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RESEARCH ARTICLE

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Homing and platform responses to entry: Historical evidence from the U.S. newspaper industry

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Abstract

Research summary: We examine how heterogeneity in customers' tendencies to single-home or multi-home affects a platform's competitive responses to new entrants in the market. We first develop a formal model to generate predictions about how a platform will respond. We then empirically test it, leveraging a historical setting: TV station entry into local U.S. newspaper markets from 1945 to 1963. A notable feature of this setting is a quasi-natural experiment: the staggered geographic and temporal rollout of TV stations that was temporarily halted during the Korean War. We find that platform firms indeed take their customers' homing tendencies into account in their responses to competition: after a TV station enters the newspaper market, newspaper firms with more single-homing consumers had lower subscription prices, circulations, and advertising rates.

Managerial summary: The theoretical and empirical results in our paper suggest that platform firms operating in multi-sided market settings need to consider their customers' single-homing and multi-homing tendencies. Heterogeneity in these tendencies is an important demand-side factor to consider when formulating responses to a competitor's entry.

KEYWORDS
multi-homing, newspaper, platform responses, single-homing, television

1 | INTRODUCTION

Firms in many industries serve as platforms that connect participants on different sides of their markets. For example, Uber connects drivers to riders, as do Lyft and other ride-sharing platforms. Other examples of platforms include search engines, such as Google and Bing; online dating sites, such as eHarmony and Match.com; online deal marketplaces, such as Groupon and LivingSocial; cable TV networks, such as Time Warner and Comcast; credit-card networks, such as Visa, MasterCard, and American Express; and video-game console developers, such as PlayStation and Xbox.

One of the major challenges faced by incumbent platforms in multi-sided markets is how to handle competition from entrants. When a new platform arrives, consumers on either side of the platform's market can choose whether to switch to the new platform (single-homing) or to adopt both platforms (multi-homing) (e.g., Ambrus, Calvano, & Reisinger, 2016; Armstrong & Wright, 2007; Bresnahan, Orsini, & Yin, 2015; Corts & Lederman, 2009; Hagiu, 2006; Hagiu & Lee, 2011; Landsman & Stremersch, 2011; Piezunka, Katila, & Eisenhardt, 2015). For example, when LivingSocial enters a market that was previously served by Groupon, both consumers and merchants on Groupon could choose to remain on it (single-home with Groupon), switch to LivingSocial (single-home with LivingSocial) or to use both platforms (multi-home).

Multi-homing has become commonplace in many platform markets and has important implications for platform responses. For example, if all consumers choose to visit both Groupon and LivingSocial, merchants would only need to work with one platform to reach all potential consumers; Groupon and LivingSocial would not have to compete for consumers but would need to compete more aggressively to attract merchants. Instead, if merchants are more likely than customers to multi-home, their responses would be different. An added complexity is that platform actions on both sides of a market are often interdependent (Parker & Van Alstyne, 2005; Rochet & Tirole, 2003; Seamans & Zhu, 2014). As a result, changes on one side of a market will require adjustment on the other side of the market.

In this paper, we use a historical setting—TV station entry into local U.S. newspaper markets from 1945 to 1963—to study how platform firms' responses depend on their customers' tendencies to single-home or multi-home. Both the newspaper firm and the TV station can be considered multi-sided market platform firms because they connect readers/viewers on one side of the market with advertisers on another side of the market. Following recent practices in the strategy literature, we use the features of our institutional setting to develop a formal theoretical model, and we derive a set of rich predictions from the model that we test with the data (e.g., Kaul & Wu, 2016; Wu & Knott, 2006). The entry of TV stations provides us with one source of variation in consumer's homing tendencies (i.e., whether they are single-homing or multi-homing). Whether the local newspaper is published in the morning or the evening (a historical artifact of the newspaper) provides us with another source of variation in consumer homing tendencies.

Our model predicts that, when a TV station enters a market, newspapers with a larger fraction of single-homing consumers (i.e., consumers who both read newspapers *or* watch TV but

are unlikely to do both) will have lower subscription prices and circulations relative to newspapers with more multi-homing consumers (i.e., consumers who read newspapers *and* watch TV). The prediction regarding newspaper firms' advertising rates is more nuanced. When more consumers multi-home, a newspaper becomes more attractive to advertisers because an advertiser can reach more consumers through the newspaper (a demand-expansion effect). At the same time, because advertisers can reach multi-homing consumers through more than one channel, an increase in the number of multi-homing consumers also reduces the attractiveness of the newspaper to advertisers (a changing-composition effect). Therefore, whether newspaper firms can charge higher advertising rates when there are more single-homing consumers depends on which effect dominates. The theoretical model also allows us to highlight the importance of recognizing the impact of consumer's homing tendencies in a competitive setting. We show that our model predictions differ from those of a model of competing platforms with different degrees of differentiation (i.e., some newspapers are more differentiated from TV stations than others).

We then empirically test these predictions and find that, consistent with these predictions, newspaper firms' responses indeed differ considerably based on their consumers' homing tendencies. Our results are robust to a battery of additional checks (for brevity, most of these are presented in Data S1), including ones in which we investigate the role of commuting patterns and the newspaper's experience with competition from radio.

Our identification strategy takes advantage of several institutional features of the newspaper industry during the 1945–1963 period.[1] First, newspaper markets during this period were essentially geographically segmented, with one or two newspapers per market (Gentzkow, 2006; Gentzkow, Shapiro, & Sinkinson, 2011). Additionally, newspapers were categorized as either morning or evening newspapers and were published and circulated to their subscribers accordingly. Approximately 80% of the newspapers in 1940 were evening newspapers, and this remained unchanged until around 1980 (see Figure 1), indicating that the morning versus evening designation was basically a fixed trait of a newspaper, an assumption that we explore in more detail in the empirical setting section. This feature is useful for our study because the entry of TV primarily affected evening but not morning newspapers. During the early period of TV station entry, no TV programs were offered in the morning. Morning newspaper subscribers were more likely to read the newspaper in the morning and watch TV at night (i.e., multi-home), while evening newspaper subscribers were more likely to treat the evening newspaper and TV as substitutes for each other and potentially switch to TV for news after a TV station's entry into the market (i.e., single-home).

The second institutional feature is that TV entry was staggered geographically and temporally (see Figure 2), partly due to the Federal Communications Commission's (FCC) decision to freeze new TV broadcast licenses during the Korean War, as we explain in the empirical setting section. This feature provides a quasi-natural experiment (Baker & George, 2010; George, 2009), which we exploit in our empirical approach.

Our study makes several contributions. First, it adds to the growing literature on platforms (e.g., Eisenmann, Parker, & Van Alstyne, 2011; Iansiti & Levien, 2004; Jeitschko & Tremblay, 2020; Kapoor & Agarwal, 2017; Piezunka et al., 2015; Yoffie & Cusumano, 2015). In many prior studies, customers' homing tendencies have been assumed to be the same across all platforms in a market (e.g., Armstrong, 2006; Casadesus-Masanell & Zhu, 2010; Choi, 2010; Gabszewicz &

[1]We choose 1963 as the end of our study period because of data availability and because of major changes in TV broadcasting, which switched from black and white to color around this time (Murray, 2018).

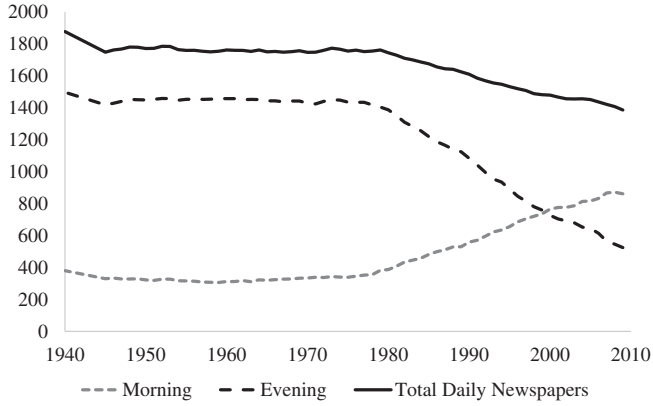


FIGURE 1 Annual count of newspapers, by year and type. *Source*: Newspaper Association of America

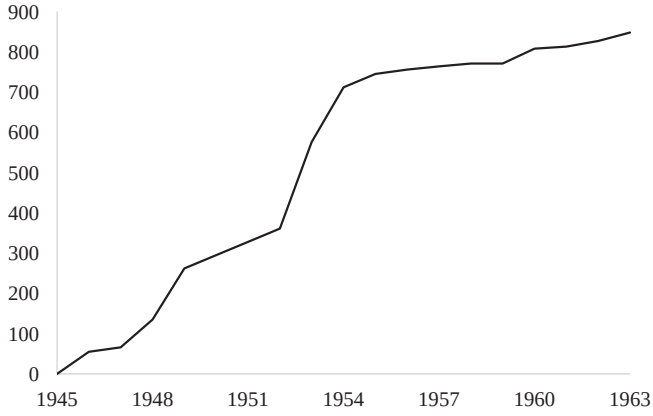


FIGURE 2 Cumulative number of counties with TV stations. *Source*: Television Factbook

Wauthy, 2004; Landsman & Stremersch, 2011; Zhu & Iansiti, 2012). Doganoglu and Wright (2006) study how multi-homing affects the compatibility decisions of competing firms. Kaiser and Wright (2006) study the magazine industry, looking at monopoly and oligopoly settings separately. In their monopoly setting, multi-homing is not possible. In their oligopoly setting, the multi-homing behaviors of consumers and advertisers are fixed and do not vary across markets. Unlike these studies, we provide a rigorous account of how a platform responds to the entry of another platform in a setting with *varying* degrees of multi-homing tendencies across markets. We theoretically and empirically show that optimal platform responses can change substantially when taking consumers' homing tendencies into account.

