

Basic cable network segmentation toward minorities and other niche audiences in the U.S.: An empirical study

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Abstract

Primarily using a database of 78 ad-supported basic cable TV networks operating in 2010, we find that advertising prices— defined as advertising revenues per household delivered-- increase with total audience size, suggesting limits to the ability of cable networks to “narrowcast” to niche audiences. Contrary to some previous research, we find no evidence that advertisers place lower value on black or Hispanic audiences. We also find that much of the variation in the size of black and Hispanic audiences on basic cable networks is explained by programming investment levels. We thus attribute an apparent “undersupply” of black and Hispanic-oriented programming on these networks to program supplier incentives to spend more on content that has broad appeal.

I. Introduction

Continuous technological change and intensifying competition among cable TV, Direct Broadcast Satellite (DBS), and other multichannel television program distributors (MVPDs) in the United States have dramatically increased opportunities for television networks to enter the market, and sharply focus toward niche audiences, including racial and ethnic minorities. Channel capacity has steadily expanded since cable programming networks began forming in the 1970s. Since the mid-1990s, digital transmission and compression have accelerated capacity expansion and also permitted specialized networks to be more efficiently placed on higher tiers offered to subscribers for additional charges.

In theory, these developments should increase economic rewards to sharper program focus. Similar to magazines, basic cable networks can earn per subscriber fees as well as advertising revenues. Either income stream can potentially be increased by moving away from the “common denominator” constraint that inherently limits broad appeal programming, such as that on the major national broadcast TV networks. In at least print media, it is well-established that advertisers are willing to pay higher prices per viewer for audiences that are segmented toward particular demographic segments (Chandra, 2009; Chandra & Kaiser, 2014; Goettler, 2012). Further, descriptive data and advertising practice strongly suggest that in television, certain demographic groups are more valuable to advertisers than others. For example, average cost-per-thousand (CPM) advertising rates in broadcast television are generally higher for the 18-34 age group and for higher income audiences (TV Dimensions, 2012). Also, sharper focus on product interest may increase ad rates as well as subscriber fees. With regard to advertising, many specialty magazines, for example, focus on particular topics (eg, photography, antiques), which increases opportunities for specialty product advertisers.¹

In multi-channel television, however, empirical experience suggests limitations to the “narrowcasting” model. With respect to racial and ethnic groups, for example, consider the Black Entertainment Network (BET), one of the only major cable TV networks clearly oriented toward African-American viewers in the U.S. Although self-identified blacks make up about 14% of the U.S. population, BET ranked 20th among all basic cable networks in total revenues in 2012 (SNL Kagan, 2013). This result seems to fall short of expectations many held in the 1970s for cable television to serve racial and ethnic minorities, or other

¹ Chandra and Kaiser (2014) reported, however, that content variables were dominated by demographics in determining magazine CPM rates.

niche audiences like classical music fans--much like radio stations have successfully done. One possible factor is that in contrast to radio, appealing TV programming is expensive to produce, as are advertisements themselves. Advertisers also want to reach high proportions of their target audiences to fulfil campaign objectives. A related factor is that historically, the maximum audience reach of cable networks has been restricted to TV households that subscribe to cable or another MVPD service (currently 85% to 90% of US TV homes), and many networks reach much fewer homes because MPVDs choose not to carry them. An engaging empirical suggestion of cable TV's overall limits to narrowcasting is that average CPM rates of cable networks in the U.S. are reportedly far below those of the major broadcast networks, even though the latter more frequently reach larger, evidently more "mass appeal" audiences overall.²

We present an empirical economic study of over 90 basic cable programming networks operating in 2010. In the first part, we explore the determinants of cable network advertising prices, which we define in terms of each network's advertising revenues per viewing household. As the source of approximately two-thirds of total revenues of the several hundred basic cable TV networks, advertising revenues are critical to the economic success of the cable TV narrowcasting model. Among the main questions we address: How sensitive are advertising prices to the total number of viewers watching, and in particular to the national subscriber reach of the network and to its Nielsen ratings? What is the marginal value to cable advertisers of segmentation toward various demographic groups, notably Blacks and Hispanics?³

In the second part of the paper, we focus on the distribution of viewing by Black and Hispanic audiences among our sample of cable networks. To what extent do these audiences isolate their viewing to a particular set of networks? What mainly determines the distribution of racial and ethnic cable viewing: programming content, or the production quality of that programming?

Our study contributes to the existing literature on targeted advertising and audience segmentation in cable networking. Although our answers are incomplete and preliminary due to data limitations, we seek to lay a useful foundation for understanding the narrowcasting

² Monday to Sunday prime time CPMs for broadcast networks in 2011-12 were \$19.48, compared to \$10.61 for cable networks. Other daypart comparisons are similar (TV Dimensions, 2012, p. 111).

³ "Black," "Hispanic" and "white" are the self-identified labels assigned by Nielsen to these groups and we use those throughout the paper.

potential of multi-channel programming distribution as well as to give insights to the even finer segmentation potential of Internet-distributed video media.

II. Prior research

Targeted advertising has attracted recent academic interest among economists following commercial development of the Internet since highly efficient targeting becomes feasible. Internet search is the most obvious example, but as widely publicized, banner and other types of advertising can be customized based on detailed information about user characteristics, including demographics. Ostensibly, sharper segmentation would appear to increase advertising prices, although some authors have shown that equilibrium outcomes of competition in Internet markets are more complex, and could result in lower advertiser prices or profits (Athey & Gans, 2010; Ben Elhadj-Ben Brahim, Lahmandi-Ayed, & Laussel, 2011; Bergemann & Bonatti, 2011). Empirical studies have been relatively few, at least with respect to documenting the premiums that advertisers pay for sharp Internet targeting (eg, Goldfarb & Tucker, 2011). In related research, Gentkow (2014) found that advertising revenues per consumer hour of usage (which he labels as the “price of attention”) were generally higher for online compared to “offline” news media, and that advertising revenue per hour for television, newspapers and magazines began declining after the advent of Internet broadband in about 2000. For surveys of Internet advertising, see Evans (2009) and Anderson (2012).

There have been several studies showing the value of targeting in print media. Chandra (2009) found that competitive newspapers charge higher ad rates because they can more efficiently segment the audience and thus deliver more homogenous groups of readers to advertisers. In the course of his study, he found significant effects of age, gender, and race, and that advertising rates tend to increase with demographic homogeneity. Other studies have involved the magazine industry, for which relatively good data have been available. Empirical studies by Depken II and Wilson (2004) and Koschat and Putsis Jr (2002) suggested that homogeneity of magazine audiences may increase ad rates. In a detailed empirical study of magazine advertising, Chandra and Kaiser (2014) found that readership homogeneity with respect to age, gender and income increased advertising rates. Studies in television media have established that advertising prices (in \$ terms) rise with audience size, and various demographic characteristics have been identified as significant determinants. Fisher, McGowan and Evans (1980) found that day-part and median household income affected broadcast TV ad rates, and suggestive evidence that higher audience ratings lead to

higher advertising revenue per viewer. A later study by Fournier and Martin (1983) implied significant effects of demographics on CPM rates. Some more recent studies of broadcast TV markets found significant differences in advertising prices for different demographic segments as collateral findings of broader empirical research projects (Baker & George, 2010; Bel & Domenech, 2009). Goettler (2012) found similar results in a study of major broadcast network prime-time programming in the 1990s, and also found that CPM advertising rates were higher for larger audiences. In a study involving the effects of multiple cable system operator buying power, Chipty and Snyder (1999) found that total cable network advertising revenues increased, but at a decreasing rate, with higher national subscriber reach.

A number of authors have studied media appeal to racial and ethnic minorities, and how those groups affect advertising rates. Conventional wisdom in the U.S. is that racial and ethnic minorities may be “underserved” by electronic media (McDowell & Dick, 2005; Wildman & Karamanis, 1998). Webster and Phalen (1997), Ofori (1999), Napoli (2002), Brown and Cavazos (2002), and McDowell and Dick (2005) all found evidence that black and/or Hispanic audiences are undervalued by television or radio advertisers relative to white populations. Rogers and Woodbury (1996) investigated how market size affects the availability of minority programming. In their study of 115 local radio markets, they found that the presence of black and Hispanic audiences leads to higher program diversity in terms of 11 defined radio formats.

In another stream of research related to this article, Waldfogel (2003) considered both programming supply and listening in 247 U.S. radio markets. He found that blacks and Hispanics had relatively intense preferences for black-oriented and Hispanic-oriented radio stations, respectively. He further showed that as the absolute sizes of black and Hispanic populations increased, the number of stations with formats oriented to those groups, as well as overall radio listening, significantly increased. He also found evidence of negative preference externalities: that is, as white populations rose, minority oriented listening declined. In a related study, Waldfogel (2004) found that the supply of TV programming oriented to blacks and Hispanics was higher in local market areas with higher populations of these minority groups. In a study of preference externalities in U.S. local newspaper markets, George and Waldfogel (2003) reported that newspaper purchase rates by blacks were positively related to the size of the black population, but inversely related to the size of the white population.

III. Background on basic cable television networking

U.S. cable TV networks initiated their competition with national broadcast networks beginning in the mid-1970s after launch of the first geostationary commercial satellites capable of television transmission. Many networks, including CNN, HBO, MTV, and Lifetime, entered and became established by the mid-1980s. Cable TV channel capacity has kept expanding, driven mainly since the mid-1990s by digital technologies which permit much more efficient utilization of bandwidth. Cable TV systems began adding “digital tiers” in the mid-1990s which generally compressed 12 channels into the space of one analog channel, and also created the opportunity for high definition (HD) channels. In response, a new wave of cable network entry began in the 1990s, and many newer networks came to be carried on higher digital tiers for extra charges. By 2010, the Federal Communications Commission (FCC) had identified several hundred national cable TV networks in business (FCC, 2012), thus dividing the relatively fixed U.S. television audience more and more finely, bringing questions we ask in this paper further to the forefront.

Cable networks are mostly of two types: “basic” networks, like TBS and CNN, earn revenues from both advertising and per-subscriber fees paid by MVPDs for the right to carry them, and are generally marketed to subscribers in bundles; “premium” networks, like HBO, generally do not sell advertising but are priced higher to subscribers, often on an a la carte basis. Our focus in this study is entirely on basic networks.

Basic cable TV networking is a typical two-sided media market, but with its own idiosyncrasies. A decision by a network to charge higher per-subscriber fees, or to offer itself for placement on a higher tier for extra charges, for example, will limit advertising revenues by reducing MVPD demand to carry the network, or by reducing the network’s audience exposure due to higher tier carriage. Thus, the market is a complex one in which advertising revenues depend on tier position and per subscriber fees as well as audience size and other characteristics, along with a variety of other elements, such as the type of programming. Subscriber reach of a network, for example, is partially determined by tier position choice, license fee rates, years since the network was launched, etc.

In this study, we do not attempt to capture all these details of the industry, but instead use single equation models, and in some cases instrumental variable techniques, to explain advertising rates and the distribution of black and Hispanic audiences.

IV. Determinants of cable advertising prices

A. Database and descriptive data

The primary data we use in our models was supplied by A.C. Nielsen and includes audience-related data for 97 basic networks in business during 2010. For each network, we obtained 2010 annual averages for the network's TV household reach, and average households delivered in a number of categories, including: total, racial/ethnic (black, Hispanic, white), four age categories, ten income categories, and gender.

The Nielsen data permitted us to calculate each network's average annual rating and the percentage audience composition among the income, gender, race/ethnic, and age categories. The Nielsen data also include total advertising revenue, allowing us to construct an advertising revenue per viewer measure, although these data were available only for 89 networks.⁴

We supplemented these Nielsen data by calculating tier positioning: the % of cable subscribers that had the network available on the lowest priced (basic or expanded basic) tier, rather than on a tier that required extra charges, using the 2010 Television & Cable Factbook (Warren Publishing, 2010). These data were available for 64 networks. We further obtained data from SNL Kagan Research for network launch dates and for total expenditures on programming for 86 of the Nielsen networks. Finally, we obtained descriptive content information, in this case for 89 of the Nielsen networks, in 10 genre categories at a Wikipedia site (originating from National Cable & Telecommunications Association, NCTA), as well as more detailed content descriptions directly from the NCTA website.

Table 1 indicates the specific variables we employ in our models, their definitions, and basic statistics. We define advertising prices, our primary dependent variable, as total annual advertising revenues divided by average households delivered (*ARH*). Although not a true price, this definition generally follows the methodology of Fisher, et al (1980), Bel and Domenech (2009), and Gentzkow (2014), and measures the overall ability of the network to raise advertising revenues as a function of viewing.

