The Welfare Effects of Bundling in Multi-Channel Television Markets*

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***** Preliminary Results *****
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Abstract

This paper evaluates the welfare effects of bundling in multichannel television markets. We use market and viewership data to estimate an industry model that has flexible distributions of consumers' tastes for television channels. We use the estimated model to conduct short-run counterfactual simulations of *à la carte* policies, i.e. policies that require cable and satellite television distributors to offer individual channels for sale to consumers. Mean consumer surplus increases by an estimated 36.5% and cable industry profits decrease by an estimated 30.6% as households still receive the networks they value highly, but pay a lower monthly bill. À la carte regulations are estimated to increase total welfare as households not served networks they value under bundling are partially served under à la carte. We find these results are robust to alternative assumptions about how the input (programming) market responds to an à la carte environment.

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1 Introduction

The proposal of an à la carte pricing regulation in the U.S. multi-channel television industry has polarized policy makers, consumers, and industry participants.[1,2] The arguments for or against usually rest upon a prediction of how prices, quantities, qualities, or costs will change if firms are subject to à la carte pricing regulations. Despite the widespread debate, there is no consensus on what the regulation's effects would be. Empirical evidence would be useful because the multi-channel television industry reaches 95 million households in the United States, and the average American household spends around seven hours per day watching television (CAB (2007)). This impressive fraction of leisure time is increasingly allocated to watching programming from a channel available predominantly through multi-channel television. À la carte pricing proposes to radically alter the choice sets facing the 112 million U.S. television households. It is therefore important to predict the regulation's impact on the distributions of consumer and producer welfare.

In this paper, we estimate a model of demand and pricing of multi-channel television services. We use the model to analyze the discriminatory incentives behind bundling behavior and to simulate counterfactual outcomes of à la carte pricing policies. We estimate a flexible distribution of household preferences for individual programming channels by exploiting the two-sided nature of multi-channel television markets: cable and satellite systems sell access to bundles of program channels to households, and the channels provided on them sell audiences to advertisers. We employ aggregate data on outcomes from both markets – market shares and prices for a sample of over 5,000 cable and satellite systems over 11 years and aggregate weekly cable ratings data for a sample of around 65 cable channels across 50 DMAs for up to 6 years – to predict the impacts of à la carte policies.

We assume households allocate their viewing of channels optimally given their preferences for channels and the channels they have access to. For each household, this yields two outcomes: the time they devote to watching each channel and the total utility enjoyed from access to a bundle of channels. We aggregate across the distribution of households within markets and relate each of these measures to their observed counterparts.

For computational reasons we divide estimation into two stages. In the first stage, we use ratings data to recover estimates of the distribution of preferences for channels (in utils). We recover the impact of demographic factors on preferences for channels by exploiting the covariation across mar-

[1] By multi-channel television, we mean television services provided by cable and satellite television systems. These are also called multi-channel video program distributors (MVPDs).

[2] In addition to numerous articles in the popular press (e.g. Reuters (2003), Squeo and Flint (2004), Shatz (2006)), the Federal Communications Commission (FCC) has published two reports analyzing à la carte pricing (FCC (2004), FCC (2006)). The National Cable and Telecommunications Association (NCTA) has a useful webpage summarizing industry perspectives at http://www.ncta.com/IssueBrief.aspx?contentId=15.

kets in ratings and demographics. We then recover the distribution of preferences for channels that is not attributable to demographics. As in recent models of demand estimation using aggregate market data (Berry, Levinsohn, and Pakes (2004b)), we do so by exploiting the variance and covariance of aggregate ratings across markets and time. If, for example, ratings for ESPN2 and ESPN positively co-vary conditional on demographics, preferences for the two channels are estimated to be positively correlated. These two steps identify the covariance structure of preferences for channels. We choose the location of the distributions according to cumulative ratings data which measures what percentage of households ever watch a channel. If 10% of the population never watches a channel, then we estimate that 10% of the population values the channel near zero.

In the second stage of the estimation, we take these parameters as given and estimate the mean utility and pricing of cable and satellite services consisting of bundles of these channels. This yields estimates of the distribution of preferences for income and the inside good (including broadcast networks), as well as estimates of the marginal costs of providing each channel as part of the bundle. With the estimated distribution of preferences from the first stage, the former permit us to measure the distribution of households' Willingness-To-Pay (WTP) for individual cable networks that form the foundation of our counterfactual à la carte policy simulations.

The estimated distribution of preferences replicates many features of the ratings data. For example, WTP for Black Entertainment Television (BET) is estimated to be higher on average for black households. Similarly, WTP for Nickelodeon and Disney Channel are estimated to be higher on average for family households than for non-family households. We find moderate correlations in WTP (both positive and negative) for most pairs of channels, an important factor in the profitability of bundles. Estimated own-price elasticities for basic cable, expanded basic cable, and satellite services are on average -2.48, -7.61, and -4.92, respectively.

We use these estimates to simulate the welfare effects of an à la carte pricing regulation. In the baseline counterfactual simulation, three downstream operators must move from each selling a single bundle of all channels to each operator setting a fixed fee and pricing each component channel individually. Consistent with economic theory, bundling in multi-channel television markets appears to facilitate surplus extraction by firms: mean consumer surplus increases by an estimated 36.5% under à la carte and cable industry profits decrease by an estimated 30.6% (with all of the losses coming from networks). À la carte regulations are estimated to increase total welfare as households not served channels they value under bundling are partially served under à la carte. We mechanically modify various combinations of assumptions underlying the baseline counterfactual for the sake of robustness. We find that higher input costs to cable and satellite operators reduce but do not eliminate consumer welfare gains (but do reduce total surplus). The impact of channel exit remains to be analyzed.

Section 2 describes the multi-channel television industry and the institutional and regulatory factors that influence household and firm behavior in the industry. Section 3 describes the data: the quantities measured, how they were collected, and various shortcomings. Section 4 specifies the model's assumptions and their relation to the empirical evidence. Section 6 presents the results of our estimation and addresses implications of those results. Section 7 measures the consequences of alternative à la carte policy proposals. Section 8 concludes.

2 The Multi-Channel Television Industry

The multi-channel television market is a *two-sided market* (Rochet and Tirole (2006)). Cable and satellite systems provide a platform connecting households and program producers andadvertisers. We denote the market in which households purchase access to television programming the Programming Market. When consumers watch programs, their consumption creates another product, audiences. We denote the market in which channels sell audiences to advertisers the Advertising Market.

Figure 2 provides a graphical representation of the supply chain by which programming is produced and sold to households and audiences are created and sold to advertisers. Downward arrows represent the flow of programming from Content Providers to Households.[3] Upward arrows represent the creation and sale of audiences to advertisers. The various sub-markets that characterize the purchase and sale of content or audiences are indicated at each step in the chain. In this paper, we focus on the for-pay distribution and advertising markets.

Insert Figure 2 Here

2.1 The MVPD Market

Multi-Channel Television Services: Bundles of Program Channels Cable television systems choose a portfolio of television channels, bundle them into services, and offer these services to consumers in local, geographically separate, markets. Satellite television systems similarly choose and bundle channels into services, but offer them to consumers on a national basis.

All cable and satellite systems offer four main types of channels. *Broadcast networks* are advertising-supported television signals broadcast over the air in the local cable market by television stations

[3]The distribution rights to content (e.g. a television program like "Crocodile Hunter") is purchased by a Television Channel (e.g. CBS or The Discovery Channel) and placed in its programming lineup (see, e.g., Owen and Wildman (1992)). These channels are then distributed to consumers in one of two ways. Broadcast Networks, like ABC, CBS, and NBC, distribute their programming over the air via local broadcast television stations at no cost to households. Cable channels like The Discovery Channel, MTV, and ESPN distribute their programming via cable or satellite television systems that charge fees to consumers. The dashed arrow between content providers and consumers represents the small but growing trend to distribute some content directly to consumer via the Internet.

and then collected and retransmitted by cable systems. Examples include the major, national broadcast networks – ABC, CBS, NBC, and FOX – as well as public and independent television stations. *Cable programming channels* are advertising- and fee-supported general and special-interest channels distributed nationally to systems via satellite. Examples include some of the most recognizable channels, including MTV, CNN, and ESPN. *Premium programming channels* are advertising-free entertainment channels. Examples include HBO and Showtime. *Pay-Per-View* are specialty channels devoted to on-demand viewing of high-value programming, typically offering the most recent theatrical releases and specialty sporting events.

Cable and satellite systems exhibit moderate differences in how they bundle channels into services. Broadcast networks and cable channels are typically bundled and offered as *Basic Service* while premium programming channels are typically unbundled and sold as *Premium Services*.[4] In the last decade, systems have begun to further divide Basic service, offering some portion of their cable channels on multiple services, called *Expanded Basic* and *Digital Services*. For either Basic or Expanded Basic Services, consumers are not able to buy access to the individual channels offered in bundles; they must instead purchase the entire bundle.

Regulation in Multi-Channel Television Markets Multi-channel television markets are subject to a number of regulations impacting channel carriage and bundling decisions, prices, and other features of these markets.

The specific content of any cable service may not be regulated on First Amendment grounds. That being said, the 1992 Cable Act introduced two regulations that impact the channels that are offered on a cable system and how they are bundled into services for sale to households. First, the Act required the creation of a Basic tier of service containing all offered broadcast and public-interest programming carried by the system. This Basic Service may also include some or many cable programming channels, at the discretion of the system. Many systems responded by introducing bare-bones "Limited Basic" services containing only those channels they were required to offer. Second, the Act introduced Must-Carry/Retransmission Consent. These regulations give local broadcast stations the option either to demand carriage on local cable systems (Must-Carry) or negotiate with those systems for compensation for carriage (Retransmission Consent).[5]

The 1992 Cable Act also re-introduced price regulation into cable television markets. Regulation differed by tiers of cable service and only applied if a system was not subject to "effective compe-

[4] In the last 5 years, premium channels have begun "multiplexing" their programming, i.e. offering multiple channels under a single brand (e.g. HBO, HBO 2, HBO Family, etc.).

[5] Smaller (esp. UHF) stations commonly select Must-Carry, but larger stations and station groups, particularly those affiliated with the major broadcast networks, have used Retransmission Consent to obtain compensation from cable systems, often in the form of carriage agreements for broadcaster-affiliated cable channels.

tition."[6] Basic tiers were regulated by the local authority, which was required to certify with the FCC. Higher tiers were regulated by the FCC. Regulation of higher tiers, however, was phased out by the 1996 Telecommunications Act as of March 31, 1999. Regulation of Basic Service rates in areas of little competition remains the only source of price regulation in the cable industry.

In the programming input market, cable and satellite systems negotiate carriage agreements for channels on a bilateral basis between a cable channel, or a group of cable channels, and an individual system or system groups, also known as Multiple System Operators (MSOs). These agreements specify transfers between the two parties and terms of carriage such as which tier the channel will be on. The 1992 Cable Act introduced rules that forbid vertically integrated cable and satellite systems and channels from discriminating against unaffiliated rivals in either the programming or distribution markets. Carriage agreements commonly have "Most Favored Nations" clauses that standardize terms between channels and cable systems of a given size.

There have been fewer regulations in the satellite television market. The Satellite Home Viewer Improvement Act (SHVIA) was passed on November 28, 1999. It permitted satellite providers to distribute local broadcast signals within local television markets.[7] This leveled the playing field between cable and satellite systems and established the latter as an effective competitor in U.S. multi-channel television markets.[8] Since 2002, satellite systems that distribute local signals must follow a "carry-one, carry-all" approach similar to Must-Carry and must negotiate carriage agreements with local television stations under Retransmission Consent (FCC (2005)). Unlike cable systems, satellite providers have never been subject to price regulations.

2.2 The Advertising Market

Most advertising space is sold by channels, but also for a few minutes per hour by the local cable system.[9] Advertising revenues account for nearly one half of total channel revenues. For particular channels, advertising revenues depend on the total number and demographics of viewers. These figures, called ratings, are measured by Nielsen Media Research (hereafter Nielsen). Ratings are measured at the Designated Metropolitan Area (DMA) level, of which there are 210 in the United States. In urban areas, the DMA usually corresponds to the greater metropolitan area. DMA's usually include multiple cable systems, often from different owners. For local advertising purposes,

[6]See Crawford (2006) for a survey of the history of price regulation in cable television markets.

[7]Within a year, satellite providers were doing so in the top 50-60 television markets. They now do so in almost 150 television markets, allowing them to provide a set of services comparable to those offered by cable systems for the vast majority of U.S. households.

[8]Every net new subscriber to multi-channel television markets since 2000 has been a satellite subscriber. See Crawford (2006) for details.

[9]SNL Kagan (2007) reports local advertising revenue to cable systems for 2006 of approximately \$3.7 billion, 5.1% of total cable system revenue.

these systems are allowed to join together to form an ”interconnect” which allows advertisers to reach multiple local systems within a DMA. We discuss ratings in more depth in the next section.

3 The Data

This section describes the data underlying this study. We divide the data into two categories: market data, which measure consumers' purchasing decisions or firms' production decisions, and viewership data, also called ratings, which measure consumers' utilization of the cable channels available to them.

3.1 Market Data

Market data in the MVPD industry comes from two sources: Warren Communications and Kagan Research. Warren produces the Television and Cable Factbook Electronic Edition monthly (henceforth Factbook). The Factbook provides data at the cable system level on prices, bundle composition, quantity, system ownership and other system characteristics. Kagan produces the Economics of Basic Cable Networks yearly (henceforth EBCN). EBCN provides data at the channel level on a variety of revenue, cost, and subscriber quantities.

Factbook and Satellite Data Our Factbook sample spans the time period 1997-2007. The Factbook collects the data by telephone and mail survey of cable systems. The key data in Factbook are the cable system's bundle compositions, the prices of its bundles, the number of monthly subscribers per bundle, and ownership. The Factbook from various time periods has been used in numerous previous studies of the MVPD industry.[10]

Tables 1-4 provide summary statistics for the Factbook data. An observation is a system-bundle-year (e.g. NY0108's Expanded Basic in 2000). We observe data on over 20,000 system-year-bundles (based on almost 16,000 system-years from over 6,800 systems). Most systems in our data offer a single (Basic) bundle, while the majority of the rest offer just Basic + Expanded Basic service. While currently rare (in that most systems now offer many tiers of service), much of our data comes from early in the sample period when fewer offerings were the norm. Table 10 documents the distribution of observations by year.

For each of these bundles and by market type, Table 5 reports the average price of the bundle (in year-2000 dollars), its market share, and the number of cable channels offered. As might be expected, systems offering multiple services differentiate them with respect to quality (as measured

[10] To name only a few: Crawford (2000), Chipty (2001), Chu (2006).

by total channels) and price: while the average Basic service in our data costs $24.14 and offers 17.4 cable channels, the average Digital Basic bundle costs $48.33 and offers 81.2 channels.[11]

One important feature of the Factbook data is the variation in composition of bundles, both within and across markets. Cable systems tailor their bundles to their market given their varied wholesale costs of channels. Tables 2-4 present the share of systems in our sample that offer each of the cable channels included in our analysis. The channels are ranked from highest to lowest by their national reach as of 2006 (from ECBN). The first column indicates whether the channel is carried on any tier of service while the second-fourth columns indicate on which tier the channel is offered. For example, ESPN is carried by almost all systems (97%) in our data. Of these, most (77%) carry it on Basic Service. By contrast, smaller channels are frequently offered on a Digital Service.

We also include in our analysis market data on satellite television offerings. Unlike for cable service, these do not vary by geography.[12] This information we collected by hand.[13] We then matched this to aggregate satellite penetration data, $\frac{totalsatellitesubscribers}{totaltvhouseholds}$, at the DMA level from Nielsen Media Research. Table 5 provides price and total channels information by year for the DirecTV Total Choice package.

Kagan (ECBN) Data We use the 2006 edition of the EBCN. The sample covers 120 cable channels with yearly observations dating back to 1994 when applicable. The key variables are total subscribers, license fee revenue, advertising revenue, and ownership. The data are collected by survey, private communication, consulting information, and some estimation. The exact methods used are not disclosed. Summary statistics for those data are provided in Table 6. EBCN has been used in fewer MVPD industry studies than Factbook.[14]

3.2 Viewership Data

Our viewership data comes from Nielsen Media Research. Television ratings data is collected by different methods depending on the market and type of data. We use tuning data from the 56 largest DMA's for about 65 of the biggest cable channels over the period 2000-2006 in each of the months of February, May, July, and November (known for historical reasons as the sweeps months). The main variables are the DMA, the program, the channel, and the program's rating,

[11] Digital basic packages were made possible by cable systems investments in digital infrastructure in the late 1990's and 2000's. This dramatically increased the bandwidth available for delivering television channels. Prior to digital upgrades, most systems offered simply a basic bundle or a basic bundle and an expanded basic bundle. Following the digital upgrades, many systems also offered a higher tier, called digital basic, and, sometimes, a digital expanded basic bundle.

[12] Save for the carriage of local broadcast signals.

[13] We also compared our collection with a dataset used by (Chu 2006) to reduce measurement error.

[14] Chu (2006) and Kagan's own commercial research.

and the channel's cumulative rating. The rating is the percentage of television households in the DMA viewing the program. The channel's cumulative ratings (”cume”) indicates what percentage of television households with access to the channel tuned to the channel for at least ten minutes in a given week. Nielsen data is used throughout the television industry for a variety of purposes. Previous academic studies using similar data include Hausman and Leonard (1997).

We aggregate the information across programs on each channel within each month of our data. Thus an observation is a channel-DMA-year-month. We have 1,482 such combinations. Table 7 presents some summary statistics for a subset of channels considered in our analysis. It demonstrates that there is considerable variance in the monthly DMA average ratings both within and across channels. The fifth and sixth columns in Tables 2-4 present the average (across DMAs, months, and years) rating and cumulative rating for each of the cable channels in our analysis. Ratings are highest for the most widely available channels, although this pattern is not monotonic. For example, The Hallmark Channel is the 41st most widely available channel, but has the 27th highest rating). Highly rated channels typically have higher average cumes.

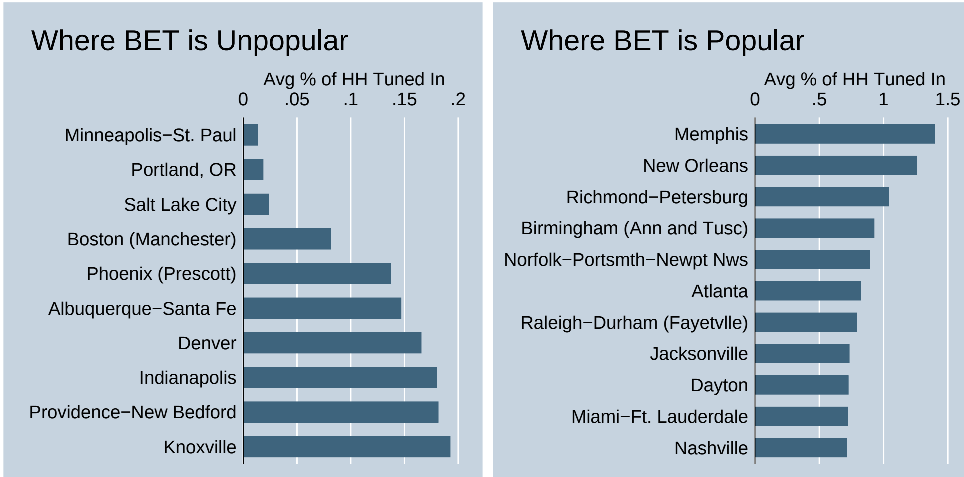
We observe that channels' ratings vary from DMA to DMA and within DMA across months and years. Two important types of across-DMA and time variation we use in our econometric estimation are (1) how ratings vary with the demographic composition of a DMA and (2) how ratings co-vary (conditional on demographic differences). We focus on eight demographic factors: Urban/Rural status, Family status, Income, Race (White/Black/Hispanic/Asian), Education, and Age.[15] Table 8 reports the DMA average values for these variables for the DMAs for which we have ratings data. As an illustrative example of the impact demographic characteristics can have on ratings, we present a graph of the ratings of Black Entertainment Television (BET) in its least popular and most popular DMA's for 2004 in Figure 1. Unsurprisingly given the target audience of BET, the channel has its highest ratings in heavily black populated DMA's such as Memphis and its lowest ratings in sparsely black populated DMA's such as Salt Lake City. The share of black population is an important predictor of ratings for BET.

