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Multi-homing and Platform Strategies:
Historical Evidence from the U.S. Newspaper Industry

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We study how local U.S. newspapers respond to entry by TV broadcast stations in 1945–1963. We find that newspaper firms' responses depend on their customers' tendencies to multi-home (adopt both newspaper and TV) or single-home (adopt only newspaper or only TV). We also find that their prior experience responding to entry by radio stations improve their capability to respond to entry by TV stations. Our research builds on and extends literatures on platforms and learning-by-doing, and offers practical implications for managers in two-sided market settings.

Keywords: two-sided markets, multi-homing, learning by doing, platform strategies,

history, newspapers

INTRODUCTION

Firms across many industries today can be characterized as "two-sided," including search engines such as Google and Bing; online dating sites such as like 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 and MasterCard; sharing-economy firms such as Uber, Airbnb, and Kickstarter; and video game consoles such as PlayStation and Xbox, among other examples. In these cases, firms serve as platforms connecting customers on different sides of the market (e.g., Uber connects drivers on one side to riders on the other side).

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

Understanding market participants' multi-homing tendencies on each side of the market has important strategic implications. Theoretical work (e.g., Gabszewicz and Wauthy, 2004) has shown that when agents on one side of the market choose to multi-home, agents on the other side of the market will prefer to single-home as they can reach the same group on the other side through one platform. At the same time, when agents on one side of the market are multi-homing, the competitive intensities between the platforms on that side of the market will be low. When agents are single-homing, however, platforms will need to compete aggressively to attract them. For

example, if all consumers choose to visit both Groupon and LivingSocial (i.e., multi-homing), merchants need to work with only one platform to reach all potential consumers. Groupon and LivingSocial do not have to compete for consumers but need to compete more aggressively to attract merchants than consumers. Their strategies would be different if instead merchants were more likely to multi-home than consumers. Adding to this complexity is that platform strategies on both sides of the markets are linked via indirect network effects (Parker and Van Alstyne, 2005; Rochet and Tirole, 2003). As a result, strategic changes on one side of market in response to entry will require adjustment of strategies on the other side of the market. Given the complexity of the strategic responses, we expect organizational learning from prior experience in responding to similar entrants (e.g., Eggers, 2014, 2016; King and Tucci, 2002; Klepper and Simons, 2000) to be particularly helpful to platform owners when they face new entrants.

To better understand how platform firms' strategies depend on their consumers' tendencies to multi-home and the role of prior experience on their ability to respond, we construct a historical dataset of U.S. newspapers for 1945–1963 and study how newspapers respond to entry by TV stations in their markets. Newspapers are platforms that link together readers and advertisers on different sides of their market (e.g., Anderson and Gabszewicz, 2006). We also consider how the newspapers' prior experience with entry by radio in earlier decades influences their responses to TV entry. To do so, we take advantage of several institutional features of the newspaper industry during this time period. First, during this time period newspaper markets are essentially geographically segmented with one or two newspapers per market (Gentzkow, 2006; Gentzkow, Shapiro, and Sinkinson, 2011). Moreover, newspapers were known as either "morning" newspapers or "evening" newspapers, and were published and circulated to their subscribers accordingly. Approximately 80 percent of newspapers in 1940 were evening newspapers and this

remained unchanged until about 1980 (see Figure 1). This feature is useful for our study because the entry of TV primarily affected evening and not morning newspapers. Morning newspaper subscribers are more likely to read the newspaper in the morning and watch TV at night (i.e., multi-home), while evening newspaper subscribers are more likely to treat the evening newspaper and TV as substitutes, and potentially switch to TV for news (i.e., single-home). Second, TV entry was staggered across geography and time (see Figure 2), owing in part to a decision by the Federal Communications Commission (FCC) to freeze new radio licenses during the Korean War, as we explain below (George, 2009; Baker and George, 2010). This feature provides a quasi-natural experiment that we exploit in our empirical approach. Third, radio stations had entered media markets in the early 1900s, and many features of the radio industry are shared by the TV industry. Thus, this feature allows us to study how platforms operating in two-sided markets learn from technological shocks over time.

Figure 1 about here

We develop a stylized model to analyze newspaper firms' strategic responses to TV entry with multi-homing and single-homing consumers (i.e., for morning and evening newspapers, respectively), and derive several empirically testable hypotheses, which compare the responses to TV entry between newspapers with multi-homing and single-homing subscribers. Our theory predicts that when a TV station enters the market, newspapers with multi-homing customers (morning newspapers) will have higher subscription prices, higher circulation, and similar ad rates per subscriber, relative to newspapers with single-homing customers (evening newspapers). We next draw from a rich literature on learning-by-doing to argue that a newspaper firm's ability to respond to entry by a TV station depends on the amount of its prior experience with technologies

with similar characteristics such as radio stations. We then take our hypotheses to data, and find broad empirical support for our hypotheses.

Our study makes several contributions. First, it adds to the growing literature on platform strategies (e.g., Eisenmann, Parker, and Van Alstyne, 2011; Iansiti and Levien, 2004; Kapoor and Agarwal, 2017; Piezunka *et al.*, 2015; Yoffie and Cusumano, 2015). Unlike prior studies where customers' multi-homing tendencies are assumed to be the same across all platforms in a market (e.g., Armstrong 2006; Casadesus-Masanell and Zhu, 2010; Choi, 2010; Landsman and Stremersch, 2011; Zhu and Iansiti, 2012), we provide an empirically rigorous account of how a platform responds to entry by another platform in a setting with varying degrees of multi-homing tendencies. We show that optimal platform strategies could change substantially when taking multi-homing into account. These findings provide empirical support of our own theory and hypotheses, and add to a growing literature on two-sided markets. Second, by studying how a platform firm's history matters for its future strategic decisions, we link the literature on learning-by-doing to the literature on two-sided markets. We therefore contribute to a broader research program that aims to build a fuller understanding of how insights from "one-sided" markets can be incorporated into the growing "two-sided" market literature (e.g., Park, 2017; Seamans and Zhu, 2017; Wright, 2004). Third, by studying how newspapers respond to entry of TV, we gain some insight into how incumbent platforms in two-sided markets respond to entrants using new technology. We find evidence that, unlike the prediction in the theoretical literature in which advertisers will single-home when consumers multi-home (e.g., Gabszewicz and Wauthy, 2004), when the incumbent and the entrant use different technologies, advertisers value their potential consumers' repeated exposures to their brands through multiple channels and still prefer to multi-home. We believe our results can shed light on newspaper responses to digitization in the late 20th

and early 21st century, and more broadly can shed light on generic responses by platforms to disruptive technology. Finally, the historical nature of the setting serves as a reminder to readers that even though research on two-sided markets is nascent, two-sided markets are not a new phenomenon. Rather, our analysis using historic data on newspaper firms during 1945–1963 shows that some of these firms have a sophisticated understanding of two-sided markets and the role of multi-homing, and they incorporate these into their strategies. Our understanding of generic firm strategies thus could be significantly enhanced through examining historical data.