Our Nielsen database also included annual average CPM rates for each network based on Nielsen estimates of actual prices paid in the marketplace for 30 second commercials.

⁴ While it would also be desirable to have ratings and other data on a program-by-program basis, these data were unavailable (and in the case of most basic cable networks, unknown because of Nielsen sample size limitations.). With only a few exceptions (eg, some professional sports programs and entertainment specials), cable advertising is sold on a day-part basis (eg, primetime, daytime, etc.), so that relatively little information should be lost with the use of annual averages.

Some authors have used similar CPM measures in empirical studies of television advertising (Fournier and Martin, 1983; Goettler, 2012). Models we estimated with this dependent variable generally produced insignificant or inconsistent results and we do not report them here.⁵ One advantage of the *ARH* measure is that it abstracts from variations by network in the number of available commercial minutes per hour and in unsold inventories.

Figures 1 and 2 illustrate bivariate relationships between our advertising price measure and the network's audience reach and its rating, respectively, for the 78 networks having complete data for the regression models that follow. As indicated in Table 1, *reach* is defined as the % of total US TV households that can receive the network. The *rating* variable is the 24 hour average percentage of those households that are able to receive the network and actually watch it. A positive relationship between *ARH* and *reach* is suggested by Figure 1, but a relationship between *ARH* and *rating* is less evident (Figure 2). A more complete bivariate correlation matrix including empirical model variables appears in Appendix Table 2.

Most of the networks on the far right of the reach graph were launched in early years of the industry and had achieved virtually 100% MVPD subscribership reach by the 1980s or '90s. Note, however, that even the most widely carried cable networks still fell short in 2010 by about 13% of all TV households because those TV households receive only broadcast signals. Thus, all cable networks have at least the 13% national coverage handicap. Many of the networks with lower reach are from the second wave of network entry which came in response to digital cable tiers rolled out in the mid-1990s. Among them are several sports networks which charged relatively high advertising prices, notably NFL Network (NFLN) and Versus (VS), and were in some cases involved in carriage disputes with MVPDs over per-subscriber fees and tier placement. Regarding the less evident relationship between *ARH* and *rating* shown in Figure 2, we note that our sample is not complete in that many existing networks (up to several hundred in fact according the FCC's latest counts) are not covered by Nielsen ratings. In the great majority of these cases, the network does not achieve the minimum criteria to be rated by Nielsen in terms of household coverage and average audience size.⁶ Thus, existing networks not in our sample can overwhelmingly be assumed to

⁵ An earlier version of this article (Ji, Lin, and Waterman, 2013), contains CPM models comparable to those we report below.

⁶ Networks with audiences sizes meeting Nielsen's minimum criteria could also be excluded from the database if they do not subscribe to Nielsen's rating service, but we did not observe any notable examples of such omission.

have smaller audiences than those in the sample.

B. Empirical specifications and estimation strategy

Our general empirical model is as follows:

$$(1) ARH = \beta_0 + \beta_1 reach + \beta_2 rating + \beta_3 age18-34 + \beta_4 income + \beta_5 \%Black + \beta_6 \%Hispanic + \beta_7 \%male + \beta_8 \%income + \beta_9 male-hhi + \beta_{10} agehhi + \beta_{11} racehhi + \beta_{12} Genre\ dummies + error$$

Our hypothesis is that *ARH* will be positively related to *reach* since advertisers presumably value homogeneously distributed, geographically complete national audiences. *Rating* may have either a positive or a negative effect. Other things equal, smaller audience sizes suggest sharper audience segmentation, which should increase advertising rates. As discussed above, however, smaller audience size may at some point diminish advertiser demand either because, for example, too low a percentage of the network's target audience is reached, or because targeted commercials cannot be cost-effectively produced.

Audience characteristics are primarily represented by Nielsen demographic data. Viewers aged 18-34 are the most desirable age group to advertisers. Similarly for females (suggesting a negative coefficient for “%male.”). Ad rates should also increase in income. Although we do not have prior expectations for the effects of %black or %Hispanic, previous research reported above suggests these variables may have negative coefficients. The three HHI terms are intended to represent the value of focussed segmentation within any of the relevant demographic categories.

Finally, network characteristics are represented by the 10 genre dummy variables described in Table 1. Ad prices are likely to be higher for certain types of content, such as sports, independently of demographics. These variables may also represent varying levels of network competition within these programming categories, which other things equal, may tend to reduce advertising rates.

We estimated several variations on the basic model set out in equation (1). First, we used different permutations or functional forms of the *rating* and *reach* variables, using an interaction term, $inter = reach \times rating$, which is equivalent to average audience delivered; squared terms for *reach*, *rating* and *inter*, and log forms of the model. The purpose of these variations is to allow for a range of different functional forms that the relationship between

reach and rating with *ARH* might take, given that we do not have prior expectations for these functional forms.

We first estimated all models by ordinary least squares, using the sample of 78 Nielsen networks which had complete data. OLS estimates might be problematic, however, because of potential endogeneity of some independent variables, notably *reach*, and thus *inter*. For example, since cable operators sell local advertising, *ARH* may be expected to positively affect network reach by making MVPD carriage of those networks more desirable. We therefore used instrumental variables to estimate *reach* and *inter*. We selected three instrumental variables: *log netage* (the time since the network's launch), *progexp* (estimated total expenditures on the network's programming), and *tier* (the % of the network's subscribership reach that is on a basic or expanded basic tier). The rationale for choosing these variables is as follows. We expect that these variables are exogenous to advertising prices conditional on the other controlled variables; and they are likely to be related to *reach* and *inter*. For example, *tier* has a direct impact on *reach*. However it is reasonable to assume that *tier* affects ad prices only through its effect on *reach* and *inter*. Similarly, we expect that changes in *progexp* and *netage* would have direct effects on *reach*, but would not directly affect ad prices.

C. Results

In Table 2, we report OLS results of seven basic models that are the same except for different permutations or functional forms of the network *reach* and *rating* variables. In Table 3, we report comparable models in which *reach* and/or *inter* were instrumented on (a) *log netage* and *progexp*, and (b) *log netage*, *progexp* and *tier*. In these text tables, however, we report only those among the seven model forms that passed the Stock-Yogo weak instrument test (Stock & Yogo, 2002) at least at the 15% level (The models that do not pass the weak instrument test at this level are reported in Appendix Table 1).

Tables 2 and 3 consistently indicate a positive and significant relationship between *ARH* and average audience delivered (*inter*) and network reach (*reach*), with exception of OLS Model 7, which shows a positive effect of *rating*. OLS Model (2) and IV Model (2) suggest ad rates to increase at a decreasing rate with average audience delivered.

Turning to other variables, there were mostly negative effects of *%male* and mostly positive effects of *%age18-34*, and sporadic positive effects of *%Hispanic*, but no significant effects of *income* or *%black*. None of the HHI variables were significant, except for a

positive effect of *race-hhi* in one model. (*age-hhi* had to be eliminated from the models because it is highly correlated to *%age18-34*.) Confirming industry wisdom, “*sports*” programming commanded generally higher ad rates, and “*kids and family*” lower rates. Note that one genre category, “*general entertainment*,” was chosen for omission from the models.

Overall, our models for advertising revenues per household delivered consistently show a positive effect of average audience delivered (i.e., total audience size), and some evidence that the effects of this variable are increasing at a decreasing rate. Our attempts to parse the effects of *rating* and *reach* separately did not lead to consistent findings, although signs were nearly all in the positive direction for both variables. Effects of demographic and other variables were mostly as expected in the case of age, income, and gender, but notably insignificant, or in two OLS models positive, for *% Hispanic*. There was thus no corroborating evidence, as suggested by previous research, that advertising rates are lower for either blacks or Hispanics

V. Black and Hispanic audience distributions

In this section, we investigate the extent to which black or Hispanic viewing of cable networks is disproportionately skewed toward a particular set of networks, or is evenly distributed among them. We then investigate the roles of programming content vs. programming investments in explaining these audience distributions.

A. Descriptive data

Eighty-four of the 97 networks in our sample had complete content and production investment, as well as black/non-black and Hispanic/non-Hispanic audience data. To more completely describe content, we added some additional information from detailed NCTA network programming descriptions for each network we obtained from the NCTA website: dummy variables identifying networks with the words “black” or “African-American” and “Hispanic” or “Spanish” oriented content.

Figures 3 and 4 illustrate the frequency distribution of “*%black*” audience composition among the 84 networks. In Figure 3, *%black* is ordered from lowest to highest, suggesting black viewing to be fairly uniform, but sharply higher for four networks, at least three of which have content descriptions that indicate black or African-American specific content (TVOne, BET and Centric). When these same data are ordered in Figure 4 by average black audience delivered (*aablack*), BET remains prominent (2th ranked), but the other three

networks with the highest % of black viewers shift well to the left, indicating that these networks have relatively small total audiences. In addition to BET, the four networks delivering the largest total black audiences—Nickelodeon, Turner Network Television, Disney Channel, and USA Network—also had the highest overall ratings in our sample. For Hispanic audiences, the general pattern is similar. Figure 5 suggests a relatively even distribution of Hispanic viewers among the 84 networks except for much higher percentages for two networks, Mun2 and Galavision, both of which have “Hispanic” or “Spanish” specific programming. When networks are ordered in Figure 6 by average Hispanic audience delivered (*aaHispanic*), Galavision, a well-established Spanish-language general entertainment network, remains near the top in audience delivered, but Mun2, a relatively small cable network, is much lower. Again, most of the top networks in terms of total Hispanic households delivered are among the most popular networks overall. In addition to Galavision, the top 5 in terms of Hispanic viewers delivered, are Nickelodeon, Disney Channel, The Cartoon Network and MTV. Note also that in our sample, the mean % black audience composition is 19.3% vs. only 9.7% for Hispanics. A likely reason for these contrasts is that some other large Spanish-language broadcast networks, including Telemundo, are not included in our cable network sample. Overall, Hispanic HHs make up approximately 16% of the US population (only a little more than blacks at 14%), but are widely known to heavily skew their TV viewing toward Spanish language programming.

These descriptive data suggest that vertical differentiation of networks in terms of programming investments may be an important driver of these black and Hispanic audience patterns.

We also calculated a segregation or “isolation” index for the distribution of black vs. non-black households across our full sample of 97 networks, and a second index for Hispanic vs. non-Hispanic households. This segregation index is similar to the bivariate “ideological isolation” index calculated by Gentzkow and Shapiro (2011) for Internet, cable, and other news media in the U.S., using 2008 data. Their index is in turn derived from the literature on racial segregation (Cutler, Glaeser, & Vigdor, 1999; White, 1986).

Our measure of segregation, for blacks:

$$S_m = \sum_{j \in J_m} \left(\frac{\text{black HH delivered by network } j}{\text{total black HH delivered }_m} \cdot \frac{\text{black HH delivered by network } j}{\text{total HH delivered }_j} \right. \\ \left. - \sum_{j \in J_m} \left(\frac{\text{non - black HH delivered by network } j}{\text{total non - black HH delivered }_m} \right. \right. \\ \left. \left. \cdot \frac{\text{black HH delivered by network } j}{\text{total HH delivered }_j} \right) \right)$$

where J_m is all 97 networks in our sample.

The isolation index for blacks and non-blacks measures the extent to which all blacks watch one set of cable networks and all non-blacks watch the other set (index = 1); or if blacks and non-blacks proportion themselves evenly over all of the networks in the sample (index = 0). These calculations produce two summary statistics: a 7.5% isolation index for blacks/non-blacks and 5.2% for Hispanics/non-Hispanics.

For comparative perspective, Gentzkow and Shapiro's (2011) bivariate ideological isolation indices for Internet and other news content are calculated using ComScore and MRI survey data in which users self-identified as "conservative" or "liberal." ("Moderates" are excluded from their index.) The Internet news index (the focus of their paper) thus shows the extent to which conservatives all use one set of Internet news sites, and liberals another, or at the other extreme, if they apportion themselves equally among different sites. They find roughly comparable, low levels of ideological isolation on Internet news (7.5%), although they report even lower levels for some comparative media, ranging from 1.8% for national broadcast network news, 3.3% for cable news, up to 10.4% for national newspapers. They report media isolation in general to be much lower than for real life: geographic distribution in neighborhoods (18.7%) or for face-to-face political discussions (39%).

Using the 2008 MRI survey data, Gentzkow and Shapiro also report parenthetically some racial (black/non-black) segregation indices that are relatively very low for media: a high of 12.8% for local newspapers, but less than 10% for other media, including cable news and Internet news. These compare, for example, to a real life black/non-black geographic racial segregation index of 49.1% for U.S. zip codes and 81.9% for person-to-person political discussions (Gentzkow & Shapiro, 2011, pp. 1829-1830).