Similar examples demonstrate the importance of ratings co-variation in our data. Table 9 reports raw (unadjusted) correlations in the DMA-month-year ratings across a subset of cable channel pairs. Most of these are consistent with prior beliefs about likely patterns of correlation in viewer tastes. In particular, ratings for children's programming (The Cartoon Network) are negatively correlated with ratings for arts programming and old movies (A&E and Turner Classic Movies, TCM). Similarly, ratings for all of ESPN's channels (showing various types of sports programming) are positively correlated.

Report cumulative ratings patterns.

[15] **Definitions.**

Figure 1: High and Low Rating DMA's for Black Entertainment Television



3.3 Data Quality

We call attention to the nonstandard features of these data sets in Appendix A. We focus on missing market share and price data. About two thirds of the possible observations on market share and price for cable bundles are either missing, not updated from the previous year, or both. We assume this data is missing at random conditional on the observable characteristics of the system. We justify this assumption in the appendix.

4 The Econometric Model

Our model of multi-channel television markets consists of three parts. On the demand side, we model both household viewing behavior and cable and satellite bundle purchases; on the supply side, we model the pricing of the observed set of bundles. Modeling both household viewing behavior and bundle purchases allows us to incorporate the information contained in our two sources of data, ratings and bundle purchases, into our estimation.[16]

The bundle purchase model specifies the utility to household i from bundle j in cable market n to be:

$$u_{ijn} \quad = \quad x'_{jn}\beta_{ij} + z'_{jn}\lambda - \alpha p_{jn} + \xi_{jn} + \sigma_\epsilon \epsilon_{ij} \qquad (1)$$

[16] Several recent papers incorporate multiple sources of data in the estimation of supply and demand, including Petrin (2003) who uses utilization data as we do, and Berry, Levinsohn, and Pakes (2004a) who use second-choice data.

where x_{jn} is a vector of dummy variables for the channels offered on bundle j for which households may have bundle-specific heterogeneous tastes (β_{ij}), z_{jn} are a set of non-channel bundle characteristics which are valued in the same manner by all households according to λ (predominantly tier, year, number of bundles offered, and firm dummies), p_{jn} is the price of the bundle, and ξ_{jn} and ϵ_{ijn} represent the portions of household utility that we do not have data on.

We augment this specification with a model of household viewing that links a household's marginal utility for channels in bundle j, β_{ij}, to their preferences for the programming offered on those channels and the amount of time spent watching that channel in bundle j:

$$\beta_{ijc} = \gamma_{ic} log(t_{ijc})$$

where γ_{ic} is the preference household i has for watching programs on channel c and t_{ijc} is the amount of time household i watches channel c in bundle j. We use ratings data to estimate preferences of household marginal utility for access to those channels (β_{ijc}).

Marginal utility for a channel depends on the other channels available for viewing; hence the dependence of β_{ij} on j. Without this dependence, the utility gained from having MSNBC will be the same in a bundle that includes CNN and one that does not. Due to the curse of dimensionality, we restrict β_{ij}'s dependence on j to a reduced form function of characteristics of the bundle like number of total channels. This assumption is critical for estimating the willingness to pay for individual channels when we only observe purchases bundles of these channels. This assumption and the instrumental variables assumption are the major assumptions in the demand model estimation. We emphasize that this a reduced form relationship inspired by the viewership model and computational considerations.

The following subsections describe the industry model in detail. We first introduce the channel viewership model. We then link the channel viewership model with the model of demand for bundles of channels. Finally, we embed the combined model of household viewership and demand into a model of supply side distributor competition. The following section describes model estimation.

4.1 Household Viewing Model

Let j index a bundle of programming being offered by cable system n in DMA d in month-year m (e.g. Comcast Digital Basic in Arlington, VA in November 2003).[17] We will suppress the market subscripts n, d, and m for the moment. Let C_j be the set of channels offered on bundle j.

[17]For convenience, we will index month-year combinations (e.g. November, 2003; May, 2004; November, 2004) by the single index, m.

Suppose household i has T_i hours per month of leisure time. We assume the utility to household i from spending their leisure time watching television (and doing non-television activities) has the Cobb-Douglas in logs form:

$$v_{ij}(t_{ij}) = \sum_{c \in C_j} \gamma_{ic} \log(t_{ijc}) + \gamma_{i0} \log(t_{ij0}) \tag{2}$$

where t_{ijc} is the number of hours household i watches channel c when the channels in bundle j are available and γ_{ic} is a parameter representing i's tastes for channel c.[18] Similarly, t_{ij0} represents the amount of time household i spends on other leisure activities (with γ_{i0} their preferences for such activities).

Each household i is assumed to optimally allocate its leisure time between watching the channels available and non-television leisure by solving:

$$\begin{aligned} Max_{t_{ijc}} \quad & \textstyle\sum_{c \in C_j} \gamma_{ic} \log(t_{ijc}) + \gamma_{i0} \log(t_{ij0}) \\ \text{subject to} \quad & \textstyle\sum_{c \in C_j} t_{ijc} + t_{ij0} \leq T_i \end{aligned} \tag{3}$$

The solution exhibits "Proportional Shares":

$$t^*_{ijc}(\gamma_i, T_i, C_j) = \frac{\gamma_{ic}}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}} T_i \tag{4}$$

Plugging this back into Equation (3) yields indirect utility (from viewing):

$$v^*_{ij}(\gamma_i, T_i, C_j) = \sum_{c \in C_j} \gamma_{ic} \log(\frac{\gamma_{ic}}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}} T_i) \tag{5}$$

This says that the indirect utility household i gets from bundle j is a function of its preferences for the channels offered on bundle j, $\gamma_{ic}, c \in C_j$, its preference parameter for non-television leisure, γ_{i0}, and the the amount of leisure time it has allocated to itself, T_i.

Approximating the Elements in v^*_{ij}

The solution to the household's time allocation problem implies that the utility of watching certain channels differs depending on the other channels in the bundle. We could accommodate this in estimation by specifying a distribution of preferences for each channel for each possible combination of other channels included in the bundle. This approach suffers from a curse of dimensionality as the number of combinations of channels grows exponentially. We now explore the consequences of

[18] Strictly speaking, this utility function isn't defined when a household chooses not to watch a given channel, i.e. $t_{ijc} = 0$. We could accommodate this defect by simply defining utility only over those channels, $c \in C_j$, for which $t_{ijc} > 0$. This introduces significantly more notation, however. In its place, we note that by l'Hôpital's rule, such a restricted utility function is the limit of our chosen specification as $\gamma_{ic} \to 0$.

approximating this utility by a reduced form dependence of marginal utility for channels on bundle characteristics.

Consider each term in the indirect utility in Equation (3), $\gamma_{ic} log(\frac{\gamma_{ic}}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}}T_i)$. This is the amount of household i's indirect utility for bundle j that can attributed to watching channel c. For exposition of the approximation, rewrite each term as $\gamma_{ic} log(\gamma_{ic}T_i S_{ij})$, where $S_{ij} = \frac{1}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}}$. S_{ij} is one over the total of household i's utility parameters for the channels included in bundle j (plus that for the outside good). Consider the second order Taylor expansion of $\gamma_{ic} log(\gamma_{ic}T_i S_{ij})$ around $S'_i = \int_{\text{j purchased by i}} \frac{1}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}} dj$. S'_i is the mean (for a given household type i) of S_{ij} over the average bundle it chooses.[19] We are attempting to remove dependence of each channel's contribution to utility on a specific bundle by approximating around it around S'_i, conceptually one over the household's utility from its "average chosen bundle".

This expansion is

$$\gamma_{ic} log(\gamma_{ic}T_i S_{ij}) \approx \gamma_{ic} log(\gamma_{ic}T_i S'_i) + \frac{\gamma_{ic}}{S'_i}(S_{ij} - S'_i) - \frac{1}{2}\frac{\gamma_{ic}}{S'^2_i}(S_{ij} - S'_i)^2 \quad (6)$$

Plugging in $S'_i = \int_{\text{j purchased by i}} \frac{1}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}} dj$ produces:

$$\begin{aligned}\gamma_{ic} log(\gamma_{ic}T_i S_{ij}) \approx\ & \gamma_{ic} log(\int_{\text{jpi}} \frac{\gamma_{ic}T_i}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}} dj) + \frac{\gamma_{ic}}{\int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}}}(S_{ij} - \int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}}) \\ & - \frac{1}{2}\frac{\gamma_{ic}}{(\int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}})^2}(S_{ij} - \int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}})^2 \quad (7)\end{aligned}$$

Further plugging in $S_{ij} = \frac{1}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}}$ allows us to write explicitly the whole approximation of the utility produced by the viewership model:

$$\begin{aligned}\gamma_{ic} log(\gamma_{ic}T_i S_{ij}) \approx\ & \gamma_{ic} log(\int_{\text{jpi}} \frac{\gamma_{ic}T_i}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}} dj) + \frac{\gamma_{ic}}{\int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}}}(\frac{1}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}} - \int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}}) \\ & - \frac{1}{2}\frac{\gamma_{ic}}{(\int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}})^2}(\frac{1}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}} - \int_{\text{jpi}} \frac{dj}{\sum_{c\in C_j}\gamma_{ic}+\gamma_{i0}})^2 \quad (8)\end{aligned}$$

which, after some algebra, simplifies to

[19] As the object we are approximating, v^*_{ij}, is household-specific, the set of bundles we are conceptually averaging over is the set of bundles chosen by household type i. For example, if household type i has strong tastes for sports (e.g. γ_{ic} is high for ESPN), they are likely to select a bundle that includes ESPN.

$$\begin{aligned}
\gamma_{ic} log(\gamma_{ic} T_i S_{ij}) &\approx \gamma_{ic}(log(\int_{\text{jpi}} \frac{\gamma_{ic} T_i}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}} dj) - \frac{3}{2}) + 2\gamma_{ic}(\frac{\frac{1}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}}}{\int_{\text{jpi}} \frac{dj}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}}}) \\
&\quad - \frac{\gamma_{ic}}{2}((\frac{\frac{1}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}}}{\int_{\text{jpi}} \frac{dj}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}}})^2) \qquad (9) \\
&\approx \gamma_{ic}(log(\int_{\text{jpi}} \frac{\gamma_{ic} T_i}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}} dj) - \frac{3}{2}) + \mu_{ijc} \qquad (10)
\end{aligned}$$

For a given household i, the first term in the approximation does not depend on the bundle they face. It is defined by integrating the denominator of the indirect utility log term over the average bundle chosen by i. The next two terms, which together are called μ_{ijc}, depend on the bundle j.

Because the first term of Equation (10) does not depend on j, we can re-write this relationship as

$$\begin{aligned}
\gamma_{ic} log(\gamma_{ic} T_i S) &\approx \gamma_{ic}(log(\int_{\text{jpi}} \frac{\gamma_{ic} T_i}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}} dj) - \frac{3}{2}) + \mu_{icj} \qquad (11) \\
&\approx \beta_{ic} + \mu_{ijc} \qquad (12)
\end{aligned}$$

where $\beta_{ic} = \gamma_{ic}(log(\int_{\text{jpi}} \frac{\gamma_{ic} T_i}{\sum_{c \in C_j} \gamma_{ic} + \gamma_{i0}} dj) - \frac{3}{2})$ is the total utility to household i from having access to the average bundle j.

If we could estimate a model with household specific tastes for each possible combination of channels, then there would be no approximation error. This is computationally intractable because of the curse of dimensionality. We use a reduced form dependence on characteristics j. We specify the reduced form to depend on the total number of channels in the bundle and the presence of high rating channels in the bundle. This specification captures that ω_{icj} depends on the distance, in terms preference weighted channel composition, the bundle is from the average bundle chosen by household i.

4.2 Bundle Demand Model

We restate our composite demand model here, reinserting subscripts for markets n, DMA's d, and months m. The utility household i derives from subscribing to bundle j in market n in DMA d in month m is approximated as:

$$u_{ijndm} \approx x'_{jndm}\beta_{ij} + z'_{jndm}\lambda - \alpha p_{jndm} + \xi_{jndm} + \sigma_\epsilon \epsilon_{ijnd} \tag{13}$$
$$= \sum_{c=1}^{C_{jn}} [\gamma_{ic} log(\int_{\text{jpi}} \frac{\gamma_{ic} T_i}{\sum_{c \in C_{jndm}} \gamma_{ic} + \gamma_{i0}} dj - \frac{3}{2}) + \mu_{ijc}] + z'_{jndm}\lambda - \alpha p_{jndm} + \xi_{jndm} + \sigma_\epsilon \epsilon_{ij}$$

where, from (5), the terms in x are channel dummy variables which represent the indirect utility to household i from viewing all the channels on bundle j, p_j is the monthly subscription fee of bundle j, and z_j are other observed system and bundle characteristics of bundle j in market n, α and λ are common taste parameters measuring the marginal utility of income and tastes for system and other bundle characteristics, and ξ_j and ϵ_{ij} are unobserved portions of household i's utility. We assume that the unobserved term has a component which is common to all households in the market, ξ_j, and an idiosyncratic term, ϵ_{ij}. We further assume that the idiosyncratic term is an i.i.d. draw from a type I Extreme Value distribution whose variance we estimate through σ_ϵ.[20]

The components of z_j indicates by which MSO, if any, the bundle is being offered, the year the bundle is being offered, and bundle dummies (e.g. "Tier 1", "Tier 2", etc.). As a consequence of this specification, ξ_{jn} is an aggregate term which represents the valuation of the deviation of unobserved bundle attributes from the MSO-year-bundle mean. These unobserved attributes include extra options such as Internet or high definition (HD) service, promotional activity, technical service, and quality of equipment. Theory predicts these unobservable attributes will be correlated with price as they affect both valuations and marginal cost. We use the instrumental variables technique to disentangle the the effect of price on utility from the effect of unobservable attributes. Identification is discussed in section 5.2.

Aggregating to Market Share Data We normalize the mean utility of not subscribing to any bundle to zero and assume that each household subscribes to the bundle which delivers the highest positive utility, or to no bundle at all. We derive the market shares implied by aggregating households' choices within a market.

Let the portion of utility of bundle j that is not derived from channel dummy variables in market n in DMA d in month m be given by

$$\delta_{jndm} = z_{jndm}\lambda - \alpha p_{jndm} + \xi_{jndm} \tag{14}$$

and let the household specific utility derived from viewing programming in the bundle be notated

[20] Typically this variance term is not identified separately, see Berry and Pakes (2007) for detail. Since, as will be shown later on, the distributional preference parameters are identified using only ratings data, the term is identified in this model.

as

$$\mu_{ijndm} = x_{jndm}(\beta_{ijc}) \tag{15}$$

Substituting yields the following formulation for the indirect utility to household i from bundle j in market n in DMA d:

$$u_{ijndm} \quad = \quad \delta_{jndm} + \mu_{ijndm} + \sigma_\epsilon \epsilon_{ij} \tag{16}$$

Let A_{jndm} be the set of households whose demographic and unobserved characteristics induce bundle j having the highest positive utility from the set of bundles available (including the empty bundle outside good $k = 0$, in market n, DMA d, and month m, i.e.

$$A_{jndm} = (D_i, v_i | \delta_{jndm} + \mu_{ijndm} \geq \delta_{kndm} + \mu_{ikndm} \forall k \in J_{ndm}) \tag{17}$$

Then under the assumption that $\epsilon_{ij} \sim$ Type I Extreme Value, the model's predicted market share for bundle j in market n in DMA d in month t is given by

$$s_{jndm} \quad = \quad \int_{A_{jndm}} \frac{(exp(\delta_{jndm} + \mu_{ijndm})\sigma_\epsilon^{-1})dF(i) \times G(v_i))}{\sum_{k=0}^{J_n dm} exp((\delta_{kndm} + \mu_{ikndm})\sigma_\epsilon^{-1})} \tag{18}$$

Estimation will partly be based on setting these predicted market shares equal to their empirical counterparts.

4.3 Pricing

We assume that each cable system chooses the price of its offered bundles to maximize profits. Due to satellite systems' nationwide-pricing strategy, we assume that individual cable system's take satellite prices as given.

Each system's problem is then

$$\max_{\{p\}_{j=1}^{J_n dm}} r(s_{ndm}(p_{ndm})) + \sum_{j=1}^{J_{ndm}} (p_{jndm} - mc_{jndm}) s_{jndm}(p_{ndm})$$

where $r(s_{ndm})$ is an advertising revenue function, and mc_{jndm} are the marginal costs of providing bundle j in market n in DMA d and month m.

The first-order conditions for this problem are:

$$r'(s_{ndm}) \frac{\partial s_{jndm}}{\partial p_{jndm}} + s_{jndm} + \sum_{j=1}^{J_n dm} (p_{jndm} - mc_{jndm}) \frac{\partial s_{jndm}}{\partial p_{jndm}} \quad = \quad 0 \tag{19}$$

As marginal cost and marginal advertising revenue are not observed, we assume a functional form for the relationship between the sum of these two terms and other variables in the data:

$$mc_{jndm} - r'(s_{ndm}) \quad = \quad w'_{jndm}\theta + \omega_{jndm}$$

where w_{jndm} is a vector of cost shifters (channel dummies, year, and MSO dummies) and market share. ω_{jndm} is an unobservable stochastic term containing factors which affect marginal cost not accounted for in w. These include the deviation from the MSO year means of discounts available to systems of large systems on programming input costs and the quality of the system's local advertising opportunities.

5 Estimation

We estimate the the model in two steps. We first parameterize and estimate the distribution of marginal utility derived from each channel, β_{ijc} using ratings data and bundle characteristics data. We then estimate λ, α, and σ_ϵ using market share, price, and bundle characteristics data. The resulting parameter estimates are therefore not efficient. While it would be efficient to estimate all the parameters jointly, we significantly reduce computational time by separate estimation.

5.1 Estimation of β_{ijc} Using Ratings and Bundle Characteristics Data

Overview The model generates a relationship between the parameters of the viewership and bundle demand decisions. Explicitly

$$\beta_{ijc} \quad = \quad \gamma_{ic} log(\frac{\gamma_{ic}T_i}{\sum_{c \in C_{jnd}} \gamma_{ic} + \gamma_{i0}}) \tag{20}$$

The expression inside of the logarithm is the number of hours of channel c watched by household i subscribing to bundle j in market n, DMA d, month m. Following our earlier notation, we denote this term t_{ijc}. γ_{ic} is the share of monthly leisure time household i would watch channel c if it had the ability to watch all channels as desired.

We parameterize β_{ij}.

$$\beta_{ij} \quad = \quad \beta + \Pi D_i + v_i + f(j) \tag{21}$$

This parametrization is restrictive. We assume that bundle characteristics enter additively separably from household characteristics. We further assume that f(j) is linear in parameters. This is the major new assumption of the paper. It says that the utility, and ultimately the willingness to pay, for channels depends on the other channels in the bundle in an additively separable manner.

We estimate β_{ij} by aggregating both sides of Equation (20) to produce an aggregate of β_{ijc} in terms of DMA d ratings data for channel c. The aggregate of β_{ijc} will depend on Π, an aggregate of v_{ic}, and an aggregate of $f(j)$ in a multivariate additively separable fashion. We can estimate the matrix Π and $f(j)$ using Ordinary Least Squares. We then choose $G(v)$ as a multivariate distribution whose sample averages generate the ordinal correlation and variances of the marginal distributions in the estimated residuals. Finally, given Π, G, and $f(j)$, we choose β to match the relative differences in cumulative ratings between channels and the average number of channels watched per household.

Details Let Υ^{dm} be the operator that takes a dataset whose units of observation are households within a DMA into the mean of the sample of television household Nielsen takes in dma d and month m.[21] Since Nielsen strives to match its sample of television households to the actual demographic distribution, Υ^{dm} has the property that the samples it generates are consistent estimates of the demographic profile of the population of the DMA.[22] For example, $\Upsilon^{dm}(\{T_i\}_{i\in d})$, in a DMA where Nielsen samples 400 television households, would produce the sample average of 400 observations of leisure time devoted to watching television in DMA d where the demographic distribution of the sample is equal (as close as possible for 400 draws) to the DMA population demographic distribution. This implies that applying Υ^{dm} to the dataset of any demographic variable would produce a sample estimate of the population average of that demographic. Applying Υ^{dm} to the left-hand side of Equation (20) produces

$$\begin{aligned}\Upsilon^{dm}\beta_{ij} &= \Upsilon^{dm}(\beta + \Pi D_i + v_i + f(j)) \\ &= \beta + \Pi D_d + \Upsilon^{dm} v_i + \Upsilon^{dm} f(j)\end{aligned} \tag{22}$$

where we assume $D_d = \Upsilon^{dm} D_i$ doesn't vary with m; The demographic data is taken from the year 2000 Census.

