The Welfare Effects of Vertical Integration in Multichannel Television Markets*

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PRELIMINARY

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Abstract

We investigate the welfare effects of vertical integration of regional sports networks (RSNs) in U.S. multichannel television markets. Vertical integration can enhance efficiency by aligning investment incentives and/or reducing double marginalization, but can also harm welfare due to foreclosure and raising rivals' costs incentives. We measure these competing effects in the carriage, channel placement, and pricing decisions of regional sports networks (RSNs) by affiliated and unaffiliated cable and satellite television distributors. We first carry out descriptive analyses that compare integrated and non-integrated RSNs and distributors' prices and carriage, and viewership ratings. We then estimate a model of viewership, subscription, distributor pricing, and input cost bargaining. We use the estimated model to analyze the welfare effects of simulated vertical mergers and de-mergers, and the "terrestrial loophole" introduced in the 1992 Cable Act by the U.S. Federal Communications Commission.

1 Introduction

The welfare effects of vertical integration is an important, but controversial, issue. The theoretical literature on the pro- and anti-competitive impacts of vertical integration is vast (c.f. Perry (1990); Riordan (2008)), and typically contrasts potential efficiencies related to the elimination of double marginalization (Spengler (1950)) and the alignment of investment incentives (Willamson (1985); Grossman and Hart (1986)) with the potential for losses arising from incentives to foreclose rivals and raise their costs (Salop and Scheffman (1983); Krattenmaker and Salop (1986); Hart and Tirole (1990); Ordover et al. (1990)). However, despite a growing literature, empirical evidence on the quantitative magnitudes of these potential effects (and the overall net impact) is still limited.

This paper attempts to quantify the welfare effects of vertical integration in cable and satellite television in the context of high value sports programming in the US. Whether or not the ownership

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of content by distributors harms welfare is at the heart of several recently proposed (e.g., Comcast and Time Warner, AT&T and DirecTV) and consummated (e.g., Comcast and NBC, approved in 2011) mergers in the television industry. The attention these mergers attracted is due to the industry's overwhelming reach: nearly 90% of the 115 million television households in the US subscribe to multichannel television, and the mean individual consumes about three hours of television per day. Regional sports programming alone comprises $4.1 billion per year in negotiated input fees paid by distributors to content providers, with an additional $700 million in advertising dollars spent on these channels.

Our focus on the multichannel television industry, and in particular sports programming, is also driven by several factors that create empirical leverage to address this question. First, there is significant variation across the industry in terms of ownership of content by multichannel video programming distributors (MVPDs). Second, although this variation is primarily at the national level for most channels, regional sports networks (RSNs) are present in smaller geographic areas, and thus provides useful variation in ownership patterns both across regions and over time. Third, the industry is the subject of significant regulatory and antitrust attention in addition to merger review, including the application of "program access rules" and exceptions to this rule, such as the "terrestrial loophole" which exempted certain distributors from supplying integrated content to rivals.

The heart of our paper is the specification and estimation of a structural model of the multichannel television industry that captures consumer viewership and subscription decisions, MVPD pricing and carriage decisions, and bargaining between MVPDs and content providers. Our paper builds off and significantly extends the model in Crawford and Yurukoglu (2012) into an empirical framework for the analysis of vertical integration and mergers, and importantly incorporates: (i) incentives to foreclose rivals' access to inputs, (ii) the potential for double marginalization, and (iii) the possibility of imperfect coordination and internalization within an integrated firm. We use data on both aggregate and individual level consumer viewership and subscription patterns with price, quantity, and channel carriage for cable and satellite at the local market level over the years 2000 to 2010.

We leverage the structural model in this paper to highlight the mechanisms through which pro-competitive and anti-competitive effects of vertical integration might occur. In particular, we estimate: (i) the degree to which firms internalize the profits of integrated units when making pricing and bundling decisions; and (ii) the incentive for an integrated channel to deny access to rival distributors. Central to identifying both of these effects are our estimates of the changes in firm profits from the addition or removal of an RSN from its bundles, which in turn relies on using variation in distributor market shares as channel bundle offerings change to inform how much consumers value content when subscribing to an MVPD, and variation in observed viewership patterns and negotiated input fees across channels to infer the relative values consumers place on different channels. Given these estimated profit effects, the pro-competitive effect of vertical integration is identified from the degree to which carriage is higher for integrated distributors, while the anti-competitive effect is identified by lower supply to downstream rivals of integrated channels.

