

## Project Description

Advertising accounts for roughly two percent of Gross National Product (GNP) in the U.S., and has important implications for society. Advertising revenue often supports the development and availability of creative content in media markets. When it does, its social effects include the potential for changes in the quality and nature of programming provided by media companies. The first goal of the project is to understand empirically how advertising impacts the development of media content.

The proposed work examines the production of media content through the lens of national television networks. Although independent researchers are unlikely to ever have unfettered access to the proprietary advertising and viewership data of the dominant social media platforms, it is possible, in principle, to observe detailed data on viewership and advertising purchases in the national television market. Indeed, a key component of the proposed research is the development of several new detailed data sources on national television programming, viewership, and advertising, covering all networks and national advertising spots over a three-year period.

The design of the television advertising market in the U.S. may potentially affect the nature of competition between networks (for advertising dollars) and between advertisers in product markets. Since the arrival of broadcast television in the 1960's, industry practices have evolved so that 'legacy' firms with long histories of participation in the market benefit from lower prices to reach the same audiences. Price differences are so significant and prevalent that the industry refers to advertisers as being either 'good money' (new participants who pay high prices) or 'bad money' (legacy advertisers who receive grandfathered low prices). This unequal access to the national television advertising market, in turn, may affect the nature of competition between firms in their relevant product markets. The second goal of the proposed research is to understand the impact that the features of the market for national television advertising have on competition between television networks, and between advertisers themselves.

## Previous literature

The project contributes to several literatures. Anderson and Gabszewicz (2006) surveys the literature on advertising in media markets and provides a framework for analyzing equilibria in two-sided media markets and the social welfare implications of advertising.<sup>1</sup> An important theme of this literature is the possibility that media companies will choose their programming to compete for advertisers. This may lead to inefficient production of content, relative to viewer-supported production, because networks may cater to the demographic groups most valued by advertisers in order to generate higher ad revenues. Empirically, researchers have examined how increased market power affects product variety in media markets in the U.S.. For example, radio markets are analyzed by Berry and Waldfogel (1999), Berry and Waldfogel (2001), Sweeting (2010), and Sweeting (2013). Gentzkow and Shapiro (2010) and Gentzkow, Shapiro and Sinkinson (2014) examine the market for newspapers and show that competition for readers and advertisers leads to increased content diversity in the market.<sup>2</sup> These studies on media content differentiation (and media bias)

---

<sup>1</sup>Anderson and Coate (2005) provide a theory of the provision of ad-supported programming when viewers incur nuisance costs from advertising.

<sup>2</sup>Other contributions include Fan (2013)'s analysis of newspapers' strategic adjustments of prices and product characteristics following a merger. Wilbur (2008) studies the national television market and finds that advertisers' most preferred genres account for a larger proportion of network content than viewers' most preferred genres. Goettler

focus on understanding the role of viewer preferences and horizontal competition between content providers. They rely on aggregate demand for advertising, assuming that advertising firms are homogeneous.

The work also connects to the growing literature on endogenous product availability and variety/product design. Analyses of non-media markets include Draganska, Mazzeo and Seim (2009), Nosko (2010), Chu (2010), Eizenberg (2014), Crawford, Shcherbakov and Shum (2015), and Wollmann (2018). Crawford (2012) reviews the literature on endogenous product choice. Recent papers have also established that vertical relations may affect product availability (Ho (2009), Conlon and Mortimer (2017), Hristakeva (2018)).

Finally, theoretical work has analyzed how differences in input costs may affect market competition, firms' entry and investment decisions, and merger incentives (Tirole (1988)).<sup>3</sup> The fact that incumbent firms, with previously established relationships in the advertising market, face lower prices for national broadcast television ads may confer a competitive advantage in their respective product markets. Furthermore, advertising itself may have strategic implications for shaping product-market competition.<sup>4</sup> For example, Sutton (1991) proposes a model in which incumbents endogenously invest in advertising, with the result that they maintain concentration in the market as it grows.

## Market description

National broadcast television advertising inventory is sold in two markets: the 'upfront' and the 'scatter.'<sup>5</sup> The scatter market sells ad slots close to the air date of a program. Prices are determined by the market, with little or no price discrimination between advertisers. The scatter market is relatively small, with broadcast networks (ABC, NBC, CBS, FOX, and CW) selling about 20% of their ad inventory in this market. Advertising inventory for popular shows may sell out before the scatter market occurs.

The majority of broadcast television ad slots are sold through the upfront market. The upfront market dates back to the 1960s and involves selling national advertising for the upcoming season in advance. Each spring, between March and June, networks organize events to preview and promote

---

and Shachar (2001) and Goettler (1999) analyze television networks' strategic scheduling choices. Berry, Eizenberg and Waldfogel (2016) analyzes optimal product variety in radio markets.

<sup>3</sup>DeGraba (1990) shows that variable input markets affect firms' choices of long-run production technology. Eső, Nocke and White (2010) explores the alternative possibility that firms may strategically attempt to limit competitors' access to an input of production. In the television market, Dukes and Gal-Or (2003) develops a model to rationalize exclusive contracts between an advertiser and a network.

<sup>4</sup>Advertising competition is well-studied theoretically in setups that disregard firms' input-sourcing choices (see Bagwell (2007) for a survey). In these cases, the effect of advertising on market structure and welfare depends on the way advertising influences consumers: whether it provides information or it affects consumers' utility derived from the product. Differences in firms' costs to advertise can affect the theoretical implications for both two-sided markets and advertising competition. For example, Doraszelski and Markovich (2007) show that the cost to advertise influences industry structure when advertising is persuasive. Most empirical studies focus on determining how consumers respond to advertising (Akerberg (2001), Dubé, Hitsch and Manchanda (2005), Shapiro (2018)). Researchers have also used data from firms' advertising choices to infer information about the nature of competition in the product market (Vilcassim, Kadiyali and Chintagunta (1999), Scott Morton (2000), Dubé and Manchanda (2005), Ellison and Ellison (2011), Qi (2013), and Chandra and Weinberg (2018)).