Before applying Υ^{dm} to the right-hand side of Equation (20), we will manipulate it to overcome difficulties due to its nonlinearity in γ_{ic}. Let t_{cdm} be the average amount of leisure time allocated to watching channel c in DMA d in month m in the bundles chosen by the respective households ($t_{cdm} = \Upsilon^{dm}\{t_{ijc}\}$). Similarly, let γ_{cdm} be the demographic weighted average of the fraction of leisure time households would allocate to channel c if they had all channels available ($\gamma_{cdm} =$

[21] $\Upsilon^{dm} = \frac{1}{N_{dm}} \sum_{i \in \text{Nielsen sample of DMA d and month m}}$ where N_{dm} is the number of households in the Nielsen sample of DMA d and month m. Note that Υ^{dm} satisfies $\Upsilon^{dm}\{kx_{id}\} = k\Upsilon^{dm}\{x_{id}\}$ for k constant and data x. We call Υ^{dm} the Nielsen operator.

[22] Any sampling error here is going to be attributed to unattributable variation in preferences.

$\Upsilon^{dm}\{\gamma_{ic}\})$.

A first-order Taylor Series expansion of $\gamma^{ic}\log(t_{ijc})$ around (γ_{cdm}, t_{cdm}) yields

$$\gamma_{ic}\log(t_{ijc}) \quad \approx \quad \gamma_{cdm}\log(t_{cdm}) + log(t_{cdm})(\gamma_{ic} - \gamma_{cdm}) + \frac{\gamma_{cdm}}{t_{cdm}}(t_{ijc} - t_{cdm})$$

Applying Υ^{dm} to this approximation of the right hand side of 20 produces:

$$\Upsilon^{dm}\gamma_{ic}\log(t_{ic}) \quad \approx \quad \gamma_{cdm}\log(t_{cdm}) \tag{23}$$

where the second and third terms in the approximation are 0 by the definition of Υ^{dm}.[23]

As we do not have information about the variance of t_{ijc} or the covariance between γ_{ic} and t_{ijc} within DMA d and month m, we cannot estimate these additional terms. If the variance/covariance matrix of t_{ic} and γ_{ic} is constant across DMA and month, then we pick up their joint effect with β_c by including channel dummies. Our assumption is that the variation in $\Upsilon^{dm}\gamma_{ic}\log(t_{ic})$ is driven by the 0th-order term, $\gamma_{cdm}\log(t_{cdm})$, rather than the second-order terms in the more general approximation.

Equating Equations (22) and (23) yields our approximation of the population relationship in the data. For channel c,

$$\gamma_{cdm}\log(t_{cdm}) = \beta_c + \Pi_c D_d + \Upsilon^{dm} v_{icm} + \Upsilon^{dm} f(j_{dm}) \tag{25}$$

To estimate this relationship, we replace the population values, t_{cdm} and γ_{cdm} with their sample analogs. For t_{cdm}, this is a direct substitution. Recall the Nielsen rating, r_{cdm}, is measured as:

$$r_{cdm} = \frac{1}{T}\sum_{h=1}^{T}\Upsilon^{dm}\{\chi_{\text{household i watches c in hour h}}\} \tag{26}$$

[23] A second-order approximation would yield, after application of Υ_{dm}:

$$\begin{aligned}\Upsilon^{dm}\gamma_{ic}\log(t_{ijc}) \quad \approx \quad & \gamma_{cdm}\log(t_{cdm}) + \frac{1}{2}[\Upsilon^{dm}(\frac{1}{t_{cdm}}(\gamma_{ic} - \gamma_{cdm})(t_{ijc} - t_{cdm}))' \\ & -\Upsilon^{dm}(\frac{\gamma_{cdm}}{t_{cdm}^2}(t_{ijc} - t_{cdm})^2)]\end{aligned} \tag{24}$$

The credibility of our first order approximation depends on the variance of the aggregated second order terms.

and t_{cdm} by definition is:

$$\begin{aligned} t_{cdm} &= \Upsilon^{dm}\{t_{ic}\} \\ &= \Upsilon^{dm}\{\sum_{h=1}^{T} \chi_{\text{household i watches c in hour h}}\} \end{aligned}$$

which implies that $r_{cdm}T = t_{cdm}$ because Υ^{dm} is a linear operator.

Determining a sample analog for γ_{cdm} presents more difficulties. Recall that γ_{cdm} is the average fraction of leisure time Nielsen households would allocate to channel c *if they had all channels available.* The Nielsen rating, on the other hand, is the average fraction of leisure time Nielsen households actually devote to the channel. Because some households do not have access to all channels, γ_{cdm} will generally be less than the Nielsen rating, r_{cdm}.

To account for this difference, we approximate γ_{cdm} with a first-order Taylor Series expansion around r_{cdm}. In particular,

$$\begin{aligned} \gamma_{cdm} \log(r_{cdm}T) &\approx r_{cdm} \log(r_{cdm}T) + \log(r_{cdm}T)(\gamma_{cdm} - r_{cdm}) \\ &\approx r_{cdm} \log(r_{cdm}T) + \zeta_{cdm} \end{aligned} \tag{27}$$

Again, we note that ζ_{cdm} will be smaller the closer the average bundle in DMA d and market m comes to including all potential offered channels and the smaller the total viewing of the bundles (due to the dependence of ζ_{cdm} on $\log(r_{cdm}T)$). We therefore include proxies for these errors in the estimating equations and denote these proxies $m_{2,dm}\mu_2$.

Inserting our sample estimates of the population values in Equation (25) yields our first-stage estimating equation:

$$r_{cdm} \log(r_{cdm}T) = \beta_c + \Pi_c D_d + m_{2,dm}\mu + \eta_{cdm} + \Upsilon^{dm} f(j_{dm}) \tag{28}$$

where r_{cdm} is the vector of ratings for each channel in a given DMA d in month m, T is the number of minutes of television viewing measured by Nielsen, $\eta_{cdm} \equiv \Upsilon^{dm} v_{icm}$, and $\Upsilon^{dm} f(j_{dm})$ is a function of aggregated bundle characteristics.

The left hand side of this equation, $r_{cdm} \log(r_{cdm}T)$ is data. D_d is demographic data from the Census. We compute DMA-year aggregated bundle characteristics from the market share data. We can estimate Π and f by multivariate ordinary least squares. A byproduct of this estimation are estimated residuals $\hat{\eta}_{dm}$. We then estimate G as a distribution whose distribution of Nielsen sample averages (which are just unconditional sample averages because these terms are distributed independently from the demographics) shares a set of moments with $\hat{\eta}_{dm}$. This says that any variance in ratings net of demographic differences is a result of the distribution of unattributable preferences for channels from which Nielsen is not able to sample perfectly.

The set of moments of $\hat{\eta}_{dm}$ we choose G to match are Kendall's τ [24] and the variance of the marginal distributions. Still, G is not identified by these moments. We further assume that the marginal distributions follow a mixture of an Exponential distribution and a Dirac distribution (i.e. mass point) at 0, with the mixture weight for each marginal given by that channel's average cumulative rating multiplied by three.[25] [26] Finally, we select β_c for each channel to match that unconditional tastes yield a share of households with WTP high enough to watch for over ten minutes per week is equal to 3 times the cumulative rating and that no households value any channels negatively. The latter follows from free disposal. These two assumptions over-identify the location of the marginal distributions. We give each assumption equal weight when choosing β_c. As we believe strongly in free disposal, we are tempted to increase the weight we place on free disposal relative to the cumulative ratings.

First-stage estimation therefore proceeds in two parts. We first conduct the regression in (28), yielding estimates $\hat{\Pi}$ and $\hat{\eta}_{dm}$ and $\hat{f}(j)$. We next compute Kendall's τ of $\hat{\eta}_{dm}$, and create a t-copula based on $\hat{\tau}$. We then choose the mixture of Exponential and Dirac distributions whose sample averages distribution has the variance of the observed marginal distributions. We set the mixture weight for each channel to 3 times its cumulative rating and allow the exponential parameter to adjust to equate the variance of the distribution of sample averages to the variance of $\hat{\eta}_{cdm}$. We can sample from this distribution by drawing multivariate uniformly distributed random variables from the estimated t-copula and applying the inverse cdf of the respective estimated univariate distributions. The multivariate distribution of sample averages of these draws will preserve $\hat{\tau}$ and have a mixed Exponential/Dirac distribution with sample average variances equal to those of $\hat{\eta}_{dm}$. Note, however, that demographic variables in (28) translate this estimated distribution of $\hat{\eta}$. We therefore choose β_c for each channel to match the fraction of all households (i.e. integrating over demographics) with positive willingness to pay to three times the cumulative rating of the channel. This ensures the average household has positive WTP for 18 channels.

[24] Kendall's τ is a measure of ordinal correlation. It can be calculated for two data series as $\frac{4P}{n(n-1)} - 1$ where P sum, over all the items, of items ranked after the given item by both rankings. Explicitly, $P = \sum_{i=1}^{N} \sum_{j=1}^{N} \chi_{\{x_j > x_i \wedge y_j > y_i\}}$. τ is equal to 1 if the orderings of the two data series are perfectly harmonious and -1 if the orderings are completely discordant. τ is invariant under CDF and inverse CDF operations.

[25] We are imposing our prior beliefs on the shape of the distributions. We discuss this issue in greater detail in the next sub-section.

[26] This approach is similar to that taken in Crawford and Cullen (2007). The Nielsen cumulative rating in our data is defined as the average share of television households that watched that channel in an average week. We wish to know the share of households that value a channel *at all* in a given year. The cumulative rating provides a lower bound on the share of households with positive WTP as some such households may value a channel but do not watch in a given week. We choose to scale the cumulative ratings for channels such that the average (across households) number of channels with positive WTP is equal to 18, the average number of channels watched by households according to Nielsen. The scale factor that achieves this equality is 3.

5.2 Identification

Before introducing our second-stage estimation, we discuss the identification of Π and G from our first-stage estimation. We are exploiting the variation in the ratings for cable channels across DMAs and time to pin down (a) how households tastes for access to those channel vary with demographic characteristics (Π) and (b) the variance and covariance in household's unobserved tastes for those channels (G) and (c) how households tastes for channels depend on the other channels in the bundle (f) . We combine this information with the cumulative ratings to pin down the relative differences in the fractions of households with positive willingness to pay for a channel.

The amount of time spent households watching channels, the ratings, are informative for what they are willing to pay for access to those channels. For Π, identification is clear: we will estimate greater mean marginal utility for a channel c the higher are mean ratings for that channel in a given DMA and month. Thus, mean marginal utility for BET is estimated higher for black households because ratings for BET are higher in markets with a greater share of black households.

Identification of G is more subtle. It is the distribution of marginal utility of channels, assumed to be common across DMAs and months once we control for the channels available and demographic differences across markets. This is identified by variation in the ratings across DMAs and markets due to random variation in the sampling process undertaken by Nielsen across markets and time. To see this, note that the error in our estimation regression, η_{cdm}, is the average across the Nielsen households in DMA d in month m of the underlying household-specific taste shock, v_{ic}, i.e. $\eta_{cdm} = \Upsilon^{dm} v_{ic}$ where $\Upsilon^{dm} = \frac{1}{N_{dm}} \sum_{i \in \text{Nielsen sample of DMA d and month m}}$. If Nielsen were able to sample from every household within the population in DMA d in month m, this error would be zero (as $E(v_{ic}) = 0$). As they cannot, there is variation between our first-stage dependent variable ($r_{cdm} \log(r_{cdm}T)$) and that predicted in the population ($\beta_{cdm} + \Pi D_d + \Upsilon^{dm} v_{ic}$) and we are able to exploit that variation to identify the underlying variation in v_{ic}.

Here is a description of the sampling procedure generating our ratings data to help understand what is driving empirical identification: After controlling for demographics and time trends, households' tastes are assumed to be drawn from a common distribution. As Nielsen samples households across DMAs and time, they are drawing tastes from this common distribution. If, then, ratings for one channel are above their mean when ratings for another channel are below their mean (i.e. they negatively co-vary), it must be because tastes in the population negatively co-vary. After controlling for the effects of different numbers of Nielsen households in each DMA and month, we can directly measure this co-variation in tastes from the co-variation in ratings.

The Shape of the Marginals While we can identify the variance-covariance structure of the underlying preferences, $G(v)$, our data do not identify their shape. Within each DMA and month, the Nielsen sampling process averages the viewing choices of hundreds of households. If preferences for channels are independent across households conditional on demographic characteristics, and the variance is finite, then the Central Limit Theorems tell us that the distribution of average viewing choices will be normally distributed no matter the shape of the distribution underlying that average. In particular, if we observe an average rating of 3.0 in a given DMA-month, we cannot tell if this meant 3% of households were watching that channels 100% of the time or if 30% of households were watching it 10% of the time (or any other equivalent combination). These have very different implications, however, about the intensity and breadth of preferences for individual channels, critical inputs into understanding likely outcomes in an à la carte environment.

We address this identification problem both by incorporating cumulative ratings data and additional assumptions. Nielsen reports indicate that the typical household does not watch many of the channels included in cable bundles (CITE). Our model says that their WTP for these channels is around zero. Therefore, we assume that the distribution of tastes for channels has a mass point at zero (representing the share of the population that does not value the channel enough to view it) and a distribution with support over the positive line. We assume that the fraction of households with positive willingness to pay for any particular channel is equal to three times the cumulative rating for that channel, with the scale factor of 3 implying that the average number of channels a household values positively is 18, the value estimated by Nielsen as the average number of channels a household watches in a year.

There remains the issue of the shape of the distribution of tastes among households with positive WTP for a channel. In the current draft, we assume that the positive portion of the mixture distribution is exponential. This comports well with the view that tastes for media products have "long tails". Other assumptions are possible, however, and we intend to explore the robustness of our conclusions to alternative distributions (e.g. lognormal, Rayleigh, "heavy-tailed" distributions, etc.).

5.3 Estimation on Market Share Data

Given $\hat{\beta}$, $\hat{\Pi}$, $\hat{G}$, and f, in the second stage we estimate the remaining parameters of the model following Berry (1994) and Berry, Levinsohn, and Pakes (2004b). We use moments from both the bundle demand and pricing equations.

The Demand Side The demand-side moments are of the form

$$\begin{aligned} E[\xi_{jndm} z^d_{jndm}] &= 0 \\ \xi_{jndm} &= \delta_{jndm}(x_{jndm}, p_{jndm}; \hat{\beta}, \hat{\Pi}, \hat{G}, \hat{f}, \sigma_\epsilon, \cdot) - z'_{jndm}\lambda + \alpha p_{jndm} \\ Z^d_{jndm} &= [x_{jndm} z_{jndm} w_{ndm}] \end{aligned}$$

where $\delta_{jndm}(x_{jndm}, p_{jndm}; \hat{\Pi}, \hat{G}, \hat{f}, \sigma_\epsilon, \cdot)$ is the outcome of the contraction mapping equating predicted and observed market shares for bundle j in market n and month m and z^d_{jndm} are demand-side instruments.

The components of the instruments Z^d_{jndm} follow standard practice in demand estimation on aggregate data. First, we allow observed product characteristics (largely dummy variables for non-channel bundle characteristics such as firm, year, and tier name), z_{jndm}, to instrument for themselves. Second, we accommodate the endogeneity of price by instrumenting for it with w_{ndm}, where w_{ndm} is the average price of other cable systems bundles within the same DMA as cable system n and with the channel dummy variables. These will be valid instrumental variables if, for bundle j in market n, (a) the unobservable demand shock, ξ_{jndm}, is uncorrelated and (b) "net" marginal costs are correlated with prices within n's DMA outside market n. The former is likely to be true in multichannel television industry because cable systems are physically distinct entities for which local managers have wide authority. The latter will be true, for the average price variable, as labor costs and advertising rates are often correlated within DMAs. Following Hausman (1996), these are often called "Hausman" instruments and have been successfully used in Nevo (2001) and Crawford (2008)). Additionally, the channel dummy variables are uncorrelated with the unobservable term as the utility generated by the channels was by construction taken out of δ. They are correlated with price through input costs.

There are two important issues that arise with this specification. First, while there are two large satellite providers, we observe only the aggregate satellite market share within each DMA. We therefore assume that there is just a single satellite product with characteristics given by the DirecTV Total Choice package.[27] Second, we are assuming product characteristics, x_{jndm}, are uncorrelated with the unobservable term, ξ_{jndm}. We don't believe the likely bias induced by violations of this assumption will be quantitatively important, in related work, we have worked on relaxing that assumption (Ackerberg and Crawford (2007)). While we are certain that the components of the bundle are chosen purposefully and strategically by the firms,[28] we do not believe that the factors influencing this decision are correlated with the unobservable term.[29]

[27] Less restrictive assumptions are possible. We could predict all satellite shares and aggregate the predicted shares to the level of the data.

[28] Other work of ours, Crawford and Shum (2006) and Yurukoglu (2008), incorporates this information into the estimation of demand or cost parameters.

[29] We restate what we believe ξ_{jndm} measures: the deviation from the MSO-year-bundle mean of extra options such

The Supply Side The supply-side moments are of the form

$$\begin{aligned}
E[\omega_{jndm} z^p_{jndm}] &= 0 \\
\omega_{jndm} &= p_{jndm} - (mc_j + r'(s_{jndm}) - \Omega^{-1} s_{ndm}(p_n dm) \\
&= p_{jndm} - \Omega^{-1} s_{ndm}(p_n dm) - w'_{jndm}\theta \\
&= p_{jndm} - markup_{jn} - w'_{jndm}\theta \\
z^p_{jndm} &= [w_{jndm} \; mar\hat{k}up_{jndm}]
\end{aligned}$$

where $S_{jr,n} = -\partial s_{rn}/\partial p_{jn}$, $j, r = 1, \ldots, J_n$,

$$\Theta_{jr,n} = \begin{cases} 1, & \text{if in market } n \text{ there exists } f : \{r, j\} \subset F_f; \\ 0, & \text{otherwise} \end{cases} \tag{29}$$

and $\Omega_{jr,n} = \Theta_{jr,n} * S_{jr,n}$.

As earlier, z^p_{jndm} are supply-side instruments, with cost shifters, w_{jndm}, instrumenting for themselves and the predicted markup, $mar\hat{k}up_{jndm}$, instrumenting for the $markup_{jndm}$ and the predicted market share instrumenting for the market share. As the predicted markup is a function of exogenous variables and instruments from the demand side, this means we are effectively instrumenting for the markup with demand shifters as in Berry, Levinsohn, and Pakes (2004b).

5.4 Standard Errors

In the first-stage estimation, we calculate block-bootstrap standard errors allowing for correlation within DMA. In the second-stage estimation, there are three sources of error: Sampling Error, Simulation Error, and 1st-Stage Estimation Error. We calculate standard errors using the usual GMM formulas modified to account for the additional sources of error as in Berry, Levinsohn, and Pakes (2004a). We first compute the expectation of the derivative of the moment conditions at the estimated values. We then compute the variance in the moments generated by sampling error at the estimated values of the parameters. Simulation error arises from simulating the values of the market shares $s_{jn}(x_n, p_n)$. We fix β, Π, G, and f at their estimated values and re-calculating the variance in moment conditions repeatedly using different sets of simulation draws. 1st-Stage estimation error arises from using our estimates, $\hat{\beta}$, $\hat{\Pi}$, $\hat{G}$, and $\hat{f}$ when calculating market shares. We fix the simulation draws and re-calculate the variance in the moment conditions by repeatedly using draws from the estimated distributions of β, Π, G, and f. As these three sources of error are independent, we can simply add the three variance-covariance matrices of the sample moments from each type of error to calculate total standard errors using these aggregates.

as Internet or high definition (HD) service, promotional activity, technical service, and quality of equipment.

6 Model Estimation Results

This section analyzes the model's estimated parameters. First, we state the estimates and their estimated precision. We explain how certain patterns in the data manifest themselves in the parameter estimates. Next, we compare the estimates with others' estimates of similar parameters. We highlight where our estimates differ from our prior beliefs or from previous estimates.

Given the diverse set of data inputs and computational requirements of estimating the industry model, we compiled an appendix outlining the methods used for computation and data treatment in this study in order to aid attempts at replicating and extending this research. The information in the appendix is sufficient for replicating the estimates below.