Second, by studying how newspapers respond to the entry of TV, we gain some insights into how incumbent platforms in two-sided markets respond to entrants who are using new technologies. Few studies have examined asymmetric competition between platforms with different technologies or different business models (e.g., Casadesus-Masanell & Zhu, 2010; Seamans & Zhu, 2014, 2017). The extant platform literature has paid less attention to non-price-related factors that affect platform participants' homing behavior. Examples of such factors include platform complementors' perception of risks (Koh & Fichman, 2014), the nature of human capital (Venkataraman, Ceccagnoli, & Forman, 2019), and the complexity of technology (Cennamo, Ozalp, & Kretschmer, 2018; Kapoor & Agarwal, 2017). Different from these studies focused on supply-side factors, we propose a demand-side factor—consumers' homing tendencies—and

study how platforms strategically take such factors into consideration. We further show that such tendencies depend on product characteristics as well as market conditions: consumers are likely to adopt both morning newspapers and TV, and this multi-homing tendency is more pronounced when the market has a convenient public transit system, which allows consumers to read morning newspapers on their way to work. We believe that our research design and results can shed light on the responses of platforms in general to new technological innovations.

Finally, the historical nature of the setting serves as a reminder to readers that, despite the nascent research on multi-sided markets and platform responses, much of which focuses on competitive interactions between contemporary technology firms, interactions between firms in multi-sided market settings is not a new phenomenon. Our analysis using historical data on newspaper firms from 1945 to 1963 shows that some of these firms already had a sophisticated understanding of the multi-sided nature of their businesses and the role of multi-homing, and they incorporated this understanding into their responses to competitor entry.

In the following sections, we first describe the historical setting before developing our formal model so that the model incorporates important features of the setting. Next, we use the model to derive our hypotheses. We then describe our data-collection efforts and methodology, present our results and robustness tests, and finally, discuss our results and the broader implications of our study.

2 | EMPIRICAL SETTING: LOCAL U.S. NEWSPAPER INDUSTRY, 1945–1963

2.1 | Historical newspapers

Newspapers in the United States have existed since the colonial period. By 1945, newspapers were established media entities in their local markets of operation. With a few exceptions (such as *The New York Times* and *The Christian Science Monitor*), each newspaper covered a limited geographical region. Newspapers were important sources of news in their local markets, even after the introduction of radio and TV. For example, in 1944, newspapers were still considered the most accurate sources of information on presidential campaigns (Gentzkow et al., 2011).

Similar to TV, a newspaper can be thought of as a platform connecting two sides of a market. Both newspapers and TV provide content to consumers and connect consumers to advertisers. While the newspaper business was homogeneous in the sense that newspapers derived most of their revenues from advertising, there were important differences among individual newspapers. Most relevant for our study, newspapers were typically categorized by the timing of their publication. Some newspapers were distributed in the morning, covering the previous day's events, while other newspapers were distributed in the evening, covering the events that occurred earlier on that same day.

From the 1940s to the 1960s, there were significantly more evening newspapers than morning newspapers, and the proportion of each remained relatively stable throughout the period (see Figure 1). It was also rare for a newspaper to switch between the two types. Figure 3 uses data from Gentzkow et al. (2014) to calculate the percentage of newspapers that switched types each year. As indicated in Figure 3, the proportion of newspapers that switched type (number of newspapers that switch type/total number of newspapers) dropped from approximately 4% per year in the early 1900s to approximately 1% per year by 1945 and then remained at that level until the 1980s, when it increased to approximately 5% per year. Note that the change in

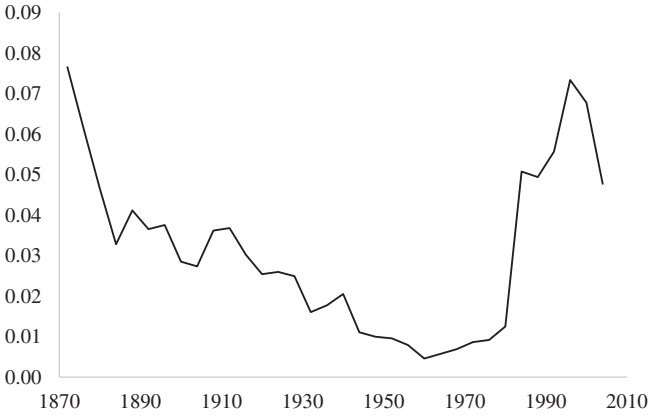


FIGURE 3 Ratio of newspaper type (morning or evening) switches, by year. *Data from*: Gentzkow, Shapiro, & Sinkinson, 2014. *Note:* The ratio is defined as (the number that switch type)/(total number of newspapers) in a given year

the early 1980s corresponded to the shift from mostly evening newspapers to mostly morning newspapers.[2]

2.2 | TV stations

The first prototypes of TV receivers were developed in the early 1920s, and TV broadcasting was started in the late 1930s by a limited number of stations in major cities. In 1931, 18 experimental broadcasting stations were operating in the United States. The FCC began licensing commercial broadcasting on July 1, 1941. However, the growth of TV and regular commercial broadcasting did not begin until after World War II.

In 1945, New York, Philadelphia, Chicago, and Schenectady were the only four U.S. cities that had commercial TV broadcasting stations. FCC licensing of commercial broadcasting expanded after the war, with 71 stations licensed in 42 cities by 1948. However, the diffusion of TV broadcasting stations did not occur smoothly and came to an unanticipated halt in September 1948, when the FCC instituted a freeze on station licensing to conduct a study on signal interference, color standards, and spectrum allocation (Baker & George, 2010; Gentzkow, 2006; Gentzkow & Shapiro, 2008; George, 2009).

Initially, the freeze was intended to last for a few months, but with the outbreak of the Korean War and the controversy over channel allocation, the freeze was kept in place until 1952. While stations that were licensed by 1948 were allowed to continue construction and begin broadcasting, no new stations began operating between 1950 and 1952. The FCC ended the freeze in 1953, issuing 142 licenses within the year. This discontinuous expansion of TV station licenses is illustrated in Figure 2, which graphs the cumulative number of counties that had TV broadcasting stations. By 1960, TV broadcasting was prevalent and reached about 96% of the U.S. population (Baker & George, 2010).

As argued by Gentzkow (2006), the Korean War and the unexpected increase in the duration of the licensing freeze were idiosyncratic events that newspapers at that time could not have anticipated. Gentzkow (2006) uses the variation generated by these idiosyncratic events to examine the impact of TV introduction on voter turnout between 1948 and 1970. He finds that

[2]Between 1900 and 1980, the switches were almost evenly split between "evening to morning" and "morning to evening." Starting in 1980, over 90% of the switches were "evening to morning."

the introduction of TV accounts for a 25–50% decline in voter turnout since the 1950s because it reduced the level of political information, even though it increased the total set of information sources. Gentzkow (2006) also shows that the introduction of TV caused consumers to move away from traditional news sources, such as newspapers, and people became less likely to rely on newspapers for information about election campaigns.

A few other studies have leveraged this exogenous variation in TV station penetration to study the effects of TV entry into society. George (2009) uses this variation to show that an increase in TV penetration was associated with fewer local breweries, lower local beer production, and higher market concentration in the beer industry. Baker and George (2010) use the same variation to show that greater exposure to advertisements increased a household's tendency to borrow money for household goods and carry debt.