We use our estimated model to conduct policy counterfactuals which examine the role of program access rules and the "terrestrial loophole," which was introduced in the 1992 FCC Cable Act. Our findings indicate that integrated firms imperfectly internalize incentives to reduce double marginalization, and that regulations prohibiting exclusive dealing by integrated firms have been effective in many markets. By closing the "loophole" in certain markets, as the FCC voted to do in 2010, and providing access to satellite distributors of those RSNs that were foreclosed to them, we find that satellite penetration would increase by 20% and consumer welfare would increase by $31 million annually in aggregate in the affected markets of Philadelphia and San Diego. On the other hand, allowing integrated cable distributors to potentially foreclose satellite from carriage of integrated RSNs in other markets not subject to the loophole—potentially allowed by the sunsetting of the Program Access Rules in 2012—would lead to changes in two large markets: Chicago and the San Francisco Bay Area, decreasing satellite market shares by 10%, and resulting in an $60 million annual aggregate consumer welfare loss.

At the moment, our analysis is partial. Ongoing work will examine price effects in markets where rivals are supplied by the integrated firm, and the overall welfare effects of vertical integration weighing reductions in double marginalization against foreclosure and raising rivals' costs effects.

Related Literature. Previous work in the cable industry, including Waterman and Weiss (1996), Chipty (2001), and Chen and Waterman (2007), have primarily relied on reduced form cross-sectional analyses for a limited subset of channels and found that integrated cable systems are more likely to carry their own as opposed to rival content. One exception that uses variation over time is Suzuki (2009), which studies the 1996 merger between Time Warner and Turner broadcasting and finds that integrated channels were more likely to be carried by Time Warner systems following the merger, and that non-integrated rival channels were less likely to be carried in Time Warner markets after the merger. In this regards, both this and our companion paper (Crawford et al., 2014) complement previous work in the cable industry with a richer panel dataset, and with a structural model we are able to both provide welfare measurements and shed light on the mechanisms through which vertical integration has an effect on welfare.

This paper also adds to the growing empirical literature on the effects of vertical integration or arrangements (e.g., Asker (2004), Hastings and Gilbert (2005), Hortacsu and Syverson (2007), Villas-Boas (2007), Houde (2012), Lee (2013)). We build on existing approaches by explicitly accounting for both efficiency and foreclosure incentives.[1] We also allow for the potential imperfect internalization of incentives across divisions within an integrated firm. Furthermore, our framework allows for potential changes in certain non-price product characteristics (such as bundle offerings) due to integration.

[1] See also Conlon and Mortimer (2013).

2 Institutional Detail and Data

Our study analyzes the US cable and satellite industry for the years 2000 to 2010, with a special focus on "Regional Sports Networks" (RSNs). We briefly describe the industry and RSNs. We then describe the data that we use to estimate the model.

Unless otherwise noted, the tables and figures referenced in this section are contained in Appendix B.

2.1 Vertical Affiliation in Multichannel Television Markets

In the time period we study, the vast majority of households in the US were able to subscribe to a multichannel television bundle from one of three downstream distributors: a local cable company (e.g., Comcast, Time Warner Cable, or Cablevision) or one of two nationwide satellite companies (DirecTV and Dish Network). Cable companies transmit their video signals through a physical wire whereas satellite companies distributed video wirelessly through a south-facing satellite dish attached to a household's dwelling. The majority of distributors' revenue comes from subscription to three different bundles of programming: a limited basic bundle which retransmits over-the-air broadcast stations, an expanded basic bundle containing 40-60 of the most popular channels available on cable (e.g., AMC, CNN, Comedy Central, ESPN, MTV, etc.), and a digital bundle containing between 10 to 50 more, smaller, niche channels.

Downstream distributors negotiate with content producers over the terms at which the distributors can offer the content producers' channels to consumers. These negotiations usually center on a monthly per-subscriber ("affiliate") fee that the downstream distributor pays the channel for every subscriber who has access to the channel, whether the subscriber watches it or not.

This study focuses on the effects of vertical integration between distributors and Regional Sports Networks. RSNs carry professional and college sports programming in a particular geographic region. For example, the New England Sports Network (NESN) carries televised games of the Boston Red Sox and the Boston Bruins that aren't concurrently being televised nationally. Metropolitan areas can have multiple RSNs. For example, in the New York City metropolitan area, there are four different RSNs (Madison Square Garden (MSG), MSG Plus, SportsNet NY, and Yankees Entertainment and Sports (YES)). Some RSNs also serve multiple metropolitan areas. For example, the Sun Sports network holds the rights to the Miami Heat and the Tampa Bay Rays, amongst others. Most RSNs are vertically integrated with a downstream distributor. Table 6 provides a variety of information about the largest RSNs in the US, including their availability, their average (across systems and years) affiliate fee, and average (across DMAs and years) viewership. Figure 8 shows each RSN's years of operation between 2000 and 2010 and ownership affiliation with a downstream distributor.[2] According to industry estimates, RSNs command the second-highest per-subscriber

[2]DirecTV, the largest satellite operator and second-largest US distributor of multichannel television, was until 2009 owned by Libery Media Corporation; though they are strictly separate companies, they share overlapping boards of directors.

affiliate fees after ESPN.[3] For example, NESN is reported to have per-subscriber monthly fees that averaged \$2.72 per month in 2010 whereas highly-rated national channels such as Fox News, TNT, and USA hover around \$1 per subscriber per month.