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

Historical newspapers

Newspapers in the United States have existed since the colonial period. By 1945, which is the start of the time period of our study, newspapers were established media entities within their local markets of operation. With a few exceptions (such as the *New York Times* and *Christian Science Monitor*), each individual newspaper covered a limited geographical region. Within their local markets, newspapers were an important source for news, even after the introduction of radio and television. For example, in 1944 the newspaper was still considered the most accurate source of information on presidential campaigns (Gentzkow, Shapiro, and Sinkinson, 2011).

Newspapers, like TV, can be thought of as a platform connecting two sides of a market. Both newspapers and TV provide content to consumers, which can be thought of as either readers or viewers, depending on the medium. Similarly, both newspapers and TV provide eyeballs (those of the readers/viewers) to advertisers. While the newspaper business was homogenous in the sense that they derived most of their revenue from advertising, there were important differences among newspapers. Most relevant for our study, newspapers differed depending on their timing of

publication or circulation. Some newspapers were distributed in the morning, which covered news of events that occurred in the prior day, while other newspapers were distributed in the evening, which covered news of events that occurred on that day. Throughout the 1940s-1960s, there were significantly more evening newspapers than morning newspapers (see Figure 1). This difference in the timing of publication may lead to different responses to the entry of new media formats such as television broadcasting.

TV stations

The first prototypes of television receivers were made in the early 1920s, and television broadcasting began 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. The growth of television and regular commercial broadcasting, however, did not begin until after World War II. In 1945, New York, Philadelphia, Chicago, and Schenectady were the only four cities in the U.S. that had commercial TV broadcasting stations. FCC licensing of commercial broadcasting expanded after the war, licensing 71 stations in 42 cities by 1948. However, the diffusion of TV broadcasting stations did not continue smoothly, and it came to an unanticipated halt in September 1948 when the FCC instituted a freeze on station licensing in order to conduct a study on signal interference, color standards, and spectrum allocation. Initially, the freeze was intended to last for a few months, but the outbreak of the Korean War and controversy over channel allocation left the freeze in place until 1952. While stations that were licensed by 1948 were allowed to continue construction and begin broadcasting, no new stations began operation between 1950 and 1952. In ending the freeze in 1953, the FCC issued 142 licenses within a year. This discontinuous expansion of television station licenses is

illustrated in Figure 2, which graphs the cumulative number of counties with a television broadcasting station. By 1960, television broadcasting was prevalent and reached about 96 percent of the U.S. population (Baker and George, 2010).

Figure 2 about here

A number of studies have leveraged this exogenous variation in TV penetration to study the impact of TV entry. George (2009) uses this variation to assess the impact of information technology innovation on local product markets between 1945 and 1960. George finds that an increase in TV penetration is associated with fewer local breweries, lower local beer production, and higher concentration in the beer industry. Baker and George (2010) use the same variation, and show that the increased exposure to advertisements after the TV entry increases a household's tendency to borrow for household goods and its tendency to carry debt. Similarly, Gentzkow (2006) uses this variation to examine the impact of TV introduction on voter turnout between 1948 and 1970. He finds that the introduction of TV accounts for about a 25 to 50 percent decline in voter turnout since the 1950s because the introduction of TV reduces the level of political information even though it increases the total set of information sources. Gentzkow also shows that the introduction of TV causes substitution away from traditional news sources such as newspapers, and people become less likely to rely on newspapers for information about election campaigns.

For our study, it is important to note that, in the early days, television broadcasting was available only in the afternoons and in the evenings. For instance, in 1941, WNBT in New York City offered programming only after 2 pm (see Figure 3). Similarly, KSD-TV in St. Louis broadcasted only after 3 pm (see Figure 4). Even by 1948, four large television networks—NBC, CBS, ABC, and DuMont—offered prime-time scheduling between 8 and 11 pm (EST) that ran

seven days a week. Thus, television broadcasting competed with evening newspapers for reader attention. Morning newspapers were less affected by TV viewing in that people could multi-home by reading newspapers in the morning and watching TV in the evening. Because of these differences between morning and evening newspapers, we expect that entry of a TV station would have a different effect on morning and evening newspapers.

Figure 3 about here

Figure 4 about here

Radio stations

Expansion of radio broadcasting predated the entry of television 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 the station began broadcasting on November 2, 1920. Similar to early television broadcasting, early radio programs were offered mostly in the afternoons and in the evenings.[1] This meant that radio broadcasting, like television broadcasting, competed with evening newspapers for advertising revenues. In fact, during the early 1930s, the newspaper industry sought to block radio transmission of news on the grounds that H. G. Wells' story of "The War of the Worlds" was construed as real news and instigated mass hysteria. The substitution effect of radio entry on newspapers, however, was not as severe as the introduction of television broadcasting because it is possible to read (newspapers) and listen (to radios) at the same time (Gentzkow, 2006).

THEORY AND HYPOTHESES

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

In this section, we develop our hypotheses on (a) how the effect of TV entry on newspaper ad rates, subscription prices, and circulation depends on a newspaper being morning or evening, the former indicating higher likelihood of consumer multi-homing, and (b) how a newspaper's prior history with radio affects its ability to respond.

We first present a stylized model to highlight the intuition behind firm strategies under single- and multi-homing. To more tightly link the theoretical findings to our empirical setting and for ease of exposition, we have chosen features of the model such that they are consistent with the underlying structure of a newspaper's business model.

Consider a newspaper that charges a lump-sum price of α to each advertiser and p to each subscriber. For simplicity and without loss of generality, we assume the marginal cost the newspaper incurs on each side of the market to be zero. On the subscriber side, we assume that the market size is S and the demand for the newspaper is $D_s = S - p$. Hence, the newspaper's subscription profit will be $D_s p$. Similar to Armstrong (2006), our functional form implicitly assumes that demand for the newspaper on the subscriber side is independent of the number of ads carried by the newspaper. This assumption is consistent with empirical findings on the newspaper industry as reported in Argentesi and Filistrucchi (2007). On the advertiser side, let β, a small positive number, be the return of each advertiser from reaching one newspaper subscriber. The demand for advertising space is $D_a = \beta D_s - \alpha$. We similarly obtain the newspaper's profit on the advertiser side as $D_a\alpha$. Hence, the total profit of the newspaper can be described as: $\pi = D_s p + D_a\alpha$.