<sup>5</sup>Firms may also purchase ads in specific geographic regions through local affiliates. These ads are typically sold to local advertisers, such as car dealers, professional services, local retailers, or political candidates in state or local elections. Industry participants refer to these local markets as the 'spot' market. The Rentrak data do not include local advertisements, and the focus throughout the work is on national ads sold by the national networks.

their programming for the upcoming Fall television season. Important benefits to purchasing in the upfront relate to the availability of programming, discounts relative to purchasing in the scatter market, and the use of firm-specific legacy discounts.<sup>6</sup>

Cable networks differ from broadcast networks in several ways. Some cable networks are primarily supported by viewer subscriptions (e.g., HBO), and have a much smaller presence in the advertising market. Large ad-supported cable networks (e.g., ESPN, USA, TNT, TBS, and Fox News) entered the upfront market in the 1990's. Unlike broadcast networks, however, they sell more than half of their inventory through the scatter market (Bollapragada et al. (2008)). The inventory that the ad-supported cable networks sell through the upfront market is sold at much lower CPMs than broadcast networks, without the legacy pricing deals used by broadcasters.<sup>7</sup>

In practice, media-buying agencies negotiate on behalf of their clients in the upfront market. The upfront proceeds in two steps. First, agencies negotiate each client's 'program mix' allocation in a network.<sup>8</sup> The programming-mix negotiations concern blocks of ad slots that reach audiences with similar demographic profiles, rather than individual ad slots in specific shows. Once the programming mix is established, agencies negotiate prices. Prices are described as the cost to reach one thousand viewers ("cost per mille," or CPM). CPM rates vary by audience size and viewer demographics, by seasonality, by day of the week, and by advertiser. The price determination process differs between new and returning business. For new accounts, the agency negotiates a CPM, which becomes the advertiser's base rate for the following year's upfront. For all returning business, agencies negotiate a percentage increase (or rarely, a decrease) that is applied uniformly to all base rates to determine each firm's price. Thus, a base rate reflects the price a firm paid in the previous upfront. For example, if Proctor & Gamble's (P&G) base rate with ABC in 2011 is \$10, and ABC secures a 10% increase in prices in 2012, then P&G will pay a CPM of \$11 in the 2012 upfront market. The difference between legacy and non-legacy prices has emerged because negotiated prices for new businesses have been consistently higher than the prices paid by returning businesses.<sup>9</sup>

The structure of this market suggests that price differentials may arise from differences in bargaining outcomes due to, for example, differences in advertising budgets or, alternatively, differences in the bargaining abilities or positions of a firm's media-buying agency. Industry reports and narratives suggest that neither of these explanations are driving the market. In 2005, an auditor of media spending, Media Performance Monitor America (MPMA), analyzed actual prices paid by major U.S. advertisers.<sup>10</sup> The report documents the presence of price variation across firms for

---

<sup>6</sup>On average, scatter rates are about 15 percent higher than average upfront rates (Lotz (2007)).

<sup>7</sup>Industry analysts cited a 3:1 price ratio between broadcast and cable in the 2014 season.

<sup>8</sup>"Some clients are more involved and request to see mixes as the agency negotiates with the network." (Lotz (2007))

<sup>9</sup>The contracts in the market for national television advertising are further complicated by audience guarantees, firm and optionable buys, and multi-year arrangements. All upfront purchases are granted network guarantee audience delivery. If a program's viewership is lower than the contracted expected viewership, then the network provides additional ad spots – potentially during other time slots or shows. Alternatively, if a program's viewership is larger than predicted, then the advertiser captures these gains at no additional cost. To fulfill these audience guarantees, networks typically reserve some inventory in advance, which may affect inventory availability and prices in the scatter market. Advertisers have some flexibility to adjust their upfront commitments. Typically, advertiser commitments for the fourth quarter of the current year are considered 'firm' buys, whereas advertisers may cancel about 25% of their upfront commitments for the first quarter of the following year, and 50% for the second and third quarters. Historically, advertisers have not aggressively exercised this option. Cancellations run between 10% and 15% (Wang, Stabler and Mukherjee (2009)). Finally, multi-year contracts may be used in the case of sporting events and other event sponsorships. These practices do not directly affect the price determination process in the upfront market.

<sup>10</sup>At the time, MPMA's clients accounted for \$3 billion in advertising expenditure.

identical time and space in the upfront (Bloom (2005)). The findings show that so-called ‘legacy’ firms, who have long histories of participation and ‘old’ base rates, may pay prices that are as much as 50% lower than the prices faced by firms on the other side of the distribution (i.e., new entrants). The report further reveals that these deals are not associated with the size of the firm or the identity of the firm’s media-buying agency.

## Data

The data for the project come from five sources: Rentrak Corporation, SQAD, and three sources that collect historic information on advertising spending: Kantar Media’s AdSpender, AdSummary periodicals, and Leading National Advertiser periodicals.<sup>11</sup> The data from Rentrak Corporation and SQAD cover a three-year period (January 2011 - December 2013).

Rentrak collects television viewership (i.e., ratings) data from over 13 million households. The demographic detail covers over 100 standard demographic variables for all members of each household (for example, gender, race, education, income, etc.). Rentrak combines these viewership data with information on ad placements, describing the advertiser (both the brand and the parent company), industry, product, ad copy, timing, and placement of each ad. For example, an observation describes that Coca-Cola Co ran the 30-second “Let the World Come to Your Home” ad for Coca-Cola during the 9:00pm showing of “Modern Family” on ABC, on October 16, 2013.

Prices of ad spots are closely guarded by industry participants and are notoriously difficult to observe. SQAD is the sole provider of data on the prices, reporting the average transaction price for an ad spot in a specific telecast (for example, “Modern Family” on ABC, shown at 9:00pm on October 16, 2013).<sup>12</sup> The data contain information on average prices separately for the upfront and scatter markets.

Brands that belong to the same parent company all benefit from the same base rate. Thus, data from Rentrak that map brands to parent companies are used to define a brand’s relevant relationship with networks. In order to infer the length of a relationship between a parent company and a network, the Rentrak and SQAD data are supplemented with three additional data sources. Each source reports information on advertising expenditures across multiple media outlets: broadcast television, cable television, online display advertising, radio, magazines, and newspapers. The distinction between the sources is that they cover different time periods. Kantar Media’s AdSpender reports monthly advertising expenditures for more than 3 million brands for the 1995-2018 sample period. Next, AdSummary books publish annual expenditures for the top 1,000 parent companies from 1974 to 1995. For the 1967-1973 period, data are collected by hand from Leading National Advertiser publications. The data include information on advertising expenditures starting in 1967, allowing us to track the length of a parent company’s presence in the broadcast advertising market.