Regulatory policy towards RSN vertical integration There are several key features of the regulatory environment for RSNs and vertically integrated content more generally that are relevant during our sample period. First, during our sample period, vertically integrated firms were subject to the "Program Access Rules" (PARs). These required that vertically integrated content be made available to rival distributors at non-discriminatory prices, subject to final-offer arbitration if required.

The Program Access Rules only applied, however, to content that was transmitted to the MVPD via satellite. This covered all national cable channels (who need satellite transmission to cost-effectively reach cable systems around the country) and most RSNs. A handful of RSNs, however, transmitted their signal terrestrially (usually via microwave), thereby avoiding the jurisdiction of the PARs. This was called the "terrestrial loophole" in the Program Access regulation. The most relevant cases of the terrestrial loophole being used are Comcast SportsNet in Philadelphia and SD4 in San Diego (owned by Cox Cable).[4] Perhaps aa result of the terrestrial loophole, Major League Baseball (MLB), National Basketball Association (NBA), and National Hockey League (NHL) games in Philadelphia were only available through cable and not through DirecTV or Dish Network. Similarly in San Diego, MLB games were only available through cable. This accident of regulatory history will be an important source of identifying variation in our econometric estimation.

The Program Access Rules were introduced in 1992 and required renewal by the FCC every five years. They were allowed to lapse in 2012 and replaced by rules giving the Commission the right to review *any* programming agreement for anti-competitive effects on a case-by-case basis under the "unfair acts" rules the Commission established in 2010 (FCC (2012)). The new case-by-case rules explicitly include a (rebuttable) presumption that exclusive deals between RSNs and their affiliated distributors are unfair.

2.2 Data

We collect a wide variety of data to analyze the effects of vertical integration. We have three categories of data: (1) downstream prices, quantities, and characteristics of cable and satellite bundles, (2) channel viewership data, and (3) channel input cost data. We briefly describe each in turn.

[3] Affiliate fees are the fees paid by distributors to content providers for the ability to distribute the channel.

[4] Time Warner Cable also employed the terrestrial loophole from 2006 to 2008 for the (then relatively new) Charlotte Bobcats NBA franchise by placing some their games on News 14, a terrestrially delivered regional news channel.

2.2.1 Downstream Prices, Quantities, and Characteristics

We combine data from multiple databases to construct downstream prices, quantities, and characteristics. Our foundational dataset is the Nielsen FOCUS database. It provides, for each cable system in the US, the set of channels offered, the number of homes passed, the total number of subscribers (i.e. to any bundle), the owner of the system, and the zip codes served. We use the years 2000 to 2010. We restrict our analysis to system-years in which the system faced no direct wire-based competition.[5] We combined these data with individual-level survey data household survey firms Mediamark and Simmons. Specifically, if a system-year had over 50 survey respondents, we took the average of the market share from the FOCUS data and the cable market share among the survey respondents. We further eliminate any system-year for which the subscriber data was not updated from the previous year, or did not have at least 50 survey respondents. We use the remaining system-years to construct our markets.

Each market is defined as a set of zip codes within a system-year served by a single cable system and, by construction, both satellite providers. For cable systems, we aggregate over bundles within a system, focusing on total system subscribers. Our demand model is therefore a distributor choice model, rather than a bundle choice model.[6] For satellite systems, we determine the number of satellite subscribers separately for each of DirecTV and Dish Network using market shares estimated from the individual-level survey data household survey firms Mediamark and Simmons. We use Mediamark for 2000 to 2007, and Simmons for 2008-2010. We restrict our attention to markets where we have at least 5 respondents in the individual-level data.[7] Furthermore, we gathered historical channel offerings and prices for DirecTV and Dish Network through the Internet Archive (archive.org).

We combined multiple sources of information on cable television prices. Systems regularly post prices for their tiers of service on their websites and these websites are often saved in the Internet Archive.[8] We use the price of Expanded Basic Service, the most popular bundle chosen by households and the bundle which typically contains all the channels in our analysis. Furthermore, newspapers often report when prices change at local cable systems. Some newspapers report this information every time cable prices change (typically yearly), providing valuable information about the history of price changes for a single (often large) system or geographic family of systems owned by the same provider. Finally, cable systems typically have “rate cards” describing their current tiers, channels, and prices which they use for marketing or to inform customers of changes in these offerings. These are sometimes stored online and can also sometimes be found. We searched the

[5]We do so because when a system faces competition from another cable operator we do not know the number of subscribers in the areas where the system faced competition relative to the areas where it didn’t.