6.1 Parameter Estimates

Tables 11-13 present estimates of the key parameters in the model. The tables report the price sensitivity parameter (α), features of the distribution of preferences for each channel (β, in column 2, and the exponential parameter, in column 4), and the estimated marginal cost for each channel (column 3). For convenience, we also report for each channel information about the distributions of WTP implied by our estimates. Reported in the last 3 columns are the share (among 2,000 simulated households) of households with positive WTP, the overall mean WTP, and the mean WTP among those households that value the network positively.

The estimated price sensitivity parameter is -0.132. This implies an average own price elasticity for basic cable service of -2.48. Table 14 shows how this parameter decreases as we move first from OLS to IV (using just the demand-side moments) and then from IV using only the demand side to IV using both demand and pricing equations. It reveals that our instrumental variables strategy is working as theory would predict. Furthermore, it reveals that the optimal pricing assumption has a significant effect on the price sensitivity estimate.

Table 15 presents estimated price elasticities for markets in which the cable operator offers a basic, expanded basic, and digital basic bundle.[30] We find demand for Digital Basic to be most elastic, followed by demand for Expanded Basic, Satellite service, and Basic service. While uniformly higher than previous estimates, this is (in part) a function of how we currently calculate them.[31],[32]

[30] While uncommon in the data (cf. Table 1), this is the most common offering among cable systems today.

[31] These are calculated by increasing the price of (e.g.) Digital Basic without also increasing the associated price of (e.g.) Expanded Basic. We are in the process of calculating elasticities that simultaneously increase prices for all services that must be purchased in order to purchase a given service.

[32] The FCC (2002) (-2.19), the GAO (2003) (-3.22), Beard, Ford, Hill, and Saba (2005) (-2.5), Chipty (2001) (-5.9), and Goolsbee and Petrin (2004) (-1.5 for EB, -3.2 for DB, -2.4 for Satellite), have all separately estimated the average own price elasticity of cable services, using market share regressions, diverse data sets, and instrumental variables techniques.

Table 16 summarizes estimated marginal costs of bundles, prices for these services, and the gross margin implied by the these values. Estimated gross margins vary from a low of 34% for digital basic to 53% for basic, with an across-service average of 53%. These values are new evidence about marginal costs of bundles of cable channels to add to those found in industry surveys (Halfon (2003, footnote 78), FCC (2003)). While the estimated bundle marginal costs are robust, the projection of estimated marginal costs onto the individual channels that form the bundle are often imprecisely estimated.

Preferences for Channels Previous demand system estimates for multichannel television either did not define preferences over channels in bundles[33] or restricted the preferences for individual channels to be the same for all households.[34] Our demand system allows for flexible multivariate distributions of preferences for channels. This property of the demand systems renders possible credible analysis of various proposed regulations such as à la carte.

Figures 3 and 4 present the estimated distribution of willingness-to-pay for a sample of 2,000 households.[35] Figure 5 presents a box and whisker plot of the estimated marginal distributions. Recall that the shape of the marginal distributions are assumed; the mean and covariance structure are estimated from ratings data.

Table 17 and Table 18 display estimated correlations in willingness to pay for a subset of pairs of channels in our specification. Figure 6 demonstrates graphically the correlation between ESPN and ESPN2, and Figure 7 for Disney Channel and Nickelodeon.

Demographic Impacts We estimate a nondegenerate distribution of taste parameters for a channel if its ratings vary across markets or time periods. The variance of this distribution could be driven by demographic differences, through Π, or if not by demographic differences, through the variance of $G(v)$. Two channels will have positively correlated tastes if their ratings covary in the same direction with the same demographic features or if their portions of ratings unexplainable by demographics (the residuals in the multivariate regression) covary positively. Tables 19-21 report all the elements of Π that are estimated to be statistically significant at conventional levels.

The demographic results are remarkably consistent with intuition. As an example of the impact of demographic variables on estimated preferences for channels, consider the estimated marginal distribution of willingness to pay for BET in Figure 8. Its variance is driven by demographic

[33] Goolsbee and Petrin (2004), Chu (2006)

[34] Crawford (2000), Rennhoff and Serfes (2007)

[35] Demographic characteristics for each of these households were drawn from the marginal distribution for the entire U.S. for each of the 8 demographic variables used in our analysis (e.g. Urban/Rural, Family/Not, Income, White/Black/Hispanic/Asian, CollegePlusEducation, and Age). Distributions of WTP for particular demographic groups are analyzed below.

factors, in particular the clump of households on the right are predominantly black households. This property of the distribution is generated by the type of data variation plotted earlier in Figure 1.

Table 22 displays estimates of the median willingness to pay for a subset of channels for just a few of the possible demographic profiles of households. We emphasize that the relative differences across a row in Table 22 are driven by the covariation of observed ratings data with demographics. This generates plausible properties of the estimated willingness to pay such as American Movie Classics, a channel of classic movies from before 1980, has a median higher value for households of age over 60 than for young, non-family households. Similarly, ABC Family Channel, Disney Channel, and Nickelodeon have higher median values for families than for the other demographic profiles. The same goes for Country Music TV for rural families, Bravo and MTV for young, non-family households, and Fox News Channel and CNN for older households. In most cases, the estimated highest value households match the desired audience of the targeted channel. These patterns are direct consequences of the conditional correlations of a channels ratings in a DMA with that DMA's demographics. One weakness of using aggregated demographics data is that there is not enough variation in the ratio of males to females to empirically identify preferences that depend on the presence of different sexes in a household. Some channels, for example WE: Women's Entertainment, are targeted at women. Household level viewership data would allow empirical identification of sex-dependent preferences.

7 The Welfare Effects of À La Carte

7.1 Theoretical Predictions

This section describes the welfare economics underlying a la carte pricing regulations in multichannel television. While we describe both short run and long run effects, our counterfactual simulations focus on short run effects.

Given that the social marginal cost of an extra household receiving an extra channel is zero (ignoring capacity constraints), the socially optimal allocation would deliver every channel in existence to each household that has a positive willingness to pay for that channel. Bundling of channels together excludes households that have positive willingness to pay for some channels, but do not derive a value from the full bundle that justifies its price. About 15% of television households did not subscribe to multichannel television in 2007.

À la carte pricing of channels allows for those excluded under bundling to enter the market. However, a la carte partially excludes households who have positive valuations for channels that do not exceed the prices at which the channels are being sold. These consumers may have been served these channels under bundling. If the distribution of tastes for a channel is such that firms price for the highest valuation households, then there is a total welfare loss from lower but positive valuation households not being served.

Which of these two effects dominates is an empirical question which we attempt to answer via counterfactual simulation of à la carte pricing regulations.

How the surplus generated by the service of multichannel television is split between and within consumers and firms is also of importance to policy makers. Bundling theory under monopoly suggests that consumers with highly variant preferences, as we estimate television households to be, are better off under a la carte pricing in the short run.[36,37] The theory under oligopoly is less established and offers ambiguous predictions about the effects of à la carte on consumer welfare. All these theories agree in predicting that the effect on firms will take the opposite sign as those on consumers.

The stated preferences of industry participants support these short-run theoretical predictions. The Consumers Union is one of the largest organized supporters of a la carte regulations.[38] Similarly, the National Cable Television Association (NCTA), the primary industry lobbying organization, vehemently opposes a la carte regulations. However, Echostar, which runs the DISH Network satellite operator, and AT&T, which in 2007 began offering its own multichannel television service, have publicly supported a la carte regulations. The reason for their different positions vis-a-vis cable operators may have to do with the impact of à la carte on channel profits. As a general rule, cable channel owners have also lined up in opposition to à la carte. Unlike Comcast and Time Warner, the two largest cable operators, Echostar and AT&T own few cable channels.

Welfare Effects in the Long Run In the long run, the conclusions of economic theory on the welfare effects of à la carte are ambiguous. Many opponents of à la carte claim some channels - particularly smaller channels appealing to niche tastes - will become unprofitable and exit in an à la carte environment. Others claim there will be significant losses in advertising revenues. While we do not model the impact of à la carte on these long-run outcomes, entry, exit, and changes in the

[36] Adams and Yellen (1976) make this point in a simple theoretical model. Crawford and Cullen (2007) assume a monopoly model and a tractable preference structure to demonstrate this possibility if the multichannel television industry were a monopoly.

[37] Chu, Leslie, and Sorensen (2008) introduce and evaluate Bundle-Sized Pricing (BSP) and compare it's profitability to component pricing (à la carte) and mixed bundling in theory and for a small California theater company. Yurukoglu (2008) evaluates BSP in this market and finds it provides intermediate welfare results between those of full à la carte and pure bundling.

[38] See http://www.consumersunion.org/pub/core_telecom_and_utilities/002902.html and an Ipsos poll of 1006 adults in December 2005 found that 78% of those would "prefer to be able to choose and pay for your own tailored selection of TV channels."

advertising and wholesale markets can generate large positive or negative effects on total welfare, consumer surplus, and firm profits. To the extent feasible, we address these issues by examining the robustness of our à la carte simulations to alternative assumptions about these long-run outcomes. Further research of their evolution in an equilibrium setting is necessary for accurate prediction of the welfare effects of à la carte regulations.

7.2 Counterfactual Simulations

Supporters have suggested various implementations of a la carte policies. These range from requiring firms which bundle to allow consumers to opt out of programming and receive a rebate[39] to separately priced themed tiers to offering separately priced individual channels. While we could implement any of these, for simplicity our simulation requires the channels to be separately priced and offered individually by all operators. Operators also charge (and compete on) a fixed fee that households must pay in order to purchase any individual channel.

We begin by specifying a set of assumptions, chosen for credibility or simplicity, for this baseline counterfactual. Under these assumptions, we examine the distributions of consumer surplus, industry profits, and total surplus under two equilibria: a single composite bundle and full (fixed-fee) à la carte. After presenting these baseline results, we explore the robustness of our conclusions to alternative assumptions.

7.2.1 Baseline Counterfactual Simulation

The main building block of our baseline counterfactual is the estimated demand system. We combine the demand system with an upstream cost structure, detailed in the next paragraph, and a pricing game. We compare the pricing game's equilibrium under bundling with its equilibrium under a la carte pricing regulations. The pricing game is characterized by the two satellite firms playing a simultaneous-move price setting game against a fictional nationwide cable firm with consumers simulated from the nationwide demographics distribution. We compute a Nash equilibrium solution.

For input costs of channels, we use the nationwide average cost per subscriber as reported in EBCN. While our estimated marginal costs of bundles are in line with outside estimates, when we project these bundle costs onto their components, the resulting estimates are either not credible or not precise in enough cases to discourage their use. Our baseline counterfactual assumes that input costs are the same for all cable operators, higher by fixed (1.2 and 1.25) proportions for the satellite firms, and invariant to the policy change.[40] Estimating more realistic cost structures is the subject

[39] Family and Consumer Choice Act of 2007.

[40] The last of these is an important assumption. We relax it in the following sub-section.

of ongoing research (Yurukoglu (2008)).

We assume all three firms offer identical products. We interpret the logit error as an idiosyncratic disturbance term on the set of channels that deliver the most net utility from each provider. For the first stage game, we calibrate the variance of this error and the level of the constant term to make predicted market shares and prices match their actual 2007 levels. We believe the calibration is appropriate because the estimated constant terms vary across firms, years, and other distributor characteristics and because the logit error captures product differentiation across markets. To incorporate installation costs we require consumers who would not purchase under bundling to pay an extra $5 monthly fee if they choose to purchase channels à la carte.

We further assume that preferences are invariant to the policy change. Similarly, we assume that channels do not alter their programming following the policy change, nor do new channels enter or existing channels exit. We assume the accounting and marketing costs of firms are the same when firms are allowed to bundle as when firms are forced to sell channels a la carte. Finally, we assume that the surplus generated by advertising changes only by an estimated change in revenues to channels. The robustness of our conclusions to each of these assumptions may be further explored.

Table 23 presents the results of our baseline counterfactual. We focus first on the left-most columns describing the bundling equilibrium. Equilibrium prices for a bundle of all 86 modeled cable channels vary from $29.68 to $36.11 in year 2000 dollars. The total distributor market share is 90.6%. Industry profits per household per month are an estimated $30.60, with distributors earning slightly less than channels on average. Mean consumer surplus is $33.76 per household per month, although it varies significantly across households, with some households garnering surplus of over $100/month. Total estimated welfare is $64.36 per household per month (roughly $81.1 billion/year on a national basis).

We turn next to predicted outcomes in an à la carte equilibrium. We report channel prices and market shares for a subset of our channels, as well as the average across all our analyzed channels.[41] We predict fixed fees of $15.77 for cable and $8.00-$8.50 for satellite. Marginal prices for channels are fairly low: most are under $1, with the most expensive being ESPN at $3.26. Predicted channel market shares are moderate, with an average share of 29.1%. As a consequence, subscribing households are predicted to purchase an average of 25.7 of the 86 channels.[42] Distributor profits are estimated to increase by 4.7% and channel profits to drop (considerably) by 54.6%, yielding a total

[41] We report full price and market share information for all our analyzed channels in an Internet Appendix. See `http://pages.stern.nyu.edu/~ayurukog/`.

[42] Recall we trade off the possibility of negative WTP for channels against fitting the industry average of 18 estimated channels. Weighting more one or the other of these constraints influences the estimated mean number of purchased channels (at the expense of the other constraint).

decrease of over one-third in industry profits.[43,44] Average consumer expenditure for subscribers is \$21.87, a reduction of 35.2%. Mean consumer surplus increases by 36.5%. Predicted total welfare increases by 4.6% to \$67.31 per household per month.

What is driving these results? Consistent with economic theory, bundling in multi-channel television markets appears to facilitate surplus extraction by firms; à la carte transfers some of this surplus back to consumers. In particular, households which were served under bundling pay lower prices (for slightly lower utility). The total welfare increase is due to households which did not subscribe to multichannel television under bundling being served under a la carte. This effect outweighs the welfare loss due to households losing access to positive, but low-valued, channels.

7.2.2 Robustness of Results to Alternative Assumptions

This section assesses the robustness of our findings to alternative assumptions about the economic environment in an à la carte equilibrium. While these modifications decrease the precision of our predictions, they allow greater confidence in our estimates when looked at in whole.[45] We have chosen the assumptions to modify by a combination of what industry participants and observers have cited as likely effects, what basic economic theory would predict would change, and how comfortable we felt with any calibrated parameters in the baseline counterfactual. Using these criteria, we changed subsets of parameter values from our baseline simulation to allow the effects of modified assumptions to generate conservative new welfare measures. The following list is not exhaustive. We are omitting the possible welfare effects of changes in advertising behavior, exclusive carriage agreements, distributor entry, changes in programming, any effects on cognitive ability from watching different amounts of television (Mander (1978) and Gentzkow and Shapiro (2007)), any accounting or other technological cost associated with implementing the regulations, and the effect of reduced channel surfing on households' preference formation.

Table 24 reports the effects of these changes in assumptions.

Allowing Input Costs to Change Our baseline counterfactual, in addition to assuming the same input cost per channel for all operators, assumes that the input cost per channels would not change following a la carte regulations. Economic theory and industry participants indicate that

[43] Note this baseline counterfactual assumes that input costs for channels do not respond to à la carte regulations. We explore the robustness of our conclusions to this assumption in the next sub-section.

[44] **Add in estimated advertising profits.**

[45] The choices we make in this section are motivated by "The Law of Decreasing Credibility" explained in depth in Manski (2003). While our choice of alternative assumptions is rather casual, they address the medium term reactions to policy change where the baseline counterfactual assumptions might fail to accurately predict the welfare effects of a la carte.

input costs are likely to adjust to such a policy change. Modeling the wholesale market explicitly (as in Rennhoff and Serfes (2005) or Yurukoglu (2008)) could deliver more credible predictions, but in this paper we simply change the values of some input costs to reflect probable changes. In one subcase, we double all input costs. In another subcase, we set all input costs to zero and stipulate that operators pay 50% of revenues from distribution to the corresponding channel.[46]

When input costs double, total welfare decreases by 7.1%. Consumer welfare is 13.3% higher than in the bundling equilibrium, much less than the 36.5% increase in the baseline counterfactual. Industry profits decrease by 24.6% (instead of 30.6%), suggesting that input costs are likely to increase under à la carte.[47]

When input costs are zero and firms share revenue, consumer welfare increases and profit decreases are amplified relative to the baseline counterfactual. An analysis of the welfare effects of channel exit remains to be completed.

The balance of this section remains to be written.

8 Conclusion

This paper has combined a model of the multichannel television industry with market and viewership data in order to evaluate the welfare effects of proposed a la carte pricing regulations. We began by extending a standard demand model to a setting of joint purchasing and viewership decisions. We then estimated the model using demand, pricing, and viewership data from the industry. We analyzed the model's estimates through comparison with previous estimates, industry wisdom, and the theory of multiproduct oligopoly. We used the estimated model to simulate an unrealized regulatory environment: a la carte pricing regulations. We compared the distributions of consumer and producer surplus under a simulated a la carte setting with those under bundling. We predict that in the short run, welfare will increase for many consumers under à la carte regulations, while industry profits will decrease, substantially for channels. Finally, we mechanically relaxed assumptions about the input market for the counterfactual simulation in order to gain a less precise but more robust set of predictions for the welfare effects of bundling in this industry. We found that the consumer benefits from à la carte would be tempered by increasing input costs. More detailed analysis of the long run effects of a la carte regulations remains an area for further research.

[46] This corresponds to our understanding of contract terms between channels and distributors for those few channels that allow distributors to offer them à la carte.

[47] In future revisions, we will calculate the increase in costs (to distributors) that maximizes *network* profits and calculate the welfare effects in this environment.

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A Data Quality Appendix

Warren Factbook Data The Factbook data suffers from two weaknesses: persistent non-updating of entries and incomplete observations. When comparing yearly entries on an individual cable system in the Factbook, it is common to see that data does not change between two (and sometimes several) years. Given industry subscriber churn rates, channel introduction during the relevant time periods, and pricing behavior, we are certain that a lack of updating is the cause. Another common occurrence when analyzing the Factbook is that a cable system will have a bundle on offer, but no price and/or quantity is listed. Similarly, some observations are missing the number of homes the cable system passes. We try to estimate this figure when possible using census data on number of households. Sometimes this estimation is obviously unsuccessful, producing market shares well over one, for example. A third dimension of incomplete data in the Factbook deals with geographical market definition. In a few geographical markets, particularly dense metropolitan areas, there is more than one cable system. However, the Factbook does not specify on what portions of the market the cable systems overlap. We drop any observation for which there is a common community served with a distinct cable system, or if Factbook designates the system an overbuild. We present statistics on the extent of these two data quality issues below in Table 25. As can be seen there, the share of observations in a given year that are full and complete varies from 2% (in 2005) to 41% (in 1997).

While we worry in general about the quality of the Factbook data and its suitability for extrapolation to cable systems as a whole, we don't think it poses a serious econometric issue. In particular, we don't think unobservable characteristics of cable systems that impact whether an entry in the Factbook is up-to-date are likely to be correlated with the demand they face and/or their pricing behavior.

Satellite Data As noted in the text, we only observe market shares for the aggregate of bundles offered by both satellite providers at the DMA level. To accommodate this data limitation, we make the following two assumptions in our modeling approach. First, we assume the only satellite bundle in the DMA is the DirecTV total choice bundle (the most popular satellite bundle offered by either provider). Second, within a DMA, we assume the unobservable quality measure of this bundle does not vary across systems.

Ratings Data Nielsen is the dominant provider of television ratings. It has a large staff dedicated to data quality, statistical integrity, and metering technology. Our data comes from Set Meters which measure electronically to what channel the television is tuned throughout the day. This data is then linked with which programs aired on the relevant channels. We therefore have considerable confidence in the quality of the ratings data.[48]

[48] That being said, it is not without its critics. Nielsen data has been criticized both for not accurately capturing the whole television universe, for example out-of-home viewing, and for sample sizes too small to accurately measure the viewing of niche programming.

A Replicability Appendix

Model estimation and counterfactual simulation for this paper required combining data from several sources and a moderately sized computer program. At various points in executing the project, we were faced with more than one reasonable option when deciding whether to make a certain assumption. While in some cases we tested the sensitivity of our results to the assumptions made, we feel it is important to detail the procedures we used so that other researchers can examine and extend our model. This appendix and the computer program's code posted online should make our procedure transparent and replicable for other researchers. Unfortunately for replication's sake, much of the data we used is proprietary and must be purchased. We provide information on obtaining the data below.

