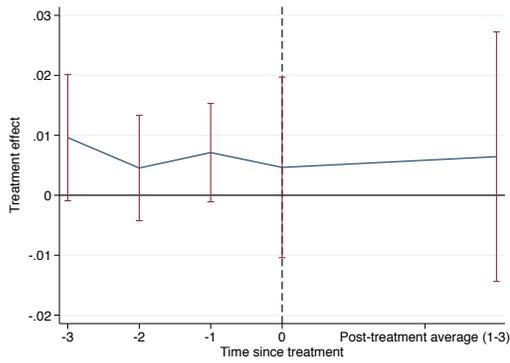
More precisely, we use the time-corrected Wald ratio (Wald-TC) estimand proposed by de Chaisemartin and D’Haultfoeuille (2018). This estimand does not rely on any assumption on treatment effects. It generalizes the changes-in-changes estimand introduced by Athey and Imbens (2006) to fuzzy designs, and identifies a local average treatment effect (LATE). Table 10 presents the results of the estimation. The reported coefficients confirm our main results of television resulting in negative shocks to circulation and national advertising.

Importantly, the Wald-TC estimand relies on a common trends assumption. We assess the plausibility of this assumption by following de Chaisemartin and D’Haultfoeuille (2018) in Figure 7 where we plot the Wald-TC estimator of the instantaneous treatment effect for our different outcomes of interest. In all cases, we see no differences in pre-trends, which is reassuring as to the validity of our estimation strategy.

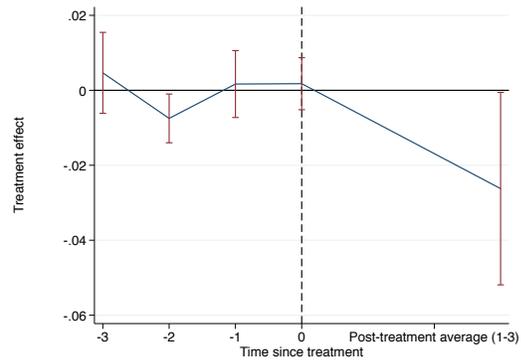
6.2 Additional Robustness Checks

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).

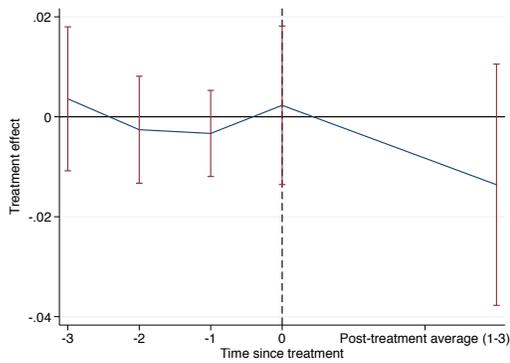
Changing the size of the window to define the “freeze” period In our preferred empirical strategy, we have focused on all the newspaper markets affected by television between 1947 and 1953. In the online Appendix Figure D.1, we show that our results are robust to using different windows around the freeze. Each sub-figure reports the σ coefficient associ-