Solving for the newspaper's optimal pricings, we have:

$$p = \frac{(2-\beta^2)S}{4-\beta^2} \text{ and } \alpha = \frac{\beta S}{4-\beta^2}. \quad (1)$$

The equations are intuitive. As the potential market size, S, increases, the newspaper is more likely to attract a large subscription base and thus becomes more attractive to advertisers.

Hence, it can charge more on both sides of the market. In addition, as the return from advertising (β) increases and the ad side of the business becomes more attractive, the newspaper decreases subscription price (p) in an effort to attract more subscribers and charge a higher rate (α) to the advertisers.

The equilibrium demand on each side of the market is:

$$D_s = \frac{2S}{4-\beta^2} \text{ and } D_a = \frac{\beta S}{4-\beta^2}. \tag{2}$$

As expected, the demand on each side increases with both S and β. In equilibrium, the ad rate per subscriber:

$$\frac{\alpha}{D_s} = \left(\frac{\beta S}{4-\beta^2}\right) / \left(\frac{2S}{4-\beta^2}\right) = \frac{\beta}{2}, \tag{3}$$

which is the effective price advertisers pay to reach one newspaper subscriber.

Role of Single- and Multi-homing

We now consider single- and multi-homing after a TV station enters the market. For instance, readers may get news content from newspaper and from TV without having to choose one over the other. Similarly, advertisers may advertise both in newspapers and on TVs. As subscribers' demand for newspaper is independent of the ads but advertisers' decisions depend on subscribers' choices, we first consider subscribers' single- and multi-homing behavior and, depending on their choices, consider whether advertisers choose to single- or multi-home.

If consumers are single-homing, some of them switch to TV for news and hence the potential market size for newspaper, S, decreases. From equations (1) and (2), this implies that price and circulation will decrease. The advertisers will prefer multi-homing, as they can reach different consumers through the newspaper and the TV. The advertisers' return from reaching one

newspaper subscriber, β, remain the same. From equations (1) to (3), we have the following predictions:

H1: When a TV station enters a newspaper market, if newspaper subscribers are single-homing, subscription price decreases, newspaper circulation decreases and ad rate per subscriber does not change.

If consumers are multi-homing, the potential market size for newspaper, S, does not change. In this case, the advertisers may have incentives to single-home, as they need to reach their potential consumers through only one channel. On the other hand, TV and newspapers offer different types of ads and hence there is synergy for an advertiser to reach the same consumer through both channels. Chandra and Kaiser (2014) find, for example, that introduction of a new platform (e.g., online media) can have complementarities with the existing platform. Chang and Thorson (2004) find that television–web advertising synergy leads to higher attention, higher perceived message credibility, and a greater number of total and positive thoughts than did repetition within one channel. When both consumers and advertisers are multi-homing, the newspaper and the TV station are effectively not competing. We thus have:

H2: When a TV station enters a newspaper market, if newspaper subscribers are multi-homing, newspaper businesses are not affected much.

Comparing the single-homing and multi-homing scenarios, we have the following hypothesis:

H3: Relative to the situation with single-homing newspaper subscribers, with multi-homing newspaper subscribers, when a TV station enters a newspaper market, newspaper subscription price increases, circulation increases, and ad rate per subscriber does not change.

In our empirical analysis, we expect to observe these differences between morning newspapers and evening newspapers.

Role of Prior History: Experience with Radio

Firms exist because they excel in sharing and transferring knowledge (Foss, 1996; Kogut and Zander, 1992). For firms to grow or adapt to changes, they need to learn and expand their knowledge base. The literature on learning suggests that past experience can generate learning that enhances growth, competitiveness, and survival (e.g., Arrow, 1962; Baum and Ingram, 1998; Dencker, Gruber, and Shah, 2009; Huber, 1991). Learning can occur vicariously by observing others, within a firm via intra-firm learning, or from an establishment's prior experience via learning-by-doing. For example, Kim and Miner (2007) find that banks in the same local market vicariously learn from the near-failures and failures of each other. Mowery, Oxley, and Silverman (1996) and Hoang and Rothaermel (2010) study how strategic alliances facilitate interfirm learning. Darr, Argote, and Epple (1995) and Kalnins and Mayer (2004) find that knowledge transfers across pizza stores owned by the same franchisee but not across stores owned by different franchisees. Seamans and Zhu (2017) find evidence of this intra-firm learning as well in a two-sided market setting. They show that U.S. newspapers respond to Craigslist's entry in 2001–2007 by repositioning on the subscriber side of the market, and these newspapers benefit from having a "sister" newspaper (owned by the same parent firm) that experienced Craigslist's entry.

The literature on learning-by-doing provides evidence that firms benefit from replication of an experience by moving down a learning curve. For example, in the context of the chemical industry, Lieberman (1989) shows that prior product experience drives down cost and can deter entry. Levitt and March (1988) point out that organizations learn by encoding inferences from

history into routines, which in turn guide their future behaviors, and learning can occur through trial-and-error experimentation. Through experiments, Schilling et al. (2003) find that some degree of variation can improve the learning rate. Kim, Kim, and Miner (2009) find that both the success and the recovery experience of a firm generate survival-enhancing learning, but only after a certain level of experience is reached. A number of studies (e.g., Chiesa and Frattini, 2011; Eggers, 2014, 2016; King and Tucci, 2002) find that firms learn from their prior experience with technological changes and new markets. Past experience may build absorptive capacity (Cohen and Levinthal, 1990) that allows firms to be more efficient in incorporating new technology. Similar to our study, Klepper and Simons (2000) relate experience in the radio market to performance in the TV market. They show that more experienced radio firms are more likely to enter TV manufacturing, and have greater market shares and longer survival in the TV market. Notably, however, all these prior settings are one-sided markets.

Learning-by-doing could be particularly important for platforms in two-sided market settings because of the complexity involved in strategic decision making as discussed above. We expect that a platform that experiences a disruptive shock from another technology to learn how to respond to this shock, and be more readily able to respond to a similar technological shock in the future. As indicated in our institutional setting discussion above and in Klepper and Simons (2000), radio shares many characteristics with TV. We thus expect that newspapers with more experience responding to radio entry learn how to better respond when TV enters:

H4: The relationships identified in H3 are stronger for newspapers that had significant experience competing with radio stations.

DATA AND METHODS

Data

We collect data from multiple historical sources. Table 1A reports summary statistics of all variables constructed. Information on the date of TV entry into different markets is from George (2009). During the time period that we study (1945–1963), commercial TV broadcasting stations enter 3,119 markets. Using this information, we create a dummy variable, $TV_in_market_{it}$, that equals one for all years, *t*, after a TV station enters newspaper *i*'s local market, and zero otherwise. We define the relevant market to be the county in which the newspaper is based, an approach consistent with other research in this area (e.g., Gentzkow and Shapiro, 2010; Seamans and Zhu, 2014) and roughly consistent with TV broadcast coverage.