It is convenient to separate the procedure we use to obtain the results in this paper into three sections: data export, model estimation, and counterfactual simulation. The data exporting involves taking raw data from various sources and transforming them by cleaning out data that is suspicious (not updated, market shares greater than one, and so on), and reshaping into a convenient and consistent format for model estimation. We did this part using Stata 9.0, and the code is available at our web sites. Model estimation recomputes the analytical model in the paper at different parameter values until the predictions the model makes are close to the what is observed in the data. Counterfactual simulation takes the results from data export and model estimation and computes the equilibrium to an altered version of our model where firms are forced to offer each channel on an individual basis, but all preferences and costs remain invariant to this alteration. We used Matlab for model estimation and counterfactual simulation. The Matlab code is available at our web sites.

A.1 Data Export

As detailed in the paper, the majority of the data comes from the Factbook or Nielsen. We assembled the Factbook data set by combining data from different annual editions of the Factbook, standardizing variable names and creating new variables, then dropping data which was incomplete or not updated. Many of these changes were simply renaming variables or standardizing company names in different years [49] The more substantive data treatment involved combining tiers of programming. The Factbook raw data would, for a single system, list a set of tiers, the channels associated with each tier, a number of subscribers, and a price. An example is in the table below:

The tiers are inclusive in that the basic programming is included in the expanded basic tier, although it is not listed that way in Factbook. The Factbook is not clear about whether the quantity and

[49] One example of many: Fox Family Channel was sold to ABC Disney and become ABC Family Channel.

prices are inclusive in the same manner. Indeed, it seems in some cases they are and in some cases they are not. Our data treatment is to assume that the prices add together as the tiers get broader, and that subscribers numbers are total subscribers for the tier in question. Since subscribers of expanded basic are subscribers of basic, we can subtract from the number of basic subscribers the number of expanded basic subscribers to get the number of basic only subscribers. This procedure is coded in main.do.

The file export_data.do takes the data produced by main.do, and drops system-year observations which were identical to the previous year's observations or did not contain all price and quantity data for a system. We then dropped DMA's whose cable market share for the systems we kept added to the satellite market share as reported by Nielsen was greater than one. Finally, we merged this data with demographic data from the census which was matched with the communities served variables of the system's Factbook observation.

The following tables details the csv files exported from Stata.

A.2 Model Estimation

The main substantive choices in model estimation involve the weighting matrix and the effect of simulation error on implied marginal costs. Choice of time units in Cobb Douglas... shape assumption on marginal distributions.

A.3 Counterfactual Simulation

Logit variance, constant terms, installation fee...

Figure 2: Television Programming Industry

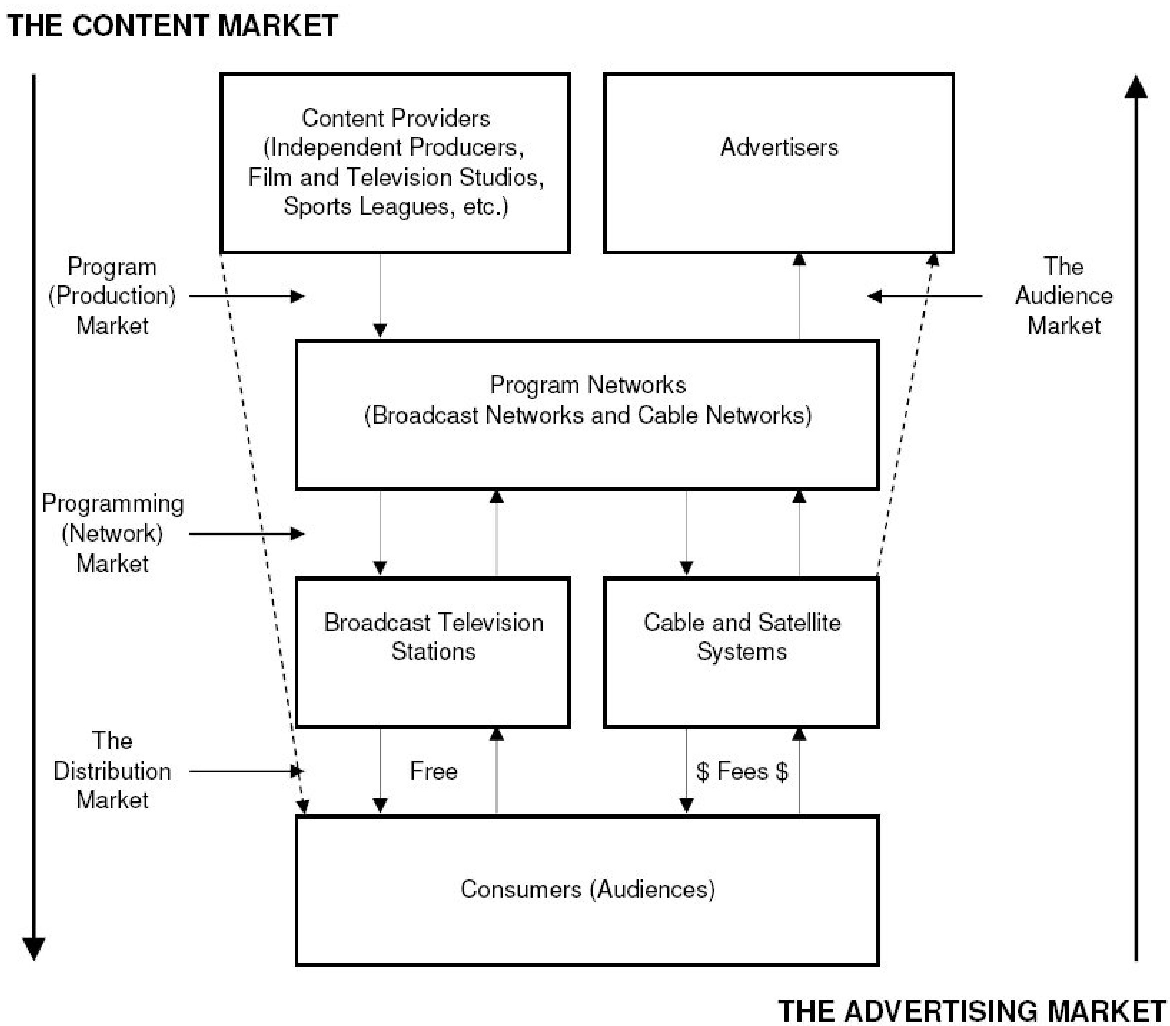

Figure 3: Estimated WTP for a Subset of Channels, Page 1

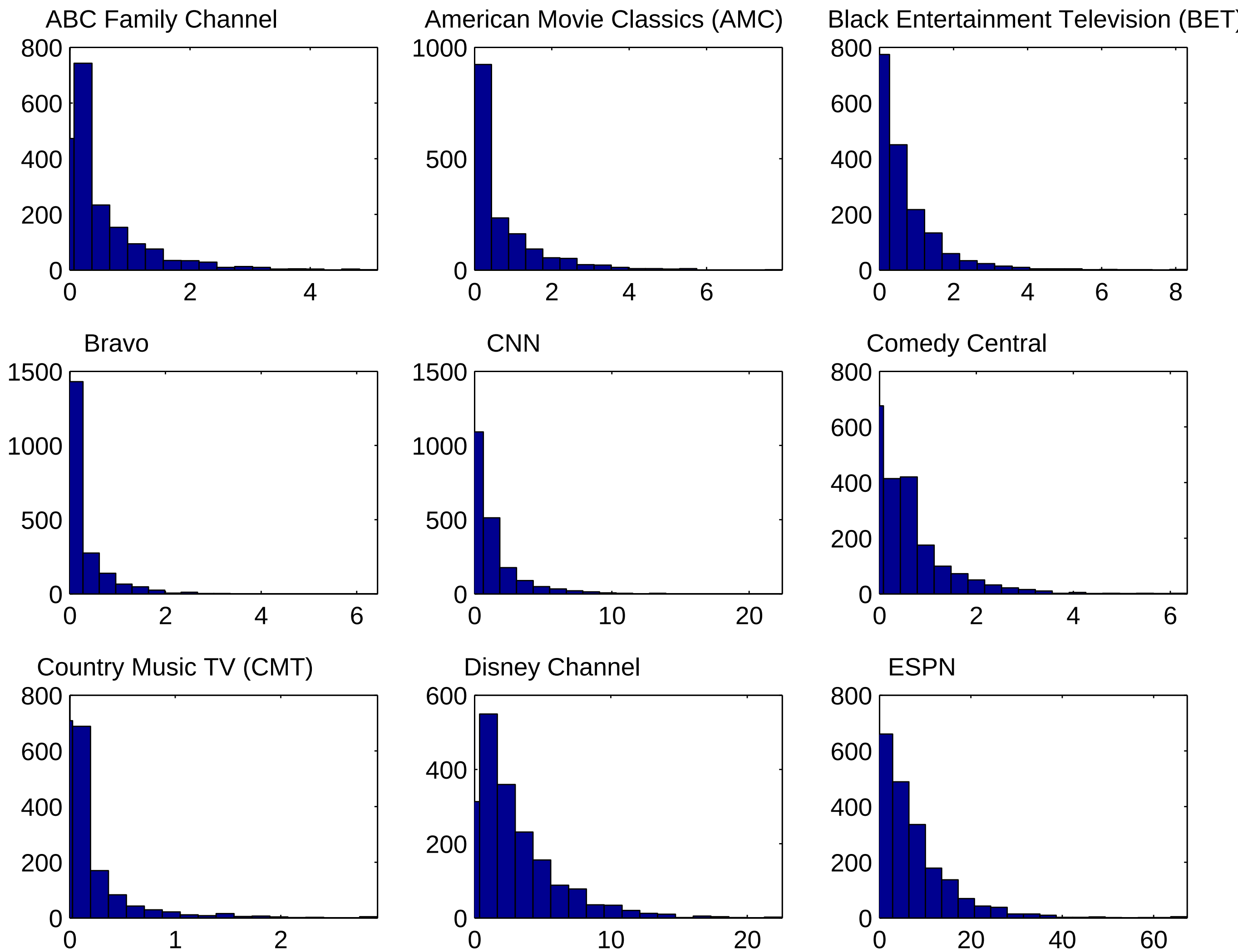

Figure 4: Estimated WTP for a Subset of Channels, Page 2

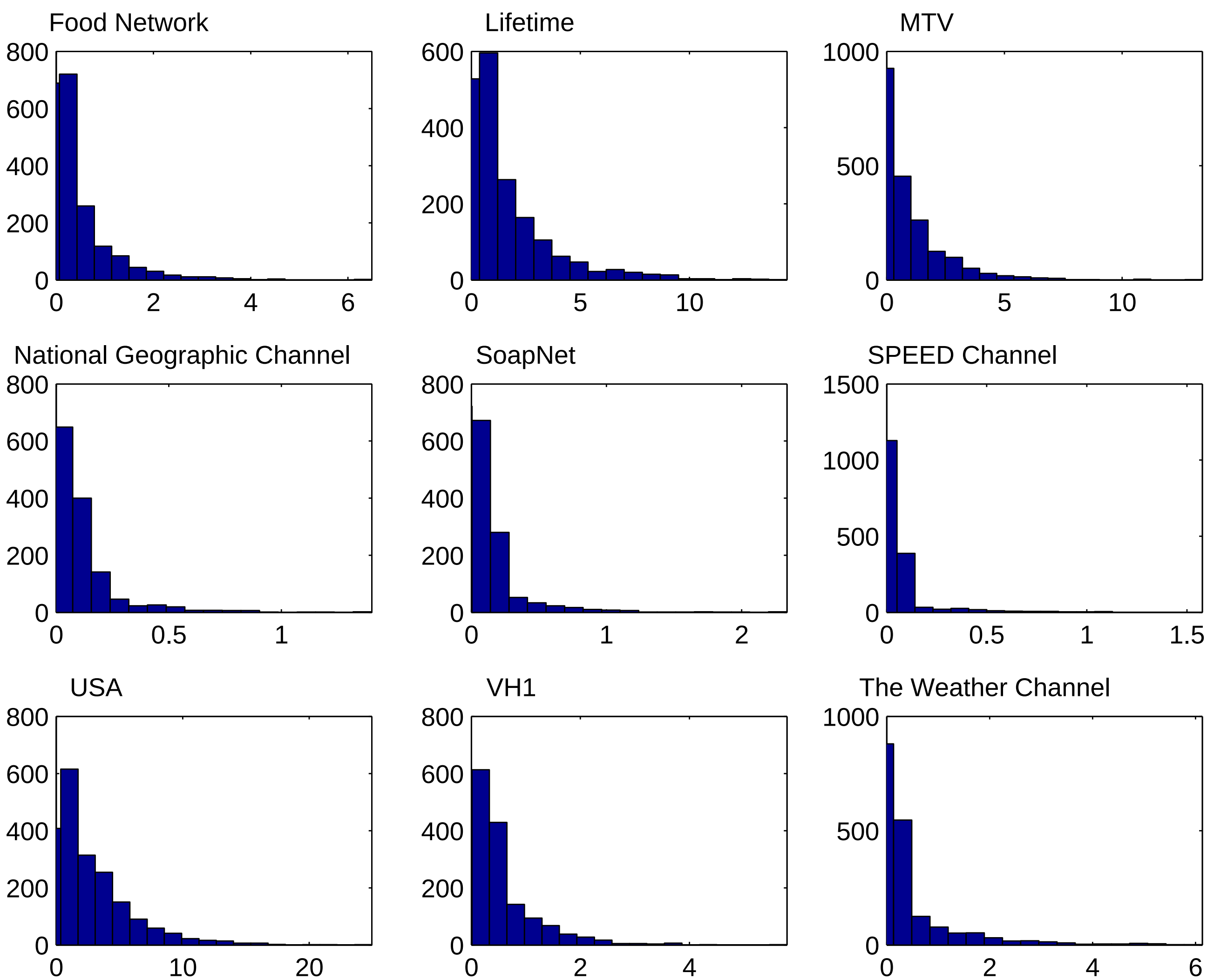

Figure 5: Box and Whisker Plot of Estimated Willingness to Pay for a Subset of Channels

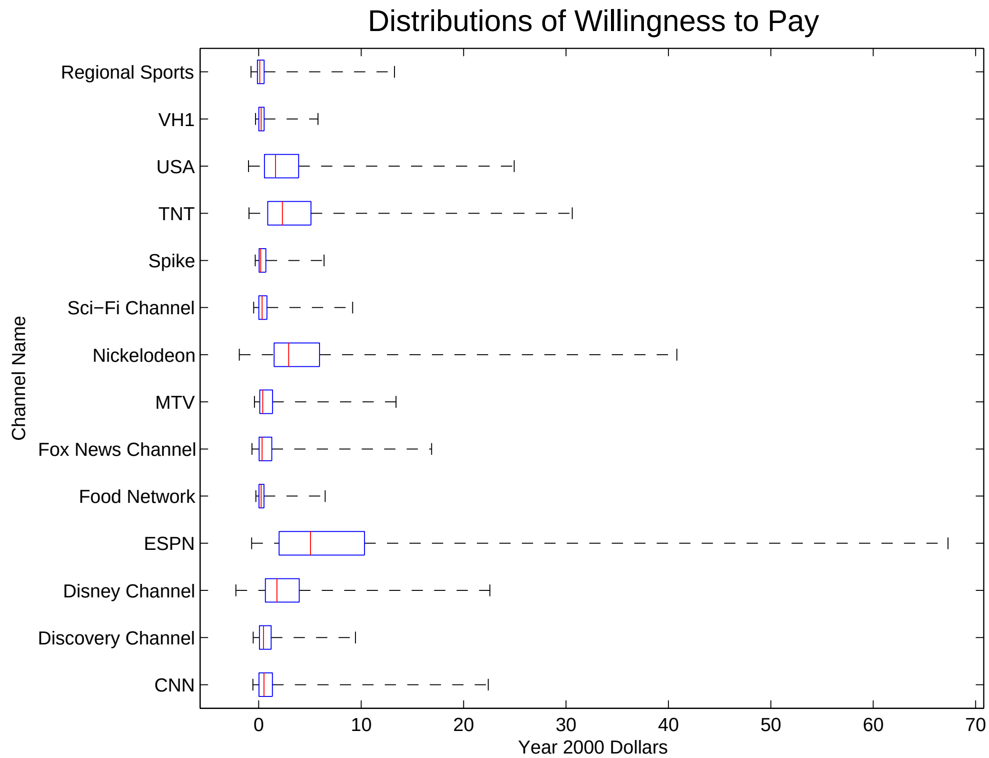

Figure 6: Scatterplot of WTP For ESPN and ESPN2

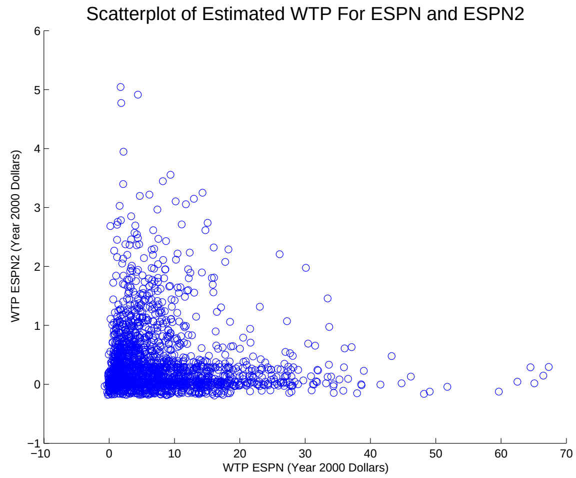

Figure 7: Scatterplot of WTP For Disney Channel and Nickelodeon

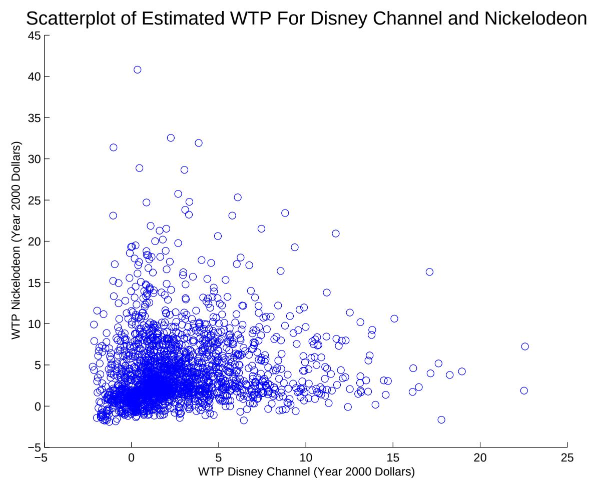

Figure 8: Estimated Distributions of Willingness to Pay for BET

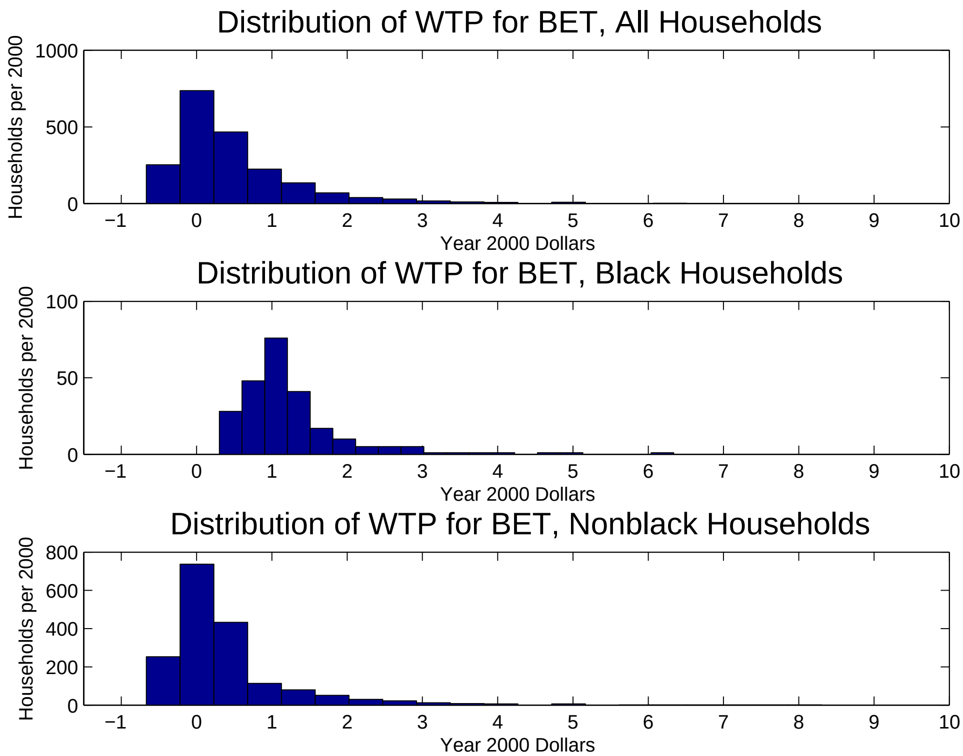

Table 1: Sample Statistics, Bundle Purchase Data

Variable	Nobs	Mean	SDev	Min	Max
Market Types					
Basic Only	20,117	0.601	0.49	0.00	1.00
Basic + Exp. Basic	20,117	0.319	0.47	0.00	1.00
Basic + Dig. Basic	20,117	0.034	0.18	0.00	1.00
Basic + Exp. Basic + Dig. Basic	20,117	0.045	0.21	0.00	1.00
All Markets					
Price	20,117	$23.75	$9.27	$1.82	$117.13
Market Share	20,117	0.461	0.259	0.010	0.990
Total Cable Channels	20,117	20.0	15.6	0.0	176.0
Basic Only Markets					
Basic Service					
Price	12,105	$24.14	$6.07	$1.94	$80.47
Market Share	12,105	0.551	0.209	0.010	0.990
Total Cable Channels	12,105	17.4	9.3	0.0	95.0
Basic + Exp. Basic Markets					
Basic Service					
Price	3,188	$13.22	$5.34	$1.82	$47.84
Market Share	3,188	0.123	0.158	0.010	0.889
Total Cable Channels	3,188	8.1	6.9	0.0	49.0
Exp. Basic Service					
Price	3,188	$27.23	$7.23	$4.98	$71.73
Market Share	3,188	0.559	0.193	0.010	0.969
Total Cable Channels	3,188	26.9	9.8	3.0	84.0
Basic + Dig. Basic Markets					
Basic Service					
Price	334	$29.32	$8.58	$3.19	$50.34
Market Share	334	0.517	0.183	0.029	0.924
Total Cable Channels	334	41.4	13.2	2.0	66.0
Dig. Basic Service					
Price	334	$45.97	$14.63	$8.29	$113.10
Market Share	334	0.120	0.081	0.010	0.705
Total Cable Channels	334	70.0	16.5	33.0	124.0
Basic + Exp. Basic + Dig. Basic Markets					
Basic Service					
Price	300	$13.37	$5.54	$5.18	$38.75
Market Share	300	0.220	0.119	0.011	0.625
Total Cable Channels	300	7.6	5.5	1.0	35.0
Exp. Basic Service					
Price	300	$36.24	$8.74	$13.35	$71.73
Market Share	300	0.367	0.145	0.013	0.799
Total Cable Channels	300	47.0	10.8	19.0	89.0
Dig. Basic Service					
Price	300	$48.33	$13.74	$18.63	$117.13
Market Share	300	0.124	0.077	0.010	0.474
Total Cable Channels	300	81.2	20.5	39.0	176.0