## Quantifying legacy discounts

Contracts between advertisers and networks are considered trade secrets, so the first empirical task in the project is to confirm the industry narrative that prices for new businesses are, on average, higher than prices paid by legacy firms with established relationships in the upfront market, and to quantify the size of these discounts. The data contain average prices in each telecast (reported

---

<sup>11</sup>Rentrak was acquired by ComScore in February 2016. SQAD is owned by Clarion Capital Partners, LLC.

<sup>12</sup>In order to solve the information revelation problem, the transaction prices are reported as an average transaction price for telecasts for which advertisers from at least two agencies purchased a spot.

by SQAD) and the identities of the firms advertising in each telecast (reported by Rentrak). With this information, one may construct price differentials across parent companies and project these differentials on parent companies' characteristics, including the length of their relationship with the upfront market.

A stylized example showcases the strategy. Suppose that there are two telecasts with average upfront prices  $p_1^u$  and  $p_2^u$ , and reported scatter prices  $p_1^s$  and  $p_2^s$ . Only two advertisers ( $a$  and  $b$ ) show ads in these telecasts and their discounts relative to scatter prices are  $\delta_a$  and  $\delta_b$ . If firm  $a$  advertises in both telecasts, and firm  $b$  shows an ad only in telecast 1, then average upfront prices are constructed as

$$p_1^u = \frac{p_1^s * \delta_a + p_1^s * \delta_b}{2} \quad \text{and} \quad p_2^u = p_2^s * \delta_a \quad (1)$$

which implies that

$$\frac{p_1^u}{p_1^s} = \frac{\delta_a + \delta_b}{2} \quad \text{and} \quad \frac{p_2^u}{p_2^s} = \delta_a \quad (2)$$

and the firm-specific discounts can be backed out as

$$\delta_a = \frac{p_2^u}{p_2^s} \quad \text{and} \quad \delta_b = 2 * \frac{p_1^u}{p_1^s} - \frac{p_2^u}{p_2^s}. \quad (3)$$

The empirical analysis proceeds in two steps. First, price ratios,  $p_i^u/p_i^s$ , are regressed on a matrix identifying the presence of a parent company in that telecast,  $X_i$ ,

$$\frac{p_i^u}{p_i^s} = X_i \delta + u_i. \quad (4)$$

The strategy assumes that the percent discounts do not change over time. Then, these estimates of firm-specific discounts are projected onto parent company budget and legacy information as

$$\hat{\delta}_i = \text{constant} + \beta(\text{parent budget, legacy status}) + \epsilon_i. \quad (5)$$

Currently, the data do not include information on the identities of media-buying agencies employed by each parent company. As a result, the evidence provided below assumes that differentials across firms are not driven by the identity of the agency used during the upfront negotiations. Industry participants report that the various agencies all secure similar percentage increases (or decreases) during the upfront market. That said, the proposed research would benefit from information on the relationships between advertisers and their media-buying agencies, to control for agency-level effects. This information is available through WinmoEdge, which collects information on firms' media spending mix, and the historical relationships between brands and advertising agencies.<sup>13</sup>

The analysis is applied to data on primetime prices and the input-sourcing advertising choices of 281 parent companies.<sup>14</sup> SQAD reports upfront prices for 44,131 unique primetime telecasts

<sup>13</sup>The Winmo data also contain extensive information on advertising agencies, such as date founded, number of employees, industry specialty, and approximate annual billings. The dataset covers nearly 100,000 brands and 14,000 agency profiles, and spans brand-agency relationships starting from about 1960. Brands often use separate agencies for media-buying and creative services.

<sup>14</sup>Primetime refers to the 8-11:00p.m. block of television programming; most television viewership and advertising expenditures are concentrated in primetime. The analysis is applied to these programs because primetime advertising reflects firms' ad-placement choices, while ad placements in non-prime time may be the result of audience deficiency guarantees.

Table 1: Advertising Firms Summary Statistics

|                                         | mean   | sd     | med   | min  | max     |
|-----------------------------------------|--------|--------|-------|------|---------|
| cpm (upfront)                           | 8.65   | 6.28   | 6.82  | 0.06 | 38.56   |
| cpm (scatter)                           | 9.62   | 6.97   | 7.62  | 0.11 | 103.39  |
| <i>Annual Firm Spending (\$ 1,000s)</i> |        |        |       |      |         |
| total spending                          | 196020 | 262529 | 97804 | 2043 | 2524224 |
| broadcast spending                      | 72806  | 104270 | 29774 | 0    | 687556  |
| broadcast primetime spending            | 45300  | 69657  | 15759 | 0    | 480695  |
| cable spending                          | 64140  | 82378  | 32368 | 30   | 854871  |
| digital spending                        | 21948  | 40499  | 6846  | 0    | 320396  |
| newspaper spending                      | 2978   | 8617   | 199   | 0    | 113704  |
| magazines spending                      | 32070  | 83279  | 7745  | 0    | 939652  |
| non-legacy relative to 1967             | 26     | 16     | 30    | 1    | 45      |
| number of brands                        | 1.76   | 2.21   | 1.00  | 1.00 | 26.00   |

Advertiser spending (in millions) estimates and length of relationship are obtained from AdSpender. The other variables are constructed using Rentrak and SQUAD data.

and 16,330 scatter prices for 30 networks. The selected advertising companies account for 80% of national television primetime advertisements during the sample period, as large companies are the main participants in the upfront market. Table 1 summarizes reported prices and company characteristics. Average upfront CPMs are \$8.65 and these are, on average, 20% lower than reported scatter prices.

Parent companies are described by their advertising budgets and legacy status. Advertising budgets for the 2011-2013 sample period are obtained from AdSpender. The average firm budget in the five broadcast networks is \$72.8 million, while cable companies capture \$64.1 million per firm. The analysis focuses on primetime advertising, which constitutes 62% of advertisers' annual spending in broadcast television. During the sample period, national television advertising constitutes, on average, 70% of firms' total advertising spending, which includes online display advertising, radio, newspapers, and magazines.