Table 1A about here

Information on each newspaper's weekly circulation ($Circulation_{it}$), subscription price ($Price_{it}$), ad rate per subscriber ($Ad\ rate_{it}$), morning or evening status, owner, and year founded is from *Editor & Publisher (E&P) International Yearbooks* for years 1945–1949, 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. The yearbooks contain data on virtually every newspaper in the U.S., and have been used extensively for newspaper studies (e.g., Gentzkow and Shapiro, 2010; Seamans and Zhu, 2014). Since the TV entry shocks are local, we focus on newspapers that have a predominantly local focus and therefore exclude large national papers, including the *Christian Science Monitor*, *New York Times, Wall Street Journal*, and *Washington Post* from our analyses. As we focus on competitive interactions, we also drop observations where a newspaper and a TV station have the same owner.

We construct the variable $morning_newspaper_i$ to indicate whether newspaper *i* is published and distributed in the morning ($morning_newspaper_i = 1$) or in the evening

($morning_newspaper_i = 0$). In some cases, a newspaper is circulated both in the morning and in the evening. For those newspapers, we calculate the circulation share of morning paper (i.e., circulation of morning paper / (circulation of morning paper + circulation of evening paper)). If the circulation share of the morning paper is larger than 70 percent, we label such newspaper as a morning newspaper. Our results are robust to different thresholds (e.g., 80 percent, 90 percent). Notably, the designation of "morning" or "evening" newspaper does not change noticeably with time. As indicated in Figure 1, the proportion of each remains relatively stable until the late 1970s. Table 1B compares morning and evening newspapers and shows that both types of newspapers are similar in many dimensions, except that morning newspapers tend to have greater circulation.

Table 1B about here

Information on radio availability in each market for years 1945–1963 is from the *American Radio History* archive. The archive contains information on whether a radio station exists in a given geographical market and the founding year of the radio station. Both *E&P* yearbooks and the *American Radio History* archive were digitized by a firm in India.

We also include the population over the age of 21 at the county level ($Population\ 21{+}_{it}$) as a demographic control variable in some regressions. We prefer this measure of population over others, as it would seem to do a good job of capturing the population of working individuals, who are the likely target of any advertisers (though as described below our results are robust to alternate population measures). This data is available at the county level for each census year 1940, 1950, 1960, and 1970 from the U.S. Census Bureau. Based on these known values, we interpolate the values for the missing intercensal years.

Methods

Our empirical approach relies on differences in the presence of a TV station across and within newspaper markets over time. Similar to prior studies (George, 2009; Baker and George, 2010; Gentzkow, 2006), we leverage the exogenous variation in TV broadcasting station penetration across geographical markets caused by the TV licensing freeze between 1950 and 1952 to establish causal relationship: it is unlikely that any local newspapers anticipated this freeze (or the Korean War which extended the freeze).

We also rely on differences in exposure to radio, which we define as the number of years that elapse from the first radio station that enters a newspaper's market to the entry of a TV broadcast station. As we argue in our theoretical section above, a newspaper's experience competing with radio should provide it with useful information that help it to compete against TV. In the same way that the timing of TV entry into a market is unanticipated, so too is the newspaper's exposure to radio prior to TV's entry.[2]

We use the following regression specification in our analysis:

$$Outcome_{it} = \beta_0 + \beta_1 TV_in_market_{it} + \beta_2 Morning_newspaper_i * TV_in_market_{it} + X_{it}B + \gamma_i + \eta_t + \varepsilon_{it},$$

where $Outcome_{it}$ are the logarithms of $Ad\ rate_{it}$, $Price_{it}$, and $Circulation_{it}$. We take logarithms of these variables because Table 1A indicates that these variables are highly skewed. X_{it} is a matrix of other newspaper-year or market-year variables. In most regressions, we use the county-year estimate of population in a market, though robustness tests described below use alternate measures. The variables γ_i and η_t are fixed effects for newspaper and year. Errors are clustered at the county level.

[2] That is, if "TV entry year" is exogenous, then "TV entry year" – "Radio entry year" is also exogenous.

For the radio experience analysis, we redo the analysis after splitting the data into roughly equal subsamples, depending on the number of years of experience with radio (above and below the median number of years of experience). We expect to observe stronger newspaper responses when the number of years of experience is greater.

RESULTS

Main results

We first present our newspaper results separately for morning and evening newspapers in Table 2, before presenting results with interactions in Table 3. Columns 1–3 in Table 2 report the results for morning newspapers, and Columns 4–6 show the results for evening newspapers. The effect of $TV_in_market_{it}$ differs for morning and evening newspapers. For morning newspapers, the main effect of $TV_in_market_{it}$ is not significant for any of the dependent variables being studied. For evening newspapers, the entry of TV leads to a significant decline in subscription prices (p-value = 0.032) and circulation (p-value = 0.002) but not in ad rates. The coefficients of the regression indicate that the entry of TV leads to roughly 1.5 percent drop in price and 3.3 percent decline in circulation for evening newspapers. These findings are consistent with Hypotheses 1 and 2.

Table 2 about here

Table 3 reports similar results using interactions. We find that the coefficients of $Morning_newspaper_i*TV_in_market_{it}$ are significant only for subscription prices and circulation but not for ad rates. Morning newspapers' subscription prices and circulation become 3.6 percent and 3.8 percent higher than evening newspapers, respectively, as a result of the entry of TV. These results are in line with our expectations in Hypothesis 3.

Table 3 about here

We next investigate how experience with radio conditions a newspaper's response to TV entry. These results are presented in Table 4. Columns 1–3 provide regressions on the sub-sample of newspapers that have "high" experience with radio (14+ years of radio experience prior to TV entry) and Columns 4–6 provide regressions on the sub-sample of newspapers that have "low" experience with radio (<14 years of radio experience prior to TV entry). The coefficients in the "high" experience category are generally of similar magnitude and significance to those presented in Table 3. The coefficients in the "low" experience category (except for the constants) are generally not significant. These findings are consistent with our expectations—it appears that more experience with radio "strengthens" newspapers' ability to respond to TV entry—as stated in Hypothesis 4.