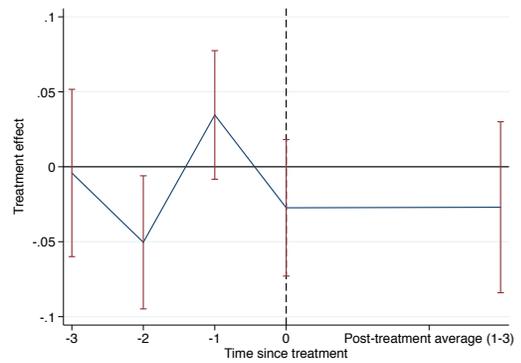
(a) Subscription price



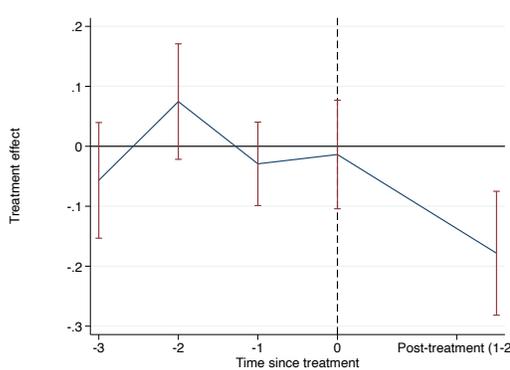
(b) Circulation



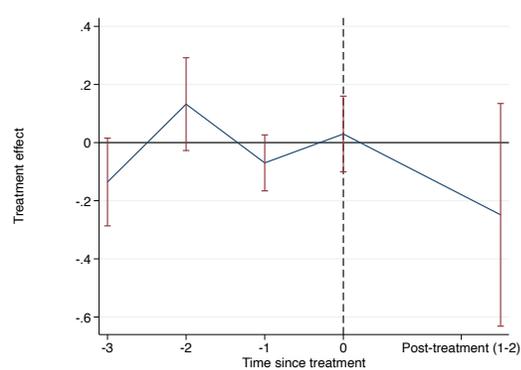
(c) Advertising price



(d) National ad lineage



(e) Total Text Stories



(f) Local Original Stories

Notes: The figures plot the estimates and 95% confidence intervals, using the de Chaisemartin et al. (2018) 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.

Figure 7: Assessing the plausibility of the common trends assumption (Wald-TC estimator of the instantaneous treatment effect)

Table 10: Wald-TC Estimates

| | Subscription price | Circulation | Advertising price | National Advertising |
|----------------------|--------------------|---------------------|-------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| TV (LATE) | -0.001 (0.012) | -0.060** (0.021) | -0.001 (0.025) | -0.098*** (0.025) |
| Sample | Evening | Evening | Evening | Evening |
| Observations | 22,269 | 22,269 | 21,103 | 13,400 |
| Clusters (TVStation) | 317 | 317 | 307 | 186 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The reported coefficients are the Wald-TC estimates. The coefficients are estimated using the de Chaisemartin et al. (2018)’s method, based on the Stata command *fuzzydid*. Standard errors are clustered at the television station level. Dependent variables are in natural logs.

ated 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 circulation (sub-Figure D.1c for all newspapers and D.1d for evening newspapers), it appears clearly that whether our “freeze” sample is defined using simply 10 months before and 10 months after the freeze, or 20 months before and 20 months after, the entry of television has led to a statistically significant decrease in newspaper circulation.

Further, in the online Appendix Tables D.2 and D.3, 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 nonetheless note a number of quantitative differences from using the entire sample.

Limiting to newspapers for which we have content data In the online Appendix Tables D.4 and D.5, we show that our results on prices and quantities on both sides of the market are robust to reducing our sample of analysis to the newspapers for which we have content data. It is reassuring that despite the much lower number of observations, we obtain a 4.6% decrease in circulation statistically significant at the 5%-level, and a 3.6% decrease in advertising prices.

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 separately evening and morning newspapers to investigate the heterogeneity of the effects. As a 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 10 without the number of newspapers as a control. The results are not significantly different from those presented in Tables 3 and 4.

7 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 Stromberg, 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 stories of all types. 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. This may have 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.⁵⁰

⁵⁰Consistently, 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 substitute for local journalism.

7.1 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 103 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 newspaper, 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, a drop of 37.5%. Moreover, we found that the content was 50 original local news (53% of all articles), compared to 96 (63%) 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 have 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.