The variable that tracks the length of parent company participation in the upfront market is constructed using parent company annual advertising expenditure from 1967 to 2013. The variable construction assumes that a firm enters the upfront market in the first year in which the parent company advertises in broadcast television, assuming that: (i) there are no gaps in spending greater than a year, and (ii) the broadcast spending by the company accounts for at least 0.01% of total broadcast revenues in that year. Ideally, the analysis would check whether a firm receives a lower price from a specific network when it has a longer historic relationship with that network. However, the historic advertising expenditure sources aggregate spending information across networks to the level of 'broadcast spending' and 'cable spending.'

The legacy status of a firm is created at the level of a parent company, as base rates in the upfront market are the same for all brands of a parent company. Data suggest that fifty parent companies have established relationships with a broadcaster in 1967, and the data track the entry of the remaining companies. The legacy variable in table 1 reports the year of entry in the upfront market past 1967. On average, firms entered the upfront market 25 years after 1967 (legacy=1 for firms that enter in 1967). The correlation between parent company legacy status and its total broadcast budget is -0.44, and the correlation between total broadcast budget and number of brands produced by the company is -0.32. The correlation between the legacy status of the parent company

Table 2: Legacy Discounts Results

|                   | broadcasters         | ABC                 | CBS                  | NBC                | FOX                | CW                   | cable               |
|-------------------|----------------------|---------------------|----------------------|--------------------|--------------------|----------------------|---------------------|
| constant          | 1.847***<br>(0.297)  | 1.431**<br>(0.570)  | 2.169***<br>(0.411)  | 0.553<br>(0.558)   | -1.511<br>(0.986)  | 4.724***<br>(0.537)  | 0.792***<br>(0.166) |
| budget            | -0.050***<br>(0.015) | -0.025<br>(0.028)   | -0.070***<br>(0.020) | 0.016<br>(0.028)   | 0.111**<br>(0.049) | -0.186***<br>(0.026) | 0.007<br>(0.009)    |
| log non-legacy    | 0.077***<br>(0.027)  | 0.103**<br>(0.048)  | 0.049<br>(0.039)     | 0.091**<br>(0.045) | 0.046<br>(0.057)   | 0.041<br>(0.058)     | 0.041<br>(0.027)    |
| non-legacy*budget | -0.000***<br>(0.000) | -0.001**<br>(0.000) | -0.000<br>(0.000)    | -0.000*<br>(0.000) | 0.000<br>(0.000)   | -0.001***<br>(0.000) | -0.000<br>(0.000)   |
| observations      | 4,254                | 1,067               | 1,364                | 930                | 401                | 492                  | 12,095              |

Number of observations tracks the price ratios used in the first stage of the regression analysis:  $p^u/p^s$ . These vary across models by the availability of pricing data for each network. The results show the projection described in equation 5, where first stage discount estimates are regressed on parent company characteristics. Reported estimates and standard errors take into account errors introduced in stage one of the analysis.

and the budget of individual brands is -0.07. These patterns suggest that legacy firms have higher budgets and a larger number of brands.

The three major broadcasters (ABC, CBS, and NBC) established the upfront market in the 1960s. FOX entered the broadcast (and upfront) market in 1986, and CW in 2006. Although legacy discounts are an important characteristic of the market for broadcast advertising, they are of less importance for national cable advertising. The analysis below shows estimates for each broadcaster, testing the hypothesis that legacy discounts are larger for the main three broadcasters.

Table 2 reports the results from the two-step analysis described in equations 4 and 5. Reported estimates and standard errors take into account errors introduced in stage one of the regression. Firm-specific discounts are parametrized using the log of total annual advertising budget by the parent company, the log of the non-legacy variable, and an interaction between legacy status and the firm annual budget.

The first column reports the average legacy discount using data from all five broadcast networks. The results from this regression are directly interpretable. For example, the coefficient on non-legacy status implies that a new entrant may face costs that are 28% higher than the cost of firms that entered in 1967. As expected, firms with larger budgets face lower average costs. The legacy benefit is largest for small advertisers, as seen by the interaction term. To compare the legacy and firm budget estimates, consider the average firm, which enters the upfront market in 1992 and has total advertising budget of \$196 million. This firm's cost relative to a firm that enters one year earlier, in 1991, and has the same budget, is predicted to be 0.47% higher. Alternatively, its cost relative to a firm that also enters in 1992, but has a budget that is 1% larger, is 0.57% higher.

The results across networks show different strategies across broadcast networks, where the data from ABC and NBC is consistent with legacy discounts, while the results from CBS and CW suggest that these networks rely more heavily on quantity discounts. The estimates for ABC suggest that these discounts may account for a price difference between a new entrant in 2013, and a legacy advertiser that entered in 1967, of 40%. This is in line with the MPMA report's estimate of 50%. The last column reports the results for cable companies. The results are consistent with the hypothesis that legacy discounts are not important for cable networks.

## Network competition

A key fact established from the pricing analysis is that broadcast networks, by adhering to legacy discounts, sell ads differently than cable networks. Legacy pricing clearly facilitates price discrimination by broadcast networks in favor of older firms. This may confer cost advantages to incumbent advertisers in their respective product markets. However, it may also soften competition between networks by functioning as a source of differentiation (an advertiser’s legacy pricing does not travel with him to a competing network) and support the development of “less specialized” programming by broadcasters. This section outlines a model of network decisions related to pricing and content choice.

National television advertising is a two-sided market, in which networks bring together viewers’ demand for content with advertisers’ demand for viewers. Ad-supported networks compete for advertisers’ demand using both ad-slot prices and product differentiation. For advertisers, product differentiation relates to the demographic profile of viewers, who are captured by the network through its content. A network’s strategic choice to differentiate its programming takes into account both sides of the market. The value of a particular program for viewers will depend on viewer characteristics (e.g., adult aged 25 - 49), and the competition for that viewer’s attention with respect to other networks’ programming and the viewer’s outside option. The return in the advertising market to capturing a viewer depends on advertiser demand for viewers with that demographic profile, and on the supply of such viewers by competing television networks. Finally, if there are cost differentials to produce content that attracts different viewers, that will also influence networks’ content production decisions.

Previous empirical studies of two-sided media markets have carefully analyzed competition in the viewer side of the market.<sup>15</sup> This project focuses instead on the role that the advertising market plays in determining networks’ content differentiation. Consider a three-stage model for the decision of a network to produce content that is appealing to a specific demographic profile. In the last stage, viewers choose which programming to watch. Viewers with different demographic profiles will likely have different preferences over content. Networks’ ability to capture viewers with specific demographics,  $Z_n(C_n, C_{-n}, \text{outside option})$ , depends on its programming characteristics  $C_n$ , the content of competing networks  $C_{-n}$ , and viewers’ outside options.