Table 4 about here

Robustness tests

We believe our results are robust to numerous alternative explanations. Our regressions include newspaper-fixed effects, which control for idiosyncratic firm differences. The year-fixed effects control for year specific shocks that affect all newspapers (such as recessions). Our regressions also include annual county population, which helps to control for any market-specific changes in demand for newspaper or TV. In addition, as we argue in our Methods subsection above, the entry of TV into a market is arguably exogenous, and unanticipated by the local newspaper. The FCC's freeze provides us with temporal and geographic variation in the entry of TV. This helps us rule out that any effect of entry of TV into a market is due to a contemporaneous shock that affects all markets at the same time. Nevertheless, we undertake several robustness tests to rule out other alternative explanations and present the results in an Appendix.

First, as indicated above, we try alternate cut-off values for our definition of morning newspaper (80 percent and 90 percent, instead of 70 percent). The results are robust to these alternate specifications (see Appendix A).

Second, to rule out that outliers (perhaps from poor coding done by the firm we used) are driving our results, we winsorize our dependent variables at the 1 percent and 99 percent levels. These results, presented in Appendix B, are similar to those presented above.

Third, we replicate our main results in separate regressions using alternate measures of county-year population such as total population in the county, male population in county, and female population in county. The results using total population are presented in Appendix C; the other population results are largely similar.

Fourth, we are worried about a 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 those which are monopolists or duopolists in their markets. The results, presented in Appendix D, are similar to our main results, and suggest that this "indirect" effect among newspapers is unlikely to be the causal reason for the change in newspaper behavior; rather, newspapers are responding to entry by TV.

Fifth, we are concerned that our findings are caused by entry and exit of newspapers before or after the TV entry shock. For example, if a large number of high circulation newspapers exited immediately after TV entry, that may drive down the "average" of the TV entry effect that we observe in Column 3 of Table 3. We conduct a robustness check by restricting our analysis to the set of newspapers that we have observations for at least three years before and after the TV entry

shock. The results, presented in Appendix E, are similar to our main results and help rule out this alternative explanation.

Finally, we provide a falsification check of our radio experience (Table 4) results. Recall our argument that newspapers with more experience dealing with radio entry will have had more time to learn how to deal with similar disruptive technological shocks. We take advantage of the fact that some newspapers were founded in a market *after* radio entered that market. These newspapers have spent their entire corporate lives operating in an environment with radio; they never needed to make an adjustment from their old strategies to the new ones, so they have learned little about how to adapt to technological shocks. In Appendix F, we split the sample of newspapers into those which were founded prior to radio entry and those which were founded after radio entered their market. The coefficients of interest are largely significant in the subsample founded before radio entry with expected signs, and largely insignificant in the subsample founded after radio entry.

DISCUSSION AND CONCLUSION

Our paper provides a study of how U.S. newspapers respond to local entry of TV broadcasting stations during 1945–1963. Our empirical setting takes advantage of a quasi-natural experiment: the staggered geographic and temporal rollout of TV stations that were temporarily halted during the Korean War. We also consider how the newspapers' prior experience with entry by radio in earlier decades influences their responses to TV entry. We find that newspapers in markets that are more likely to have multi-homing customers (i.e., morning newspapers and TV) have higher prices and higher circulation relative to newspapers in markets with single-homing customers (i.e., evening newspapers and TV). These results suggest that platforms need to take their users' multi-

homing tendencies into consideration when adjusting their strategies in response to entry. We also find that these effects are stronger for newspapers with more experience with radio. These results suggest that "ability to adapt" to technological shocks in two-sided market settings is an important capability that shapes a platform's response. Additional results (in Appendix F) suggest that it is a capability that needs to be learned from experience, not observed vicariously.

Our study makes several contributions. Importantly, we demonstrate the value of linking two-sided market theory to a broader corporate strategy literature by studying how a platform firm's prior history matters for its future strategic decisions. Moreover, we provide theoretically grounded empirical evidence of how a platform firm responds to entry by another platform in a setting with varying degrees of multi-homing tendencies—an area with recent theoretical research, but little empirical work. Finally, even though our study draws from a historical context over half a century ago, we believe it has implications that are managerially relevant today. Firms in multiple industries can now be characterized as "two-sided"; firms in these settings need to consider how their customers' behavior—i.e., whether they multi-home or single-home—may influence the trajectory of competition in a market.

While our empirical setting and a battery of robustness checks help assuage concerns around selection and other types of endogeneity, our findings and research design do have limitations. First, our story relies only on indirect evidence of learning by doing based on the number of years that radio has been in a newspaper's market. Future research may want to gather more direct evidence to better understand the mechanisms through which learning occurs. Second, for data availability reasons, we focus only on price, ad rate and circulation responses. However, firms have other means of responding to technological disruption, including resource reconfiguration (Karim and Mitchell, 2000; Lieberman, Lee, and Folta, 2017), cost cutting (Love

and Nohria, 2005), and other types of differentiation (Seamans and Zhu, 2017; Wang and Shaver, 2014, 2016). Future research may want to examine how single- and multi-homing affect non-price dimensions of strategy. Third, firm strategies such as product differentiation and exclusive contracts may influence single-homing and multi-homing tendencies (e.g., Cennamo and Santalo, 2013). Future research can explore the effectiveness of these strategies in other settings. Finally, we study the role 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 (such as multiple, geographically segmented markets and staggered entry of TV into these markets), but the drawback is that we cannot know how well these results generalize to other settings. Thus, future research may want to examine single- and multi-homing in other settings.