It is important to note that, during the period of our study, TV broadcasting was available only in the afternoons and evenings. For instance, in 1941, WNBT in New York City offered programming only after 2 p.m. (see Figure 4), and KSD-TV in St. Louis broadcasted only after 3 p.m. (see Figure 5). Even by 1948, four large TV networks—NBC, CBS, ABC, and DuMont—only offered prime-time scheduling from 8 to 11 p.m. EST 7 days a week. Thus, TV broadcasting competed with evening newspapers for reader attention. Morning newspapers were less affected by TV viewing in that it was easier for people to multi-home by reading newspapers in the morning and watching TV in the evening. During this early period of TV introduction, roughly 50% of TV sets were in use during the daytime, while over 80% were turned on in the evening (see figure 6 in Kersta, 1940). Moreover, according to a survey, newspaper reading was less frequent in households with TV sets (BBDO, 1951). In line with this statistic, media analyst John Morton states, "Television has captured time that had been devoted to reading afternoon newspapers...Meanwhile, changes in the economy have produced more service and less industry, which means more white-collar workers who go to work later, a pattern favoring morning papers" (Mann, April, 1992).

3 | THEORY AND HYPOTHESES

3.1 | Theoretical model

In this section, we present a stylized model to highlight the intuition behind firm responses under single- and multi-homing. To better link the theoretical findings to our empirical setting and for ease of exposition, we have chosen the model's features that are consistent with the underlying structure of newspaper and TV station business models. We use our theoretical model to derive several hypotheses, which we then apply to the data presented in the following sections.

We consider a market with one newspaper firm and one TV broadcasting station. While the newspaper generates revenues from subscription fees and advertisements, the TV station provides programs free to viewers and generates revenue only from advertisements. The market has one unit of consumers, among whom r of them, where $0 < r < 1$, are multi-homing, meaning that they both read the newspaper *and* watch the TV station (and $1 - r$ are single-homing, meaning that they read either the newspaper *or* watch TV but not both). The assumption of r multi-homing subscribers follows Doganoglu and Wright (2006) and Kaiser and Wright (2006).

Assume that consumers are uniformly distributed along a Hotelling line of unit interval. The newspaper firm is located at 0, and the TV station is located at 1. The subscription price

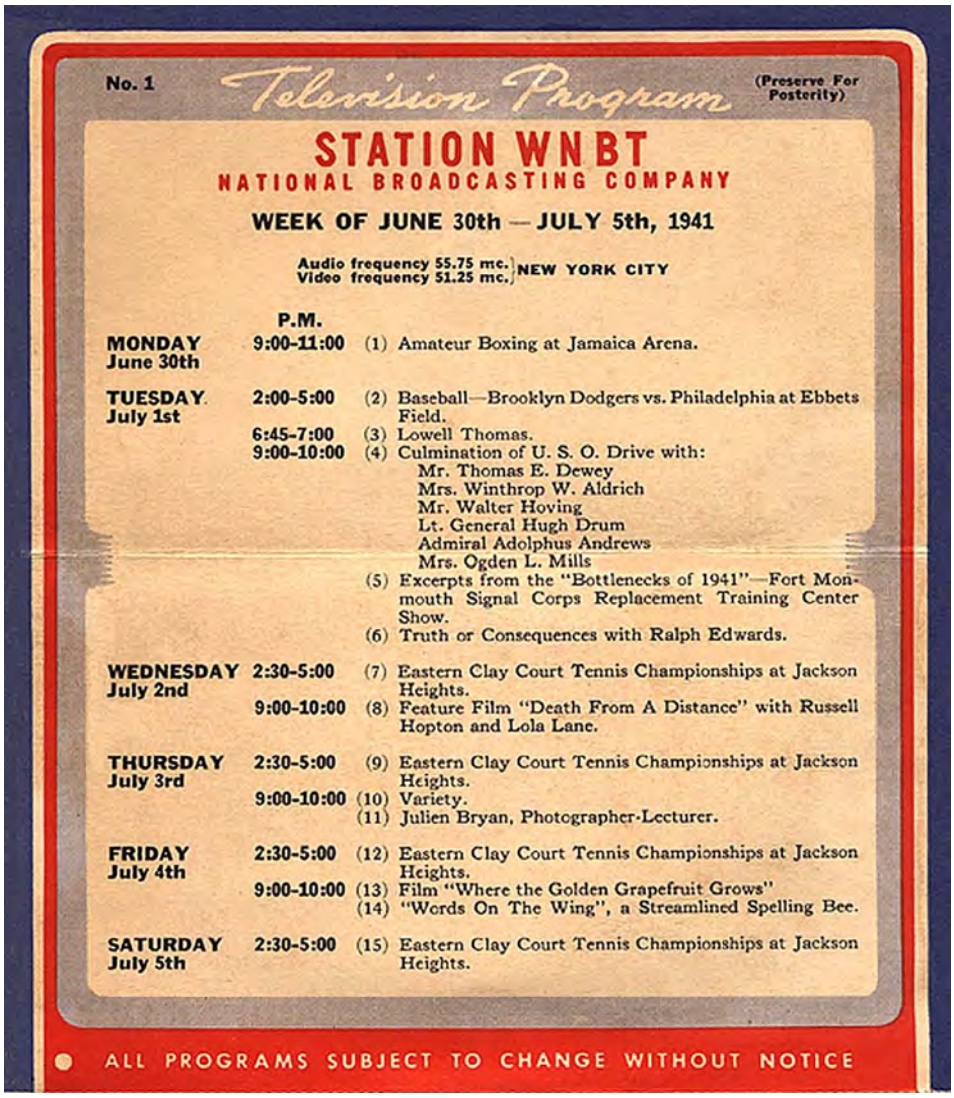


FIGURE 4 1941 TV programming schedule for WNBT in New York City.[3] *Source*: Paley Center for Media

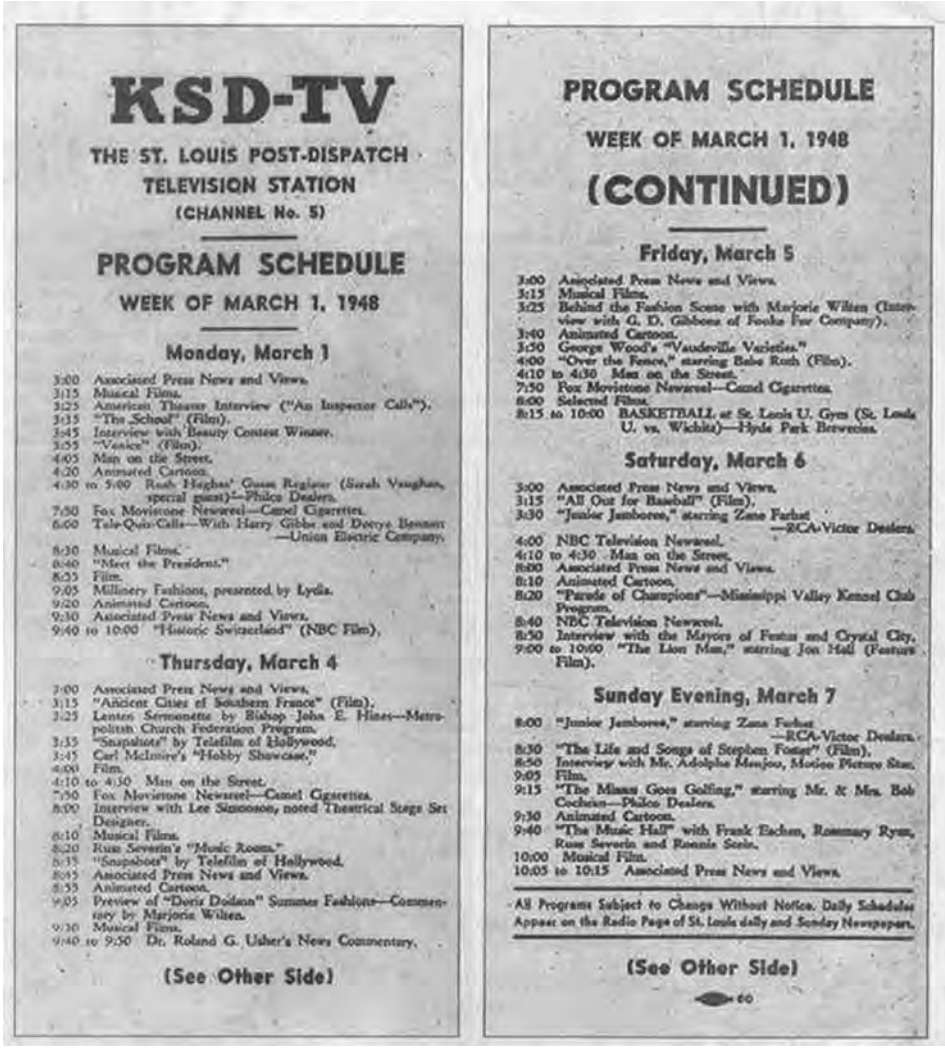
charged by the newspaper firm is p_n, and the rental price of a TV set is p_t.[4] Note that TVs are sold by TV manufacturers rather than by TV broadcasting stations. Since a TV is a durable good, we assume that consumers watching TV pay a rental price set by a TV manufacturer. TV stations provide their programs free to viewers with TVs. We also assume that the market is covered and that both firms have positive market shares in equilibrium.[5]

The utility of a consumer with location x from adopting the newspaper is $\nu_n - p_n - tx$, and that from adopting TV is $\nu_t - p_t - t(1-x)$, where ν_n and ν_t denote the qualities of the newspaper and the TV station, respectively, and t represents a unit mismatch cost. Similar to Armstrong (2006), our

[3]Source: https://www.paleycenter.org/p-70-tv-countdown-july-1-1941, accessed December 2018.