Table 2: Sample Statistics, Cable Networks 1-30

Network	**Any Tier**	**Basic**	**Expanded Basic**	**Digital Basic**	**Average Rating**	**Average Cume**
ESPN	0.97	0.77	0.19	0.00	0.91	22.2
Discovery Channel	0.86	0.72	0.14	0.00	0.62	18.6
TBS	0.97	0.92	0.05	0.00	1.09	24.0
TNT	0.82	0.64	0.18	0.00	1.33	27.2
USA	0.87	0.67	0.19	0.00	1.17	27.2
Nickelodeon	0.68	0.53	0.15	0.00	1.83	0.0
CNN	0.94	0.78	0.16	0.00	0.75	13.6
Lifetime	0.56	0.42	0.14	0.00	0.90	16.7
Spike	0.86	0.70	0.16	0.00	0.52	17.7
The Weather Channel	0.52	0.41	0.11	0.00	0.30	8.4
HGTV	0.21	0.13	0.07	0.01	0.55	14.0
VH1	0.33	0.23	0.10	0.00	0.36	14.0
TLC (The Learning Channel)	0.40	0.30	0.10	0.00	0.54	15.1
ESPN 2	0.30	0.20	0.09	0.01	0.29	12.3
Cartoon Network	0.24	0.16	0.08	0.00	1.57	10.0
History Channel	0.26	0.18	0.08	0.01	0.55	16.7
ABC Family Channel	0.91	0.76	0.14	0.00	0.42	15.8
CNBC	0.29	0.20	0.10	0.00	0.20	3.9
Animal Planet	0.18	0.12	0.06	0.00	0.34	11.8
Food Network	0.08	0.05	0.04	0.00	0.41	12.9
Fox News Channel	0.15	0.10	0.05	0.00	0.76	12.8
American Movie Classics (AMC)	0.48	0.32	0.17	0.00	0.52	17.0
Arts & Entertainment (A&E)	0.64	0.49	0.15	0.00	0.70	18.7
Comedy Central	0.18	0.11	0.07	0.00	0.49	18.3
Disney Channel	0.38	0.30	0.08	0.00	1.19	16.9
TV Land	0.19	0.15	0.04	0.00	0.47	10.8
FX	0.15	0.10	0.06	0.00	0.53	19.7
MTV	0.43	0.29	0.13	0.00	0.70	17.3
E! Entertainment Television	0.17	0.11	0.06	0.00	0.29	13.0
Sci-Fi Channel	0.24	0.16	0.08	0.01	0.53	14.7
Top30	14.27	11.00	3.23	0.04		

Notes: Reported are the proportion of sample systems carrying each network on Basic Service, Expanded Basic Service, or Digital Basic Service and the corresponding average number of networks offered. 1st column reports carriage on *any* offered service (Any Tier). Remaining columns disaggregate carriage by tier.

Table 3: Sample Statistics, Cable Networks 31-60

Network	**Any Tier**	**Basic**	**Expanded Basic**	**Digital Basic**	**Average Rating**	**Average Cume**
Court TV	0.11	0.05	0.06	0.00	0.45	12.4
MSNBC	0.09	0.05	0.04	0.00	0.30	8.7
Bravo	0.08	0.03	0.03	0.01	0.25	12.7
Black Entertainment Television (BET)	0.16	0.10	0.05	0.00	0.43	9.0
Travel Channel	0.13	0.08	0.04	0.00	0.19	10.4
Country Music TV (CMT)	0.47	0.38	0.09	0.00	0.19	8.9
TV Guide Channel	0.13	0.11	0.02	0.00	0.19	9.7
Golf Channel	0.05	0.02	0.02	0.02	0.06	3.0
Turner Classic Movies	0.20	0.15	0.03	0.02	0.23	0.0
SPEED Channel	0.07	0.03	0.02	0.02	0.12	5.8
Hallmark Channel	0.05	0.03	0.01	0.00	0.38	12.0
Versus	0.05	0.01	0.01	0.02	0.08	3.8
Discovery Health Channel	0.01	0.01	0.00	0.00	0.10	0.0
ESPN Classic Sports	0.04	0.01	0.01	0.02	0.05	4.8
Game Show network	0.04	0.01	0.01	0.03	0.17	6.0
MTV2	0.01	0.00	0.00	0.00	0.07	5.7
Oxygen	0.01	0.00	0.01	0.00	0.12	8.1
WE: Womens Entertainment	0.03	0.01	0.01	0.02	0.09	7.5
National Geographic Channel	0.03	0.01	0.00	0.02	0.10	9.9
G4	0.04	0.01	0.00	0.03	0.05	3.4
SoapNet	0.02	0.00	0.00	0.01	0.11	5.4
Toon Disney	0.05	0.02	0.01	0.02	0.16	4.6
Noggin / The N	0.03	0.00	0.00	0.03	0.09	3.7
Lifetime Movie Network	0.02	0.00	0.00	0.02	0.23	8.2
BBC America	0.03	0.00	0.00	0.03	0.05	3.1
ESPNews	0.04	0.01	0.00	0.02	0.04	0.0
Style Network	0.02	0.00	0.00	0.01	0.05	4.9
FitTV	0.02	0.01	0.01	0.01	0.02	0.9
Fuse	0.03	0.01	0.00	0.02	0.02	1.5
Great American Country	0.06	0.04	0.01	0.01	0.05	3.2
Top60	16.39	12.20	3.75	0.43		

Notes: Reported are the proportion of sample systems carrying each network on Basic Service, Expanded Basic Service, or Digital Basic Service and the corresponding average number of networks offered. 1st column reports carriage on *any* offered service (Any Tier). Remaining columns disaggregate carriage by tier.

Table 4: Sample Statistics, Cable Networks 61+

Network	**Any Tier**	**Basic**	**Expanded Basic**	**Digital Basic**	**Average Rating**	**Average Cume**
Military Channel	0.04	0.00	0.00	0.04	0.05	3.7
Do-It-Yourself	0.01	0.00	0.00	0.01	0.03	0.0
GalaVision	0.03	0.02	0.01	0.00	0.08	0.0
Independent Film Channel (IFC)	0.03	0.00	0.00	0.03	0.02	0.0
The Science Channel	0.04	0.00	0.00	0.04	0.05	5.2
NickToons TV	0.02	0.00	0.00	0.02	0.07	4.3
Discovery Home Channel	0.04	0.00	0.00	0.04	0.00	0.0
Discovery Times	0.00	0.00	0.00	0.00	0.03	3.5
History Channel International	0.03	0.00	0.00	0.03	0.04	4.1
Games and Sports (GAS)	0.02	0.00	0.00	0.02	0.02	0.0
Biography	0.03	0.00	0.00	0.03	0.06	5.2
NFL Network	0.00	0.00	0.00	0.00	0.05	0.0
Fine Living	0.00	0.00	0.00	0.00	0.01	0.0
Fox Soccer Channel	0.03	0.00	0.00	0.03	0.00	0.0
Fox Movie Channel	0.03	0.01	0.00	0.02	0.00	0.0
Outdoor Channel	0.08	0.06	0.01	0.02	0.00	0.0
Fuel	0.00	0.00	0.00	0.00	0.00	0.0
Sundance Channel	0.01	0.00	0.00	0.01	0.00	0.0
Black Family Channel	0.00	0.00	0.00	0.00	0.00	0.0
BET Jazz	0.02	0.00	0.00	0.01	0.00	0.0
Ovation	0.01	0.00	0.00	0.01	0.00	0.0
Si TV	0.03	0.03	0.00	0.00	0.00	0.0
Hallmark Movie Channel	0.00	0.00	0.00	0.00	0.00	0.0
TopNets	16.89	12.32	3.78	0.78		
Regional Sports	0.39	0.24	0.12	0.02		
Cable Audio	0.04	0.00	0.00	0.03		
Religious Channels	0.53	0.40	0.11	0.05		
Other Channels	2.71	2.15	0.63	0.32		
All Nets	20.55	15.12	4.65	1.20		

Notes: Reported are the proportion of sample systems carrying each network on Basic Service, Expanded Basic Service, or Digital Basic Service and the corresponding average number of networks offered. 1st column reports carriage on *any* offered service (Any Tier). Remaining columns disaggregate carriage by tier.

Table 5: Real Price and Total Channels of DirecTV Total Choice Bundle by Year

DirecTV Total Choice Bundle		
Year	*Real Price*	*Channels*
1997	32.18	37
1998	31.68	37
1999	31.00	37
2000	29.99	37
2001	31.10	80
2002	30.62	85
2003	31.81	87
2004	36.45	86
2005	35.26	86
2006	35.87	109
2007	40.14	95

Year	*Variable*	*N*	*Mean*	*Std. Dev.*	*Min*	*Max*
1998	Subscribers (Millions)	84	28.65	27.40	0.3	74.9
	Average License Fee ($)	83	0.12	0.22	0	1.7
	Net Advertising Revenue (Millions of $)	84	72.70	137.64	0	655.1
	Total Expenses (Millions of $)	83	89.94	128.36	0.2	596.6
1999	Subscribers (Millions)	91	29.97	28.57	0.1	77.6
	Average License Fee ($)	91	0.11	0.19	0	1.2
	Net Advertising Revenue (Millions of $)	91	82.44	156.03	0	776.3
	Total Expenses (Millions of $)	90	98.39	138.48	0.3	644.2
2000	Subscribers (Millions)	100	31.18	29.33	0	80
	Average License Fee ($)	100	0.11	0.18	0	1.14
	Net Advertising Revenue (Millions of $)	100	89.09	165.71	0	825
	Total Expenses (Millions of $)	99	103.15	151.76	0.3	786.2
2001	Subscribers (Millions)	103	36.13	30.66	0	84.2
	Average License Fee ($)	103	0.12	0.18	0	1.3
	Net Advertising Revenue (Millions of $)	103	84.98	155.27	0	709.5
	Total Expenses (Millions of $)	102	110.13	160.57	0.4	882.5
2002	Subscribers (Millions)	109	39.84	31.72	0	87.6
	Average License Fee ($)	109	0.12	0.20	0	1.6
	Net Advertising Revenue (Millions of $)	109	83.47	149.95	0	681.1
	Total Expenses (Millions of $)	108	115.09	169.95	0.5	914.8
2003	Subscribers (Millions)	114	42.19	31.87	0	88.1
	Average License Fee ($)	114	0.13	0.23	0	1.93
	Net Advertising Revenue (Millions of $)	114	91.37	160.41	0	725.4
	Total Expenses (Millions of $)	112	113.69	160.47	0.9	932.2
2004	Subscribers (Millions)	123	42.71	32.23	0	89
	Average License Fee ($)	123	0.14	0.25	0	2.28
	Net Advertising Revenue (Millions of $)	123	94.72	169.32	0	798.7
	Total Expenses (Millions of $)	120	108.44	145.13	0.2	789.5
2005	Subscribers (Millions)	136	42.37	32.83	0	90.9
	Average License Fee ($)	136	0.14	0.27	0	2.6
	Net Advertising Revenue (Millions of $)	136	97.33	176.02	0	880.4
	Total Expenses (Millions of $)	133	109.54	148.30	3	831.3
2006	Subscribers (Millions)	137	46.21	32.63	0.2	94.1
	Average License Fee ($)	137	0.15	0.30	0	2.91
	Net Advertising Revenue (Millions of $)	136	103.75	178.03	0	925.1
	Total Expenses (Millions of $)	134	119.71	158.45	4.1	881.8

Table 6: Summary Statistics from EBCN

Table 7: Sample Statistics, Ratings Data, Selected Networks

Network	Nobs	Mean	SDev	Min	Max
ABC Family	1,482	0.42	0.13	0.05	0.94
AMC	1,482	0.52	0.16	0.12	1.31
BET	1,477	0.43	0.32	0.01	2.38
Bravo	1,472	0.25	0.16	0.01	0.86
CNN	1,481	0.75	0.32	0.21	2.82
Comedy	1,482	0.49	0.18	0.09	1.41
CMT	1,467	0.19	0.13	0.01	0.90
Disney	1,482	1.19	0.42	0.13	2.99
ESPN	1,482	0.91	0.45	0.17	3.68
Food	1,481	0.41	0.20	0.01	1.12
Lifetime	1,563	0.90	0.37	0.01	2.19
MTV	1,482	0.70	0.23	0.10	1.79
Natl. Geog.	1,109	0.10	0.08	0.00	0.53
SoapNet	1,210	0.11	0.11	0.00	0.70
SPEED	1,037	0.12	0.09	0.00	0.62
USA	1,481	1.17	0.36	0.17	2.57
VH1	1,480	0.36	0.13	0.03	0.96
Weather	1,478	0.30	0.21	0.01	2.69

Table 8: Sample Statistics, Other Estimation Data

Variable	NObs	Mean	SDev	Min	Max
First-Stage Estimation Covariates					
Channel Dummies	See Tables 2-4				
Demographics					
Urban	56	0.61	0.22	0.14	0.99
Family	56	0.68	0.03	0.59	0.77
Household Income	56	$0.48	$0.07	$0.38	$0.75
Black	56	0.10	0.09	0.00	0.34
Hispanic	56	0.12	0.11	0.02	0.54
Asian	56	0.02	0.03	0.00	0.19
College Degree or Greater	56	0.18	0.06	0.09	0.36
Age	56	0.37	0.02	0.33	0.42
Approximation Error Covariates					
TBD					
TBD					
Second-Stage Estimation Covariates					
Channel Dummies	See Tables 2-4				
Approximation Error Covariates					
Log(1 + Sum of Channels)	20,117	2.39	0.95	0.00	4.33
Log(1 + Sum of Ratings)	20,117	-0.07	0.06	-0.41	0.00
Instruments					
Within-DMA Price of Other Systems	20,117	$23.75	$2.60	$7.12	$44.04
MSO Dummies	See Table 10				
Year Dummies	See Table 10				

Table 9: Correlation in the Ratings Data

Network	Cartoon Network	A&E	Turner Classic Movies	Discovery Channel	ESPN	ESPN2	ESPN Classic	ESPN News
Cartoon Network	1							
A&E	-0.14	1						
TCM	-0.29	0.09	1					
Discovery	0.18	0.28	-0.33	1				
ESPN	0.14	0.01	0.07	-0.08	1			
ESPN2	0.11	0.16	0.10	0.08	0.54	1		
ESPN Classic	0.30	-0.10	0.16	-0.17	0.16	0.15	1	
ESPNews	0.35	-0.16	0.06	-0.09	0.26	0.20	0.39	1

Notes:

Table 10: Sample Statistics, MSO and Year Dummies

MSOs	NObs	Share	Years	NObs	Share
AT&T Broadband	360	1.79	1997	4,516	22.45
Adelphia	320	1.59	1998	2,585	12.85
Bright House	24	0.12	1999	2,833	14.08
Buford	480	2.39	2000	1,986	9.87
Cable One	275	1.37	2001	1,726	8.58
Cablevision	230	1.14	2002	1,006	5.00
Century Communications	61	0.30	2003	1,526	7.59
Charter Communications	816	4.06	2004	1,994	9.91
Classic/Cequel/Suddenlink	852	4.24	2005	187	0.93
Comcast	804	4.00	2006	1,412	7.02
Cox	210	1.04	2007	346	1.72
Douglas Communications	29	0.14			
Falcon	84	0.42			
Fanch	103	0.51			
Galaxy	750	3.73			
Insight	28	0.14			
Intermedia Partners	107	0.53			
Jones Cable	50	0.25			
Mediacom	942	4.68			
Mediaone	134	0.67			
Midcontinent Cable	447	2.22			
Northland Communications	77	0.38			
Other	10,078	50.10			
Regional Cable	195	0.97			
TCI	1,518	7.55			
Tele-media Corp	85	0.42			
Time Warner Cable	539	2.68			
Triax Telecommunications	519	2.58			
Total	20,049	100.00	Total	20,117	100.00