Finally, Gentzkow and Shapiro report that ideological segregation of Internet news is strongly correlated with the overall size rank of sites in terms of total users. That is, sites that are strongly segregated ideologically tend to be relatively small, while the most popular sites apparently have relatively broad ideological appeal, that is, more evenly visited by both

conservatives and liberals. Although Gentzkow and Shapiro do not have cost data, they infer from these correlations that vertical differentiation drives ideological segregation, a pattern similar to that suggested by Figures 4-7 above for black and Hispanic cable audiences.

B. Regression models

In general, two broad factors determine a network's audience size and composition: programming content and programming investments. To better understand the relative contributions of content vs. quality to the distribution of black and Hispanic viewing among cable networks, we conducted a series of OLS regressions of the following basic form:

$$(2) \text{aaBlack}(or \%Black) = \beta_0 + \beta_1 \text{netage} + \beta_2 \text{Black AfricanAmerican} + \beta_3 \text{Hispanic} + \beta_4 \text{genrdummies} + \beta_5 \text{progexp} + \text{error}$$

We expect the *black/African-American* content variables to be significantly positive and similarly for age of the network and production investment. For comparison, we replaced *aablack* with *%black* as the dependent variable. In that model, we also expect content variables to be significant determinants, but if higher programming investments affect black, Hispanics and white viewers the same, *progexp* should have no explanatory power. We estimated comparable sets of models for *aaHispanic*, *% Hispanic*, *aawhite*, and *%white*.⁷

C. Results

We report in Tables 4-6 a set of identical models for blacks, Hispanics, and whites. Each set contains the same five permutations of the explanatory variables. *Log netage* appears in all models. The variable, *log progexp* performed consistently better than *progexp*, and we report only results with the log form.

Turning first to black audiences (Table 4), *black/African-American* specific content has consistently positive effects on both *aablack* and *%black*, while Hispanic oriented content has in some cases a significantly negative effect. Production investment is positive and significant in the *aablack* models, but as expected is insignificant in the *%black* models. For Hispanics (Table 5), the pattern is similar, although the effects of *Hispanic/Spanish*

⁷ Note from Table 1 that “white” and “% white” in these models are defined by those indicating “white” instead of “black”, or “other.” Among the 3 possible choices in one of the Nielsen questions. “Whites” as defined by this question may thus include some Hispanics.

language content are consistently significant only in the %Hispanic models. Production investment positively affects *aaHispanic*, but not *%Hispanic*. Models for whites (Table 6) show the same pattern, although in this case *black/African-American* and *Hispanic/Spanish* specific content significantly reduces white viewing, at least in the *%white* models.

While these results are generally as expected, it is instructive to compare the models in terms of the % of variance explained (Table 7). Three main patterns are evident. First, in models with only the black/Hispanic or genre dummies included as independent variables, these content variables explain a higher percentage of the variance in the *%black/%Hispanic/%white* models than in the *aablack/aaHispanic/aawhite* models. This pattern is expected since the “%” models are independent of the effects of vertical differentiation. Secondly, models with only production investment (*log progexp*) explain a substantial proportion of variance in the average audience models--but virtually none in the “%” audience models, confirming that the positive effects of production investment work independently of race or ethnic origin.

A third pattern is that in the average audience models, production investment alone accounts for a higher percentage of the total variance than do the black/Hispanic dummies alone. Of course, we do not know how completely these model variables, or their functional forms, represent the actual effects of content or production investment. Also, of course, production investment and content decisions can be changed in the long run. Nevertheless, these models take a step toward answering a fundamental question in the economics of media: the roles of programming content vs. programming cost in explaining the distribution of audiences.

In summary, we find persuasive evidence that both programming content and vertical differentiation are major factors explaining the distribution of black and Hispanic audiences among cable networks

VI. Conclusion

Using a sample of 78 U.S. basic cable networks in 2010, we employed a range of model specifications and estimation methods to investigate the determinants of network advertising prices, which we define as annual advertising revenue divided by average household delivered. In nearly all cases we found ad prices to be increasing in total audience size (that is, average audience delivered). Results of our attempts to break down the source of this total audience size effect into its components--the network’s national TV household

reach, and its audience rating—were less clear, although coefficient signs on these variables were mostly positive and significant. Coefficients on demographic factors (age, income, and gender) were generally in the expected directions, although their statistical significance was sporadic. Confirming industry wisdom, some types of content, such as sports, command significantly higher, and “kids and family” programs lower, ad rates.

Overall, these findings suggest that there are economic limits on the profitability of segmenting cable network content toward finer and finer audience segments. Although we found little evidence about the reasons for those limits, these findings are consistent with those of Goettler (2012) for the major broadcast networks, suggesting that the net empirical effect of sharper audience segmentation on advertising prices is negative.

Turning to our investigation of apparent shortages of basic cable network programming that is oriented toward black and Hispanic audiences, insignificant or in some cases significantly positive coefficients on “%black” and “%Hispanic” variables in our *ARH* models are contrary to findings or suggestions of previous research that advertisers undervalue these minority groups. Thus, advertiser valuations do not appear to contribute to any “underservice” of these groups by cable networks.

Our investigation of the distribution of black and Hispanic audiences among 84 networks showed that both content variables (specifically black or Hispanic oriented content, and genre labels) and network programming investments are both strongly positive determinants of average black and Hispanic audiences delivered by cable networks. Content variables are even stronger determinants of the % of cable network audiences made up by blacks and Hispanics, but production investments have zero explanatory power in these models.

The implication of these results is that vertical differentiation is a major driver of cable audiences without regard to race or ethnic background. The quality factor thus appears to trump content for many black and Hispanic viewers. In effect, our results suggest a preference externality outcome arising from programming quality. That is, cable network program producers have a strong incentive to produce a higher variety of higher quality programming that primarily serves majority population segments, and that minority groups choose to watch this programming rather than cheaper productions whose content they would otherwise prefer. The end result, however, is surely more textured. Producers have the strongest incentive to invest in high quality programs that have broadest appeal among both minority and majority populations.

Whether the outcomes of cable network programming incentives are socially beneficial is another question. Of course, there is much to be said for consumer sovereignty. But small minorities are unlikely to be served by high quality programming that is sharply focussed to them, and this outcome in the media could serve to diminish real life social and cultural cohesion of these groups.

We acknowledge a number of shortcomings in this study. We have employed relatively simple models that do not explicitly take account of the two-sided nature of the cable television networking industry. Our samples are also limited in size and for a single year, and exhibit a good deal of network to network heterogeneity. Further, our analysis excludes a number of other basic cable networks that were in business in 2010 and are not rated, as well as a number of national broadcast networks that competitively interact with basic cable networks.

Our results nevertheless take a step toward understanding fundamental and important questions about the ability of profit motives to robustly act upon the finer and finer audience segmentation that technology allows in multi-channel television, and in particular, to produce high quality programming that successfully serves racial and ethnic minority audiences.

References

- Anderson, S., 2012, 'Advertising on the Internet,' In M. Peitz and J. Waldfogel, Eds., *The Oxford handbook of the digital economy* (pp. 355-396). New York, NY: Oxford University Press.
- Athey, S., and Gans, J., 2010, 'The Impact of Targeting Technology on Advertising Markets and Media Competition,' *American Economic Review*, 100(2), pp. 608-613.
- Baker, M., and George, L., 2010, 'The News Hour: Estimating the Value of Television News,' working paper.
- Bel, G., and Domenech, L., 2009, 'What influences advertising price in television channels?: An empirical analysis on the Spanish market,' *Journal of Media Economics*, 22(3), pp. 164-183.
- Ben Elhadj-Ben Brahim, N., Lahmandi-Ayed, R., and Laussel, D., 2011, 'Is targeted advertising always beneficial?' *International Journal of Industrial Organization*, 29(6), pp. 678-689.
- Bergemann, D., and Bonatti, A., 2011, 'Targeting in advertising markets: implications for offline versus online media,' *The RAND Journal of Economics*, 42(3), pp. 417-443.
- Brown, K. S., and Cavazos, R. J., 2002, 'Network revenues and African American broadcast television programs,' *The Journal of Media Economics*, 15(4), pp. 227-239.
- Chandra, A., 2009, 'Targeted Advertising: The role of subscriber characteristics in media markets,' *The Journal of Industrial Economics*, 57(1), pp. 58-84.
- Chandra, A., and Kaiser, U., 2014, 'Targeted advertising in magazine markets and the advent of the internet,' *Management Science* 60(7), pp. 1829-1843.
- Chipty, T., and Snyder, C. M., 1999, 'The role of firm size in bilateral bargaining: A study of the cable television industry,' *Review of Economics and Statistics*, 81(2), pp. 326-340.
- Cutler, D. M., Glaeser, E. L., and Vigdor, J. L., 1999, 'The Rise and Decline of the American Ghetto,' *Journal of Political Economy*, 107(3).
- Depken II, C. A., and Wilson, D. P., 2004, 'Is Advertising a Good or a Bad? Evidence from US Magazine Subscriptions,' *The Journal of Business*, 77(S2), pp. 61-80.
- Evans, D. S., 2009, 'The online advertising industry: Economics, evolution, and privacy,' *Journal of Economic Perspectives*, 23(3), pp. 37-60.
- FCC, 2012, *Fourteenth Report.*, MB Docket No. 07-269). Federal Communications Commission.
- Fisher, F. M., McGowan, J. J., and Evans, D. S., 1980, 'The audience-revenue relationship for local television stations,' *The Bell Journal of Economics*, pp. 694-708.
- Fournier, G. M., and Martin, D. L., 1983, 'Does government-restricted entry produce market power?: New evidence from the market for television advertising,' *The Bell Journal of Economics*, pp. 44-56.
- Gentzkow, M., 2014, 'Trading Dollars for Dollars: The Price of Attention Online and Offline,' *The American Economic Review*, 104(5), pp. 481-488.
- Gentzkow, M., and Shapiro, J. M., 2011, 'Ideological segregation online and offline,' *The Quarterly Journal of Economics*, 126(4), pp. 1799-1839.
- George, L., and Waldfogel, J., 2003, 'Who affects whom in daily newspaper markets?' *Journal of Political Economy*, 111(4), pp. 765-784.
- Goldfarb, A., and Tucker, C., 2011, 'Online display advertising: Targeting and obtrusiveness,' *Marketing Science*, 30(3), pp. 389-404.
- Goettler, R. L., 2012, 'Advertising Rates, Audience Composition, and Competition in the Network Television Industry,' working paper, <http://goettler.simon.rochester.edu/research/papers/adrates.pdf>.

- Ji, Lin, and Waterman, 2013, 'Basic Cable Network Segmentation Toward Minorities and Other Niches Audiences in the U.S.: An Empirical Study,' 11th Annual Workshop on Media Economics, Tel Aviv, Israel, Oct. 9-10, 2013.
http://www.tau.ac.il/~spiegel/media-workshop/Cable%20TV%20segmentation-Ji,%20Lin,%20Waterman%209-20-13_1_.pdf
- Koschat, M. A., and Putsis Jr, W. P., 2002, 'Audience characteristics and bundling: a hedonic analysis of magazine advertising rates,' *Journal of Marketing Research*, pp. 262-273.
- McDowell, W. S., and Dick, S. J., 2005, 'Exploring the dynamics of power ratios among US radio stations,' *Journal of Media Business Studies*, 2(2), pp. 1-15.
- Napoli, P. M., 2002, 'Audience valuation and minority media: An analysis of the determinants of the value of radio audiences,' *Journal of Broadcasting and Electronic Media*, 46(2), pp. 169-184.
- National Cable and Telecommunications Association, www.ncta.com
- Nielsen database., 2012, <http://www.nielsen.com/us/en.html>
- Ofori, K. A., 1999, 'When being no. 1 is not enough: The impact of advertising practices on minority-owned & minority-formatted broadcast stations,' Office of Communications Business Opportunities, Federal Communications Commission.
- Rogers, R. P., and Woodbury, J. R., 1996, 'Market structure, program diversity, and radio audience size,' *Contemporary Economic Policy*, 14(1), pp. 81-91.
- SNL Kagan, 2011, 'The Economics of Basic Cable Networks, 1989-2010,' *Cable Program Investor*, July 27, 2011.
- SNL Kagan, 2013, 'Supplement file,' *Cable Program Investor*, , September 03, 2013.
- Stock, J. H., and Yogo, M., 2002, 'Testing for weak instruments in linear IV regression,' National Bureau of Economic Research Cambridge, Mass., USA.
- TV Dimensions., 2012, New York: Media Dynamics: Inc.
- Waldfogel, J., 2003, 'Preference externalities: an empirical study of who benefits whom in differentiated-product markets,' *Rand Journal of Economics*, 34(3), pp. 557-568.
- Waldfogel, J., 2004, 'Who benefits whom in local television markets?' *Brookings-Wharton Papers on Urban Affairs*, Brookings Institution Press, 2004, pp. 257-305.
- Warren Publishing., 2010, 'Television and Cable Factbook,' Washington, DC: Warren Publishing.
- Webster, J. G., and Phalen, P. F., 1997, 'The mass audience: Rediscovering the dominant model,' Erlbaum Mahwah, NJ.
- White, M. J., 1986, 'Segregation and diversity measures in population distribution,' *Population index*, 52(2), pp. 198-221.
- Wikipedia. List of United States cable and satellite television networks. from http://en.wikipedia.org/wiki/List_of_United_States_cable_and_satellite_television_networks.
- Wildman, S. S., and Karamanis, T., 1998, 'The economics of minority programming,' In A.K. Garmer (Eds.), *Investing in diversity: advancing opportunities for minorities and the media*, Washington, D.C.: The Aspen Institute.