The second stage models the market for national television advertising, taking each network’s content as given. The model assumes that ad-supported media companies compete for advertisers, who differ in their valuation of viewers with different demographic profiles. Thus, understanding networks’ strategic choices requires a detailed analysis of advertisers’ choices of heterogeneous advertising inputs for the ‘production’ of the final product sold to consumers.<sup>16</sup> The ‘product’ purchased in this input market is an ad that reaches a particular set of viewers, and its main characteristics are the size and demographic profile of viewership. To define a product, telecasts are combined into clusters using the demographic profile of viewers reached; thus each cluster  $j$  is described by its viewership profile  $Z_j$ .<sup>17</sup> This definition approximates the block-buying practice in the upfront market, and decreases the dimensionality of the problem, while preserving the variation in viewership characteristics across inputs.<sup>18</sup>

---

<sup>15</sup>For example Gentzkow, Shapiro and Sinkinson (2014) study how newspapers’ incentives to soften competition increase the political diversity of newspapers in the market.

<sup>16</sup>Advertising agencies select the advertising mix separately for each of their clients. The implicit assumption is that an agency maximizes the payoffs of each of its clients separately. Industry practitioners confirm that the interests of advertising agencies and their clients are aligned.

<sup>17</sup>Empirically, programs are grouped into clusters using an affinity propagation algorithm.

<sup>18</sup>The model does not account for specific ad scheduling within a cluster. These choices may be important for



Advertisers may reach different viewers when advertising in different clusters, so clusters are imperfect substitutes in the production of the final product sold to consumers. The data show that firms typically place ads in multiple, but not necessarily all, clusters, and they often purchase several ad slots within the same cluster.<sup>19</sup> As a result, the model of advertiser demand should accommodate multiple discreteness and diminishing marginal returns to an input (i.e., placing additional ads within the same cluster).

One approach to modeling these payoffs is based on the Multiple Discrete-Continuous Extreme Value literature (MDCEV, see Bhat (2008)).<sup>20</sup> Estimates of this model on the Rentrak and SQAD data (not reported) are consistent with the results of the regressions used to estimate the legacy discount, and indicate that firms face decreasing marginal returns to advertising in the same cluster.<sup>21</sup>

One may assume that, in equilibrium, networks simultaneously choose prices for each cluster to maximize profits, given advertisers' demand,  $q(Z, X, p, \theta)$ . A network's pricing decision will differ between broadcast and cable networks, as the pricing analysis is consistent with the hypothesis that cable companies do not utilize legacy discounts. Variable profits for cable companies may be written as

$$\pi_c = \sum_{j \in J_c} (q_j(Z, X, p, \theta)(p_j - mc_j)), \quad (7)$$

where  $J_c$  denotes the 'products' (i.e., clusters) produced by network  $c$ ;  $p_j$  is the price of an ad in cluster  $j$ ; and marginal cost,  $mc_j$  captures a network's benefit from showing promotional videos of their own content rather than paid ads.

For broadcast networks, the variable profit function reflects the fact that advertisers benefit from firm-level discounts, and it is defined as

$$\pi_b = \sum_{j \in J_b} \sum_{i \in \text{adv.}} (q_{ij}(Z, X, p, \theta)(p_j \delta_i - mc_j)), \quad (8)$$

where the second summation applies to the set of advertisers in the market.

In the first stage, networks choose their content differentiation strategy with respect to viewers' demographic profiles. The approach holds the characteristics of each cluster fixed and allows networks to redistribute programming time and resources across its clusters. Let  $C_n = C_{1n} \dots C_{Jn}$  track

the advertiser; however, such scheduling occurs months after the upfront market, and as a result, they do not affect network competition for advertisers.

<sup>19</sup>On average, firms advertise in 31 unique clusters (out of about 120 options) and place 3.5 ads in each selected cluster.

<sup>20</sup>Define firm  $i$ 's payoff from sending  $q_i$  ads in a set of clusters  $A_i$  as

$$\text{Payoff}(q_i) = \sum_{j \in [A_i, 0]} \exp(Z_j \beta_i + X_{ij} \gamma_i + \epsilon_{ij}) \frac{((q_{ij} + 1)^{\alpha_j} - 1)}{\alpha_j} \quad (6)$$

where  $q_{ij}$  is the number of ads that firm  $i$  shows to viewers of cluster  $j$ . The  $\alpha_j$  parameters govern firms' diminishing marginal returns to advertising in the same cluster, allowing that the value of showing an ad to the same (or similar) viewers may decrease with repetition. Firms may also use other media outlets to reach consumers, and this is captured through an outside option,  $j = 0$ . Similarly to discrete-choice models, the value of the outside option is normalized,  $X_{i0} \beta_i + \epsilon_{i0} = \epsilon_{i0}$ , and its price is set to  $p_0 = 1$ . The model imposes that firms choose their advertising mix by maximizing payoffs subject to a budget constraint,  $B_i$ . The expenditure captures spending on national television combined with online, radio, newspapers, or outdoors advertising.

<sup>21</sup>An alternative approach to modeling advertising demand would be to simplify the discrete choice across clusters and employ a Constant Elasticity of Substitution (CES) demand model.

the hours of programming developed in each cluster, then cable networks’ optimization problem is

$$\max_{C_c} \sum_{j \in J_c} (q_j(Z(C), X, p, \theta)(p_j - mc_j)) - \text{cost}_{j_c}, \quad (9)$$

and broadcasters’ choices are described by

$$\max_{C_b} \sum_{j \in J_b} \sum_{i \in \text{adv.}} (q_{ji}(Z(C), X, p, \theta)(p_j \delta_i - mc_j)) - \text{cost}_{j_b}. \quad (10)$$

The setup can allow for commonly-owned stations to account for demand externalities when determining their optimal product design.<sup>22</sup>

## Data patterns

This section explores several key data patterns in broadcast and cable networks’ content development choices and advertisers’ targeting strategies.