[4]"Rental price" is an abstraction that can be thought of as the amortized, per-period cost of owning a TV set.

[5]Mathematically, these assumptions require that $\frac{4rt}{1-r} + 3t \leq \nu_n + \nu_t + b_1$ and $-3t < \nu_n - \nu_t + b_1 < 3t$.



KSD-TV

THE ST. LOUIS POST-DISPATCH TELEVISION STATION (CHANNEL No. 5)

PROGRAM SCHEDULE

WEEK OF MARCH 1, 1948

Monday, March 1

3:00 Associated Press News and Views.
3:15 Musical Films.
3:25 American Theater Interview ("An Inspector Calls").
3:35 "The School" (Film).
3:45 Interview with Beauty Contest Winner.
3:55 "Venice" (Film).
4:05 Man on the Street.
4:20 Animated Cartoon.
4:30 to 5:00 Ruth Hughes' Guess Register (Sarah Vaughan, special guest)—Philco Dealers.
7:50 Fox Movietone Newsreel—Camel Cigarettes.
8:00 Tele-Quiz-Calls—With Harry Gibbs and Dorcye Bennett —Union Electric Company.
8:30 Musical Films.
8:40 "Meet the President."
8:55 Film.
9:05 Millinery Fashions, presented by Lydia.
9:20 Animated Cartoon.
9:30 Associated Press News and Views.
9:40 to 10:00 "Historic Switzerland" (NBC Film).

Thursday, March 4

3:00 Associated Press News and Views.
3:15 "Ancient Cities of Southern France" (Film).
3:25 Lenten Sermonette by Bishop John E. Hines—Metropolitan Church Federation Program.
3:35 "Snapshots" by Telefilm of Hollywood.
3:45 Carl McIntire's "Hobby Showcase."
4:00 Film.
4:10 to 4:30 Man on the Street.
7:50 Fox Movietone Newsreel—Camel Cigarettes.
8:00 Interview with Lee Simonson, noted Theatrical Stage Set Designer.
8:10 Musical Films.
8:20 Russ Severin's "Music Room."
8:35 "Snapshots" by Telefilm of Hollywood.
8:45 Associated Press News and Views.
8:55 Animated Cartoon.
9:05 Preview of "Doris Dodson" Summer Fashions—Commentary by Marjorie Wilten.
9:30 Musical Films.
9:40 to 9:50 Dr. Roland G. Usher's News Commentary.

(See Other Side)

PROGRAM SCHEDULE

WEEK OF MARCH 1, 1948

(CONTINUED)

Friday, March 5

3:00 Associated Press News and Views.
3:15 Musical Films.
3:25 Behind the Fashion Scene with Marjorie Wilten (Interview with G. D. Gibbons of Fooks Fur Company).
3:40 Animated Cartoon.
3:50 George Wood's "Vaudeville Varieties."
4:00 "Over the Fence," starring Babe Ruth (Film).
4:10 to 4:30 Man on the Street.
7:50 Fox Movietone Newsreel—Camel Cigarettes.
8:00 Selected Films.
8:15 to 10:00 BASKETBALL at St. Louis U. Gym (St. Louis U. vs. Wichita)—Hyde Park Breweries.

Saturday, March 6

3:00 Associated Press News and Views.
3:15 "All Out for Baseball" (Film).
3:30 "Junior Jamboree," starring Zana Farbar —RCA-Victor Dealers.
4:00 NBC Television Newsreel.
4:10 to 4:30 Man on the Street.
8:00 Associated Press News and Views.
8:10 Animated Cartoon.
8:20 "Parade of Champions"—Mississippi Valley Kennel Club Program.
8:40 NBC Television Newsreel.
8:50 Interview with the Mayors of Fenton and Crystal City.
9:00 to 10:00 "The Lion Man," starring Jon Hall (Feature Film).

Sunday Evening, March 7

8:00 "Junior Jamboree," starring Zana Farbar —RCA-Victor Dealers.
8:30 "The Life and Songs of Stephen Foster" (Film).
8:50 Interview with Mr. Adolphe Menjou, Motion Picture Star.
9:05 Film.
9:15 "The Misses Goes Golfing," starring Mr. & Mrs. Bob Cochran—Philco Dealers.
9:30 Animated Cartoon.
9:40 "The Music Hall" with Frank Eachen, Rosemary Ryan, Russ Severin and Ronnie Scott.
10:00 Musical Film.
10:05 to 10:15 Associated Press News and Views.

All Programs Subject to Change Without Notice. Daily Schedules Appear on the Radio Page of St. Louis daily and Sunday Newspapers.

(See Other Side)

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FIGURE 5 1948 TV programming schedule for KSD-TV in St. Louis.[6] Source: Early Television Museum

functional form implicitly assumes that consumer demand for the newspaper and the TV station is independent of the number of advertisements carried by each. This assumption is consistent with empirical findings on the newspaper industry, as reported by Argentesi and Filistrucchi (2007). Let D_n, D_t, and D_m be the single-homing demand for the newspaper, the single-homing demand for the TV station, and the multi-homing demand for both, respectively.

Let x^* be the location of the indifferent consumer. By solving $\nu_n - p_n - tx^* = \nu_t - p_t - t(1 - x^*)$, we obtain the following:

$$D_m = r \tag{1}$$

$$D_n = \frac{\nu_n - p_n + t - \nu_t + p_t}{2t}(1 - r) \tag{2}$$

[6]Source: http://www.earlytelevision.org/ksd-tv.html, accessed December 2018.

$$D_t = \frac{\nu_t - p_t + t - \nu_n + p_n}{2t}(1-r) \tag{3}$$

On the advertiser side, assume that each advertiser only purchases a maximum of one unit of advertisement per outlet (newspaper or TV). Let the newspaper and the TV station charge a lump sum of α_n and α_t, respectively, to advertisers. Following the assumption of prior studies (e.g., Ambrus et al., 2016; Anderson, Foros, & Kind, 2018; Anderson & Gabszewicz, 2006; Llanes & Ruiz-Aliseda, 2015; Rey & Verge, 2004), we assume a unit mass of homogeneous advertisers. Since the advertisers are homogeneous, each platform makes an offer that makes every advertiser indifferent to accepting or rejecting it. In this way, the platforms extract the maximum surplus from the advertiser side. We assume that each advertiser is willing to pay b_1 per ad per single-homing consumer reached and b_2 for multi-homing consumers.

Thus, we can derive the optimal advertising rates, α_n and α_t, as follows:

$$\alpha_n = b_1 D_n + b_2 D_m \tag{4}$$

$$\alpha_t = b_1 D_t + b_2 D_m \tag{5}$$

We have the following profit functions for the newspaper firm, the TV manufacturer, and the TV station, respectively:

$$\pi_n = p_n(D_n + D_m) + \alpha_n = p_n(D_n + D_m) + b_1 D_n + b_2 D_m \tag{6}$$

$$\pi_r = p_t(D_t + D_m) \tag{7}$$

$$\pi_t = \alpha_t = b_1 D_t + b_2 D_m \tag{8}$$

The game has two stages. In the first stage, the newspaper firm, the TV manufacturer, and the TV station make their pricing decisions. In the second stage, consumers make adoption decisions.

3.1.1 | Newspaper subscription price

Using the first-order conditions of the newspaper's profit function with respect to the subscription price and the TV manufacturer's profit function with respect to the TV rental price, we obtain the following:

$$p_n = \frac{1}{2}(\nu_n + t - \nu_t) + \frac{rt}{1-r} - \frac{b_1}{2} + \frac{1}{2}p_t \tag{9}$$

$$p_t = \frac{1}{2}(\nu_t + t - \nu_n) + \frac{rt}{1-r} + \frac{1}{2}p_n \tag{10}$$

We solve for the equilibrium prices as follows:

$$p_n = \frac{1}{3}(\nu_n + 3t - \nu_t) + \frac{2rt}{1-r} - \frac{2b_1}{3} \tag{11}$$

$$p_t = \frac{1}{3}(\nu_t + 3t - \nu_n) + \frac{2rt}{1-r} - \frac{b_1}{3} \tag{12}$$

Note that, as b_1 increases, the two prices both decrease for different reasons. The newspaper decreases its subscription price to increase the number of subscribers so that it can sell advertisers access to its subscribers for more profits. The TV manufacturer cannot benefit from an increase in b_1. Instead, because of the decrease in p_n, the demand for the TV station decreases. Hence, the TV rental price decreases.