Table 1: Model variables and summary statistics

| Variables | Obs. | Mean | Std. Dev. | Min | Max | Definition | Source |
|---|-------------|-------------|------------------|------------|------------|---|------------------|
| <i>ARH</i> (\$) | 80 | 628.84 | 347.66 | 5.84 | 1708.30 | Total advertising revenue (\$ 000) / average audience delivered (000) | Nielsen |
| <i>%Hispanic</i> (%) | 92 | 0.08 | 0.04 | 0.00 | 0.25 | % average audience delivered that is Hispanic | Nielsen |
| <i>%black</i> (%) | 92 | 0.20 | 0.15 | 0.00 | 0.88 | % average audience delivered that is black | Nielsen |
| <i>%male</i> (%) | 92 | 0.49 | 0.15 | 0.20 | 0.81 | % average audience delivered that is male | Nielsen |
| <i>income</i> (\$ 000) | 92 | 46.22 | 6.29 | 31.66 | 60.31 | Average income (calculated) | Nielsen |
| <i>%age18-34</i> (%) | 92 | 0.23 | 0.09 | 0.04 | 0.45 | % average audience delivered, age 18 to 34 | Nielsen |
| <i>male-hhi</i> (%) | 92 | 0.55 | 0.05 | 0.50 | 0.70 | $\%male^2 + \%female^2$ | Nielsen |
| <i>age-hhi</i> (%) | 92 | 0.66 | 0.10 | 0.51 | 0.92 | $\%age18-34^2 + \%other\ age^2$ | Nielsen |
| <i>race-hhi</i> (%) | 92 | 0.60 | 0.11 | 0.37 | 0.94 | $\%white^2 + \%hispanic^2 + \%black^2$ | Nielsen |
| <i>reach</i> (%) | 92 | 0.68 | 0.18 | 0.32 | 0.87 | HHs reached by the network/total TV HH | Nielsen |
| <i>rating</i> | 92 | 0.37 | 0.33 | 0.01 | 1.74 | Average audience delivered/HHs reached by the network | Nielsen |
| <i>inter</i> (<i>reach</i> x <i>rating</i>) | 92 | 0.29 | 0.30 | 0.01 | 1.51 | $(rating \times reach) =$ Avg. audience delivered/total TV HH | Nielsen |
| <i>Documentaries</i> | 89 | 0.12 | 0.32 | 0 | 1 | primary genre, documentary = 1 | Wikipedia (NCTA) |
| <i>Entertainment</i> | 89 | 0.27 | 0.45 | 0 | 1 | Primary genre, Entertainment = 1 | Wikipedia (NCTA) |

Table 1 Continued

| Variables | Obs. | Mean | Std. Dev. | Min | Max | Definition | Source |
|--------------------------------|-------------|-------------|------------------|------------|------------|---|-----------------------------|
| <i>Kids and Family</i> | 89 | 0.15 | 0.36 | 0 | 1 | Primary genre, Kids and Family-1 | Wikipedia (NCTA) |
| <i>Lifestyle & Culture</i> | 89 | 0.12 | 0.32 | 0 | 1 | Primary genre, Lifestyle & Culture = 1 | Wikipedia (NCTA) |
| <i>Movies</i> | 89 | 0.06 | 0.25 | 0 | 1 | Primary genre, Movie = 1 | Wikipedia (NCTA) |
| <i>Music</i> | 89 | 0.09 | 0.29 | 0 | 1 | Primary genre, Music = 1 | Wikipedia (NCTA) |
| <i>News and information</i> | 89 | 0.09 | 0.29 | 0 | 1 | Primary genre, News and information = 1 | Wikipedia (NCTA) |
| <i>Religion</i> | 89 | 0.01 | 0.11 | 0 | 1 | Primary genre, Religion= 1 | Wikipedia (NCTA) |
| <i>Sports</i> | 89 | 0.09 | 0.29 | 0 | 1 | Primary genre, Sports = 1 | Wikipedia (NCTA) |
| <i>netage</i> | 92 | 16.50 | 9.68 | 0 | 35 | Years since network launch | FCC |
| <i>aablack (000)</i> | 92 | 63.60 | 78.52 | 0 | 360 | black average audience delivered | Nielsen |
| <i>aaHispanic (000)</i> | 92 | 28.13 | 43.42 | 0 | 304 | Hispanic average audience delivered | Nielsen |
| <i>black/African-American</i> | 92 | 0.02 | 0.15 | 0 | 1 | “black” or “African-American” contained in NCTA network programming = 1 | NCTA |
| <i>Hispanic/Spanish</i> | 92 | 0.02 | 0.15 | 0 | 1 | “Hispanic”/”Spanish” contained in NCTA network programming summary = 1 | NCTA |
| <i>tier (%)</i> | 65 | 0.52 | 0.43 | 0 | 0.996 | % of subscribers on basic/expanded basic tier Cable | Television & Cable Factbook |
| <i>progexp (\$ mil)</i> | 86 | 215.78 | 546.56 | 6.47 | 4924.13 | Total annual expenditure on programming | Kagan Research |

Table 2: ARH OLS models

| Variables | (1) <i>ARH</i> | (2) <i>ARH</i> | (3) <i>ARH</i> | (4) <i>ARH</i> | (5) <i>ARH</i> | (6) <i>log ARH</i> | (7) <i>log ARH</i> |
|----------------------------|----------------------|-----------------------|----------------------|----------------------|----------------------|--------------------|--------------------|
| <i>inter</i> | 335.59*** (2.94) | 1199.28*** (4.08) | | 22.04 (0.15) | | | |
| <i>inter</i> ² | | -751.86*** (-3.15) | | | | | |
| <i>reach</i> | | | 885.93*** (3.10) | 885.95*** (3.00) | -2724.53 (-1.62) | | |
| <i>reach</i> ² | | | | | 2697.83* (2.00) | | |
| <i>rating</i> | | | 20.76 (0.16) | | 439.26 (1.15) | | |
| <i>rating</i> ² | | | | | -318.79 (-1.48) | | |
| <i>log inter</i> | | | | | | 0.41*** (4.47) | |
| <i>log reach</i> | | | | | | | 0.004 (0.01) |
| <i>log rating</i> | | | | | | | 0.51*** (3.00) |
| <i>%black</i> | -181.23 (-0.72) | -43.88 (-0.18) | 97.95 (0.38) | 99.34 (0.39) | 70.35 (0.29) | -0.14 (-0.20) | -0.36 (-0.46) |
| <i>%Hispanic</i> | 607.27 (0.48) | 1168.93 (0.98) | 663.89 (0.56) | 664.46 (0.56) | 1163.38 (1.01) | 7.61** (2.14) | 7.49** (2.10) |
| <i>%male</i> | -763.59** (-2.52) | -680.13** (-2.39) | -594.25** (-2.04) | -594.62** (-2.04) | -585.51** (-2.10) | -1.72* (-1.97) | -1.75* (-2.00) |
| <i>income</i> | 1.60 (0.23) | 4.08 (0.63) | 5.37 (0.82) | 5.38 (0.82) | 6.00 (0.95) | -0.01 (-0.41) | -0.01 (-0.48) |

| | | | | | | | |
|--------------------------------|----------------------|---------------------|----------------------|----------------------|-----------------------|---------------------|---------------------|
| <i>%age18-34</i> | 1539.96*** (3.09) | 1010.07** (2.04) | 740.87 (1.37) | 737.35 (1.37) | 641.59 (1.22) | 0.44 (0.31) | 0.94 (0.58) |
| <i>male-hhi</i> | 327.37 (0.40) | 145.04 (0.19) | -48.64 (-0.06) | -49.57 (-0.06) | 305.30 (0.40) | 2.15 (0.94) | 2.38 (1.02) |
| <i>race-hhi</i> | 456.95 (1.19) | 440.77 (1.23) | 385.86 (1.07) | 385.10 (1.07) | 305.66 (0.87) | 2.51** (2.31) | 2.47** (2.26) |
| <i>Documentaries</i> | -54.57 (-0.47) | -72.63 (-0.66) | -64.85 (-0.59) | -64.67 (-0.59) | -86.72 (-0.82) | -0.16 (-0.49) | -0.18 (-0.53) |
| <i>Kids and Family</i> | -291.63** (-2.21) | -313.7** (-2.54) | -325.96** (-2.61) | -325.83** (-2.61) | -328.47*** (-2.75) | -1.26*** (-3.37) | -1.24*** (-3.31) |
| <i>Lifestyle & Culture</i> | -46.68 (-0.39) | -12.41 (-0.11) | -40.61 (-0.36) | -41.19 (-0.37) | -43.05 (-0.39) | -0.29 (-0.86) | -0.26 (-0.74) |
| <i>Movies</i> | -47.09 (-0.35) | -76.99 (-0.60) | -48.7 (-0.38) | -48.5 (-0.38) | -90.71 (-0.73) | -0.65* (-1.69) | -0.67* (-1.73) |
| <i>Music</i> | 43.7 (0.35) | 137.76 (1.15) | 71.58 (0.61) | 70.98 (0.6) | 129.26 (1.1) | 0.58 (1.57) | 0.62 (1.67) |
| <i>News and information</i> | 73.33 (0.55) | 18.12 (0.14) | -142.17 (-0.98) | -143.12 (-0.99) | -129.22 (-0.89) | 0.09 (0.22) | 0.23 (0.53) |
| <i>Religion</i> | -337.06 (-1.21) | -250.93 (-0.96) | -249.08 (-0.95) | -250.12 (-0.95) | -294.48 (-1.15) | -0.9 (-1.14) | -0.91 (-1.14) |
| <i>Sports</i> | 375.54** (2.09) | 426.77** (2.53) | 350.5** (2.07) | 350.29** (2.07) | 366.34** (2.22) | 0.97* (1.9) | 1.00* (1.95) |
| Constant | 30.3 (0.05) | -89.57 (-0.16) | -347.25 (-0.61) | -344.62 (-0.6) | 511.8 (0.74) | 4.93*** (2.98) | 4.81*** (2.87) |
| Observations | 78 | 78 | 78 | 78 | 78 | 78 | 78 |
| R ² | 0.53 | 0.60 | 0.59 | 0.59 | 0.64 | 0.55 | 0.55 |
| Adj. R ² | 0.41 | 0.49 | 0.48 | 0.48 | 0.52 | 0.43 | 0.42 |