References

- Abadie, A. and G. Imbens (2006). Large Sample Properties of Matching Estimators for Average Treatment Effects. *Econometrica* 74(1), 235–267.
- Abadie, A. and G. Imbens (2011). Bias-Corrected Matching Estimators for Average Treatment Effects. *Journal of Business and Economic Statistics* 29(1), 1–11.
- Adams, W. and J. L. Yellen (1976). Commodity Bundling and the Burden of Monopoly. *The Quarterly Journal of Economics* 90(3), 475–498.
- Anderson, S. P. and S. Coate (2005). Market Provision of Broadcasting: A Welfare Analysis. *The Review of Economic Studies* 72(4), 947–972.
- Angelucci, C. and J. Cagé (2019). Newspapers in Times of Low Advertising Revenues. *American Economic Journal: Microeconomics* 11(3), 319–364.
- Angrist, J. D. and J. S. Pischke (2009). *Mostly Harmless Econometrics: an Empiricist’s Companion*. Princeton University Press.
- Armstrong, M. (2006). Competition in Two-sided Markets. *Rand Journal of Economics* 37(3), 668–691.
- Armstrong, M. and J. Wright (2007). Minimum Differentiation in Commercial Media Markets. *Economic Theory* 32, 353–380.
- Athey, S., E. Calvano, and J. S. Gans (2018). The Impact of Consumer Multi-homing on Advertising Markets and Media Competition. *Management Science* 64(4), 1574–1590.
- Athey, S. and J. S. Gans (2010). The Impact of Targeting Technology on Advertising Markets and Media Competition. *American Economic Review* 100(2), 608–613.
- Athey, S. and G. W. Imbens (2006). Identification and Inference in Nonlinear Difference-in-Differences Models. *Econometrica* 74(2), 431–497.
- Bakos, Y. and E. Brynjolfsson (1999). Bundling Information Goods: Pricing, Profits, and Efficiency. *Management Science* 45(12), 1613–1630.
- Barnouw, E. (1990). *Tube of Plenty: The Evolution of American Television*. Oxford University Press.
- Berry, S. T. and J. Waldfogel (2001). Do Mergers Increase Product Variety? Evidence from Radio Broadcasting. *The Quarterly Journal of Economics* 116(3).
- Berry, S. T. and J. Waldfogel (2010). Product Quality and Market Size. *Journal of Industrial Economics* 58(1), 1–31.
- Boczkowski, P. J., E. Mitchelstein, and M. Matassi (2017). Incidental News: How Young People Consume News on Social Media. In *Hawaii International Conference on System Sciences*, pp. 1785–1792.
- Cagé, J. (2016). *Saving the Media*. Harvard University Press.
- Cagé, J. (2019). Media Competition, Information Provision and Political Participation: Evidence from French Local Newspapers and Elections, 1944-2014. *Journal of Public Eco-*

nomics.

- Cagé, J., N. Hervé, and M.-L. Viaud (2019). The Production of Information in an Online World. *Review of Economic Studies*.
- Caillaud, B. and B. Jullien (2001). Competing Cybermediaries. *European Economic Review* 45(4/6), 797–808.
- Caillaud, B. and B. Jullien (2003). Chicken and Egg: Competition among Intermediation Service Providers. *Rand Journal of Economics* 34(2), 309–328.
- Chandra, A. and U. Kaiser (2014). Targeted Advertising in Magazine Markets and the Advent of the Internet. *Management Science* 60(7), 1829–1843.
- Chen, Y. and M. H. Riordan (2013). Profitability of Product Bundling. *International Economic Review* 54(1), 35–57.
- Chu, C. S., P. Leslie, and A. Sorensen (2011). Bundle-Size Pricing as an Approximation to Mixed Bundling. *American Economic Review* 101(1), 263–303.
- Crampes, C., C. Haritchabalet, and B. Jullien (2009). Advertising, Competition and Entry in Media Industries. *Journal of Industrial Economics* 57(1), 7–31.
- Crawford, G. S. and A. Yurukoglu (2012). The Welfare Effects of Bundling in Multichannel Television Markets. *American Economic Review* 102(2), 643–85.
- de Chaisemartin, C. and X. D’Haultfoeuille (2018). Fuzzy Differences-in-Differences. *Review of Economic Studies* 85(2), 999–1028.
- de Chaisemartin, C. and X. D’Haultfoeuille (2019). Two-way Fixed Effects Estimators with Heterogeneous Treatment Effects.
- de Chaisemartin, C., X. D’Haultfoeuille, and Y. Guyonvarch (2018). FUZZYDID: Stata module to estimate Fuzzy Difference-in-Difference Designs. Statistical Software Components, Boston College Department of Economics.
- de Corniere, A. and M. Sarvary (2018). Social Media and the News Industry. Working paper.
- de Leon, C. L. P. (2015). *That’s the Way it Is. A History of Television News in America*. The University of Chicago Press Books.
- Drago, F., T. Nannicini, and F. Sobbrío (2014). Meet the Press: How Voters and Politicians Respond to Newspaper Entry and Exit. *American Economic Journal: Applied Economics* 6(3), 159–188.
- Esfahani, N. N. and D.-S. Jeon (2016). News Aggregators and Competition Among Newspapers on the Internet. *American Economic Journal: Microeconomics* 8(4), 91–114.
- Esther Gal-Or, Tansev Geylani, and T. P. Yildirim (2012). The Impact of Advertising on Media Bias. *Journal of Marketing Research* 49(1), 92–99.
- Falck, O., R. Gold, and S. Heblich (2014). E-lections: Voting Behavior and the Internet. *American Economic Review* 104(7), 2238–2265.
- Fan, Y. (2013, sep). Ownership Consolidation and Product Characteristics: A Study of the