It is easy to see that the following equation holds:

$$\frac{\partial p_n}{\partial r} = \frac{2t}{1-r} + \frac{2rt}{(1-r)^2} > 0$$

Proposition 1 *The newspaper subscription price, p_n, increases with the number of multi-homing consumers, r.*

Proposition 1 is intuitive. As the number of multi-homing consumers increases, fewer consumers abandon their newspaper subscriptions and switch to TV. Hence, the newspaper firm can increase its subscription price.[7] Conversely, as the number of single-homing consumers increases, the newspaper will decrease its subscription price.

3.1.2 | Newspaper circulation

We next examine how the newspaper circulation, $D_n + D_m$, changes with r:

$$\frac{d(D_n + D_m)}{dr} = \frac{d\left(\frac{\nu - p_n + t + \nu_t + p_t}{2t}(1-r) + r\right)}{dr} = \frac{d\left(\left(\frac{\nu - \nu_t}{6t} + \frac{1}{2} + \frac{b_1}{6t}\right)(1-r) + r\right)}{dr}$$

Define $\theta = \frac{D_n}{1-r} = \frac{\nu_n - \nu_t}{6t} + \frac{1}{2} + \frac{b_1}{6t}$, where θ represents the newspaper's market share among single-homing consumers. We know that $0 < \theta < 1$ and that θ is independent of r. We can then derive the following:

$$\frac{d(D_n + D_m)}{dr} = 1 - \theta > 0$$

Proposition 2 *The newspaper circulation, $D_n + D_m$, increases with the number of multi-homing consumers, r.*

Proposition 2 shows that, as expected, more multi-homing consumers increase the demand for the newspaper. Conversely, more single-homing consumers decrease the demand for the newspaper.

[7]Note that a corollary is that TV rental prices increase with the number of multi-homing consumers, but we do not list it here because of the data limitation as well as our focus on the newspaper and the TV station rather than on the TV manufacturer.

3.1.3 | Newspaper advertising rate

We re-express the newspaper advertising rate, α_n, as follows:

$$\alpha_n = b_1 D_n + b_2 D_m = b_1 \theta (1-r) + b_2 r \tag{13}$$

Differentiating it with respect to r, we obtain the following:

$$\frac{\partial \alpha_n}{\partial r} = b_2 - \theta b_1$$

$$\begin{cases} \frac{\partial \alpha_n}{\partial r} > 0 \; if \; b_2 > \theta b_1 \\ \frac{\partial \alpha_n}{\partial r} \leq 0 \; if \; b_2 \leq \theta b_1 \end{cases}$$

Proposition 3 *There exists* $\theta = \frac{\nu_n - \nu_t}{6t} + \frac{1}{2} + \frac{b_1}{6t} \in (0,1)$ *such that the following statements hold*:

1. *When* $b_2 > \theta b_1$, *the advertising rate charged by the newspaper firm increases with the number of multi-homing consumers*, r.
2. *When* $b_2 < \theta b_1$, *the advertising rate charged by the newspaper firm decreases with the number of multi-homing consumers*, r.
3. *When* $b_2 = \theta b_1$, *the number of multi-homing consumers*, r, *does not affect the advertising rate charged by the newspaper firm*.

The intuition for this proposition is that the newspaper circulation increases as r increases, making the newspaper more attractive to advertisers in terms of the number of consumers they can reach (the demand-expansion effect). However, as r increases, the composition of single-homing and multi-homing consumers in the circulation changes (the changing-composition effect); there is a greater proportion of multi-homing consumers. When $b_2 > \theta b_1$, the demand-expansion effect dominates the changing-composition effect. The newspaper becomes more attractive to advertisers, so the newspaper firm will increase its advertising rate. When b_2 is small, the newspaper becomes less attractive to advertisers, so the newspaper firm will reduce its advertising rate.

3.1.4 | TV advertising rate

We re-express the TV advertising rate, α_t, as follows[8]:

[8]Note that the coefficients b_1 and b_2 here are the same as those determining the newspaper ad rate. This implies that the advertiser's willingness to pay to reach the same consumers via newspaper or TV is the same, regardless of the medium used.

$$\alpha_t = b_1 D_t + b_2 D_m = b_1 \frac{\nu_t - p_t + t - \nu_n + p_n}{2t}(1-r) + b_2 r = b_1 \left(\frac{\nu_t - \nu_n}{6t} + \frac{1}{2} - \frac{b_1}{6t} \right)(1-r) + b_2 r \quad (14)$$

Define $\omega = \frac{D_t}{1-r} = \frac{\nu_t - \nu_n}{6t} + \frac{1}{2} - \frac{b_1}{6t}$, where ω represents the TV station's market share among single-homing consumers. Since $0 < D_t < 1 - r$, $0 < \omega < 1$, and ω is independent of r. Taking the derivative of α_t with respect to r gives us the following:

$$\frac{\partial \alpha_t}{\partial r} = b_2 - \omega b_1$$

$$\begin{cases} \frac{\partial \alpha_t}{\partial r} > 0 \, if \, b_2 > \omega b_1 \\ \frac{\partial \alpha_t}{\partial r} \leq 0 \, if \, b_2 \leq \omega b_1 \end{cases}$$

Proposition 4 *There exists* $\omega = \frac{\nu_n - \nu_t}{6t} + \frac{1}{2} - \frac{b_1}{6t} \in (0,1)$ *such that the following statements hold*:

1. *When* $b_2 > \omega b_1$, *the advertising rate charged by the TV station increases with the number of multi-homing consumers*, r.
2. *When* $b_2 < \omega b_1$, *the advertising rate charged by the TV station decreases with the number of multi-homing consumers*, r.
3. *When* $b_2 = \omega b_1$, *the number of multi-homing consumers*, r, *does not affect the advertising rate charged by the TV station*.

The intuition for this proposition is similar to that for Proposition 3 for the newspaper advertising rate. As r increases, there is a demand-expansion effect as well as a changing-composition effect for the TV station. The threshold here indicates when one effect dominates the other.

3.2 | Hypotheses

In our empirical context, consumers are more likely to single-home in a market with a TV station and an evening newspaper than in a market with a TV station and a morning newspaper. Based on Propositions 1 and 2, we have the following two empirical hypotheses:

Hypothesis (H1) *When a TV station enters a market, evening newspaper subscription prices decrease relative to morning newspaper subscription prices.*

Hypothesis (H2) *When a TV station enters a market, the evening newspaper circulation decreases relative to the morning newspaper circulation.*

Propositions 3 and 4 suggest that the relationship between newspaper and TV advertising rates and the number of multi-homing consumers depends on the magnitude of b_2

(an advertiser's willingness to pay per multi-homing consumer) relative to b_1 (an advertiser's willingness to pay per single-homing consumer). We thus have the following hypotheses for empirical tests:

Hypothesis (H3) *When a TV station enters a market, evening newspaper advertising rates decrease relative to morning newspaper advertising rates if advertisers' willingness to pay per multi-homing consumer is sufficiently high. Otherwise, evening newspaper advertising rates increase relative to morning newspaper advertising rates.*

Hypothesis (H4) *When advertisers' willingness to pay per multi-homing consumer is sufficiently high relative to their willingness to pay per single-homing consumer, a TV station's advertising rate decreases with the number of evening newspaper readers relative to the number of morning newspaper readers. Otherwise, the TV station's advertising rate increases with the number of evening newspaper readers.*

We also note that a model based on product differentiation, in which morning and evening newspapers have different degrees of differentiation from TV stations, does not produce the same set of predictions. Without a change in the consumer's homing tendency (i.e., assuming r is constant), we will find that newspaper advertising rates always move in the opposite direction as TV advertising rates as the degree of differentiation (measured by t, the unit mismatch cost, which measures the degree of differentiation between the two media) changes.[9] Our hypotheses based on multi-homing (H3 and H4) suggest that newspaper advertising rates and TV advertising rates can move in the same direction after the TV entry in markets with more single-homing consumers (i.e., more evening newspapers). Our empirical analysis thus also serves as a test of the model assumptions.