^ p < .15; * p < .1; ** p < .05; *** p < .01

Table 3: ARH IV models that passed the weak instrument test

| Variables | (1) ARH (2 inst. ^a) | (2) ARH (2 inst.) | (3) ARH (2 inst.) | (4) ARH (3 inst. ^b) | (5) log ARH (3 inst.) | (6) log ARH (3 inst.) |
|----------------------------|------------------------------------|----------------------|----------------------|------------------------------------|--------------------------|--------------------------|
| <i>inter</i> | 1004.07*** (5.26) | | 653.79*** (5.06) | | | |
| <i>inter</i> ² | | | | | | |
| <i>reach</i> | | | | 640.81** (2.05) | | |
| <i>reach</i> ² | | | | | | |
| <i>rating</i> | | | | 159.15 (1.23) | | |
| <i>rating</i> ² | | | | | | |
| <i>log inter</i> | | 0.63*** (4.91) | | | 0.26*** (4.31) | |
| <i>log reach</i> | | | | | | 0.41 (0.82) |
| <i>log rating</i> | | | | | | 0.20 (1.56) |
| <i>%black</i> | -24.34 (-0.10) | 0.09 (0.13) | -94.29 (-0.45) | 16.69 (0.08) | -0.15 (-0.42) | -0.09 (-0.20) |
| <i>%Hispanic</i> | -353.53 (-0.29) | 6.64** (1.98) | -416.98 (-0.32) | -234.50 (-0.19) | 2.38 (1.06) | 2.29 (1.01) |
| <i>%male</i> | -418.38 (-1.37) | -1.13 (-1.32) | -367.05 (-1.34) | -328.47 (-1.26) | -0.82* (-1.75) | -0.80* (-1.67) |
| <i>income</i> | 0.99 (0.15) | -0.005 (-0.26) | 1.93 (0.31) | 3.74 (0.64) | 0.002 (0.19) | 0.002 (0.19) |
| <i>%age18-34</i> | 1619.14*** (3.21) | 0.25 (0.17) | 1810.66*** (4.11) | 1409.42*** (2.80) | 1.79** (2.27) | 1.67* (1.78) |

| | | | | | | |
|--------------------------------|----------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| <i>male-hhi</i> | 893.93 (1.11) | 2.29 (1.06) | 576.61 (0.81) | 144.09 (0.21) | 1.31 (1.09) | 1.23 (1.01) |
| <i>race-hhi</i> | 220.92 (0.59) | 2.24** (2.17) | 134.98 (0.36) | 158.57 (0.45) | 0.92 (1.43) | 0.92 (1.43) |
| <i>Documentaries</i> | -20.54 (-0.18) | -0.18 (-0.58) | -40.07 (-0.39) | -65.46 (-0.69) | -0.14 (-0.83) | -0.14 (-0.77) |
| <i>Kids and Family</i> | -266.95** (-2.04) | -1.27*** (-3.53) | -222.28* (-1.68) | -215.79* (-1.76) | -0.71*** (-3.14) | -0.70*** (-3.09) |
| <i>Lifestyle & Culture</i> | 87.78 (0.71) | -0.08 (-0.22) | 83.13 (0.75) | 50.78 (0.5) | 0.01 (0.04) | 0 (0.01) |
| <i>Movies</i> | -19.39 (-0.15) | -0.63* (-1.76) | 95.82 (0.7) | 112.26 (0.88) | 0.08 (0.36) | 0.12 (0.47) |
| <i>Music</i> | 198.84 (1.53) | 0.85** (2.29) | 84.19 (0.8) | 37.57 (0.39) | 0.28 (1.47) | 0.25 (1.3) |
| <i>News and information</i> | 88.04 (0.64) | 0.05 (0.13) | 37.15 (0.31) | -92.52 (-0.7) | 0.05 (0.25) | 0.01 (0.02) |
| <i>Religion</i> | -158.94 (-0.59) | -0.49 (-0.65) | -228.98 (-1) | -211.49 (-0.98) | -1.10*** (-2.78) | -1.12*** (-2.81) |
| <i>Sports</i> | 317.99* (1.82) | 0.93* (1.94) | 273.74* (1.75) | 251.44* (1.72) | 0.49* (1.83) | 0.46* (1.7) |
| Constant | -457.76 (-0.76) | 5.03*** (3.2) | -200.83 (-0.35) | -315.42 (-0.57) | 5.34*** (5.63) | 5.39*** (5.61) |
| Observations | 73 | 73 | 64 | 64 | 64 | 64 |
| R ² | 0.47 | 0.53 | 0.57 | 0.63 | 0.64 | 0.63 |
| Adj. R ² | 0.32 | 0.40 | 0.43 | 0.50 | 0.51 | 0.50 |
| Cragg-Donald Wald F | 17.178 [^] | 23.496* | 27.044** | 42.038** | 51.750** | 14.664** |

[^] p < .15; * p < .1; ** p < .05; *** p < .01

^a *progexp* and *log netage* are used as instruments.

^b *progexp*, *log netage* and *tier* are used as instruments.

Table 4: Black audience distribution models

| Variables | (1) <i>aa black</i> | (2) <i>aa black</i> | (3) <i>aa black</i> | (4) <i>aa black</i> | (5) <i>aa black</i> | (6) % <i>black</i> | (7) % <i>black</i> | (8) % <i>black</i> | (9) % <i>black</i> | (10) % <i>black</i> |
|--------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| <i>log netage</i> | 38.09*** (3.96) | 38.33*** (4.19) | 38.20*** (4.21) | 14.24 (1.52) | 13.37 (1.65) | -0.02 (-0.95) | -0.02 (-1.38) | -0.03* (-1.94) | -0.03 (-1.09) | -0.04* (-1.93) |
| <i>black/African-American</i> | | 127.92*** (2.92) | 111.72** (2.63) | | 140.39*** (4.14) | | 0.68*** (8.49) | 0.66*** (8.38) | | 0.66*** (8.33) |
| <i>Hispanic/Spanish</i> | | -64.77 (-1.48) | -62.54 (-1.48) | | -9.21 (-0.27) | | -0.15* (-1.81) | -0.20** (-2.51) | | -0.19** (-2.32) |
| <i>Documentaries</i> | | | -41.18* (-1.93) | | -10.86 (-0.62) | | | -0.10** (-2.63) | | -0.10** (-2.4) |
| <i>Kids and Family</i> | | | 37.14* (1.74) | | 45.35*** (2.68) | | | -0.01 (-0.27) | | -0.01 (-0.24) |
| <i>Lifestyle & Culture</i> | | | -32.36 (-1.31) | | -5.3 (-0.27) | | | -0.10** (-2.25) | | -0.1 (-2.1) |
| <i>Movies</i> | | | -12.84 (-0.45) | | 14.32 (0.62) | | | -0.02 (-0.34) | | -0.01 (-0.25) |
| <i>Music</i> | | | -36.83 (-1.59) | | -2.03 (-0.11) | | | 0.06 (1.31) | | 0.06 (1.38) |
| <i>News and information</i> | | | -50.26* (-1.88) | | -47.64*** (-2.25) | | | -0.04 (-0.83) | | -0.04 (-0.81) |
| <i>Religion</i> | | | -39.8 (-0.67) | | 62.33 (1.26) | | | 0.03 (0.25) | | 0.04 (0.38) |
| <i>Sports</i> | | | -32.2 (-1.38) | | -49.55*** (-2.66) | | | 0.01 (0.17) | | 0 (0.11) |
| <i>log progexp</i> | | | | 31.95*** (5.44) | 37.84*** (6.63) | | | | 0.01 (0.54) | 0.01 (0.47) |
| Constant | -45.04 (-1.69) | -47.19 (-1.86) | -30.63 (-1.04) | -127.64*** (-4.63) | -152.54*** (-5.13) | 0.25 (3.91) | 0.24 (5.18) | 0.29*** (5.33) | 0.23*** (2.95) | 0.27*** (3.88) |
| Observations | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| R ² | 0.16 | 0.26 | 0.42 | 0.39 | 0.64 | 0.01 | 0.49 | 0.6 | 0.01 | 0.6 |
| Adj. R ² | 0.15 | 0.23 | 0.33 | 0.37 | 0.58 | -0.001 | 0.47 | 0.53 | -0.01 | 0.53 |

* p<.1; ** p<.05; *** p<.01, t-statistics in parenthesis

Table 5: Hispanic audience distribution models

| Variables | (1) <i>aa</i> <i>Hispanic</i> | (2) <i>aa</i> <i>Hispanic</i> | (3) <i>aa</i> <i>Hispanic</i> | (4) <i>aa</i> <i>Hispanic</i> | (5) <i>aa</i> <i>Hispanic</i> | (6) % <i>Hispanic</i> | (7) % <i>Hispanic</i> | (8) % <i>Hispanic</i> | (9) % <i>Hispanic</i> | (10) % <i>Hispanic</i> |
|--------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|
| <i>log netage</i> | 20.39*** (3.31) | 20.31*** (3.26) | 23.37*** (3.99) | 10.19 (1.55) | 11.34* (1.92) | 0.01 (0.5) | 0.0003 (0.04) | 0.002 (0.42) | 0.03 (1.13) | -0.003 (-0.45) |
| <i>black/African-American</i> | | -20.08 (-0.67) | -17.67 (-0.64) | | -3.79 (-0.15) | | -0.04 (-1.34) | -0.03 (-1.33) | | -0.03 (-1.11) |
| <i>Hispanic/Spanish</i> | | 13.88 (0.47) | 21.15 (0.78) | | 46.98* (1.88) | | 0.86*** (29.01) | 0.85*** (32.67) | | 0.87*** (32.66) |
| Documentaries | | | -3.4 (-0.25) | | 11.28 (0.88) | | | -0.004 (-0.28) | | 0.003 (0.19) |
| <i>Kids and Family</i> | | | 53.95*** (3.91) | | 57.93*** (4.69) | | | 0.05*** (4.1) | | 0.06*** (4.28) |
| <i>Lifestyle & Culture</i> | | | -4.91 (-0.31) | | 8.19 (0.56) | | | -0.02 (-1.26) | | -0.01 (-0.88) |
| <i>Movies</i> | | | -2.13 (-0.11) | | 11.03 (0.66) | | | 0.0004 (0.02) | | 0.01 (0.34) |
| <i>Music</i> | | | -10.8 (-0.72) | | 6.05 (0.43) | | | 0.02 (1.29) | | 0.03* (1.75) |
| <i>News and information</i> | | | -21.98 (-1.27) | | -20.71 (-1.34) | | | -0.03* (-1.69) | | -0.03* (-1.68) |
| <i>Religion</i> | | | -10.47 (-0.27) | | 38.99 (1.09) | | | -0.05 (-1.23) | | -0.02 (-0.63) |
| <i>Sports</i> | | | -12.28 (-0.82) | | -20.68 (-1.53) | | | 0.0001 (0.01) | | -0.004 (-0.25) |
| <i>log progexp</i> | | | | 13.68*** (3.32) | 18.33*** (4.41) | | | | -0.02 (-1.47) | 0.01* (1.79) |
| Constant | -26.61 (-1.56) | -26.24 (-1.52) | -37.12* (-1.94) | -61.98*** (-3.2) | -96.16*** (-4.44) | 0.07 (1.23) | 0.08*** (4.57) | 0.07*** (3.71) | 0.13* (1.84) | 0.04* (1.86) |
| Observations | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| R ² | 0.12 | 0.13 | 0.38 | 0.22 | 0.51 | 0.003 | 0.91 | 0.94 | 0.03 | 0.95 |
| Adj. R ² | 0.11 | 0.09 | 0.28 | 0.20 | 0.43 | -0.01 | 0.91 | 0.93 | 0.01 | 0.94 |

* p<.1; ** p<.05; *** p<.01, t-statistics in parenthesis

Table 6: White audience distribution models

| Variables | (1) <i>aa</i> <i>white</i> | (2) <i>aa</i> <i>white</i> | (3) <i>aa</i> <i>white</i> | (4) <i>aa</i> <i>white</i> | (5) <i>aa</i> <i>white</i> | (6) % <i>white</i> | (7) % <i>white</i> | (8) % <i>white</i> | (9) % <i>white</i> | (10) % <i>white</i> |
|--------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| <i>log netage</i> | 143.41*** (4.55) | 147.35*** (4.75) | 147.31*** (4.65) | 48.16* (1.73) | 47.24* (1.88) | 0.02 (0.9) | 0.03 (1.55) | 0.04** (2) | 0.02 (0.77) | 0.04** (2.11) |
| <i>black/African-American</i> | | -220.51 (-1.49) | -250.35* (-1.69) | | -134.81 (-1.28) | | -0.63*** (-7.21) | -0.61 (-7.28) | | -0.61*** (-7.29) |
| <i>Hispanic/Spanish</i> | | -250.74* (-1.69) | -200.65 (-1.36) | | 14.28 (0.13) | | -0.33*** (-3.81) | -0.28*** (-3.37) | | -0.29*** (-3.44) |
| Documentaries | | | -36.61 (-0.49) | | 85.59 (1.57) | | | 0.1 (2.48) | | 0.1 (2.2) |
| <i>Kids and Family</i> | | | 123.68 (1.66) | | 156.76*** (2.97) | | | -0.03 (-0.69) | | -0.03 (-0.74) |
| <i>Lifestyle & Culture</i> | | | -48.98 (-0.57) | | 60.07 (0.97) | | | 0.11** (2.24) | | 0.10** (2.03) |
| <i>Movies</i> | | | -60.92 (-0.61) | | 48.52 (0.68) | | | 0.03 (0.51) | | 0.02 (0.37) |
| <i>Music</i> | | | -159.84* (-1.97) | | -19.6 (-0.33) | | | -0.07 (-1.48) | | -0.08 (-1.63) |
| <i>News and information</i> | | | -31.17 (-0.33) | | -20.64 (-0.31) | | | 0.06 (1.15) | | 0.06 (1.14) |
| <i>Religion</i> | | | -146.74 (-0.71) | | 264.86* (1.73) | | | 0.04 (0.3) | | 0.01 (0.05) |
| <i>Sports</i> | | | -124.79 (-1.54) | | -194.7*** (-3.37) | | | -0.02 (-0.41) | | -0.01 (-0.3) |
| <i>log progexp</i> | | | | 127.63*** (7.33) | 152.50*** (8.59) | | | | 0.001 (0.04) | -0.01 (-0.75) |
| Constant | -164.20* (-1.88) | -163.51* (-1.9) | -133.59 (-1.29) | -494.24*** (-6.05) | -624.88*** (-6.75) | 0.65*** (9.69) | 0.65*** (12.99) | 0.61*** (10.6) | 0.65*** (8.02) | 0.65*** (8.77) |
| Observations | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| R ² | 0.2 | 0.25 | 0.37 | 0.52 | 0.69 | 0.01 | 0.45 | 0.58 | 0.01 | 0.58 |
| Adj. R ² | 0.19 | 0.22 | 0.27 | 0.51 | 0.64 | -0.002 | 0.43 | 0.51 | -0.01 | 0.51 |