- US Daily Newspaper Market. *American Economic Review* 103(5), 1598–1628.
- Ferraz, C. and F. Finan (2008). Exposing Corrupt Politicians: The Effects of Brazil’s Publicly Released Audits on Electoral Outcomes. *Quarterly Journal of Economics* 123(2), pp. 703–746.
- Gabszewicz, J., D. Laussel, and N. Sonnac (2004). Programming and Advertising Competition in the Broadcasting Industry. *Journal of Economics & Management Strategy* 13(4), 657–669.
- Gabszewicz, J. J., D. Laussel, and N. Sonnac (2001, may). Press advertising and the ascent of the ‘Pensée Unique’. *European Economic Review* 45(4-6), 641–651.
- Gal-Or, E. and A. Dukes (2003). Minimum Differentiation in Commercial Media Markets. *Journal of Economics & Management Strategy* 12(3), 291–325.
- Gao, P., C. Lee, and D. Murphy (2020). Financing dies in darkness? the impact of newspaper closures on public finance. *Journal of Financial Economics* 135(2), 445 – 467.
- Gavazza, A., M. Nardotto, and T. Valletti (2019). Internet and Politics: Evidence from U.K. Local Elections and Local Government Policies. *The Review of Economic Studies* 86(5), 2092–2135.
- Gentzkow, M. (2006). Television and Voter Turnout. *Quarterly Journal of Economics* 121(3), 931–972.
- Gentzkow, M., E. Glaeser, and C. Goldin (2006). The Rise of the Fourth Estate: How Newspapers Became Informative and Why It Mattered. In *Corruption and Reform: Lessons from America’s Economic History*. National Bureau of Economic Research.
- Gentzkow, M., N. Petek, J. M. Shapiro, and M. Sinkinson (2015). Do Newspapers Serve The State? Incumbent Party Influence On The US Press, 1869–1928. *Journal of the European Economic Association* 13(1), 29–61.
- Gentzkow, M. and J. M. Shapiro (2008). Preschool Television Viewing and Adolescent Test Scores: Historical Evidence from the Coleman Study. *The Quarterly Journal of Economics* 123(1), 279–323.
- Gentzkow, M. and J. M. Shapiro (2010). What Drives Media Slant? Evidence from US Daily Newspapers. *Econometrica* 78(1).
- Gentzkow, M., J. M. Shapiro, and M. Sinkinson (2011). The Effect of Newspaper Entry and Exit on Electoral Politics. *American Economic Review* 101(7), 2980–3018.
- Gentzkow, M., J. M. Shapiro, and M. Sinkinson (2014). Competition and Ideological Diversity: Historical Evidence from US Newspapers. *American Economic Review* 104(10), 3073–3114.
- Gentzkow, M., J. M. Shapiro, and M. Taddy (2016). Measuring Polarization in High-Dimensional Data: Method and Application to Congressional Speech. NBER Working Papers 22423, National Bureau of Economic Research, Inc.
- George, L. (2007). What’s Fit to Print: The Effect of Ownership Concentration on Product