Table 3 summarizes networks’ content strategies using genre information.<sup>23</sup> Column 1 reports average hourly viewership (in millions) for each network. Columns 2 and 4 identify the genres with the largest (and second largest) viewership shares for each network. These patterns suggest that networks differentiate their programming across genres. For example, 53% of CBS’s average monthly viewership in prime time is attributed to Drama programming, while for ESPN 99% of viewership is driven by Sports, and Home Improvement captures 94% of HGTV’s viewership. The last column summarizes concentration across genres within a network using an Herfindahl-Hirschman index (HHI).<sup>24</sup> This genre-level HHI statistic indicates that cable networks provide “more specialized” programming relative to broadcasters.

Table 4 describes networks’ content differentiation using viewership demographic profiles. Rentrak reports household-level demographic indices for each telecast (or individual airing of a show). These variables identify whether the telecast attracts a disproportionate share of a particular demographic (e.g. single males) relative to other telecasts airing at the same time. The summary analysis in table 4 lists the five networks that are most attractive to several major demographic groups, conditional on viewership size.<sup>25</sup> The results highlight the fact that different networks appeal to different viewers. For example, households with family members aged 18-24 are disproportionately attracted to MTV, FX, TBS, ABC Family, and Bravo.

The next set of empirical tests relate to firms’ advertising choices and answer the following two questions. First, do advertisers that have longer relationships with broadcasters advertise disproportionately more on broadcast than on cable networks? Second, do advertisers that have longer relationships with broadcasters use similar targeting strategies on broadcast and cable?

These questions are addressed using data at the ‘parent company’-brand-month level to allow for the fact that brands within a parent company may have different advertising objectives, even

<sup>22</sup>In the U.S. radio market, Berry and Waldfofel (2001) find that “consolidation reduced station entry and increased the number of formats available relative to the number of stations.” Sweeting (2010) finds that merging stations differentiate the merged set of stations to limit cannibalization, while reducing differentiation with respect to competitors.

<sup>23</sup>Rentrak identifies 22 unique genres. The top three genres across all networks are Reality, Drama, and Sports.

<sup>24</sup>For each network  $\text{HHI}_n = \sum_{g \in G} (s_{gn}^2)$ , where  $G$  is the set of genres identified by Rentrak, and  $s_{gn}$  tracks the share of network  $n$ ’s viewership attributed to genre  $g$ .

<sup>25</sup>The demographic variables describe gender (single male and single female households), income, age, and race.

Table 3: Network programming genres

| network | viewers | top genre   | genre share | second genre | genre share | HHI   |
|---------|---------|-------------|-------------|--------------|-------------|-------|
| CBS     | 11.0    | Drama       | 53.3        | Comedy       | 14.5        | 3,343 |
| ABC     | 9.3     | Reality     | 31.6        | Drama        | 23.6        | 1,988 |
| NBC     | 9.3     | Sports      | 29.6        | Reality      | 26.7        | 2,045 |
| FOX     | 6.6     | Reality     | 41.9        | Sports       | 18.7        | 2,533 |
| ESPN    | 3.1     | Sports      | 99.3        | News         | 0.3         | 9,855 |
| USA     | 2.6     | Drama       | 68.5        | Sports       | 16.6        | 5,078 |
| TBS     | 2.4     | Comedy      | 49.0        | Movies       | 22.7        | 3,303 |
| FNC     | 2.3     | Politics    | 82.6        | News         | 14.8        | 7,050 |
| HST     | 2.1     | Reality     | 65.5        | Documentary  | 27.6        | 5,063 |
| TNT     | 2.1     | Sports      | 35.4        | Movies       | 30.8        | 3,126 |
| A&E     | 1.6     | Reality     | 71.4        | Drama        | 15.4        | 5,468 |
| HGTV    | 1.6     | Home Impr.  | 94.4        | Reality      | 5.1         | 8,928 |
| CW      | 1.5     | Drama       | 66.0        | Reality      | 13.6        | 4,632 |
| DSC     | 1.4     | Reality     | 81.0        | Documentary  | 15.2        | 6,795 |
| FX      | 1.3     | Movies      | 78.5        | Comedy       | 11.6        | 6,325 |
| AMC     | 1.2     | Movies      | 79.5        | Drama        | 18.3        | 6,660 |
| FOOD    | 1.2     | Reality     | 61.3        | Cooking      | 37.9        | 5,192 |
| ABCFAM  | 1.1     | Movies      | 73.1        | Drama        | 11.8        | 5,588 |
| CNN     | 1.1     | News        | 59.7        | Talk         | 29.1        | 4,454 |
| SYFY    | 1.1     | Movies      | 43.4        | Sports       | 20.1        | 2,695 |
| LIFE    | 1.1     | Movies      | 55.5        | Reality      | 27.4        | 3,951 |
| TLC     | 1.0     | Reality     | 71.3        | Documentary  | 20.2        | 5,545 |
| MSNBC   | 0.9     | News        | 44.7        | Politics     | 27.5        | 3,046 |
| MTV     | 0.8     | Reality     | 69.7        | Movies       | 13.6        | 5,096 |
| BET     | 0.8     | Movies      | 54.0        | Comedy       | 17.6        | 3,428 |
| SPKE    | 0.8     | Movies      | 39.4        | Reality      | 30.1        | 2,925 |
| BRAVO   | 0.8     | Reality     | 78.0        | Movies       | 18.0        | 6,406 |
| truTV   | 0.7     | Reality     | 83.2        | Documentary  | 7.7         | 7,019 |
| APL     | 0.6     | Documentary | 53.2        | Reality      | 42.3        | 4,621 |
| TRAVEL  | 0.5     | Travel      | 91.0        | Reality      | 6.2         | 8,321 |

Networks are ordered using their average hourly viewership size (in millions). Columns 3-6 show the most important (and second most important) genres for each network and their share of average monthly viewership. Column 7 reports the HHI measure of concentration across all genres within each network.

though they face the same price of an ad. For example the parent company *Toyota Motor Corp* owns three brands in the data: *Lexus*, *Scion*, and *Toyota*. The sample includes 466 unique brands advertised by 281 parent companies.

To account for confounding factors, the analyses control for firm advertising expenditure across all media outlets, and the share of digital advertising as a fraction of total spending. In addition, brands are classified into product categories, and category fixed effects capture category-specific benefits of reaching a viewer on broadcast (rather than cable). Conditional on these controls, the focus of the analysis is on testing whether legacy firms reach disproportionately more viewers on broadcast.