* p<.1; ** p<.05; *** p<.01, t-statistics in parenthesis

Table 7: Racial/ethnic audience composition models: % variance explained

| | Black/Hispanic content dummies | Black/Hispanic content + genre dummies | Production cost (<i>log progexp</i>) | Combined variables |
|-------------------|---|---|---|-------------------------------|
| <i>%black</i> | 47.4 | 53.3 | 0.1 | 52.8 |
| <i>aablack</i> | 23.4 | 32.7 | 37.0 | 57.9 |
| <i>%Hispanic</i> | 91.1 | 93.4 | 0.5 | 93.6 |
| <i>aaHispanic</i> | 9.2 | 28.1 | 20.4 | 42.7 |
| <i>% white</i> | 43.3 | 51.5 | -1.4 | 51.1 |
| <i>aawhite</i> | 22 | 27.3 | 50.8 | 63.8 |

Figure 1: ARH \times reach

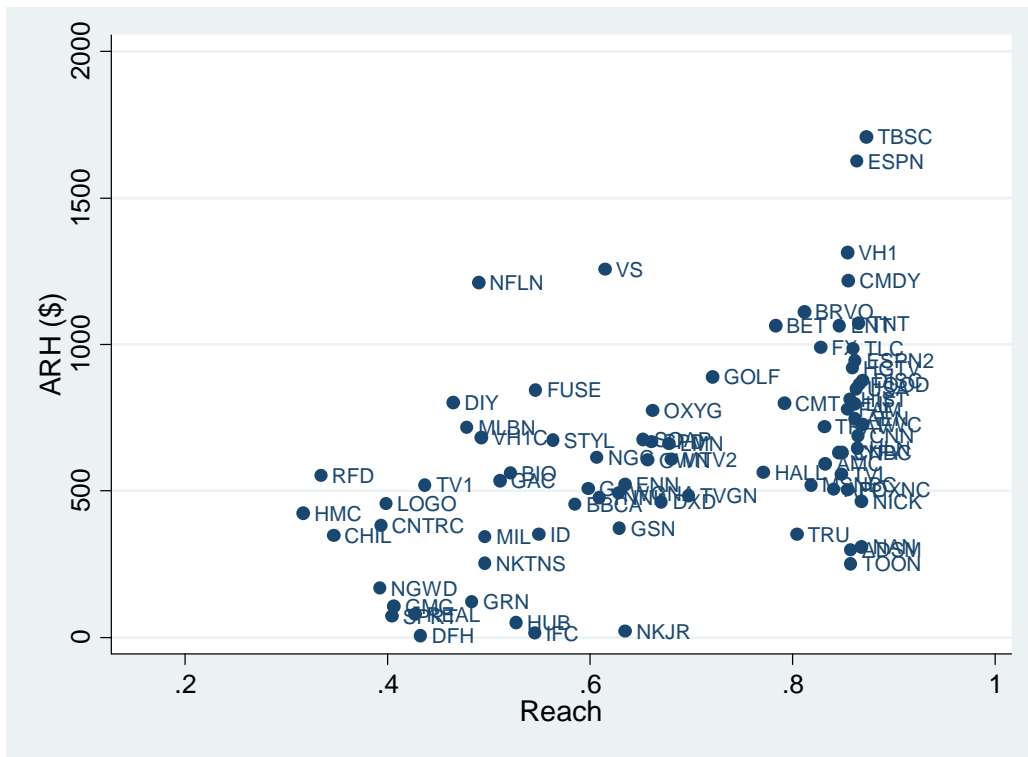


Figure 2: ARH \times rating

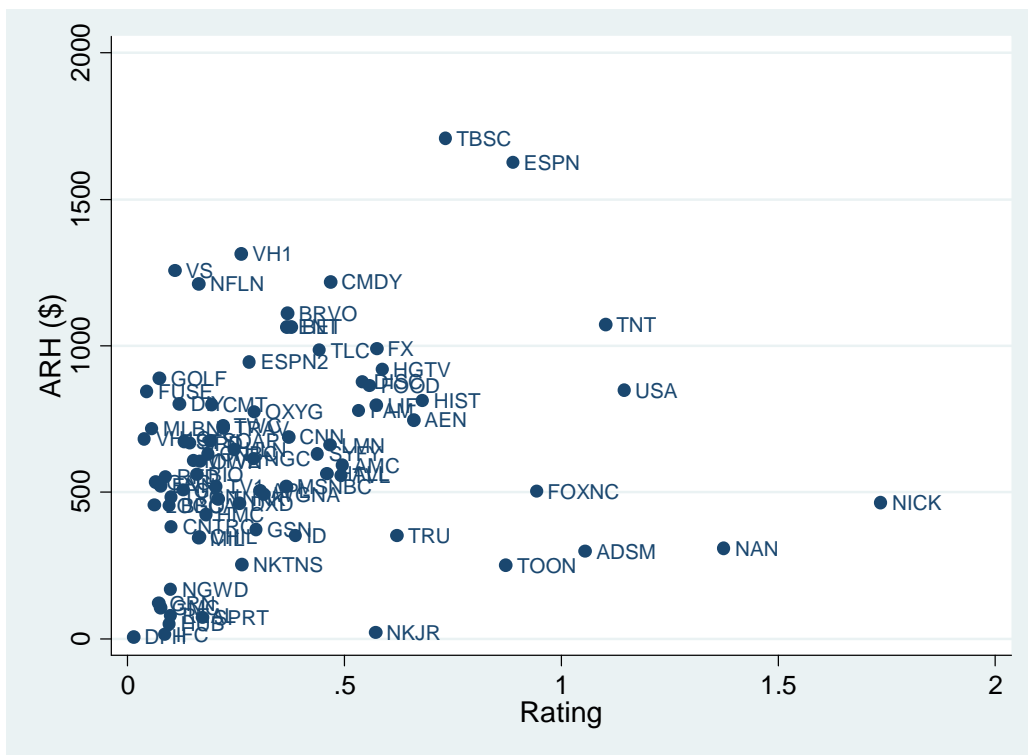


Figure 3: % Black audience composition ordered from low to high %black

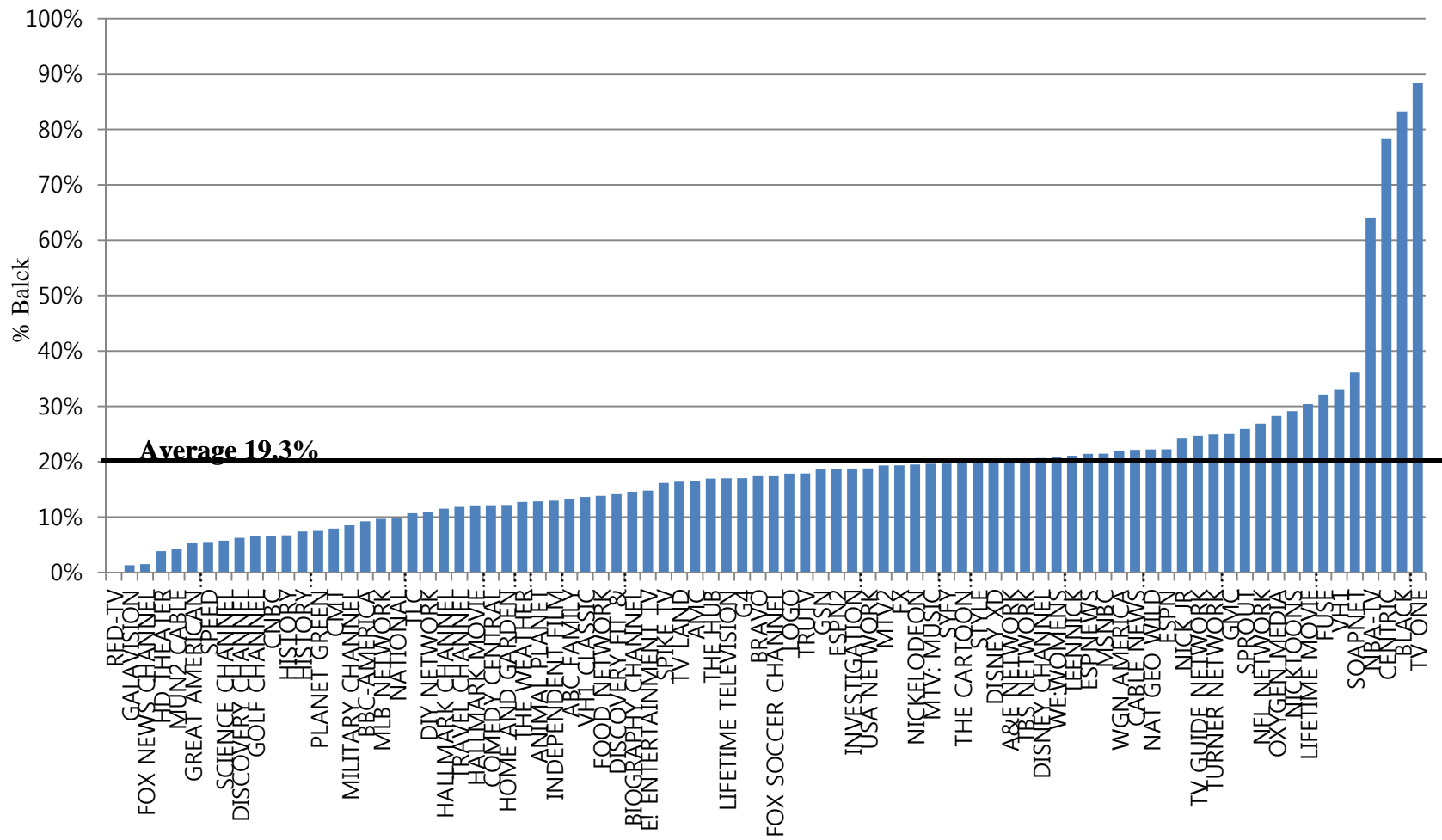


Figure 4: % Black audience composition ordered by average black audience delivered (*aablack*)