- Variety in Daily Newspaper Markets. *Information Economics and Policy* 19(3-4), 285–303.
- George, L. and J. Waldfogel (2003). Who Affects Whom in Daily Newspaper Markets? *Journal of Political Economy* 111(4), pp. 765–784.
- George, L. M. and J. Waldfogel (2006). The New York Times and the Market for Local Newspapers. *American Economic Review* 96(1), 435–447.
- Groseclose, T. and J. Milyo (2005). A Measure of Media Bias. *Quarterly Journal of Economics* 120(4), 1191–1237.
- Hamilton, J. T. (2004). *All the News That's Fit to Shell: How the Market Transforms Information Into News*. Princeton University Press.
- Hess, S. (1991). *Live from Capitol Hill!: studies of Congress and the media*. Newswork Series. The Brookings Institution.
- Ho, K., J. Ho, and J. H. Mortimer (2012). The Use of Full-Line Forcing Contracts in the Video Rental Industry. *American Economic Review* 102(2), 686–719.
- Hurkens, S., D.-S. Jeon, and D. Menicucci (2019). Dominance and Competitive Bundling. *American Economic Journal: Microeconomics* 11(3), 1–33.
- Jin, G. Z. and M. Rysman (2015). Platform Pricing at Sports Card Conventions. *The Journal of Industrial Economics* 63(4), 704–735.
- Kaiser, U. and M. Song (2009). Do media consumers really dislike advertising? An empirical assessment of the role of advertising in print media markets. *International Journal of Industrial Organization* 27(2), 292–301.
- Kaiser, U. and J. Wright (2006). Price structure in two-sided markets: Evidence from the magazine industry. *International Journal of Industrial Organization* 24(1), 1–28.
- Kennedy, P. J. and A. Prat (2019). Where Do People Get Their News? *Economic Policy* 34(97), 26–43.
- Koenig, F. (2018). Superstar Earners and Market Size: Evidence from the Roll-Out of TV. Working paper.
- Lazarsfeld, P. F. (1940). *Radio and the Printed Page*. Duell, Sloan & Pearce, Inc.
- Lichty, L. W. and M. C. Topping (1975). *American Broadcasting: A Source Book on the History of Radio and Television*. Studies in public communication. Hastings House Publishers.
- Martin, G. J. and J. McCrain (2019). Local news and national politics. *American Political Science Review* 113(2), 372–384.
- McAfee, P. R., J. McMillan, and M. D. Whinston (1984). Multiproduct Monopoly, Commodity Bundling, and Correlation of Values. *The Quarterly Journal of Economics* 104(2), 371–383.
- McChesney, R. and J. Nichols (2010). *The Death and Life of American Journalism: The Media Revolution that Will Begin the World Again*. Nation Book.
- Nalebuff, B. (2004). Bundling as an Entry Barrier. *The Quarterly Journal of Economics* 119(1), 159–187.

- Peitz, M. and T. Valletti (2008). Content and Advertising in the Media: Pay-TV versus Free-to-Air. *International Journal of Industrial Organization* 26(4), 949–965.
- Petrova, M. (2011). Newspapers and Parties: How Advertising Revenues Created an Independent Press. *The American Political Science Review* 105(4), pp. 790–808.
- Prior, M. (2007). *Post-Broadcast Democracy: How Media Choice Increases Inequality in Political Involvement and Polarizes Elections*. Cambridge Studies in Public Opinion and Political Psychology. Cambridge University Press.
- Puglisi, R. and J. Snyder (2015). The Balanced Us Press. *Journal of the European Economic Association* 13(2), 240–264.
- Rochet, J.-C. and J. Tirole (2003). Platform Competition in Two-sided Markets. *Journal of the European Economic Association* 1(4), pp. 990–1029.
- Rochet, J.-C. and J. Tirole (2006). Two-Sided Markets: A Progress Report. *Rand Journal of Economics* 35(3), 645–667.
- Rysman, M. (2004). Competition between Networks: A Study of the Market for Yellow Pages. *The Review of Economic Studies* 71(2), pp. 483–512.
- Schmalensee, R. (1982). Commodity Bundling by Single-Product Monopolies. *The Journal of Law & Economics* 25(1), 67–71.
- Schudson, M. (1981). *Discovering the News: A Social History of American Newspapers*. Basic Books.
- Seamans, R. and F. Zhu (2014). Responses to Entry in Multi-Sided Markets: The Impact of Craigslist on Local Newspapers. *Management Science* 60(2), 476–493.
- Seim, K. (2006). An Empirical Model of Firm Entry with Endogenous Product-Type Choices. *The RAND Journal of Economics* 37(3), 619–640.
- Shiller, B., J. Waldfogel, and J. Ryan (2017). Will Ad Blocking Break the Internet? Working Paper 23058, National Bureau of Economic Research.
- Snyder, J. M. and D. Stromberg (2010). Press Coverage and Political Accountability. *Journal of Political Economy* 118(2), 355–408.
- Song, M. (2015). Estimating Platform Market Power in Two-sided Markets with an Application to Magazine Advertising. *Mimeo, Bates White Economic Consulting*.
- Starr, P. (1982). *The Creation of the Media: Political Origins of Modern Communications*. Basic Books.
- Sterling, C. and S. Head (1994). *Broadcasting in America*. Houghton Mifflin.
- Stigler, G. (1968). A Note on Block Booking. Homewood, IL.
- Strömberg, D. (2004). Mass Media Competition, Political Competition, and Public Policy. *Review of Economic Studies* 71(1), 265–284.
- Stromberg, D. (2004). Radio’s Impact on Public Spending. *Quarterly Journal of Economics* 119(1).