Table 11: Parameter Estimates

	Demand Estimate (StdErr)	Cost Estimate (StdErr)	Exponential Estimate (StdErr)	Share Positive	Mean	Mean Among Positive
Price Estimate						
Price	**-0.13**	—–	—–			
	(0.01)					
log(# of channels)	**-0.54**	—–	—–			
	(0.04)					
log(1+sum ratings)	-0.05	—–	—–			
	(0.43)					
log(# of channels) x log(1+sum ratings)	**-0.30**	—–	—–			
	(0.13)					
Network Estimates						
ABC Family Channel	—–	-1.14	**0.006**	0.787	$0.44	$0.60
		(16.88)	(0.001)			
American Movie Classics (AMC)	—–	1.58	**0.005**	0.801	$0.55	$0.72
		(16.17)	(0.000)			
Animal Planet	—–	2.64	**0.008**	0.752	$0.23	$0.33
		(17.98)	(0.001)			
Arts & Entertainment (A&E)	—–	-0.35	**0.008**	0.843	$0.84	$1.04
		(115.61)	(0.001)			
BBC America	—–	-7.23	**0.023**	0.656	$0.01	$0.02
		(164.81)	(0.001)			
Black Entertainment Television (BET)	—–	1.73	**0.018**	0.686	$0.48	$0.80
		(68.33)	(0.003)			
BET Jazz	**-1.85**	6.48	—–	—–	—–	—–
	(0.26)	(68.18)				
Biography	—–	-2.96	**0.013**	0.917	$0.02	$0.02
		(766.93)	(0.000)			
Black Family Channel	**1.62**	5.71	—–	—–	—–	—–
	(0.40)	(140.32)				
Bravo	—–	-0.61	**0.013**	0.792	$0.29	$0.37
		(152.87)	(0.001)			
CNBC	—–	-0.82	**0.011**	0.764	$0.17	$0.23
		(107.31)	(0.000)			
CNN	—–	-0.40	**0.022**	0.777	$1.11	$1.48
		(170.15)	(0.003)			
Cartoon Network	—–	0.21	**0.098**	0.798	$2.75	$3.60
		(38.76)	(0.005)			
Comedy Central	—–	0.14	**0.006**	0.806	$0.57	$0.72
		(236.28)	(0.000)			
Country Music TV (CMT)	—–	1.42	**0.015**	0.605	$0.11	$0.25
		(42.81)	(0.001)			
Court TV	—–	1.02	**0.010**	0.676	$0.38	$0.66
		(54.48)	(0.001)			
Discovery Channel	—–	-0.49	**0.006**	0.798	$0.85	$1.11
		(168.54)	(0.001)			
Discovery Health Channel	—–	-0.64	**0.020**	0.611	$0.04	$0.09
		(124.74)	(0.001)			
Discovery Home Channel	-0.57	-23.05	—–	—–	—–	—–
	(0.80)	(224.97)				
Discovery Times	—–	23.82	**0.020**	1.000	$0.00	$0.00
		(48.77)	(0.001)			
Disney Channel	—–	1.61	**0.037**	0.854	$2.63	$3.22
		(14.63)	(0.003)			
Do-It-Yourself	—–	-4.65	**0.011**	0.983	$0.00	$0.00
		(328.50)	(0.000)			
E! Entertainment Television	—–	-0.11	**0.008**	0.823	$0.24	$0.31
		(88.56)	(0.000)			
ESPN	—–	7.86	**0.042**	0.988	$7.54	$7.64
		(86.88)	(0.005)			
ESPN 2	—–	-0.20	**0.010**	0.794	$0.37	$0.48
		(108.42)	(0.000)			
ESPN Classic Sports	—–	0.10	**0.020**	0.724	$0.01	$0.02
		(28.93)	(0.001)			
ESPNews	—–	1.56	**0.024**	0.640	$0.01	$0.01
		(138.81)	(0.001)			

Notes:

Table 12: Parameter Estimates

	Demand Estimate (StdErr)	Cost Estimate (StdErr)	Exponential Estimate (StdErr)	Share Positive	Mean	Mean Among Positive
Network Estimates, cont.						
FX	——	0.61	**0.009**	0.798	$0.78	$1.02
		(81.81)	(0.001)			
Fine Living	——	7.73	**0.009**	0.992	$0.00	$0.00
		(268.44)	(0.001)			
FitTV	——	0.99	**0.022**	0.993	$0.00	$0.00
		(47.65)	(0.001)			
Food Network	——	-1.57	**0.010**	0.803	$0.42	$0.54
		(187.72)	(0.001)			
Fox Movie Channel	**0.39**	-2.73	——	——	——	——
	(0.17)	(60.65)				
Fox News Channel	——	2.41	**0.024**	0.785	$1.02	$1.34
		(22.93)	(0.002)			
Fox Soccer Channel	**-0.96**	3.31	——	——	——	——
	(0.27)	(197.30)				
Fuel	**5.71**	3.16	——	——	——	——
	(0.84)	(103.24)				
Fuse	——	-2.95	**0.025**	0.538	$0.00	$0.01
		(103.99)	(0.001)			
G4	——	1.52	**0.023**	0.597	$0.00	$0.02
		(95.00)	(0.001)			
Game Show network	——	1.76	**0.018**	0.598	$0.13	$0.33
		(50.98)	(0.001)			
GalaVision	——	-0.30	**0.030**	0.604	$0.02	$0.06
		(127.42)	(0.001)			
Golf Channel	——	-2.57	**0.017**	0.695	$0.02	$0.03
		(154.19)	(0.001)			
Great American Country	——	-0.38	**0.022**	0.631	$0.00	$0.02
		(132.63)	(0.001)			
HGTV	——	1.56	**0.007**	0.824	$0.47	$0.59
		(64.27)	(0.001)			
Hallmark Channel	——	0.21	**0.018**	0.720	$0.48	$0.73
		(140.91)	(0.001)			
Hallmark Movie Channel	**2.26**	11.62	——	——	——	——
	(0.48)	(119.78)				
History Channel	——	-0.07	**0.005**	0.812	$0.65	$0.83
		(85.42)	(0.000)			
History Channel International	——	2.81	**0.012**	0.645	$0.00	$0.01
		(880.66)	(0.000)			
Independent Film Channel (IFC)	——	-1.71	**0.024**	0.926	$0.00	$0.00
		(168.93)	(0.001)			
Lifetime	——	-0.09	**0.021**	0.829	$1.42	$1.79
		(21.11)	(0.001)			
Lifetime Movie Network	——	5.96	**0.019**	0.663	$0.42	$0.74
		(175.97)	(0.001)			
MSNBC	——	0.85	**0.011**	0.799	$0.41	$0.53
		(68.77)	(0.001)			
MTV	——	-0.57	**0.010**	0.833	$0.93	$1.15
		(97.93)	(0.001)			
MTV2	——	-1.19	**0.023**	0.571	$0.00	$0.02
		(66.40)	(0.001)			
Military Channel	——	14.41	**0.015**	0.688	$0.01	$0.01
		(242.18)	(0.000)			
NFL Network	——	8.10	**0.010**	1.000	$0.01	$0.01
		(192.55)	(0.000)			
National Geographic Channel	——	-1.35	**0.022**	0.622	$0.06	$0.13
		(40.34)	(0.001)			
Games and Sports (GAS)	——	-7.75	**0.018**	0.840	$0.00	$0.00
		(447.11)	(0.001)			

Notes:

Table 13: Parameter Estimates

	Demand Estimate (StdErr)	Cost Estimate (StdErr)	Exponential Estimate (StdErr)	Share Positive	Mean	Mean Among Positive
Network Estimates, cont.						
NickToons TV	—–	4.68	**0.013**	0.736	$0.02	$0.03
		(177.37)	(0.000)			
Nickelodeon	—–	-0.85	**0.063**	0.923	$4.23	$4.64
		(152.62)	(0.005)			
Noggin / The N	—–	-4.46	**0.024**	0.592	$0.01	$0.05
		(547.40)	(0.001)			
Outdoor Channel	0.08	-1.04	—–	—–	—–	—–
	(0.07)	(50.96)				
Ovation	**1.26**	3.53	—–	—–	—–	—–
	(0.40)	(188.35)				
Oxygen	—–	-7.73	**0.022**	0.668	$0.15	$0.26
		(181.98)	(0.001)			
Sci-Fi Channel	—–	-0.42	**0.007**	0.756	$0.61	$0.86
		(50.53)	(0.001)			
The Science Channel	—–	19.17	**0.025**	0.702	$0.02	$0.03
		(122.84)	(0.001)			
Si TV	**0.36**	-0.61	—–	—–	—–	—–
	(0.13)	(113.89)				
SoapNet	—–	-2.78	**0.023**	0.574	$0.06	$0.17
		(182.88)	(0.001)			
SPEED Channel	—–	2.47	**0.015**	0.624	$0.04	$0.09
		(41.59)	(0.000)			
Spike	—–	0.21	**0.006**	0.816	$0.52	$0.66
		(106.41)	(0.000)			
Style Network	—–	2.67	**0.026**	0.613	$0.00	$0.01
		(111.22)	(0.001)			
Sundance Channel	**-0.69**	2.13	—–	—–	—–	—–
	(0.30)	(43.43)				
TBS	—–	1.64	**0.028**	0.936	$3.26	$3.51
		(139.69)	(0.005)			
TNT	—–	-0.61	**0.040**	0.934	$3.60	$3.89
		(141.95)	(0.003)			
TV Guide Channel	—–	1.32	**0.014**	0.753	$0.27	$0.38
		(132.89)	(0.001)			
TV Land	—–	1.23	**0.012**	0.711	$0.38	$0.63
		(64.52)	(0.001)			
TLC (The Learning Channel)	—–	0.63	**0.004**	0.845	$0.62	$0.75
		(171.51)	(0.000)			
Toon Disney	—–	-1.75	**0.017**	0.615	$0.22	$0.53
		(160.30)	(0.001)			
Travel Channel	—–	-1.16	**0.011**	0.675	$0.20	$0.34
		(122.68)	(0.001)			
Turner Classic Movies	—–	0.04	**0.011**	0.709	$0.26	$0.43
		(21.01)	(0.001)			
USA	—–	2.82	**0.028**	0.901	$2.67	$3.00
		(146.69)	(0.002)			
Versus	—–	-1.25	**0.024**	0.661	$0.04	$0.07
		(105.97)	(0.001)			
VH1	—–	0.75	**0.007**	0.751	$0.39	$0.56
		(130.27)	(0.000)			
WE: Womens Entertainment	—–	2.89	**0.018**	0.741	$0.08	$0.12
		(107.17)	(0.001)			
The Weather Channel	—–	-0.73	**0.016**	0.694	$0.38	$0.61
		(117.43)	(0.002)			
Regional Sports	—–	1.28	**0.012**	0.619	$0.61	$1.12
		(27.09)	(0.005)			
Cable Audio	**-0.91**	-5.24	—–	—–	—–	—–
	(0.22)	(40.18)				

Notes:

Table 14: Price Sensitivity Parameter Estimates Under Various Moment Restrictions.

OLS No Pricing Equation	IV No Pricing Equation	IV Pricing Equation
-0.021	-0.101	-0.132

Table 15: Estimated Price Elasticities in Markets where Cable Operator Offers Basic, Expanded Basic, and Digital Basic Bundles

Price Elasticity of	wrt	Mean	Std. Dev.
Basic	Outside Good	0.3372	0.5402
	Basic	-2.478	2.825
	Expanded Basic	1.518	1.739
	Digital Basic	0.536	0.860
	Satellite	0.425	1.045
Expanded Basic	Outside Good	0.134	2.761
	Basic	0.322	1.243
	Expanded Basic	-7.605	4.151
	Digital Basic	4.367	4.202
	Satellite	1.462	2.264
Digital Basic	Outside Good	0.028	0.164
	Basic	0.285	1.235
	Expanded Basic	11.421	5.249
	Digital Basic	-21.440	8.762
	Satellite	2.584	2.848
Satellite	Outside Good	0.021	0.209
	Basic	0.130	0.939
	Expanded Basic	2.286	2.766
	Digital Basic	1.595	2.262
	Satellite	-4.922	3.554

Table 16: Summary of Estimated Marginal Costs, by Bundle Type

	Median Price	Median Marginal Cost	Median Margin
Basic	$22.69	$8.46	1.53
Exp. Basic	$34.60	$13.67	1.47
Dig. Basic	$46.85	$26.98	1.34
All	$23.82	$8.78	1.54

	Fam	AMC	BET	CNN	Ctoon	Cmdy	CMT	Disc	Dsny	E!	ESPN	Food	FNC	Golf	Hist	Life
ABC Family Channel	1.00	0.17	0.17	0.11	-0.24	-0.26	0.76	0.84	0.77	-0.64	-0.34	-0.02	0.34	0.07	-0.18	0.74
American Movie Classics	0.17	1.00	0.43	0.75	0.49	0.19	0.36	-0.01	0.18	0.35	0.32	0.16	0.66	0.43	0.42	0.55
BET	0.17	0.43	1.00	0.37	0.47	0.06	0.01	-0.17	0.33	0.24	0.52	0.13	0.14	0.37	-0.11	0.42
CNN	0.11	0.75	0.37	1.00	0.23	0.00	0.45	0.02	0.01	0.10	0.26	-0.17	0.85	0.71	0.21	0.63
Cartoon Network	-0.24	0.49	0.47	0.23	1.00	0.78	-0.26	-0.51	-0.10	0.79	0.47	0.74	-0.11	0.05	0.70	-0.14
Comedy Central	-0.26	0.19	0.06	0.00	0.78	1.00	-0.31	-0.44	-0.34	0.65	0.28	0.85	-0.31	-0.10	0.83	-0.39
Country Music TV	0.76	0.36	0.01	0.45	-0.26	-0.31	1.00	0.84	0.66	-0.58	-0.51	-0.25	0.72	0.42	-0.05	0.80
Discovery Channel	0.84	-0.01	-0.17	0.02	-0.51	-0.44	0.84	1.00	0.74	-0.77	-0.68	-0.26	0.37	0.06	-0.27	0.64
Disney Channel	0.77	0.18	0.33	0.01	-0.10	-0.34	0.66	0.74	1.00	-0.41	-0.38	-0.05	0.26	0.05	-0.28	0.63
E! Entertainment	-0.64	0.35	0.24	0.10	0.79	0.65	-0.58	-0.77	-0.41	1.00	0.52	0.54	-0.22	-0.05	0.60	-0.45
ESPN	-0.34	0.32	0.52	0.26	0.47	0.28	-0.51	-0.68	-0.38	0.52	1.00	0.25	-0.06	0.05	0.15	-0.12
Food Network	-0.02	0.16	0.13	-0.17	0.74	0.85	-0.25	-0.26	-0.05	0.54	0.25	1.00	-0.40	-0.32	0.72	-0.30
Fox News Channel	0.34	0.66	0.14	0.85	-0.11	-0.31	0.72	0.37	0.26	-0.22	-0.06	-0.40	1.00	0.64	0.01	0.77
Golf Channel	0.07	0.43	0.37	0.71	0.05	-0.10	0.42	0.06	0.05	-0.05	0.05	-0.32	0.64	1.00	-0.01	0.51
History Channel	-0.18	0.42	-0.11	0.21	0.70	0.83	-0.05	-0.27	-0.28	0.60	0.15	0.72	0.01	-0.01	1.00	-0.20
Lifetime	0.74	0.55	0.42	0.63	-0.14	-0.39	0.80	0.64	0.63	-0.45	-0.12	-0.30	0.77	0.51	-0.20	1.00
MTV	-0.39	0.09	0.42	-0.10	0.80	0.75	-0.64	-0.70	-0.35	0.72	0.59	0.72	-0.51	-0.17	0.48	-0.43
NFL Network	0.04	-0.34	0.02	-0.27	-0.16	-0.04	-0.31	-0.12	-0.17	-0.16	0.20	0.01	-0.34	-0.21	-0.24	-0.16
National Geographic	-0.53	0.49	0.37	0.55	0.53	0.27	-0.24	-0.65	-0.43	0.61	0.55	0.02	0.27	0.45	0.32	-0.07
Nickelodeon	0.63	0.49	0.49	0.15	0.33	0.08	0.38	0.37	0.69	0.01	0.10	0.36	0.18	-0.10	0.12	0.55
Oxygen	0.34	0.18	0.17	0.48	-0.24	-0.21	0.44	0.28	0.01	-0.46	0.07	-0.31	0.49	0.49	-0.15	0.52
Sci-Fi Channel	0.14	0.52	0.18	0.22	0.77	0.76	0.07	-0.11	0.04	0.47	0.22	0.80	0.04	-0.06	0.82	0.04
SoapNet	0.73	0.08	0.26	0.17	-0.48	-0.65	0.76	0.79	0.80	-0.67	-0.42	-0.48	0.47	0.31	-0.56	0.76
Spike	0.88	0.38	0.23	0.28	-0.01	-0.12	0.85	0.81	0.83	-0.43	-0.38	0.08	0.48	0.20	0.03	0.77
TNT	0.29	0.59	0.78	0.31	0.50	0.08	0.13	0.01	0.50	0.29	0.34	0.24	0.21	0.17	0.06	0.48
The Learning Channel	0.34	-0.15	-0.13	-0.44	0.23	0.45	-0.08	0.15	0.11	-0.03	0.02	0.67	-0.46	-0.58	0.36	-0.17
Toon Disney	-0.42	0.61	0.54	0.48	0.71	0.36	-0.21	-0.57	-0.14	0.78	0.52	0.23	0.21	0.36	0.39	0.00
Turner Classic Movies	-0.50	0.55	0.42	0.42	0.62	0.31	-0.29	-0.63	-0.22	0.79	0.53	0.18	0.18	0.29	0.35	-0.10
USA	0.29	0.83	0.64	0.63	0.67	0.38	0.29	-0.04	0.26	0.35	0.40	0.40	0.45	0.37	0.47	0.54
VH1	0.44	-0.11	0.00	-0.36	0.31	0.49	0.14	0.32	0.36	-0.04	-0.22	0.69	-0.37	-0.37	0.36	-0.03
The Weather Channel	0.69	0.28	0.11	0.43	-0.50	-0.67	0.80	0.74	0.58	-0.68	-0.31	-0.58	0.72	0.38	-0.44	0.85
Regional Sports	0.39	-0.56	-0.56	-0.46	-0.76	-0.46	0.24	0.59	0.19	-0.74	-0.54	-0.32	-0.15	-0.35	-0.43	0.02

Table 17: Estimated Correlations in Willingness to Pay (Cont on next page)

	MTV	NFL	NatGeo	Nick	Oxyg	Sci-Fi	Soap	Spike	TNT	TLC	Tdsny	TCM	USA	VH1	TWC	Rsports
ABC Family Channel	-0.39	0.04	-0.53	0.63	0.34	0.14	0.73	0.88	0.29	0.34	-0.42	-0.50	0.29	0.44	0.69	0.39
American Movie Classics	0.09	-0.34	0.49	0.49	0.18	0.52	0.08	0.38	0.59	-0.15	0.61	0.55	0.83	-0.11	0.28	-0.56
BET	0.42	0.02	0.37	0.49	0.17	0.18	0.26	0.23	0.78	-0.13	0.54	0.42	0.64	0.00	0.11	-0.56
CNN	-0.10	-0.27	0.55	0.15	0.48	0.22	0.17	0.28	0.31	-0.44	0.48	0.42	0.63	-0.36	0.43	-0.46
Cartoon Network	0.80	-0.16	0.53	0.33	-0.24	0.77	-0.48	-0.01	0.50	0.23	0.71	0.62	0.67	0.31	-0.50	-0.76
Comedy Central	0.75	-0.04	0.27	0.08	-0.21	0.76	-0.65	-0.12	0.08	0.45	0.36	0.31	0.38	0.49	-0.67	-0.46
Country Music TV	-0.64	-0.31	-0.24	0.38	0.44	0.07	0.76	0.85	0.13	-0.08	-0.21	-0.29	0.29	0.14	0.80	0.24
Discovery Channel	-0.70	-0.12	-0.65	0.37	0.28	-0.11	0.79	0.81	0.01	0.15	-0.57	-0.63	-0.04	0.32	0.74	0.59
Disney Channel	-0.35	-0.17	-0.43	0.69	0.01	0.04	0.80	0.83	0.50	0.11	-0.14	-0.22	0.26	0.36	0.58	0.19
E! Entertainment	0.72	-0.16	0.61	0.01	-0.46	0.47	-0.67	-0.43	0.29	-0.03	0.78	0.79	0.35	-0.04	-0.68	-0.74
ESPN	0.59	0.20	0.55	0.10	0.07	0.22	-0.42	-0.38	0.34	0.02	0.52	0.53	0.40	-0.22	-0.31	-0.54
Food Network	0.72	0.01	0.02	0.36	-0.31	0.80	-0.48	0.08	0.24	0.67	0.23	0.18	0.40	0.69	-0.58	-0.32
Fox News Channel	-0.51	-0.34	0.27	0.18	0.49	0.04	0.47	0.48	0.21	-0.46	0.21	0.18	0.45	-0.37	0.72	-0.15
Golf Channel	-0.17	-0.21	0.45	-0.10	0.49	-0.06	0.31	0.20	0.17	-0.58	0.36	0.29	0.37	-0.37	0.38	-0.35
History Channel	0.48	-0.24	0.32	0.12	-0.15	0.82	-0.56	0.03	0.06	0.36	0.39	0.35	0.47	0.36	-0.44	-0.43
Lifetime	-0.43	-0.16	-0.07	0.55	0.52	0.04	0.76	0.77	0.48	-0.17	0.00	-0.10	0.54	-0.03	0.85	0.02
MTV	1.00	0.17	0.39	0.11	-0.27	0.54	-0.66	-0.36	0.30	0.35	0.49	0.42	0.36	0.30	-0.73	-0.59
NFL Network	0.17	1.00	-0.19	-0.13	0.08	-0.13	-0.13	-0.22	-0.13	0.26	-0.30	-0.24	-0.20	0.07	-0.13	0.22
National Geographic	0.39	-0.19	1.00	-0.19	0.08	0.23	-0.39	-0.36	0.19	-0.45	0.78	0.76	0.41	-0.48	-0.24	-0.76
Nickelodeon	0.11	-0.13	-0.19	1.00	-0.04	0.48	0.38	0.70	0.75	0.39	0.15	0.04	0.64	0.45	0.32	-0.13
Oxygen	-0.27	0.08	0.08	-0.04	1.00	-0.10	0.33	0.25	-0.06	-0.12	-0.17	-0.25	0.20	-0.13	0.50	0.12
Sci-Fi Channel	0.54	-0.13	0.23	0.48	-0.10	1.00	-0.35	0.31	0.37	0.54	0.37	0.29	0.68	0.52	-0.27	-0.44
SoapNet	-0.66	-0.13	-0.39	0.38	0.33	-0.35	1.00	0.71	0.27	-0.23	-0.27	-0.33	0.06	0.02	0.82	0.34
Spike	-0.36	-0.22	-0.36	0.70	0.25	0.31	0.71	1.00	0.43	0.23	-0.16	-0.27	0.46	0.46	0.66	0.16
TNT	0.30	-0.13	0.19	0.75	-0.06	0.37	0.27	0.43	1.00	0.02	0.53	0.42	0.74	0.14	0.19	-0.48
The Learning Channel	0.35	0.26	-0.45	0.39	-0.12	0.54	-0.23	0.23	0.02	1.00	-0.35	-0.39	0.11	0.77	-0.25	0.24
Toon Disney	0.49	-0.30	0.78	0.15	-0.17	0.37	-0.27	-0.16	0.53	-0.35	1.00	0.89	0.59	-0.28	-0.26	-0.87
Turner Classic Movies	0.42	-0.24	0.76	0.04	-0.25	0.29	-0.33	-0.27	0.42	-0.39	0.89	1.00	0.46	-0.36	-0.30	-0.82
USA	0.36	-0.20	0.41	0.64	0.20	0.68	0.06	0.46	0.74	0.11	0.59	0.46	1.00	0.16	0.17	-0.61
VH1	0.30	0.07	-0.48	0.45	-0.13	0.52	0.02	0.46	0.14	0.77	-0.28	-0.36	0.16	1.00	-0.16	0.20
The Weather Channel	-0.73	-0.13	-0.24	0.32	0.50	-0.27	0.82	0.66	0.19	-0.25	-0.26	-0.30	0.17	-0.16	1.00	0.33
Regional Sports	-0.59	0.22	-0.76	-0.13	0.12	-0.44	0.34	0.16	-0.48	0.24	-0.87	-0.82	-0.61	0.20	0.33	1.00