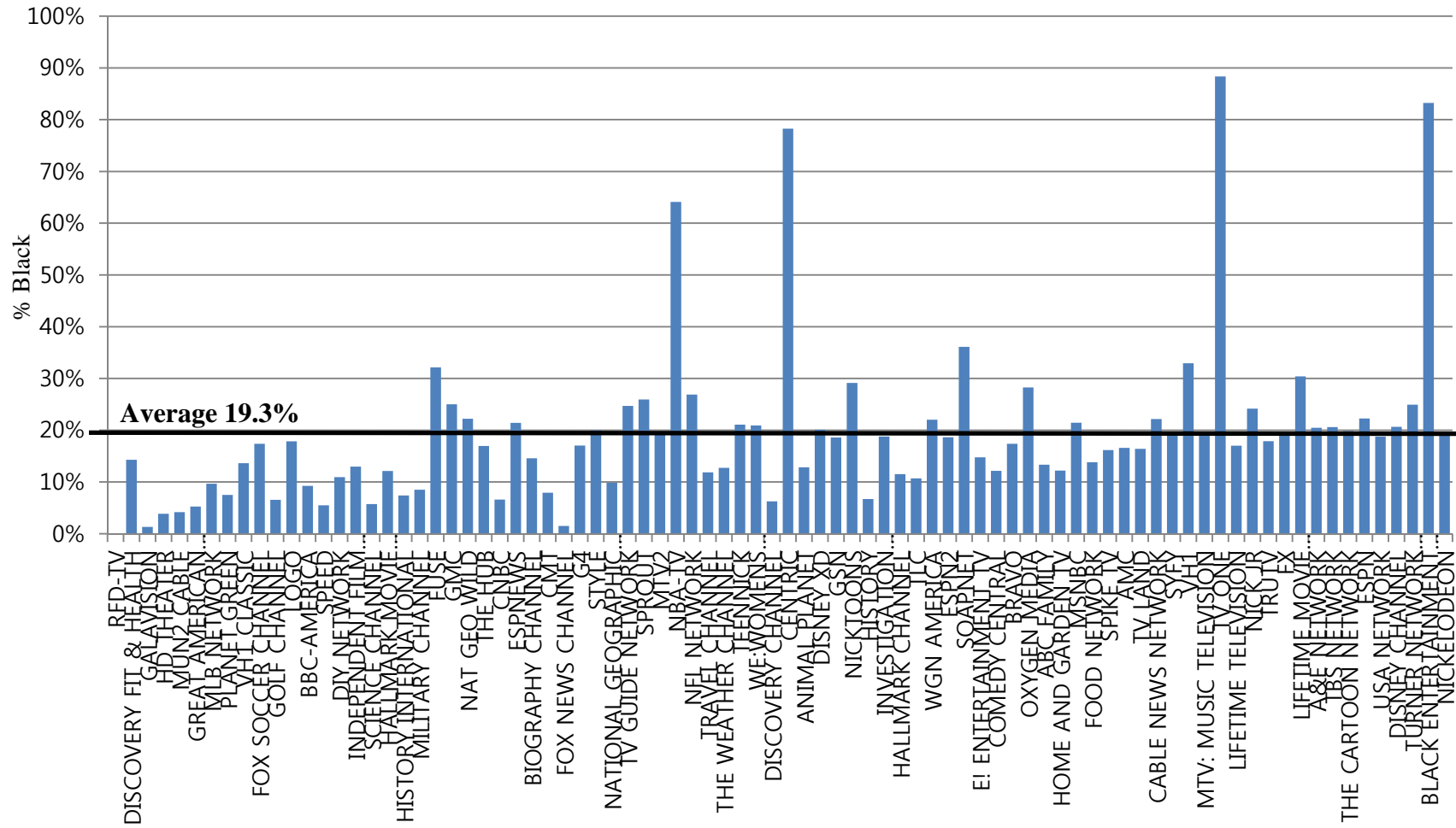


Figure 5: % Hispanic audience composition ordered from low to high %Hispanic

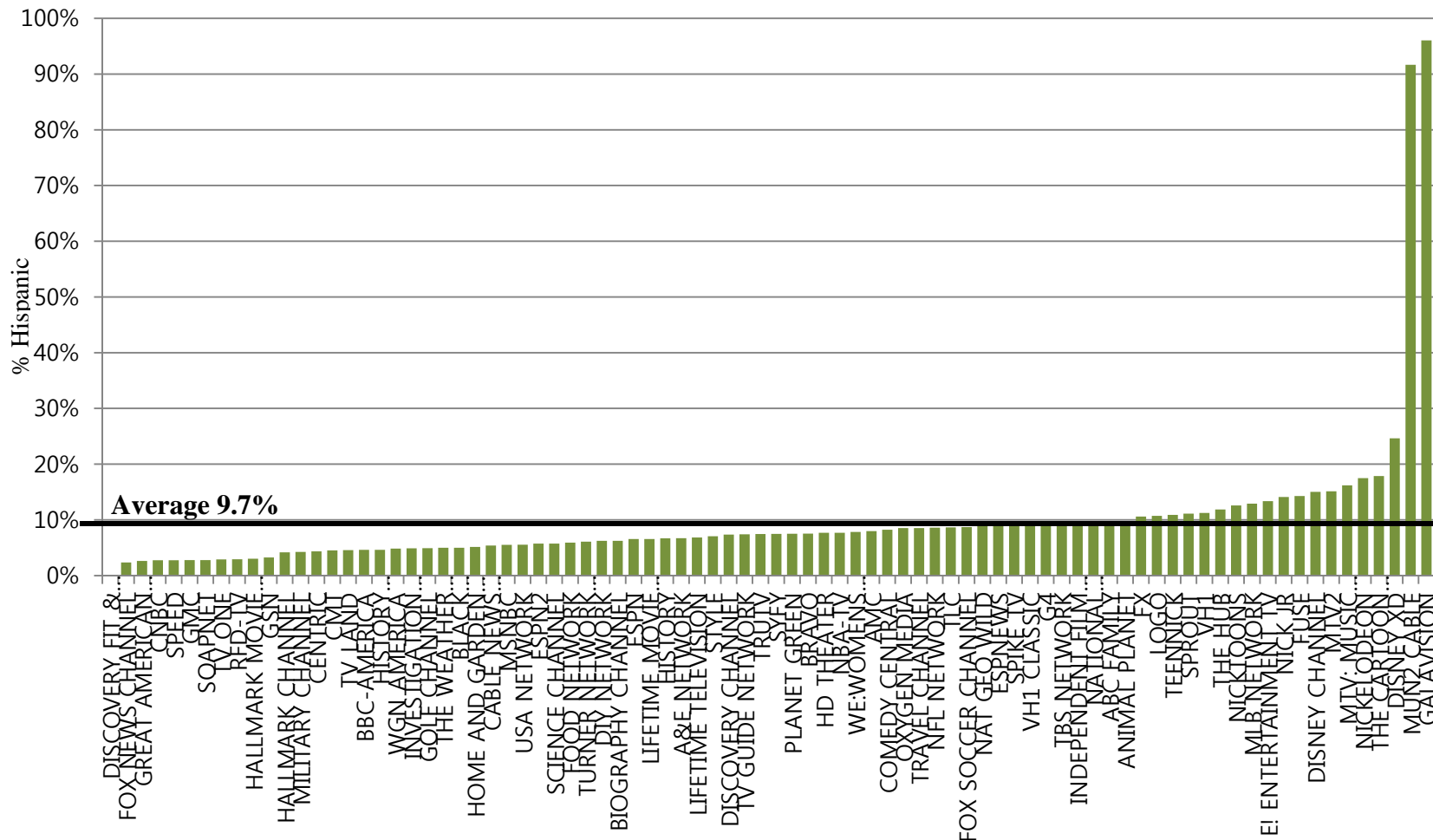
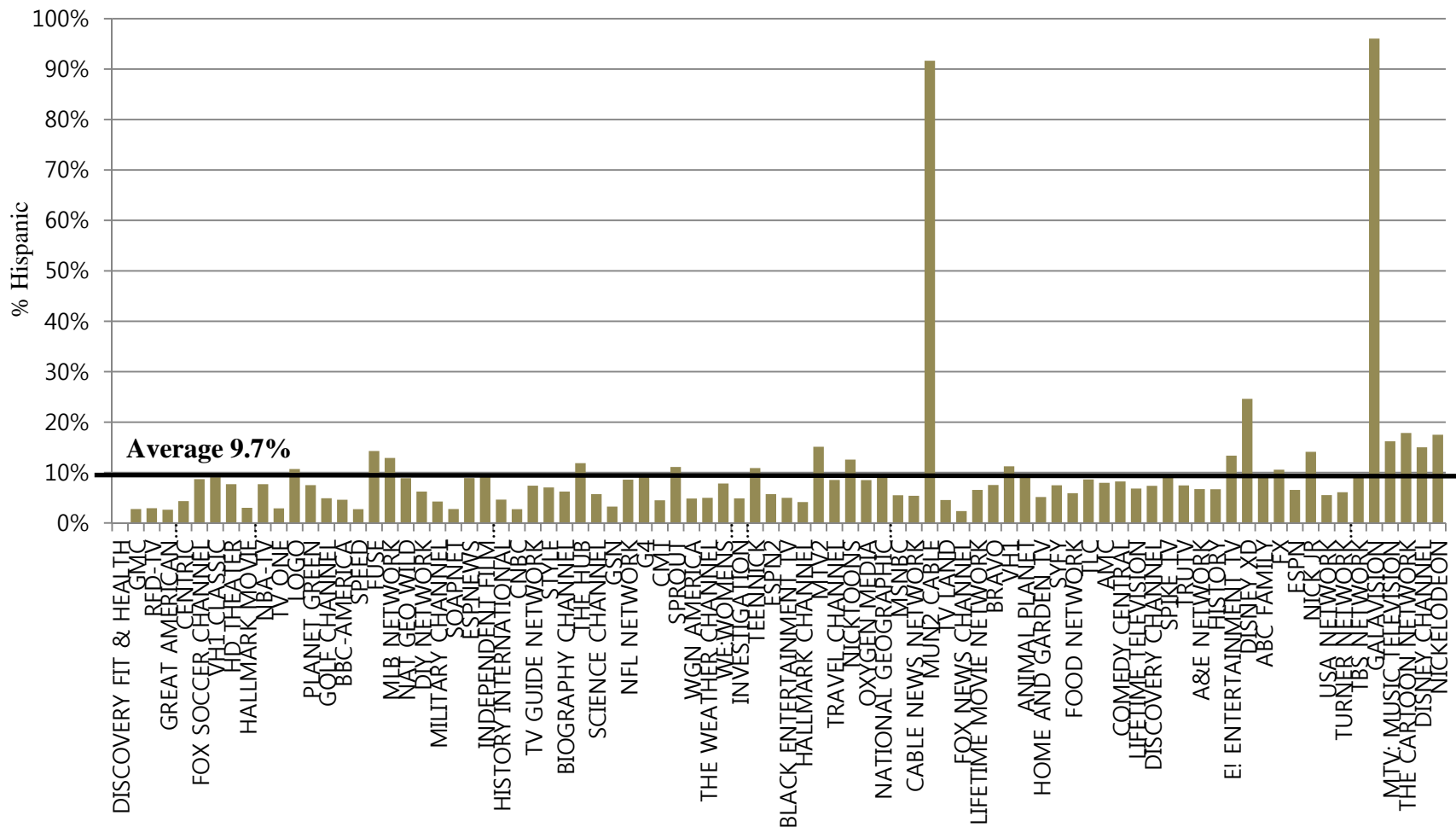


Figure 6: % Hispanic audience composition ordered by average Hispanic audience delivered (*aaHispanic*)



Appendix Table 1: ARH Models (IV) that did not pass weak instrument test

| Variables | ARH (2 inst. ^a) | ARH (2 inst.) | ARH (2 inst.) | ARH (2 inst.) | log ARH (2 inst.) | ARH (3 inst. ^b) | ARH (3 inst.) | ARH (3 inst.) |
|----------------------------|--------------------------------|----------------------|--------------------|----------------------|----------------------|--------------------------------|----------------------|-----------------------|
| <i>inter</i> | 9131.58 (0.49) | | 622.60 (1.47) | | | -858.23 (-0.74) | 1179.18*** (2.75) | |
| <i>inter</i> ² | -8283.49 (-0.43) | | | | | 1597.77 (1.33) | | |
| <i>reach</i> | | 1924.88*** (2.72) | 813.70 (0.99) | -2.1e+04* (-1.75) | | | -992.99 (-1.32) | -8490.05** (-1.97) |
| <i>reach</i> ² | | | | 18540.39* (1.80) | | | | 6617.73** (2.05) |
| <i>rating</i> | | -223.96 (-0.87) | | -1782.43 (-1.06) | | | | 645.70 (1.63) |
| <i>rating</i> ² | | | | 557.95 (0.81) | | | | -365.22* (-1.68) |
| <i>log inter</i> | | | | | | | | |
| <i>log reach</i> | | | | | 4.25* (1.73) | | | |
| <i>log rating</i> | | | | | -0.39 (-0.70) | | | |
| <i>%black</i> | 1152.31 (0.40) | 452.62 (1.33) | 217.25 (0.65) | 469.62 (0.83) | 2.06 (1.23) | -321.18 (-0.84) | -345.38 (-1.07) | -190.72 (-0.79) |
| <i>%Hispanic</i> | 7719.67 (0.40) | 539.46 (0.46) | -80.02 (-0.07) | 1272.12 (0.65) | 9.18** (2.00) | -2147.96 (-0.86) | -557.54 (-0.34) | 174.81 (0.14) |
| <i>%male</i> | 75.94 (0.05) | -324.65 (-1.09) | -332.89 (-1.12) | -222.77 (-0.45) | -1.42 (-1.30) | -331.34 (-0.74) | -493.86 (-1.40) | -475.24* (-1.74) |
| <i>Income</i> | 30.16 (0.42) | 9.14 (1.21) | 5.04 (0.67) | 10.46 (0.85) | 0.01 (0.51) | -4.36 (-0.40) | -1.44 (-0.18) | 3.40 (0.57) |
| <i>%age18-34</i> | -3860.55 | 56.55 | 892.50 | -963.16 | -3.90 | 2910.75*** | 2598.75*** | 1477.90*** |