4 | DATA AND METHODS

4.1 | Data

We have collected data from multiple historical sources. Table 1 reports the summary statistics of all variables used. We define the relevant market as the county where the newspaper is based, an approach consistent with that of other research in this area (e.g., Gentzkow & Shapiro, 2010; Seamans & Zhu, 2014) and roughly consistent with TV broadcast coverage. The information on the dates of TV entry into different markets is obtained from George (2009). During the period under study (1945–1963), commercial TV broadcasting stations entered 848 markets. Using this information, we create a dummy variable, $TV\ in\ market_{it}$, which equals one for all years, t, after a TV station enters newspaper i's local market; otherwise, it has a value of zero.

The information on each newspaper's weekly circulation ($Circulation_{it}$), subscription price ($Price_{it}$), advertising rate ($Ad\ rate_{it}$), morning or evening status, owner, and year founded is obtained from the *Editor & Publisher (E&P) International Year Book* for the years 1945–1949 and 1952–1963. We focus on these years because they are the most active years of TV entry (see Figure 1) and because of data availability.[10] The *Year Book* contains data on virtually every

[9]To see this, using equations (13) and (14), we have $\frac{\partial \alpha_n}{\partial t} = b_1(1-r)\frac{\partial \theta}{\partial t} < 0$ and $\frac{\partial \alpha_l}{\partial t} = b_1(1-r)\frac{\partial \omega}{\partial t} > 0$.

[10]We were not able to obtain data for 1950–1951.

TABLE 1 Summary statistics

					Distribution		
	Mean	***SD***	**Min**	**Max**	**10th**	**50th**	**90th**
Evening newspaper	0.88	0.33	0.00	1.00	0.00	1.00	1.00
TV in Market	0.70	0.46	0.00	1.00	0.00	1.00	1.00
Price	0.31	0.11	0.04	2.10	0.20	0.30	0.42
Circulation	27,226.06	67,629.33	2001.00	2,156,137.00	3,385.00	8,502.50	55,465.00
Ad rate	0.13	0.20	0.01	11.50	0.04	0.08	0.25
TV ad rate	543.34	671.72	50.00	7,000.00	125.00	325.00	1,200.00
% low education	0.32	0.05	0.00	0.63	0.26	0.32	0.38
% high education	0.08	0.03	0.00	0.38	0.05	0.07	0.12
% labor force	0.38	0.05	0.03	0.82	0.08	0.38	0.44
Year	1954.21	5.50	1945.00	1963.00	1946.00	1955.00	1962.00

newspaper in the United States and has been used extensively for newspaper studies (e.g., Gentzkow & Shapiro, 2010; Seamans & Zhu, 2014). Since TV entry takes place in local markets, we focus on newspapers that have a predominantly local concentration. As a result, we exclude large national papers, including *The Christian Science Monitor*, *The New York Times*, *The Wall Street Journal*, and *The Washington Post*, from our analysis. Due to our focus on competitive interactions, we also drop those observations where a newspaper and a TV station have the same owner.[11]

We have also collected the $TV\ ad\ rate_{it}$ data from 1949, 1955, 1957, and 1962—the only years when such data were available. This information comes from *Television Factbook*, which was founded in 1945 by Martin Codel's Radio News Bureau. *Television Factbook* contains information about broadcasting stations' locations, personnel, networks, and advertising rates. In our analysis, we focus on the rates that stations charged for 1 hr of advertising. We rely on a third party to digitize and code hard-copy versions of the *E&P International Year Book* and *Television Factbook*. We have used this third party several times in the past and believe it to be reliable. Nevertheless, we conduct additional tests (described later) to rule out the possibility that coding errors might affect our results.

We construct variables to indicate the newspaper type. $Morning\ newspaper_i$ indicates whether newspaper i is published and distributed in the morning ($Morning\ newspaper_i = 1$), and $Evening\ newspaper_i$ indicates whether newspaper i is published and distributed in the evening ($Evening\ newspaper_i = 1$). In some cases, a newspaper is circulated in both the morning and the evening. For those newspapers, we calculate the circulation share with *circulation of morning paper*/(*circulation of morning paper* + *circulation of evening paper*). If the circulation share of the morning paper is greater than 70%, the newspaper is considered a morning newspaper, and it is considered an evening paper otherwise. However, our results are robust to different thresholds (see Data S1, Appendix A).

Notably, the morning or evening newspaper designation does not change noticeably with time. As indicated in Figure 1, the proportion of each remains relatively stable throughout the period under study, and as indicated in Figure 3, the proportion of papers that switch types (number of newspapers that switch type/total number of newspapers) is very low

[11]There are 7,064 newspaper-year observations where a newspaper and a TV station have the same owner.

TABLE 2 Summary statistics by newspaper type

	(a) Morning newspaper				(b) Evening newspaper			
	Mean	***SD***	**Min**	**Max**	**Mean**	***SD***	**Min**	**Max**
TV in market	0.69	0.46	0.00	1.00	0.70	0.46	0.00	1.00
Price	0.36	0.14	0.04	1.30	0.31	0.11	0.04	2.10
Circulation	53,495.07	115,158.50	2002.00	2,156,137.00	23,506.61	56,856.31	2001.00	1,327,791.00
Ad rate	0.22	0.30	0.01	4.75	0.12	0.17	0.01	11.50
TV ad rate	505.88	475.77	50.00	3,083.33	555.38	723.58	50.00	7,000.00
% low education	0.33	0.05	0.03	0.54	0.32	0.05	0.00	0.63
% high education	0.08	0.03	0.01	0.22	0.08	0.03	0.00	0.38
% labor force	0.39	0.05	0.03	0.62	0.38	0.05	0.03	0.82
Year	1954.15	5.63	1945.00	1963.00	1954.22	5.48	1945.00	1963.00

TABLE 3 Pairwise correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Log price	1								
(2) Log circulation	0.366	1							
	[0.000]								
(3) Log ad rate	0.494	0.797	1						
	[0.000]	[0.000]							
(4) TV in Market	0.408	0.087	0.307	1					
	[0.000]	[0.000]	[0.000]						
(5) Evening newspaper	−0.115	−0.241	−0.232	0.003	1				
	[0.000]	[0.000]	[0.000]	[0.631]					
(6) % Low education	0.129	0.199	0.209	0.121	−0.079	1			
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]				
(7) % High education	0.244	0.226	0.299	0.156	−0.060	−0.052	1		
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]			
(8) % Labor force	0.023	0.285	0.204	−0.041	−0.100	0.459	0.322	1	
	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]		
(9) Year	0.558	0.041	0.356	0.737	0.004	0.100	0.157	−0.148	1
	[0.000]	[0.000]	[0.000]	[0.000]	[0.502]	[0.000]	[0.000]	[0.000]	

p-Values in brackets.

(approximately 1%) during the period under study. Thus, we can assume that the morning or evening newspaper designation is a fixed trait of a newspaper. We therefore treat these designations as a fixed characteristic that does not vary over year *t*. Later, we relax this assumption and explore the robustness of our results by dropping newspapers that switch types. However, given the limited number of switches, the results are basically unchanged (see Data S1, Appendix E).

Table 2 compares morning and evening newspapers and shows that both types are similar across many dimensions, although morning newspapers tend to have a larger circulation. The pairwise correlations among the variables used in the analysis are reported in Table 3.

We include multiple demographic control variables. Following George (2009), we track the demographics at the county level. We include the percentage of the population with less than a college education ($\%\ Low\ education_{it}$), the percentage with at least a college education ($\%\ High\ education_{it}$), and the percentage over the age of 14 that is included in the labor force ($\%\ Labor\ force_{it}$). We prefer this measure over others, as it captures the population of working individuals who are the likely targets of advertisers. These data are available at the county level from the U.S. Census Bureau for each census year (1940, 1950, 1960, and 1970). Based on these values, we linearly interpolate the values for the years between the censuses.

5 | METHODS

Our empirical approach for the analysis of newspapers (H1–H3) relies on the differences in the presence of a TV station across and within newspaper markets over time. Similar to prior

studies (Baker & George, 2010; Gentzkow, 2006; George, 2009), we leverage the exogenous variation in the TV–broadcasting–station penetration across geographical markets caused by the TV-licensing freeze between 1950 and 1952 to establish a causal relationship; it is unlikely that any local newspapers anticipated this freeze (or the Korean War, which extended the freeze).

For the analysis of TV advertising rates, we rely on the differences in the presence of evening newspapers across and within TV broadcasting markets. We believe that this approach is justifiable, given the exogenous variation in the timing of TV station entry into the markets, as noted above, as well as the fact that newspapers rarely change their type from year to year (see Figure 3).