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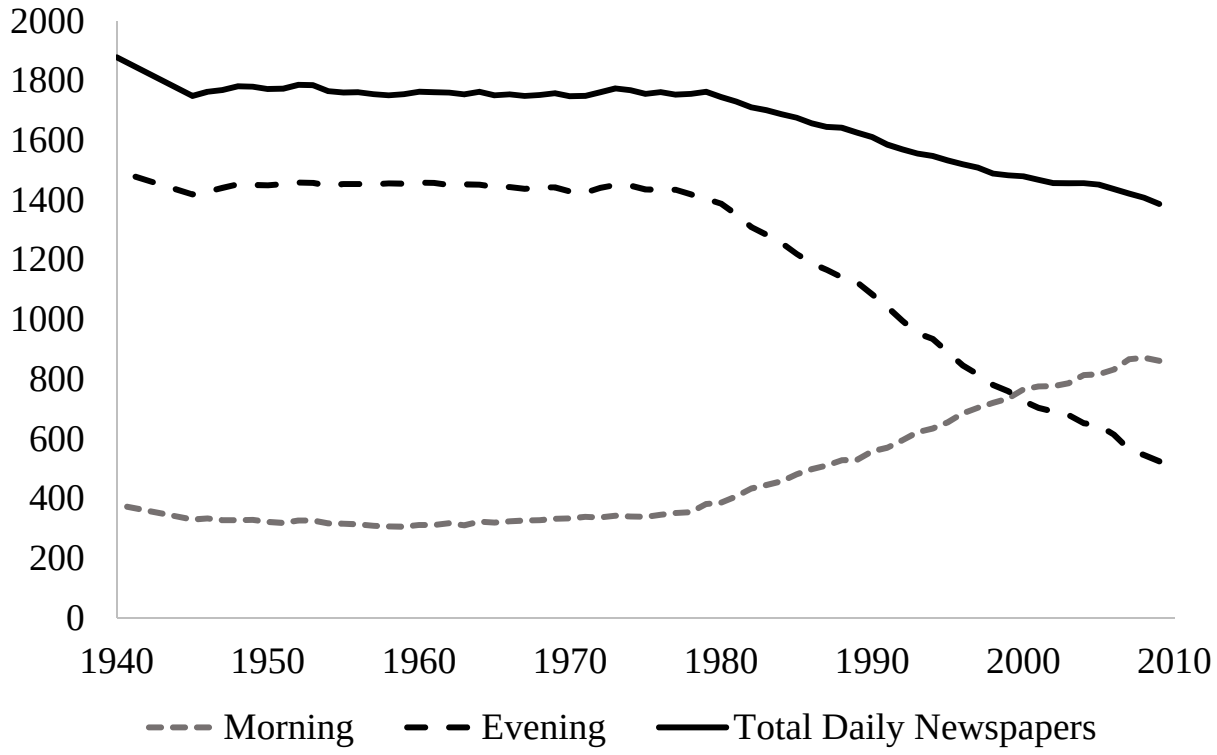
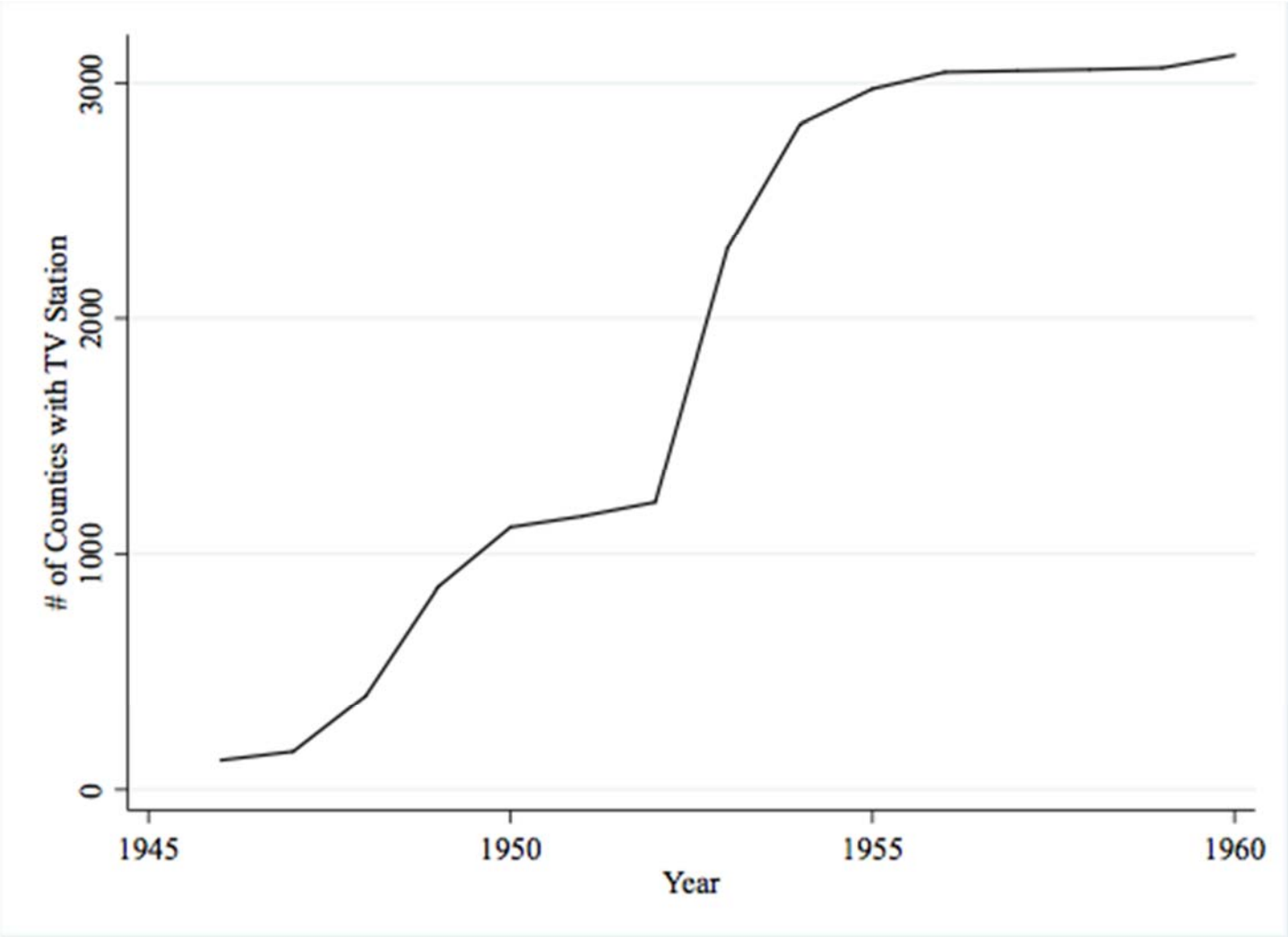