- Sweeting, A. (2010). The effects of mergers on product positioning: evidence from the music radio industry. *The RAND Journal of Economics* 41(2), 372–397.
- Sweeting, A. (2013). Dynamic Product Positioning in Differentiated Product Markets: The Effect of Fees for Musical Performance Rights on The Commercial Radio Industry. *Econometrica* 81(5), 1763–1803.
- Weyl, E. G. (2010). A Price Theory of Multi-sided Platforms. *American Economic Review* 100(4), 1642–1672.
- Whinston, M. D. (1990). Tying Foreclosure, and Exclusion. *American Economic Review* 80(4), 837–859.
- Wood, S. C. (1990). Television’s First Political Spot Ad Campaign: Eisenhower Answers America. *Presidential Studies Quarterly* 20(2), 265–283.

A Appendix: Theory Proofs

A.1 Proof of Lemma 1

Condition $\beta < 1$ ensures objective function (1) is strictly concave in (p_I^R, p_I^A) . Differentiating (1) 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 (p_I^R, p_I^A) yields the expressions stated in Lemma 1.

Last, setting $(q_L, q_N) = (\bar{q}, \bar{q})$ yields higher profits than $(q_L, q_N) = (\underline{q}, \underline{q})$ if and only if $F \leq \tilde{F}_1 \equiv \frac{(2+\beta)\Delta q + 2(\bar{q}^2 - \underline{q}^2)}{4 - \beta^2}$. Similarly, setting $(q_L, q_N) = (\bar{q}, \bar{q})$ yields higher profits than $(q_L, q_N) = (\underline{q}, \bar{q}), (\bar{q}, \underline{q})$ if and only if $F \leq \tilde{F}_2 \equiv \frac{(2+\beta)\Delta q + 3\bar{q}^2 - 2q\bar{q} - \underline{q}^2}{4 - \beta^2}$. Finally, setting $(q_L, q_N) = (\underline{q}, \bar{q}), (\bar{q}, \underline{q})$ yields higher profits than $(q_L, q_N) = (\underline{q}, \underline{q})$ if and only if $F \leq \tilde{F}_3 \equiv \frac{(2+\beta)\Delta q + \bar{q}^2 + 2q\bar{q} - 3\underline{q}^2}{4 - \beta^2}$. Further, $\bar{q} > \underline{q}$ implies that $\tilde{F}_3 < \tilde{F}_1 < \tilde{F}_2$. It follows that setting $(q_L, q_N) = (\bar{q}, \bar{q})$ (resp. $(q_L, q_N) = (\underline{q}, \underline{q})$) 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 1.

A.2 Proof of Lemma 3 and Lemma 4

We begin by stating the expressions for the thresholds listed in Lemma 3 and below:

$$\begin{aligned}
 \gamma_I &= 2 + 9\beta^3 - 5\beta - 5\beta^2, \\
 \gamma_E &= 1 + 12\beta^3 - 4\beta - 4\beta^2, \\
 \mu_I &= 2 + \beta - 3\beta^2, \\
 \mu_E &= 1 - \beta - 3\beta^2, \\
 \kappa_I &= \frac{1}{2} (8 + 9\beta^3 - 14\beta^2 - 4\beta), \\
 \kappa_E &= \frac{1}{2} (2 + 18\beta^3 - 2\beta^2 - 7\beta).
 \end{aligned} \tag{11}$$

Condition $\beta \leq \frac{1}{5}$ ensures all these thresholds are positive. We also state E 's equilibrium prices:

$$p_E^R = \frac{\gamma_E + 2(1 - 3\beta^2) \left(q_{E,N} - \sum_{k \in \{L,N\}} q_{I,k} \right)}{6(1 - 2\beta^2)}, \tag{12}$$

$$p_E^A = \frac{\mu_E + 2\beta \left(q_{E,N} - \sum_{k \in \{L,N\}} q_{I,k} \right)}{6(1 - 2\beta^2)}, \tag{13}$$

where $\gamma_E, \mu_E > 0$. Further, E 's profits are equal to:

$$\pi_E^M = \frac{\kappa_E + (2 - 3\beta - 6\beta^2) (q_{E,N} - q_{I,L} - q_{I,N}) + 2(q_{E,N} - q_{I,L} - q_{I,N})^2}{9(1 - 2\beta^2)}. \tag{14}$$