We use the following regression specification to test our predictions on newspaper prices, circulation, and advertising rates (H1–H3):

$$Outcome_{it} = \beta_0 + \beta_1 TV\ in\ market_{it} + \beta_2 Evening\ newspaper_i \times TV\ in\ market_{it} + X_{it}B + \gamma_i + \eta_t + \varepsilon_{it}$$

In the above equation, $Outcome_{it} = log(Price_{it})$, $log(Circulation_{it})$, or $log(Ad\ Rate_{it})$. We use the logarithm of these variables because Table 1 indicates that these variables are highly skewed. X_{it} is a matrix of other newspaper-year or market-year variables. The variables γ_i and η_t are fixed effects for newspaper and year; because we include fixed newspaper effects, we do not include the variable $Evening\ newspaper_i$ or any other time-invariant variables in our regressions. Errors are clustered at the county level. The variable β_2 captures the *relative* effect of single-homing on newspaper outcomes. Based on H1 and H2, we expect $\beta_2 < 0$; that is, prices and circulation decrease with single-homing. For H3, when advertisers' willingness to pay per multi-homing consumer is sufficiently high *relative* to their willingness to pay per single-homing consumer, we expect $\beta_2 < 0$; that is, advertising rates decrease with single-homing.

We use the following regression specification to test our predictions on TV advertising rates from H4:

$$log(TV\ Ad\ Rate_{mt}) = \beta_0 + \beta_1 \%Evening\ circulation_{mt} + X_{mt}B + \gamma_m + \eta_t + \varepsilon_{mt}$$

We use the logarithm of the TV advertising rate because Table 1 indicates that this variable is highly skewed. Note that, unlike the prior regressions, which are at the newspaper level, the TV advertising rate regression is at the market level. Additionally, the other specifications use the exogenous entry of TV into newspaper markets. However, we cannot do so here because the TV advertising rate is undefined until TV enters the market. Instead, we focus on the percentage of the newspaper circulation in market m and year t for evening newspapers ($\%Evening\ circulation_{mt}$); the higher this percentage, the higher the percent of the market that single-homes. X_{mt} is a matrix of other market-year variables. The variables γ_m and η_t are fixed effects for market and year. Errors are clustered at the market level. The variable β_1 captures the effect of single-homing on TV advertising rates. Per H4, when advertisers' willingness to pay per multi-homing consumer is sufficiently high relative to their willingness to pay per single-homing consumer, we expect $\beta_1 < 0$; that is, TV advertising rates decrease with single-homing.

6 | RESULTS

6.1 | Main results

We present our newspaper-level results, testing H1–H3, in Table 4 before turning to the market-level results, testing H4, in Table 5. We rely on Ordinary Least Square (OLS) regressions

TABLE 4 Effect of TV entry on morning and evening newspapers

	(1)	(2)	(3)
Variables	Log Price	Log circulation	Log ad rate
TV in market	0.019	0.005	0.024
	(0.014)	(0.016)	(0.018)
Evening newspaper × TV in market	−0.039	−0.038	−0.054
	(0.013)	(0.017)	(0.016)
%Low education	0.073	−2.625	−1.490
	(0.205)	(0.312)	(0.289)
%High education	−0.529	−4.378	−1.100
	(0.579)	(0.883)	(0.872)
%Labor force	0.028	1.232	0.854
	(0.221)	(0.272)	(0.301)
Constant	−1.556	9.740	−2.678
	(0.050)	(0.080)	(0.068)
Year FE	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes
Observations	22,836	23,999	21,250
Number of newspapers	2,796	2,851	2,500
Adjusted R-squared	0.547	0.306	0.393

Note: Clustered standard errors in parentheses.

in all cases. The coefficients on $Evening\ newspaper_i \times TV\ in\ market_{it}$ are all negative and statistically significant ($p = .002$, .028, and .001, respectively), suggesting that TV entry has a negative impact on the subscription prices, circulation, and advertising rates of newspapers with more single-homing readers. Note that the coefficients on $TV\ in\ market_{it}$ are positive but not statistically significant in all three cases, suggesting that TV entry has little impact on the subscription prices, circulation, and advertising rates of newspapers with multi-homing readers.

Table 5 presents the results on TV advertising rates. In Column 1, we present the results from a fixed-market-effect model that uses all 4 years of the data that we have on TV advertising rates. The coefficient on $\%Evening\ circulation_{mt}$ is negative and statistically significant (p-value = .024). Our interpretation is that TV advertising rates are lower in markets where evening newspapers dominate. In Column 2, we present Winsorized results, which are consistent with those in Column 1.

Overall, these results support H1 and H2. They also support the first parts of H3 and H4, suggesting that, in this setting, advertisers' willingness to pay per multi-homing consumer is sufficiently high relative to their willingness to pay per single-homing consumer. In other words, there is synergy for an advertiser to reach the same consumer through different types of channels. Advertisers have a target for the number of advertisement impressions per consumer (Yuan, Wang, & Zhao, 2013), and there are synergies for reaching a consumer across multiple media (Laroche, Kiani, Economakis, & Richard, 2013; Naik & Peters, 2009; Olbrich & Schultz, 2014). Our results are consistent with Chandra and Kaiser's (2014) finding that the

TABLE 5 Effect of multi-homing on TV ad rates

	(1)	(2)
Variables	Log TV Ad rate	Winsorized
%Evening circulation	−0.135	−0.107
	(0.059)	(0.060)
# of Newspapers	0.001	−0.014
	(0.011)	(0.013)
% Low education	3.157	2.963
	(2.196)	(2.201)
% High education	4.848	4.424
	(5.381)	(5.376)
% Labor force	−2.162	−2.013
	(2.208)	(2.218)
Constant	3.789	3.847
	(0.314)	(0.316)
Year FE	Yes	Yes
Market FE	Yes	Yes
Observations	548	548
Number of markets	227	227
Adjusted *R*-squared	0.836	0.835

Note: Clustered standard errors in parentheses.

introduction of a new platform (e.g., online media) can have complementarities with an existing platform as well as with Chang and Thorson's (2004) findings that TV and web advertising synergy leads to higher attention, higher perceived message credibility, and a greater number of total and positive thoughts than repetition in one channel. Additionally, our results indicating that both newspaper and TV advertising rates decrease more in markets with evening newspapers relative to those with morning newspapers help to rule out the alternative theoretical model based on product differentiation.

6.2 | Robustness and mechanism tests

We believe that our results are robust to numerous alternative explanations. Our newspaper regressions include newspaper-fixed effects, and our TV advertising rate regressions include TV market-fixed effects, which control for idiosyncratic firm and market differences, respectively. The year-fixed effects control for year-specific shocks that affect all newspapers or all markets (e.g., recessions). Our regressions also include various measures of annual county population, which helps control for any market-specific changes in the demand for newspapers or TV. Moreover, the entry of TV into a market is arguably exogenous and unanticipated by the local newspapers. The FCC's freeze provides us with temporal and geographic variations in the entry of TV. This helps us rule out the idea that any effect of TV entry into a market is due to a contemporaneous shock that affects all markets at the same time. Nevertheless, we perform several robustness tests to rule out other

alternative explanations. The results of these robustness tests are provided in Data S1, Appendices A–G.

First, as indicated above, we try alternate cutoff values for our definition of morning newspapers (80% and 100% instead of 70%). The results are robust to these alternate specifications (see Data S1, Appendix A).

Second, to rule out the possibility that outliers are driving our results (perhaps due to poor coding by the firm that we used), we Winsorize our dependent variables at the 1% and 99% levels. These results, presented in Data S1 (Appendix B), are similar to those presented above.

Third, one might worry about the more complicated story that TV entry affects the nature of competition among newspapers more generally and, in turn, leads to changes in advertising rates, subscription prices, and circulation. We thus replicate our main results after restricting our sample of newspapers to the monopolists or duopolists in their markets. The results, presented in Data S1 (Appendix C), are similar to our main results and suggest that any indirect effect among newspapers is unlikely to be the causal reason for the change in newspaper behavior.

Fourth, one might be concerned that our findings are caused by the entry and exit of newspapers before or after TV enters the market. For example, if a large number of high-circulation newspapers exit immediately after the TV entry, this may drive down the average effect of the TV entry observed in Column 3 of Table 5. We conduct a robustness check by restricting our analysis to the set of newspapers for which we have observations at least 3 years before and after the entry of TV. The results, presented in Data S1 (Appendix D), are similar to our main results and help rule out this alternative explanation.

Fifth, we determine whether a newspaper was a morning or an evening type by its circulation share in the first year of observation. It is possible that newspapers not only change their prices and advertising rates in response to TV entry but also switch from morning to evening or from evening to morning types. Although only a small fraction of newspapers changed their types during our sample period, to address this issue, we drop the newspapers that changed types over the years and only include those that did not change types. Again, we find similar results to those of our main model, as shown in Data S1, Appendix E.