Advertising intensity on broadcast is measured as the fraction of primetime viewers reached on broadcast networks. On average, advertisers reach 45% of their viewers through broadcast programming. The first column of table 5 reports results using data for all broadcast networks. The remaining columns report results separately for each broadcast network. Estimates show that non-legacy firms reach a smaller fraction of viewers on through broadcast networks.<sup>26</sup> The results

<sup>26</sup>Advertising in broadcast and cable primetime programs may be imperfect substitutes because these media reach

Table 4: Most attractive networks by demographic

| Demographic      | First | Second | Third | Fourth | Fifth |
|------------------|-------|--------|-------|--------|-------|
| single male      | MSNBC | CNN    | SYFY  | SPKE   | AMC   |
| single female    | BET   | LIFE   | USA   | CW     | ABC   |
| income \$20-30   | BET   | SYFY   | truTV | SPKE   | MTV   |
| income \$100+    | CNN   | BRAVO  | HGTV  | FNC    | NBC   |
| age18-24         | MTV   | FX     | TBS   | ABCFAM | BRAVO |
| children present | MTV   | ABCFAM | BET   | TLC    | SPKE  |
| age65+           | FNC   | MSNBC  | CNN   | CBS    | ABC   |
| African American | BET   | MSNBC  | BRAVO | TNT    | SYFY  |
| Hispanic         | MTV   | SPKE   | FX    | ABCFAM | CW    |
| Asian American   | CNN   | TRAVEL | FOOD  | CW     | ESPN  |
| White            | FNC   | HST    | DSC   | CBS    | NBC   |

Columns 1 - 5 list the (1st through 5th) most popular networks for each demographic group, conditional on viewership size, based on Rentrak data.

across broadcasters highlight that these patterns are less pronounced for the younger broadcast networks, FOX and especially CW.

Table 5: Fraction of viewers across networks

|                     | broadcasters         | ABC                  | CBS                  | CW                   | FOX                  | NBC                  |
|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| log non-legacy      | -0.533***<br>(0.025) | -0.359***<br>(0.020) | -0.286***<br>(0.020) | -0.023***<br>(0.006) | -0.116***<br>(0.013) | -0.342***<br>(0.019) |
| log budget          | -0.025***<br>(0.004) | -0.031***<br>(0.004) | -0.018***<br>(0.003) | 0.002*<br>(0.001)    | 0.006**<br>(0.002)   | -0.017***<br>(0.003) |
| non-legacy * budget | 0.031***<br>(0.001)  | 0.021***<br>(0.001)  | 0.017***<br>(0.001)  | 0.001***<br>(0.000)  | 0.007***<br>(0.001)  | 0.021***<br>(0.001)  |
| share of digital    | -0.306***<br>(0.023) | -0.178***<br>(0.016) | -0.239***<br>(0.019) | -0.008*<br>(0.004)   | -0.074***<br>(0.011) | -0.114***<br>(0.016) |
| constant            | 0.985***<br>(0.073)  | 0.843***<br>(0.063)  | 0.549***<br>(0.060)  | 0.041*<br>(0.021)    | 0.098*<br>(0.040)    | 0.517***<br>(0.058)  |
| month & year FE     | yes                  | yes                  | yes                  | yes                  | yes                  | yes                  |
| brand category FE   | yes                  | yes                  | yes                  | yes                  | yes                  | yes                  |
| observations        | 10866                | 10866                | 10866                | 10866                | 10866                | 10866                |
| adjusted $R^2$      | 0.247                | 0.196                | 0.205                | 0.153                | 0.157                | 0.156                |

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The dependent variable in all regressions is the fraction of viewers reached on all broadcasters or a specific broadcast network. An observation is defined at the brand-month level.

To test whether legacy advertisers have similar targeting strategies on broadcast and on cable, the analysis also examines the degree of ‘targeting’ across genres. A brand-level HHI indicates the concentration of viewers across genres reached by each brand, separately by network type. The brand-level HHI has a mean of 3102 for broadcast and 2250 for cable (2406 overall). Table 6 regresses the cable and broadcast brand-level HHI variables on advertiser characteristics. Both

different audiences. To account for potential differences in the target audiences, the analysis is also done separately for each individual demographic group. The same pattern holds. That is, legacy firms reach a larger fraction of viewers (with each demographic profile) in broadcast than firms that enter the broadcast advertising market later in time.

Table 6: Advertising strategies across cable and broadcast television

|                         | cable                     | broadcasters               |
|-------------------------|---------------------------|----------------------------|
| non-legacy              | 1.993*<br>(1.170)         | 13.130***<br>(1.950)       |
| log budget              | -342.543***<br>(11.767)   | -481.387***<br>(17.330)    |
| share of digital        | 602.519***<br>(141.529)   | 96.325<br>(249.815)        |
| constant                | 8,977.262***<br>(209.210) | 11,686.600***<br>(322.098) |
| month & year FE         | yes                       | yes                        |
| brand category FE       | yes                       | yes                        |
| observations            | 10,866                    | 8,379                      |
| adjusted R <sup>2</sup> | 0.200                     | 0.225                      |

The dependent variable in both regressions is the brand-level HHI measure of the concentration of ad-placement decisions by a brand in a month.

regressions also control for product category and time unobservables. The non-legacy variable suggests that brands produced by legacy parent companies have less concentrated advertising strategies in broadcast compared to non-legacy brands. However, there is no difference between legacy and non-legacy brands with regards to cable programming concentration. Results also show that, as expected, brands with large advertising budgets employ less-targeted advertising strategies.

## Intellectual Merit

Media firms typically function as platforms in two-sided markets, bringing together consumers and advertisers. Past research has explored the possibility that competitive consumer markets for content may not supply the socially-optimal level of variety, particularly in media industries.<sup>27</sup> However, for ad-supported media firms, advertisers' heterogeneous preferences may also influence the quality and nature of programming. Research on the relationship between the advertising market and the development of creative content is often stymied by a lack of detailed, advertiser-level data on prices and ad-placement choices.