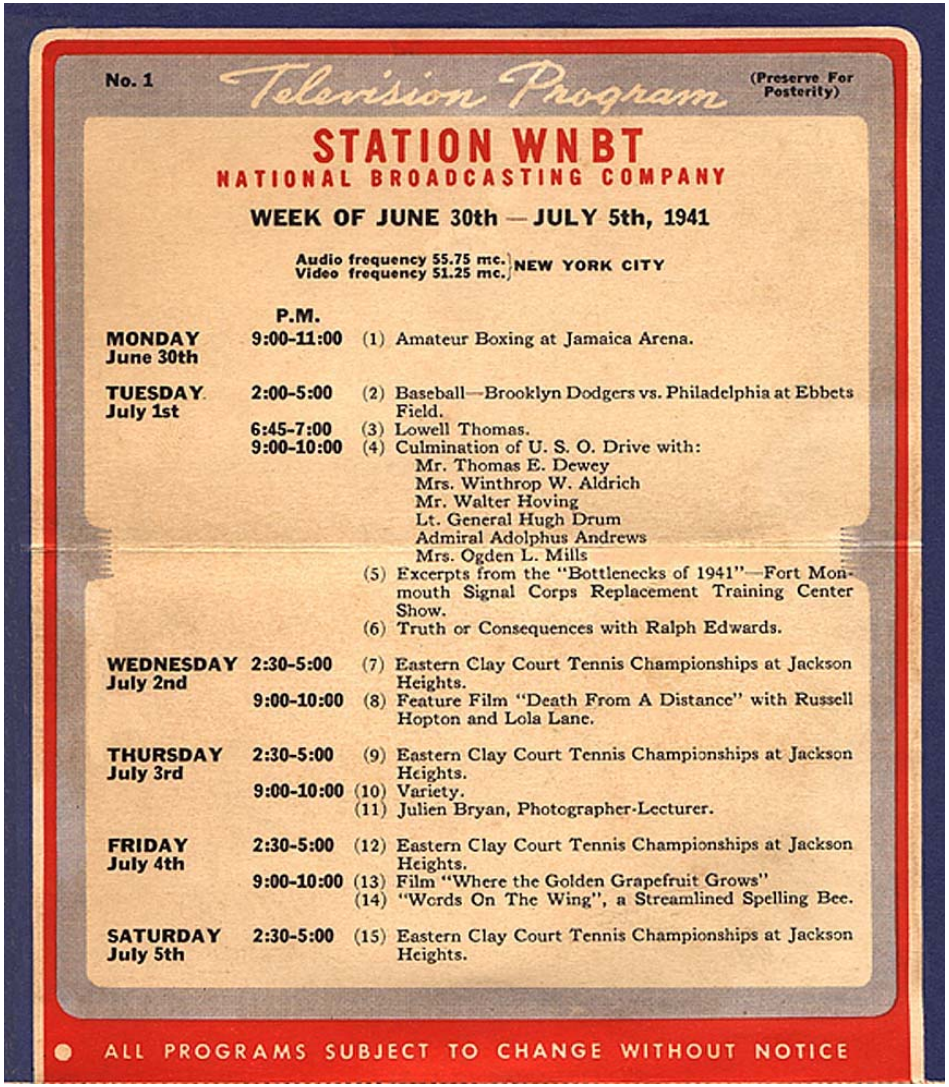
Source: Newspaper Association of America

Figure 1: Annual Count of Newspapers, by Year and Type



Source: Television Factbook

Figure 2: Cumulative Number of Counties with TV Stations



No. 1

Television Program

(Preserve For Posterity)

STATION WNBT

NATIONAL BROADCASTING COMPANY

WEEK OF JUNE 30th — JULY 5th, 1941

Audio frequency 55.75 mc.
Video frequency 51.25 mc. NEW YORK CITY

	P.M.	
MONDAY June 30th	9:00-11:00	(1) Amateur Boxing at Jamaica Arena.
TUESDAY July 1st	2:00-5:00	(2) Baseball—Brooklyn Dodgers vs. Philadelphia at Ebbets Field.
	6:45-7:00	(3) Lowell Thomas.
	9:00-10:00	(4) Culmination of U. S. O. Drive with: Mr. Thomas E. Dewey, Mrs. Winthrop W. Aldrich, Mr. Walter Hoving, Lt. General Hugh Drum, Admiral Adolphus Andrews, Mrs. Ogden L. Mills
		(5) Excerpts from the "Bottlenecks of 1941"—Fort Monmouth Signal Corps Replacement Training Center Show.
		(6) Truth or Consequences with Ralph Edwards.
WEDNESDAY July 2nd	2:30-5:00	(7) Eastern Clay Court Tennis Championships at Jackson Heights.
	9:00-10:00	(8) Feature Film "Death From A Distance" with Russell Hopton and Lola Lane.
THURSDAY July 3rd	2:30-5:00	(9) Eastern Clay Court Tennis Championships at Jackson Heights.
	9:00-10:00	(10) Variety.
		(11) Julien Bryan, Photographer-Lecturer.
FRIDAY July 4th	2:30-5:00	(12) Eastern Clay Court Tennis Championships at Jackson Heights.
	9:00-10:00	(13) Film "Where the Golden Grapefruit Grows"
		(14) "Words On The Wing", a Streamlined Spelling Bee.
SATURDAY July 5th	2:30-5:00	(15) Eastern Clay Court Tennis Championships at Jackson Heights.

ALL PROGRAMS SUBJECT TO CHANGE WITHOUT NOTICE

Source: Television Obscurities

Figure 3: 1941 TV Programming Schedule for WNBT in New York City

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 Rush Hughes' Guest Register (Sarah Vaughan, special guest)—Philco Dealers.
7:50 Fox Movietone Newsreel—Camel Cigarettes.
8:00 Tele-Quiz-Calls—With Harry Gibbs and Dorrye 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 Wilsen.
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 Wilsen (Interview with G. D. Gibbons of Fouke 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 Zane Farhat —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 Festus 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 Zane Farhat —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 Missus 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 Stein.
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)

Source: Early Television Museum

Figure 4: 1948 TV Programming Schedule for KSD-TV in St. Louis

Table 1A: Summary Statistics

					Distribution		
	Mean	SD	Min	Max	10th	50th	90th
Morning Newspaper	0.12	0.33	0.00	1.00	0.00	0.00	1.00
TV in Market	0.70	0.46	0.00	1.00	0.00	1.00	1.00
Ad Rate	0.01	0.02	0.00	0.93	0.00	0.01	0.02
Price	0.31	0.12	0.04	2.10	0.20	0.30	0.42
Circulation	26574.77	66877.39	1001.00	2156137.00	3152.00	8231.00	53751.00
Population 21+	67263.44	193630.10	388.57	2389465.00	5000.30	16172.53	125919.00
Year	1954.21	5.50	1945	1963	1946	1955	1962

Table 1B: 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
Ad Rate	0.01	0.02	0.00	0.83	0.01	0.02	0.00	0.93
Price	0.36	0.14	0.04	1.80	0.31	0.11	0.04	2.10
Circulation	52583.65	114300.10	1018.00	2156137.00	22923.67	56202.35	1001.00	1327791.00
Year	1954.15	5.63	1945.00	1963.00	1954.22	5.48	1945.00	1963.00

Table 2: Effect of TV Entry on Morning and Evening Newspapers

	Morning Newspapers			Evening Newspapers		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation	Log Ad Rate	Log Price	Log Circulation
TV in Market	-0.032	-0.011	0.010	0.017	-0.015	-0.033
	(0.033)	(0.019)	(0.027)	(0.014)	(0.007)	(0.011)
Constant	-5.277	-1.485	9.734	-4.896	-1.563	8.985
	(0.055)	(0.038)	(0.045)	(0.014)	(0.011)	(0.013)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Newspaper FE	YES	YES	YES	YES	YES	YES
Observations	2,650	2,361	3,027	18,119	20,461	21,579
Number of Newspapers	392	355	410	2,049	2,440	2,495
Adjusted R-squared	0.255	0.540	0.209	0.157	0.548	0.255

Clustered standard errors in parentheses.