Table 18: Estimated Correlations in Willingness to Pay (Cont from previous page)

Table 19: Estimates, Demographic Parameters (Π), Page 1

Network	Urban	Family	Income	Black	Hispanic	Asian	College+	Age
ABC Family Channel	-0.004	0.039	-0.031	0.016	-0.009	0.014	0.011	0.053
	(0.001)	(0.011)	(0.006)	(0.002)	(0.002)	(0.005)	(0.005)	(0.013)
American Movie Classics (AMC)	0.004		-0.040	0.016		0.014		0.070
	(0.002)		(0.009)	(0.002)		(0.007)		(0.016)
Animal Planet			-0.016			0.011		0.033
			(0.005)			(0.004)		(0.009)
Arts & Entertainment (A&E)	0.010	-0.075		0.010		0.035	-0.054	
	(0.003)	(0.015)		(0.002)		(0.007)	(0.009)	
BBC America					-0.001		0.002	
					(0.000)		(0.001)	
Black Entertainment Television (BET)		-0.054	-0.057	0.129	0.007	0.045		-0.065
		(0.016)	(0.011)	(0.007)	(0.002)	(0.009)		(0.020)
Biography				0.001				
				(0.000)				
Bravo	0.008	-0.022				0.026		
	(0.001)	(0.009)				(0.005)		
CNBC	0.004	-0.046		0.004	0.005			
	(0.001)	(0.006)		(0.001)	(0.001)			
CNN	-0.012	-0.095		0.042	0.023		-0.048	
	(0.003)	(0.031)		(0.005)	(0.003)		(0.015)	
Cartoon Network	0.021		-0.172	0.129	0.020	0.165		
	(0.010)		(0.039)	(0.009)	(0.008)	(0.036)		
Comedy Central		-0.063		0.008		0.041	-0.018	-0.049
		(0.012)		(0.002)		(0.007)	(0.005)	(0.015)
Country Music TV (CMT)	-0.016	-0.016	-0.013	0.006		0.026	-0.016	
	(0.001)	(0.007)	(0.004)	(0.001)		(0.002)	(0.003)	
Court TV		-0.029	-0.058	0.011	-0.008	0.051		0.039
		(0.013)	(0.011)	(0.002)	(0.002)	(0.007)		(0.015)
Discovery Channel		-0.058	-0.027			0.050	-0.026	-0.066
		(0.016)	(0.009)			(0.009)	(0.008)	(0.021)
Discovery Health Channel				0.002	0.002	-0.007		
				(0.001)	(0.001)	(0.002)		
Disney Channel	0.025	0.124	-0.247	0.042		0.089	0.064	
	(0.005)	(0.039)	(0.022)	(0.010)		(0.021)	(0.019)	
E! Entertainment Television	0.005	-0.016		0.003		0.012	-0.019	
	(0.001)	(0.008)		(0.001)		(0.003)	(0.004)	
ESPN		-0.116		0.069	-0.021	-0.044		
		(0.049)		(0.007)	(0.006)	(0.018)		
ESPN 2	-0.006	-0.033		0.012	-0.003	0.014	-0.019	
	(0.001)	(0.010)		(0.002)	(0.001)	(0.004)	(0.005)	
ESPN Classic Sports			0.003	0.001		-0.002	-0.003	
			(0.001)	(0.000)		(0.001)	(0.001)	
ESPNews	-0.001		0.003	0.001			-0.001	
	(0.000)		(0.001)	(0.000)			(0.001)	

Table 20: Estimates, Demographic Parameters (Π), Page 2

Network	Urban	Family	Income	Black	Hispanic	Asian	College+	Age
FX		-0.059		0.015	-0.006	0.031	-0.034	-0.055
		(0.019)		(0.004)	(0.002)	(0.008)	(0.011)	(0.024)
Food Network	0.010	-0.043		0.014		0.028	-0.016	-0.031
	(0.001)	(0.009)		(0.002)		(0.007)	(0.006)	(0.013)
Fox News Channel	-0.012			0.015	0.014	-0.036		0.167
	(0.004)			(0.005)	(0.004)	(0.013)		(0.045)
Fuse	-0.001		0.002	0.000		0.001	-0.002	0.002
	(0.000)		(0.001)	(0.000)		(0.000)	(0.001)	(0.001)
G4	-0.001	0.005				-0.001		0.006
	(0.000)	(0.002)				(0.000)		(0.002)
Game Show network		0.031	0.030			-0.013	-0.032	0.055
		(0.013)	(0.007)			(0.004)	(0.007)	(0.016)
GalaVision	-0.001	-0.010	0.010		0.013		-0.011	-0.015
	(0.000)	(0.004)	(0.002)		(0.001)		(0.003)	(0.005)
Golf Channel	-0.001			0.001		0.002		
	(0.000)			(0.000)		(0.001)		
Great American Country	0.000	0.004			-0.001			0.003
	(0.000)	(0.001)			(0.000)			(0.001)
HGTV	-0.004		-0.023	0.023	-0.013	0.023		
	(0.002)		(0.008)	(0.003)	(0.002)	(0.005)		
Hallmark Channel	-0.016	-0.075		0.010	0.006		-0.036	
	(0.002)	(0.020)		(0.003)	(0.002)		(0.009)	
History Channel	0.003	-0.063		-0.007	-0.009	0.039	-0.033	-0.044
	(0.001)	(0.016)		(0.002)	(0.002)	(0.007)	(0.008)	(0.021)
History Channel International		0.001	-0.001		0.000		0.001	0.001
		(0.001)	(0.000)		(0.000)		(0.000)	(0.001)
Independent Film Channel (IFC)						0.001		
						(0.000)		
Lifetime		0.044	-0.130	0.080		0.054	0.028	0.185
		(0.022)	(0.016)	(0.004)		(0.010)	(0.014)	(0.025)
Lifetime Movie Network	-0.015	-0.111		0.032	0.015	0.015	-0.035	-0.129
	(0.002)	(0.017)		(0.004)	(0.002)	(0.005)	(0.008)	(0.020)
MSNBC	0.010	-0.069		0.010	0.005			
	(0.002)	(0.014)		(0.002)	(0.002)			
MTV	0.007		-0.038	0.039	0.012	0.033		
	(0.002)		(0.011)	(0.004)	(0.003)	(0.009)		
MTV2	0.001		-0.004	0.002		0.003		-0.009
	(0.000)		(0.002)	(0.001)		(0.001)		(0.004)
Military Channel		0.002		0.000				0.002
		(0.001)		(0.000)				(0.001)
National Geographic Channel	-0.005	-0.016	0.010	0.003	0.005		-0.008	-0.019
	(0.001)	(0.006)	(0.003)	(0.001)	(0.001)		(0.003)	(0.006)
Games and Sports (GAS)			0.000					
			(0.000)					

Table 21: Estimates, Demographic Parameters (II), Page 3

Network	Urban	Family	Income	Black	Hispanic	Asian	College+	Age
NickToons TV						0.002		
						(0.001)		
Nickelodeon		0.261	-0.088	0.093	-0.022	0.077	-0.082	0.360
		(0.065)	(0.036)	(0.009)	(0.008)	(0.017)	(0.032)	(0.083)
Noggin / The N		0.010		0.002				0.010
		(0.003)		(0.001)				(0.004)
Oxygen	-0.003	-0.043	0.008	0.007	0.002	0.005	-0.013	-0.040
	(0.001)	(0.007)	(0.003)	(0.001)	(0.001)	(0.002)	(0.003)	(0.008)
Sci-Fi Channel		-0.068		0.015		0.039	-0.043	-0.056
		(0.015)		(0.002)		(0.009)	(0.010)	(0.019)
The Science Channel			-0.003				0.001	-0.003
			(0.001)				(0.001)	(0.001)
SoapNet	-0.002	-0.020	-0.017	0.014		0.011	0.006	-0.034
	(0.001)	(0.005)	(0.004)	(0.001)		(0.002)	(0.002)	(0.006)
SPEED Channel	-0.005		0.008	0.003		0.007	-0.010	0.014
	(0.001)		(0.003)	(0.001)		(0.002)	(0.002)	(0.004)
Spike	-0.008		-0.017	0.021		0.031	-0.020	0.040
	(0.002)		(0.007)	(0.002)		(0.006)	(0.007)	(0.015)
Style Network			0.003	0.001		-0.003		0.007
			(0.001)	(0.000)		(0.001)		(0.003)
TBS	-0.020	-0.091		0.053	0.026		-0.100	
	(0.005)	(0.028)		(0.006)	(0.006)		(0.020)	
TNT		-0.129		0.096	0.016	0.047	-0.111	
		(0.040)		(0.007)	(0.005)	(0.020)	(0.017)	
TV Guide Channel	-0.008	-0.020	0.013	0.018	0.009	0.011	-0.020	
	(0.001)	(0.007)	(0.005)	(0.001)	(0.001)	(0.003)	(0.003)	
TV Land	-0.020	-0.047		0.040		0.032	-0.064	
	(0.002)	(0.022)		(0.004)		(0.007)	(0.010)	
TLC (The Learning Channel)		-0.049	-0.014	0.006	-0.014	0.013	-0.018	-0.061
		(0.013)	(0.007)	(0.002)	(0.002)	(0.005)	(0.005)	(0.016)
Toon Disney	-0.006	-0.088	0.043	0.014	0.009	0.013	-0.066	-0.109
	(0.001)	(0.013)	(0.007)	(0.001)	(0.001)	(0.004)	(0.008)	(0.016)
Travel Channel	0.002	-0.054					-0.016	-0.054
	(0.001)	(0.005)					(0.002)	(0.007)
Turner Classic Movies	-0.003	-0.050	0.023	0.007	0.006		-0.033	-0.054
	(0.001)	(0.013)	(0.006)	(0.002)	(0.001)		(0.007)	(0.016)
USA	0.010	-0.065	-0.119	0.074		0.047		
	(0.005)	(0.031)	(0.020)	(0.005)		(0.015)		
VH1		-0.052		0.012		0.024	-0.019	-0.059
		(0.008)		(0.001)		(0.005)	(0.005)	(0.011)
WE: Womens Entertainment	-0.003	-0.013	0.007	0.005	0.003		-0.008	
	(0.001)	(0.004)	(0.003)	(0.001)	(0.001)		(0.002)	
The Weather Channel	-0.012	0.032		0.017		-0.017		0.108
	(0.002)	(0.013)		(0.003)		(0.007)		(0.020)
Regional Sports	0.020			-0.029	-0.021		0.053	
	(0.004)			(0.005)	(0.006)		(0.014)	

	Household Type				
Channel	White Rural Family	Black Urban Family	Rich College Grad	Nonfamily Under-30 College Grad	Over 60
ABC Family Channel	0.45	0.50	0.40	0.23	0.52
American Movie Classics	0.49	0.68	0.26	0.46	0.67
BET	0.33	1.26	0.28	0.85	0.39
Bravo	0.23	0.29	0.36	0.40	0.32
CNN	1.06	1.46	1.20	1.52	1.23
Comedy Central	0.52	0.46	0.50	0.90	0.45
Country Music TV (CMT)	0.14	0.06	-0.06	0.11	0.09
Disney Channel	2.42	3.42	1.92	2.58	2.46
ESPN	7.24	7.16	8.20	9.33	7.14
FX	0.76	0.63	0.44	1.29	0.75
Food Network	0.34	0.55	0.25	0.57	0.38
Fox News Channel	1.00	1.14	0.84	0.79	1.47
Lifetime	1.22	1.89	0.83	1.61	1.56
MTV	0.89	1.07	0.76	0.99	1.18
National Geographic Channel	0.08	0.04	0.06	0.15	0.03
SoapNet	0.05	0.12	0.02	0.21	0.00
SPEED Channel	0.05	0.05	0.01	0.01	0.06
USA	2.52	3.12	1.91	2.29	2.73
VH1	0.38	0.39	0.32	0.64	0.33
Regional Sports	0.53	0.43	0.67	0.46	0.64

Table 22: Estimated Median Willingness to Pay for a Subset of Channels by a Subset of Household Demographic Profiles

Table 23: Baseline Counterfactual

Bundling Equilibrium

Bundle Price			
	Cable	Satellite 1	Satellite 2
Full Bundle	$36.11	$29.68	$29.92
Platform Market Shares			
Cable	Satellite 1	Satellite 2	Total
0.571	0.198	0.137	0.906
Distributor Profits			
Cable	Satellite 1	Satellite 2	Total
$9.58	$1.70	$1.09	$12.37
Network Profits			
Cable	Satellite 1	Satellite 2	Total
$11.03	$4.18	$3.01	$18.23
Total Industry Profits			
Cable	Satellite 1	Satellite 2	Total
$20.61	$5.89	$4.10	$30.60
Channels Purchased			
			86.0
Average Consumer Expenditure			
			$33.76
Consumers Surplus			
25th Percentile	75th Percentile	Max	Mean
$19.55	$46.44	$107.92	$33.76
Total Welfare			
			$64.36

Full À La Carte Equlibrium

Channel Prices and Market Shares				
		Channel Prices		Shares
	Cable	Satellite 1	Satellite 2	All Platforms
Fixed Fee	$15.77	$8.58	$8.07	$12.83
ABC Family	$0.24	$0.27	$0.28	0.433
AMC	$0.27	$0.27	$0.28	0.422
BET	$0.18	$0.18	$0.18	0.517
Bravo	$0.16	$0.17	$0.17	0.462
CNN	$0.53	$0.53	$0.55	0.495
Comedy	$0.13	$0.14	$0.14	0.615
CMT	$0.07	$0.06	$0.06	0.356
Disney	$1.95	$2.05	$2.13	0.454
ESPN	$3.17	$3.20	$3.26	0.628
Food	$0.06	$0.06	$0.06	0.661
Lifetime	$0.25	$0.27	$0.28	0.697
MTV	$0.33	$0.34	$0.35	0.514
Natl. Geog.	$0.21	$0.23	$0.24	0.086
SoapNet	$0.11	$0.12	$0.12	0.268
SPEED	$0.16	$0.16	$0.16	0.045
USA	$0.52	$0.55	$0.57	0.758
VH1	$0.15	$0.14	$0.15	0.545
Weather	$0.11	$0.12	$0.13	0.494
Average Price or Share	$0.23	$0.24	$0.25	0.291
Platform Market Shares				
	Cable	Satellite 1	Satellite 2	Total
	0.585	0.222	0.164	0.971
Distributor Profits				
	Cable	Satellite 1	Satellite 2	Total
	$9.67	$1.94	$1.34	$12.96
Network Profits				
	Cable	Satellite 1	Satellite 2	Total
	$4.82	$1.96	$1.49	$8.27
Total Industry Profits				
	Cable	Satellite 1	Satellite 2	Total
	$14.49	$3.90	$2.83	$21.23
Channels Purchased				
				25.7
Average Consumer Expenditure				
				$21.87
Consumers Surplus				
	25th Percentile	75th Percentile	Max	Mean
	$33.63	$58.35	$118.34	$46.08
Total Welfare				
				$67.31

Notes:

Table 24: Counterfactual Robustness

	Baseline	Full À La Carte	Double Costs	Revenue Sharing	Fixed Fee At Zero	Fixed Fee At $10
Results						
Fixed Fee		$12.83	$12.88	$12.88	$0.00	$10.00
Weighted Average Price	$33.76	$0.24	$0.47	$0.00	$0.48	$0.29
Average Channel Share		0.291	0.213	0.640	0.210	0.270
Platform Share	0.906	0.971	0.955	0.988	0.990	0.977
Distributor Profits	$12.37	$12.96	$12.81	$6.45	$8.35	$12.34
Network Profits	$18.23	$8.27	$11.49	$6.45	$5.81	$7.72
Industry Profits	$30.60	$21.23	$24.30	$12.91	$14.16	$20.06
Channels Purchased	86.0	25.7	19.2	55.7	18.2	23.8
Average Consumer Expenditure	$33.76	$21.87	$25.45	$13.07	$14.31	$20.54
Mean Consumers Surplus	$33.76	$46.08	$38.24	$58.13	$49.51	$46.76
Mean Total Surplus	$64.36	$67.31	$62.54	$71.04	$63.67	$66.82
Assumptions						
Marginal Costs	Kagan	Kagan	Kagan x 2	Rev. Share	Kagan	Kagan
Channels	All	All	All	All	All	All
Fixed Fee	None	Comp.	Comp.	Comp.	$0	$10

Notes:

Table 25: Data Quality of Factbook

Year	*Variable*	*Number of Bundles*	*Fraction of Bundles*
1997	Total Bundles	15205	1.00
	Full Information	10740	0.71
	Updated	9264	0.61
	Full Information and Updated	6165	0.41
1998	Total Bundles	15743	1.00
	Full Information	10872	0.69
	Updated	4714	0.30
	Full Information and Updated	3461	0.22
1999	Total Bundles	15497	1.00
	Full Information	10444	0.67
	Updated	5663	0.37
	Full Information and Updated	3595	0.23
2000	Total Bundles	15453	1.00
	Full Information	10312	0.67
	Updated	3358	0.22
	Full Information and Updated	2478	0.16
2001	Total Bundles	15391	1.00
	Full Information	9793	0.64
	Updated	4173	0.27
	Full Information and Updated	2663	0.17
2002	Total Bundles	15287	1.00
	Full Information	7776	0.51
	Updated	5086	0.33
	Full Information and Updated	1484	0.10
2003	Total Bundles	15365	1.00
	Full Information	8370	0.54
	Updated	9744	0.63
	Full Information and Updated	4750	0.31
2004	Total Bundles	15145	1.00
	Full Information	7137	0.47
	Updated	8175	0.54
	Full Information and Updated	3556	0.23
2005	Total Bundles	15001	1.00
	Full Information	7009	0.47
	Updated	846	0.06
	Full Information and Updated	327	0.02
2006	Total Bundles	14653	1.00
	Full Information	4577	0.31
	Updated	8141	0.56
	Full Information and Updated	2303	0.16
2007	Total Bundles	13879.00	1.00
	Full Information	4070.00	0.29
	Updated	3135.00	0.23
	Full Information and Updated	711	0.05
1997-2007	Total Bundles	166619	1.00
	Full Information	91100	0.55
	Updated	62299	0.37
	Full Information and Updated	31493	0.19