The proposed research addresses this gap in the literature. The work can be accomplished in three steps. In the first step, extensive new data of brand-level ad-placement choices in the national television market from 2011-2013 and average telecast prices are combined with detailed data on the historical relationships between advertisers and broadcast and cable networks. The Principal Investigators (PIs) have already built this data infrastructure, and have identified one additional source of data linking advertisers with media-buying agencies. A key component of the data infrastructure, from Rentrak, is proprietary and has not previously been available for research.

In the second step, the unusual, and consequential, features of the television advertising industry are described and empirically verified. A large share of this task has been accomplished, and several of the key patterns and results are contained in the legacy pricing and data patterns sections of the proposal. Some of the key patterns include prices that vary across advertisers for the same ad slot, heterogeneous advertising strategies by firms, and variation in the degree of content differentiation

<sup>27</sup>Two examples are Gentzkow, Shapiro and Sinkinson (2014) and Berry, Eizenberg and Waldfogel (2016).

by networks.

In the third step, the network, viewer, and advertising sides of the market need to be credibly modeled. This task comprises the bulk of the remaining work to be done. As stated in the network competition section of the proposal, one parametric model of advertisers' choices, the multiple discrete-continuous extreme value model, has been successfully estimated on the data, and predicts similar estimates of legacy discounts as those estimated from the SQAD data. The specification and estimation of broadcast and cable networks' choices of pricing and content differentiation will complete the model. Although empirical models of endogenous product characteristics have been developed in the previous literature, these typically focus on product entry, rather than an allocation of resources across multiple products (e.g., programming time), and omit the feature of legacy pricing. Thus, the proposed work requires a new and expanded modeling approach.

Taken together, the work offers a combination of new data, unique (and relatively understudied) industry practices, and new modeling approaches. This combination is used to confront two important questions: "How does advertising impact the development of media content?," and "What impact does the design of the upfront market have on competition between television networks and between advertisers themselves?" Answering these questions improves knowledge of the national television industry and advances understanding of ad-supported content markets more generally.

## Broader Impacts

Advertising and media markets are large and growing sectors of the economy, and both play important roles in society. Advertising may impact the nature of product market competition and firm entry; media markets provide social capital through the provision of creative content, and are fundamental to free speech and the functioning of a healthy democracy. Past public policy interventions have included, for example, changes in ownership restrictions for media companies, the placing and lifting of bans on advertisements (e.g., pharmaceuticals and cigarettes), and regulatory restrictions on the amount of advertising in children's programming. Current policy debates focus on the role that ad-supported social media play in society and in political systems.

The proposed work facilitates a better understanding of a wide range of policy questions by providing a framework for incorporating heterogeneous advertiser demand and advertiser-specific pricing into a model of the supply of media content. The outcome of the proposed work is a research framework that allows for answers to two general research questions. A concrete example of a policy implication of each research question illustrates the broader impacts of the work.

The first research question is "What impact does the design of the national television advertising market have on competition between television networks and between advertisers themselves?" As an example, one may evaluate the implications of this question through the potential for efficiency gains and anti-competitive effects from conglomerate mergers (i.e., a merger between firms in unrelated product markets).

On one hand, firms often invoke efficiency rationales to justify a merger; however, cost savings are hard to identify and measure.<sup>28</sup> National television advertising is an input for which a merger may decrease firms' costs even if the firms operate in unrelated downstream markets. Industry practitioners report that for merging parties with different base rates in the upfront market, the

---

<sup>28</sup>Horizontal merger analyses highlight the trade-off between potential production efficiencies and incentives to raise price (Williamson (1968)). The empirical evidence on cost savings is scarce due to the difficulties in identifying and measuring potential gains in efficiency. Ashenfelter, Hosken and Weinberg (2015) is an exception (see Ashenfelter, Hosken and Weinberg (2014) for a survey).

newly-merged firm immediately purchases inventory at the lower rate. A back-of-the-envelope calculation presents a lower bound to the potential cost savings from merging with a legacy firm. Consider a merger between two firms with the same budgets of \$196 million, but with different upfront entry timing: 1967 and 2013. Keeping average prices and firm advertising selections fixed, the stand-alone cost saving from accessing the legacy discount is \$11.3 million.<sup>29</sup>

On the other hand, as national television advertising is a common input market for firms in many industries, a merger between two firms may have anticompetitive effects, even if the firms operate in separate industries. Concerns about unequal access to advertising have been considered by both academics and antitrust authorities. Porter (1976) highlights that national firms benefit from advertising nationally, and that this competitive advantage may create barriers to entry for small local firms. A similar concern was raised when the FTC challenged Procter & Gamble’s acquisition of Clorox in 1957. In the market for liquid bleach, advertising is an important competitive instrument. The Commission was concerned that after the acquisition, Clorox would be able to access national advertising at a discount relative to its competitors; therefore, the merger would discourage competition and entry in that market.<sup>30</sup> Today, antitrust authorities would likely treat such efficiencies in the same way as, for example, distribution efficiencies (Mensch and Freeman (1990)).

The second research question identified in the proposal is “How does advertising impact the development of media content?” At first glance, the empirical setting of the broadcast television market may seem to provide a narrow answer to the question, at least from a technological perspective. Indeed, one may be concerned that demand for television broadcasts is declining as digital forms of distribution ascend, despite the two formats currently being roughly at parity. However, beginning in 2008, the “NewFront” was launched to provide an equivalent market to the television upfront market for digital video content producers and advertisers. In 2018, ESPN and Viacom joined Disney (which joined in 2017) in this market. Although researchers do not have access to the details of the NewFront market design, or data from transactions in this marketplace, the presence of the NewFront indicates that the lessons learned by studying the television market remain important to understanding newer digital markets too. Indeed, industry participants report that, after pulling ads from YouTube in 2017, Procter & Gamble returned to YouTube in April, 2018 after YouTube made several changes to protect brands from appearing in controversial content.<sup>31</sup>

---

<sup>29</sup>The calculation is a lower bound because a firm can also re-optimize its advertising mix. These cost savings will not be due to economies of scale or an improved bargaining position.

<sup>30</sup>During the 1950s and 1960s, firms purchased advertising by sponsoring television programming, which benefited large firms. In the 1960s, broadcasters switched to selling ads according to the practices used today. Blank (1968) and Peterman and Carney (1978) show that right after this change, large advertisers stopped benefiting from discounts.

<sup>31</sup>According to industry reports, these changes included both algorithmic changes, as well as guarantees that a brand’s ads would only appear in videos that had been verified by a human.