Table 3: Effect of TV Entry on Morning and Evening Newspapers: Interactions

	(1)	(2)	(3)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation
TV in Market	0.010	-0.018	-0.033
	(0.014)	(0.007)	(0.010)
Morning Newspaper × TV in Market	0.012	0.036	0.038
	(0.021)	(0.013)	(0.018)
Constant	-4.944	-1.555	9.079
	(0.014)	(0.010)	(0.011)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Newspaper FE	YES	YES	YES
Observations	20,769	22,822	24,606
Number of Newspapers	2,441	2,795	2,905
Adjusted R-squared	0.166	0.546	0.247

Clustered standard errors in parentheses.

Table 4: Effect of Radio Experience on Newspaper Responses to TV Entry

	High Radio Experience			Low Radio Experience		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation	Log Ad Rate	Log Price	Log Circulation
TV in Market	0.016	-0.022	-0.036	-0.007	-0.015	-0.023
	(0.021)	(0.010)	(0.018)	(0.018)	(0.010)	(0.012)
Morning Newspaper × TV in Market	0.016	0.031	0.048	-0.037	0.023	0.000
	(0.024)	(0.014)	(0.022)	(0.042)	(0.027)	(0.029)
Constant	-5.161	-1.503	9.568	-4.775	-1.594	8.584
	(0.016)	(0.015)	(0.017)	(0.029)	(0.019)	(0.017)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Newspaper FE	YES	YES	YES	YES	YES	YES
Observations	10,106	11,354	12,529	10,663	11,468	12,077
Number of Newspapers	1,285	1,500	1,549	1,156	1,295	1,356
Adjusted R-squared	0.214	0.538	0.229	0.133	0.560	0.275

Clustered standard errors in parentheses.

Appendix A: Robustness Tests (80%, 90% cutoffs for morning newspaper classification)

	80% Cutoff			90% Cutoff		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation	Log Ad Rate	Log Price	Log Circulation
TV in Market	0.010	-0.018	-0.032	0.010	-0.018	-0.032
	(0.014)	(0.007)	(0.010)	(0.014)	(0.007)	(0.010)
Morning Newspaper × TV in Market	0.015	0.036	0.036	0.015	0.036	0.036
	(0.021)	(0.012)	(0.018)	(0.021)	(0.012)	(0.018)
Constant	-4.944	-1.555	9.079	-4.944	-1.555	9.079
	(0.014)	(0.010)	(0.011)	(0.014)	(0.010)	(0.011)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Newspaper FE	YES	YES	YES	YES	YES	YES
Observations	20,769	22,822	24,606	20,769	22,822	24,606
Number of Newspapers	2,441	2,795	2,905	2,441	2,795	2,905
Adjusted R-squared	0.166	0.546	0.247	0.166	0.546	0.247

Clustered standard errors in parentheses.

Appendix B: Robustness Tests (Winsorized (1%, 99%) DVs)

	(1)	(2)	(3)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation
TV in Market	0.010	-0.018	-0.034
	(0.013)	(0.007)	(0.010)
Morning Newspaper × TV in Market	0.015	0.037	0.040
	(0.019)	(0.012)	(0.018)
Constant	-4.941	-1.548	9.078
	(0.013)	(0.009)	(0.012)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Newspaper FE	YES	YES	YES
Observations	20,769	22,822	24,606
Number of Newspapers	2,441	2,795	2,905
Adjusted R-squared	0.185	0.564	0.253

Clustered standard errors in parentheses.

Appendix C: Robustness Tests (Total population per county)

	(1)	(2)	(3)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation
TV in Market	0.006	-0.020	-0.024
	(0.015)	(0.007)	(0.010)
Morning Newspaper × TV in Market	0.011	0.036	0.038
	(0.021)	(0.013)	(0.018)
Constant	-4.912	-1.558	9.022
	(0.014)	(0.011)	(0.020)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Newspaper FE	YES	YES	YES
Observations	20,797	22,851	24,635
Number of Newspapers	2,444	2,798	2,908
Adjusted R-squared	0.166	0.547	0.254

Clustered standard errors in parentheses.

Appendix D: Robustness Tests (Monopoly & duopoly markets)

	(1)	(2)	(3)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation
TV in Market	-0.020	-0.015	-0.018
	(0.013)	(0.007)	(0.009)
Morning Newspaper × TV in Market	-0.006	0.030	0.036
	(0.024)	(0.017)	(0.021)
Constant	-4.869	-1.574	8.820
	(0.018)	(0.013)	(0.013)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Newspaper FE	YES	YES	YES
Observations	15,146	16,224	17,107
Number of Newspapers	1,803	2,018	2,084
Adjusted R-squared	0.164	0.561	0.267

Clustered standard errors in parentheses.

Appendix E: Robustness Tests (Newspapers that exist ±3 years of TV entry)

	(1)	(2)	(3)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation
TV in Market	-0.026	-0.022	-0.000
	(0.012)	(0.007)	(0.007)
Morning Newspaper × TV in Market	0.008	0.037	0.045
	(0.021)	(0.013)	(0.019)
Constant	-4.929	-1.540	8.983
	(0.027)	(0.017)	(0.022)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Newspaper FE	YES	YES	YES
Observations	14,887	16,138	17,200
Number of Newspapers	1,128	1,238	1,248
Adjusted R-squared	0.208	0.573	0.259

Clustered standard errors in parentheses.

Appendix F: Robustness Tests (Newspapers founded before or after radio entry)

	Founded Before Radio Entry			Founded After Radio Entry		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables:	Log Ad Rate	Log Price	Log Circulation	Log Ad Rate	Log Price	Log Circulation
TV in Market	0.006	-0.018	-0.030	0.060	-0.019	-0.066
	(0.014)	(0.007)	(0.010)	(0.045)	(0.021)	(0.034)
Morning Newspaper × TV in Market	0.016	0.033	0.037	-0.025	0.062	0.052
	(0.022)	(0.014)	(0.019)	(0.066)	(0.038)	(0.060)
Constant	-4.959	-1.546	9.104	-4.786	-1.651	8.750
	(0.014)	(0.011)	(0.012)	(0.046)	(0.026)	(0.027)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Newspaper FE	YES	YES	YES	YES	YES	YES
Observations	19,068	21,062	22,771	1,701	1,760	1,835
Number of Newspapers	2,257	2,597	2,708	184	198	197
Adjusted R-squared	0.165	0.547	0.252	0.170	0.540	0.194

Clustered standard errors in parentheses.