| | | | | | | | | |
|--------------------------------|----------|-----------|-----------|----------|----------|---------|---------|----------|
| | (-0.30) | (0.07) | (1.03) | (-0.58) | (-1.07) | (2.66) | (3.22) | (2.87) |
| <i>male-hhi</i> | -2101.41 | -282.16 | 500.01 | 1791.19 | 0.46 | 1366.15 | 1066.35 | 679.51 |
| | (-0.28) | (-0.35) | (0.59) | (1.16) | (0.15) | (1.05) | (1.11) | (0.92) |
| <i>race-hhi</i> | 609.27 | 284.42 | 229.99 | -604.18 | 3.23** | 31.88 | 128.36 | -286.45 |
| | (0.37) | (0.80) | (0.65) | (-0.79) | (2.24) | (0.05) | (0.27) | (-0.66) |
| <i>Documentaries</i> | -341.74 | -63.08 | -29.28 | -161.89 | 0.03 | 28.24 | -15.25 | -72.17 |
| | (-0.4) | (-0.59) | (-0.27) | (-0.9) | (0.06) | (0.16) | (-0.12) | (-0.74) |
| <i>Kids and Family</i> | -627.49 | -322.77** | -300.04** | -398.00* | -1.33*** | -200.01 | -211.39 | -206.51 |
| | (-0.65) | (-2.53) | (-2.36) | (-1.87) | (-2.81) | (-0.93) | (-1.29) | (-1.63) |
| <i>Lifestyle & Culture</i> | 149.31 | 7.87 | 80.15 | -338.04 | -0.42 | 115.78 | 103.93 | -44.62 |
| | (0.31) | (0.07) | (0.7) | (-1.23) | (-0.93) | (0.64) | (0.76) | (-0.39) |
| <i>Movies</i> | -416.18 | -28.08 | -14.76 | -232.71 | -0.32 | 194.13 | 52.7 | -118.3 |
| | (-0.4) | (-0.22) | (-0.12) | (-1.03) | (-0.62) | (0.83) | (0.31) | (-0.73) |
| <i>Music</i> | 851.43 | 109.51 | 208.58* | 37.97 | 0.38 | -27.64 | 91.52 | 63.39 |
| | (0.53) | (0.93) | (1.71) | (0.19) | (0.81) | (-0.14) | (0.7) | (0.61) |
| <i>News and information</i> | -576.28 | -361.8 | -100.8 | -682.47 | -1.08 | 136.32 | 246.28 | 5.04 |
| | (-0.36) | (-1.66) | (-0.44) | (-1.41) | (-1.15) | (0.65) | (1.13) | (0.04) |
| <i>Religion</i> | 506.42 | -89.26 | -90.52 | -849.41 | -0.44 | -333.26 | -297 | -517.15* |
| | (0.28) | (-0.34) | (-0.34) | (-1.51) | (-0.45) | (-0.88) | (-1.03) | (-1.89) |
| <i>Sports</i> | 838.45 | 287.58* | 307.35* | 67.24 | 0.72 | 131.82 | 314.23 | 323.36** |
| | (0.62) | (1.74) | (1.87) | (0.22) | (1.14) | (0.48) | (1.61) | (2.09) |
| Constant | -1168.87 | -969.57 | -808.43 | 5470.18 | 5.28** | -207.9 | 140.82 | 2624.42* |
| | (-0.42) | (-1.49) | (-1.22) | (1.61) | (2.55) | (-0.22) | (0.19) | (1.73) |
| Observations | 73 | 73 | 73 | 73 | 73 | 64 | 64 | 64 |
| R ² | -6.11 | 0.53 | 0.54 | -0.23 | 0.20 | -0.12 | 0.35 | 0.61 |
| Adj. R ² | -8.31 | 0.38 | 0.39 | -0.68 | -0.05 | -0.53 | 0.11 | 0.44 |
| Cragg-Donald Wald F | 0.04 | 5.384 | 3.857 | 0.835 | 2.825 | 0.974 | 3.218 | 1.950 |

[^] p < .15; * p<.1; ** p<.05; *** p<.01

^a *progexp* and *log netage* are used as instruments.

^b *progexp*, *log netage* and *tier* are used as instruments.

Appendix Table 2: Correlation Matrix

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|--------------------------------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| (1) <i>ARH</i> | 1 | | | | | | | | |
| (2) <i>inter</i> | 0.23** | 1 | | | | | | | |
| (3) <i>inter</i> ² | 0.08 | 0.93** | 1 | | | | | | |
| (4) <i>reach</i> | 0.51** | 0.66** | 0.45** | 1 | | | | | |
| (5) <i>reach</i> ² | 0.51** | 0.71** | 0.49** | 0.99** | 1 | | | | |
| (6) <i>rating</i> | 0.2 | 0.97** | 0.9** | 0.52** | 0.58** | 1 | | | |
| (7) <i>rating</i> ² | 0.07 | 0.92** | 0.99** | 0.39** | 0.44** | 0.93** | 1 | | |
| (8) <i>log inter</i> | 0.38** | 0.85** | 0.64** | 0.79** | 0.83** | 0.84** | 0.65** | 1 | |
| (9) <i>log reach</i> | 0.50** | 0.58** | 0.39** | 0.98** | 0.93** | 0.41** | 0.32** | 0.70** | 1 |
| (10) <i>log rating</i> | 0.31** | 0.82** | 0.64** | 0.58** | 0.64** | 0.88** | 0.68** | 0.95** | 0.45** |
| (11) <i>male</i> | 0.04 | -0.17 | -0.1 | -0.21** | -0.21** | -0.16 | -0.1 | -0.27** | -0.21** |
| (12) <i>income</i> | 0.16 | -0.08 | -0.05 | -0.1 | -0.09 | -0.05 | -0.03 | -0.11 | -0.12 |
| (13) <i>age18-34</i> | 0.49** | -0.02 | -0.06 | 0.036 | 0.06 | -0.01 | -0.05 | -0.0001 | -0.012 |
| (14) <i>male-hhi</i> | 0.26** | -0.14 | -0.15 | 0.04 | 0.004 | -0.18 | -0.17 | -0.09 | 0.08 |
| (15) <i>race-hhi</i> | 0.04 | -0.18 | -0.18 | -0.05 | -0.07 | -0.23** | -0.21** | -0.17 | -0.02 |
| (16) <i>tier</i> | 0.53** | 0.69** | 0.46** | 0.92** | 0.95** | 0.65** | 0.45** | 0.82** | 0.88** |
| (17) <i>log netage</i> | 0.49** | 0.44** | 0.32** | 0.47** | 0.52** | 0.45** | 0.34** | 0.55** | 0.39** |
| (18) <i>progexp</i> | 0.47** | 0.40** | 0.32** | 0.30** | 0.32** | 0.39** | 0.31** | 0.35** | 0.28** |
| (19) <i>aablack</i> | 0.21 | 0.88** | 0.85** | 0.52** | 0.56** | 0.86** | 0.84** | 0.73** | 0.46** |
| (20) <i>%black</i> | 0.09 | -0.01 | 0.01 | -0.10 | -0.10 | 0.02 | 0.02 | 0.01 | -0.09 |
| (21) <i>aaHispanic</i> | 0.06 | 0.86** | 0.91** | 0.45** | 0.49** | 0.84** | 0.90** | 0.64** | 0.39** |
| (22) <i>%Hispanic</i> | -0.03 | -0.03 | 0.02 | -0.15 | -0.14 | -0.02 | 0.02 | -0.10 | -0.15 |
| (22) <i>aawhite</i> | 0.24** | 0.98** | 0.89** | 0.68** | 0.73** | 0.95** | 0.88** | 0.84** | 0.60** |
| (24) <i>%white</i> | 0.01 | 0.03 | -0.02 | 0.17 | 0.17 | 0.00 | -0.03 | 0.07 | 0.16 |

** p < .05

Appendix Table 2 continued

| Variables | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
|--------------------------------|---------|---------|---------|---------|-------|---------|--------|--------|--------|
| (1) <i>ARH</i> | | | | | | | | | |
| (2) <i>inter</i> | | | | | | | | | |
| (3) <i>inter</i> ² | | | | | | | | | |
| (4) <i>reach</i> | | | | | | | | | |
| (5) <i>reach</i> ² | | | | | | | | | |
| (6) <i>rating</i> | | | | | | | | | |
| (7) <i>rating</i> ² | | | | | | | | | |
| (8) <i>log inter</i> | | | | | | | | | |
| (9) <i>log reach</i> | | | | | | | | | |
| (10) <i>log rating</i> | 1 | | | | | | | | |
| (11) <i>male</i> | -0.25** | 1 | | | | | | | |
| (12) <i>income</i> | -0.09 | 0.43** | 1 | | | | | | |
| (13) <i>age18-34</i> | 0.01 | 0.24** | 0.11 | 1 | | | | | |
| (14) <i>male-hhi</i> | -0.14 | 0.08 | 0.34** | 0.08 | 1 | | | | |
| (15) <i>race-hhi</i> | -0.2** | 0.13 | -0.23** | -0.16 | -0.01 | 1 | | | |
| (16) <i>tier</i> | 0.73** | -0.06 | 0.1 | 0.23 | -0.03 | -0.06 | 1 | | |
| (17) <i>log netage</i> | 0.54** | -0.04 | -0.03 | 0.25** | -0.03 | 0.03** | 0.67** | 1 | |
| (18) <i>progexp</i> | 0.34** | 0.16 | 0.13 | 0.18 | 0.14 | -0.11 | 0.31** | 0.24** | 1 |
| (19) <i>aablack</i> | 0.71** | -0.21** | -0.20** | 0.07 | -0.14 | -0.30** | 0.53** | 0.39** | 0.40** |
| (20) <i>%black</i> | 0.05 | -0.21** | -0.28** | 0.19 | 0.013 | -0.34** | -0.12 | -0.06 | 0.012 |
| (21) <i>aaHispanic</i> | 0.64** | -0.10 | -0.10 | 0.05 | -0.17 | -0.22** | 0.44** | 0.35** | 0.21 |
| (22) <i>%Hispanic</i> | -0.07 | 0.10 | -0.32** | 0.35** | -0.14 | 0.32** | -0.14 | 0.08 | -0.05 |
| (23) <i>aawhite</i> | 0.82** | -0.15 | -0.04 | -0.05 | -0.13 | -0.12 | 0.71** | 0.43** | 0.40** |
| (24) <i>%white</i> | 0.02 | 0.12 | 0.35** | -0.37** | 0.05 | 0.23** | 0.18 | 0.05 | 0.02 |

** p < .05

Appendix Table 2 continued

| Variables | (20) | (21) | (22) | (23) | (24) | (25) |
|--------------------------------|---------|---------|--------|---------|------|------|
| (1) <i>ARH</i> | | | | | | |
| (2) <i>inter</i> | | | | | | |
| (3) <i>inter</i> ² | | | | | | |
| (4) <i>reach</i> | | | | | | |
| (5) <i>reach</i> ² | | | | | | |
| (6) <i>rating</i> | | | | | | |
| (7) <i>rating</i> ² | | | | | | |
| (8) <i>log inter</i> | | | | | | |
| (9) <i>log reach</i> | | | | | | |
| (10) <i>log rating</i> | | | | | | |
| (11) <i>male</i> | | | | | | |
| (12) <i>income</i> | | | | | | |
| (13) <i>age18-34</i> | | | | | | |
| (14) <i>male-hhi</i> | | | | | | |
| (15) <i>race-hhi</i> | | | | | | |
| (16) <i>tier</i> | | | | | | |
| (17) <i>log netage</i> | | | | | | |
| (18) <i>progexp</i> | | | | | | |
| (19) <i>aablack</i> | 1 | | | | | |
| (20) <i>%black</i> | 0.32** | 1 | | | | |
| (21) <i>aaHispanic</i> | 0.79** | -0.01 | 1 | | | |
| (22) <i>%Hispanic</i> | -0.03 | -0.15 | 0.22** | 1 | | |
| (23) <i>aawhite</i> | 0.78** | -0.11 | 0.79** | -0.06 | 1 | |
| (24) <i>%white</i> | -0.28** | -0.87** | -0.11 | -0.35** | 0.14 | 1 |

** p < .05