Sixth, we conduct an additional analysis to further assess our assumption—based on historical evidence—that markets with morning newspapers are more likely to have multi-homing consumers (i.e., read newspapers *and* watch TV) and that markets with evening newspapers are more likely to have single-homing consumers (i.e., read newspapers *or* watch TV). To empirically investigate whether the assumption is legitimate, we re-estimate our main model on subsamples, split into markets with more public transit commuters and markets with fewer public transit commuters. Our rationale is that public transit commuters comprise a group of people who are especially more likely to multi-home in our context; they are likely to read morning newspapers on their way to work and watch TV at home in the evening (i.e., the parameter r in our theoretical model is bigger). Following this logic, we test whether the interaction term *Evening newspaper* × *TV in Market* is different among markets with different numbers of public transit commuters.

To conduct this test, we collected additional data on the number of public transit commuters from the 1960 census. Using these data, we identify regions[12] with high numbers of public transit commuters (i.e., above the median) and regions with low numbers of public transit

[12]The 1960 census reports public transit commuter information at the Standard Metropolitan Statistical Area (SMSA) level. We match SMSA with county to conduct our analysis.

commuters (i.e., below the median), although we do lose a number of observations because of the lack of data on commuting. We find that the interaction term *Evening newspaper* × *TV in Market* for all three dependent variables is statistically significant in areas with a high number of public transit commuters but not in areas with a low number of public transit commuters (see Data S1, Appendix F); the chi-square tests for equality of the regression coefficients show that the coefficients for the interaction term *Evening newspaper* × *TV in Market* are significantly larger for the regression model using markets with a high number of public transit commuters. These results indicate that newspapers are more likely to make appropriate adjustments to their pricing (based on whether they are morning or evening newspapers) if they operate in markets with a high number of public transit commuters. This lends further support to our assumption that readers in markets with evening newspapers are more likely to single-home than readers in markets with only morning newspapers.

Finally, we conduct an empirical analysis to gain further insights about the underlying decision-making process of newspapers. Although we cannot directly observe newspapers accounting for their customers' single-homing or multi-homing tendencies, we can study newspapers with differing degrees of *ability* to make appropriate adjustments based on their customers' homing tendencies. We hypothesize that newspapers that have more experience in dealing with a shock similar to the one that they experienced when TV entered their markets will be better able to make appropriate adjustments that consider their customers' homing tendencies.

One such shock that is similar to the introduction of TV is the introduction of radio. The expansion of radio broadcasting predated the entry of TV stations. Commercial radio broadcasting in the United States began in 1920. KDKA was the first station that received a federal license for radio broadcasting and began broadcasting on November 2, 1920. Radio had a similar business model as TV, depending primarily on advertising revenues (Meyers, 2013). Similar to early TV broadcasting, early radio programs were offered mostly in the afternoons and evenings.[13] We collected additional information about radio availability in a market in 1945–1963 from the *American Radio History* archives. This archive contains information about whether a radio station exists in a given geographic market and the founding year of that radio station.

Using these data, we compare newspapers that experienced radio entry earlier (i.e., "high radio experience") and newspapers that experienced radio entry later (i.e., "low radio experience"). We conduct a split sample analysis between these two groups of newspapers to test whether the interaction term *Evening Newspaper* × *TV Entry* is different. We find that newspapers with high radio experience have a significant negative *Evening Newspaper* × *TV Entry* interaction term, while the opposite is true in the case of newspapers with low radio experience (see Data S1, Appendix G). Although the chi-square tests for equality of the regression coefficients do not find a significant difference between the two sets of regression coefficients, the direction of the coefficients is in line with our theory. These results indicate that newspapers with high radio experience engage in appropriate adjustments in response to the entry of TV based on their customers' homing tendencies (i.e., based on whether a newspaper is a morning or an evening newspaper). However, newspapers with low radio experience do not seem to show such differential adjustments in response to the entry of TV. These results suggest heterogeneity in the decision-making process of newspapers and highlight the role of experience with prior shocks in appropriately responding to a current shock. Nonetheless, we want to

[13]See a sample programming schedule at https://ephemeralnewyork.wordpress.com/2010/04/24/whats-on-the-radio-december-19-1934/, accessed September 2017.

emphasize that these results on learning are suggestive rather than conclusive. We leave it to future research to provide a more in-depth treatment of this mechanism.

7 | DISCUSSION AND CONCLUSION

We study how consumer homing tendencies affect platform responses in a historical setting. Specifically, we study how U.S. newspapers respond to the entry of TV in local media markets from 1945 to 1963. Our empirical setting takes advantage of a quasi-natural experiment—the staggered geographic and temporal rollout of TV stations that was temporarily halted during the Korean War. We find that newspapers in markets that are more likely to have single-homing consumers (i.e., evening newspapers and TV) have lower subscription prices, circulation, and advertising rates relative to newspapers in markets with multi-homing consumers (i.e., morning newspapers and TV). We also find that TV advertising rates are lower in markets with more single-homing consumers. Overall, these results suggest that platforms in multi-sided market settings need to consider their consumers' tendencies to single-home or multi-home when formulating their responses to a competitor's entry.

Our study makes two contributions to the existing literature. First, we provide theoretically grounded empirical evidence of how a platform responds to the entry of another platform in a setting with varying degrees of consumer homing tendencies—an area that has been the subject of recent theoretical research but limited empirical work. We show that heterogeneity in consumer homing tendencies is an important demand-side consideration. Thus, our study complements existing research (e.g., Cennamo et al., 2018; Kapoor & Agarwal, 2017; Koh & Fichman, 2014; Venkataraman et al., 2019) by highlighting the importance of considering demand-side constraints.

Second, even though our study draws from the historical context of over half a century ago, we believe that it has managerially relevant implications today. Firms in multiple modern industries can be characterized as platforms operating in two-sided markets that have to consider whether their customers are single- or multi-homing and how that may influence the trajectory of competition in a market. For example, consider Disney's entry into online streaming, which Disney CEO Bob Iger characterized in the company's 2018 third-quarter-earnings call as "the biggest priority of the company during calendar 2019."[14] To respond appropriately to Disney's entry into the video-streaming market, incumbent platforms, such as Netflix and Amazon Prime Video, need to understand their own users' homing tendencies. In our study, consumers' homing tendencies are influenced by when they read the newspaper, but in the video-streaming industry, customers' homing tendencies are likely to be influenced by content overlap among different platforms. The impact of Disney's entry will be more disruptive if there is a larger overlap in content offerings between Disney and the existing streaming platforms. In such a case, consumers' single-homing (i.e., subscribing only to Disney *or* only to their existing platform) will be more likely, similar to when evening newspapers faced the entry of TV into their market. However, the impact of Disney's entry will be less significant if there is little content overlap between Disney and the existing streaming platforms because customers' multi-homing (i.e., subscribing to both Disney *and* their existing platform) will be more likely, similar to when morning newspapers faced the entry of TV into their market. We thus predict that if consumers multi-home their

[14]Source: https://disneydiary.com/2018/08/this-is-the-walt-disney-co-s-biggest-priority-in-2019/, accessed November 2018.

streaming providers, then subscription prices and advertising rates will be higher (to the extent that a streaming platform relies on advertising revenue as part of its business model).

While our empirical setting and a battery of robustness checks help assuage concerns about selection and other types of endogeneity, our findings and research design do have limitations. First, for data availability reasons, we focus only on the newspapers' prices, circulation, and advertising rate responses and on TV stations' advertising rates. However, firms have other means of responding to technological disruption, including resource reconfiguration (Karim & Mitchell, 2000; Lieberman, Lee, & Folta, 2017), cost cutting (Love & Nohria, 2005), and repositioning (Seamans & Zhu, 2017; Wang & Shaver, 2014, 2016). Future research could further examine how single- and multi-homing affect non-price dimensions of firm responses.

Second, firm strategies such as product differentiation and exclusive contracts may influence single- and multi-homing tendencies (e.g., Cennamo & Santalo, 2013). Thus, future research could explore the effectiveness of these strategies in other settings.

Third, we leverage the variation in the fraction of multi-homing consumers across different markets (i.e., parameter r in our theoretical model) to illustrate the mechanism. Future research could explore other variations, such as those around each advertiser's willingness to pay per single-homing or multi-homing consumer (i.e., parameters b_1 and b_2 in our theoretical model), to provide further evidence regarding the mechanism.

Finally, we study the roles of single- and multi-homing in a single industry. The benefit of this approach is that it allows us to take advantage of several key institutional features (e.g., multiple, geographically segmented media markets and the staggered entry of TV into these markets), but the drawback is that we cannot know how well these results can be generalized to other settings. Thus, future studies should examine single- and multi-homing in other settings.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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