Conditions $\beta \leq \frac{1}{5}$ and $\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \in (\frac{1}{2}(-2 - \beta + 2\beta^2), \frac{1}{2}(1 - \beta - 4\beta^2))$ 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 $(p_I^R, p_I^A, p_E^R, p_E^A)$ yields the expressions stated in Lemma 3.

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

$$\begin{aligned} d_I^R &= \frac{2 + \beta - 2\beta^2 + 2 \left(\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \right)}{3 - 6\beta^2} \in (0, 1), \\ d_I^A &= \frac{2 + \beta - 3\beta^2 + 2\beta \left(\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \right)}{3 - 6\beta^2} \in (0, 1), \end{aligned} \quad (15)$$

that is, both media outlets are active on both sides of the markets and all consumers make a purchase.

The proof for the derivation of \tilde{F}^D (Lemma 4) is almost identical to that for \tilde{F}^M provided above (using expression (8) instead of (3)). We omit it for the sake of brevity.

A.3 Proof of Proposition 1 and Corollary 1

We begin by proving the statement regarding prices. Suppose first that the values attached to the local and national news products are perfectly positively correlated. Using Lemma 1 and Lemma 3, I charges lower reader prices under duopoly than monopoly if and only if the following inequality holds:

$$\begin{aligned} & \frac{2 - \beta(1 + \beta) + (2 - \beta^2) \sum_{k \in \{L, N\}} q_{I,k}}{4 - \beta^2} \\ & \geq \frac{2 + 9\beta^3 - 5\beta - 5\beta^2 + 2(1 - 3\beta^2) \left(\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \right)}{6(1 - 2\beta^2)}. \end{aligned} \quad (16)$$

Anticipating the fact that I chooses weakly lower values of $(q_{I,L}, q_{I,N})$ under duopoly than monopoly (see below), inequality (16) 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) $\frac{2 - \beta^2}{4 - \beta^2} > \frac{1(1 - 3\beta^2)}{3(1 - 2\beta^2)}$ hold when $\beta \leq \frac{1}{5}$. Similarly, I charges lower advertising prices under duopoly than monopoly if and only if:

$$\frac{2 + \beta + \beta \sum_{k \in \{L, N\}} q_{I,k}}{4 - \beta^2} \geq \frac{2 + \beta - 3\beta^2 + 2\beta \left(\sum_{k \in \{L, N\}} q_{I,k} - q_{E,N} \right)}{6(1 - 2\beta^2)}. \quad (17)$$

Again anticipating the fact that I chooses weakly lower values of $(q_{I,L}, q_{I,N})$ under duopoly than monopoly, conditions $\sum_{k \in \{L,N\}} q_{I,k} - q_{E,N} \in (\frac{1}{2}(-2 - \beta + 2\beta^2), \frac{1}{2}(1 - \beta - 4\beta^2))$ and $\beta \leq \frac{1}{5}$ ensure that inequality (17) always holds. Suppose now that the values attached to the local and national news products are perfectly negatively correlated. Comparing the expressions stated in Lemma 1 and Lemma 2, one shows – using condition $\bar{q} \leq \frac{1}{4}(2 + \beta)(1 - \beta)$ – 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). 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. Suppose first that the values attached to the local and national news products are perfectly positively correlated. I chooses a weakly lower value of $(q_{I,L}, q_{I,N})$ under duopoly if and only if:

$$\tilde{F}^M = \frac{(2 + \beta) \Delta q + 2(\bar{q}^2 - \underline{q}^2)}{4 - \beta^2} > \tilde{F}^D = \frac{(4 - 3\beta^2) \Delta q + 4(\bar{q}^2 - \underline{q}^2 - q_{E,N} \Delta q)}{9(1 - 2\beta^2)}. \quad (18)$$

Inequality (18) 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 $\beta \leq \frac{1}{5}$. Suppose now that the values attached to the local and national news products are perfectly negatively correlated. Lemma E.2 establishes that Δq is higher than the left-hand side of (18). 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 1.