[6]While we would prefer a bundle demand model, our subscriber data was not rich enough to estimate bundle-specific quantities. This isn’t overly limiting, as our focus is on the impact of vertical integration on inter-distributor demand.

[7]We dropped any constructed market whose total market share exceeded one or which had a zero market share for one of the satellite providers which happens naturally due to sampling error.

[8]Following industry practice, we refer to the set of channels offered at a given (incremental) price as a tier of service and the combination of tiers chosen by households as the bundle that they buy. Thus the expanded basic bundle (service) consists of the limited basic tier and the expanded basic tier.

Internet for all such information about cable prices and linked the information obtained to Focus systems by hand based on the provider, principal community served, and other communities served as reported in the newspaper or listed on the rate card. For system-years where we do not find a price from websites, rate sheets, or newspapers, we link to the TNS Bill Harvesting database. These data are individual-level bills for cable service which report the company providing the service, the household's expenditure, and their zip code. For a given system-year, we use the mean expenditure for subscribers to that system. These data also provide the level of a tax on satellite television service in states where it exists, which we use as an instrumental variable for price in demand estimation.

Table 7 reports the average price, market share, and RSN, cable, and total channels offered across markets and years in our estimation dataset. We use over 6,000 markets over 11 years, with an average coverage of 31.5 million (roughly 30% of) US households.[9] Average prices are quite similar across providers, whether on an unweighted basis or weighted by the number of households in the market. The satellite companies generally offer more channels on their Expanded Basic service than the local cable system, but a similar number of RSNs.

2.2.2 Viewership

We estimate demand using both bundle purchase and viewing data. We have two kinds of viewing data: some at the level of individual households and others reporting aggregate viewing decisions at the level of the Designated Market Area (DMA "ratings").[10] Average viewership for RSNs are reported in Table 6 and average viewership for other cable networks are reported in Tables 8-9.

The first group of data come from our MRI and Simmons datasets described in the previous subsection. Our MRI data reports the number of hours watched for each of the sampled households of 96 channels from 2000 to 2007 while our Simmons data reports the same information for 99 channels between 2008 and 2010. Our aggregate ratings data come from Nielsen. Reported is the average rating on each of between 63 and 100 channels, of which 18 to 29 are RSNs, depending on the year, in each of the 44 to 56 largest DMAs between 1998 and 2011.

Tables 6, 8, and 9 report summary statistics for our viewing data. Tables 8 and 9 report, for each of our sources of viewing data, the mean rating for each of the 87 non-RSNs in either dataset, as well as additional information from our household data. For example, the average rating for the ABC Family Channel in the Nielsen data across the 747 DMA-years for which the information was recorded is 0.418. This is measured in percentage points, so it suggests a household selected at random in one of these years and DMAs would be watching the ABC Family Channel with probability 0.418 percent. While small, this is above average for cable networks. Similarly, the average rating for the RSN, Yankees Entertainment & Sports (YES) from Table 6, is 0.27. For

[9] While we observe the population of channel lineups, incomplete reporting of subscriber information in the Focus dataset and the inability to collect cable prices in some markets prevents us from constructing the information we need in every US cable market.

[10] DMAs are mutually exclusive and exhaustive definitions of television markets created by Nielsen and used for the purchase of advertising time.

RSN viewership, we have additional information about the average RSN rating by platform chosen by households (i.e. cable or each satellite operator), which we report there.

Our household-level data provide further details about viewing which are summarized in the remaining columns of Tables 8 and 9. The last column reports the share of households on average across DMAs and years that report *any* viewing of that channel. As noted in Crawford and Yurukoglu (2012), this provides valuable information about whether a household has any interest in a channel that we will use to inform the estimated distribution of preferences for channels across households.

2.2.3 Average Affiliate Fees

As described earlier, affiliate fees are the monthly per-subscriber charges paid by distributors to content providers for the ability to distribute the channel. SNL Kagan maintains a database with aggregate information about individual cable television networks, both nationally-distributed networks like CNN and ESPN as well as RSNs like the family of Comcast and Fox networks. For many networks, we use information about the average affiliate fee paid by cable systems to each such network. For cable channels, we have information about affiliate fees paid by between 120 and 210 channels per year between 1998 and 2011. For RSNs, we also have information about the total national subscribers served by each of 88 providers between 1998 and 2011. These are also reported in Tables 6, 8, and 9. The average affiliate fee in our data is \$0.16 per subscriber per month for a nationally distributed channel and \$1.45 for an RSN.

3 Model

In this section, we develop an industry model that predicts: (i) household viewership of channels; (ii) household demand for multichannel television services; (iii) the prices and bundles that are offered by distributors; and (iv) the negotiated distributor-channel specific input costs.

Index consumer households by i, markets by m, and time periods by t. There are a set of "downstream" multichannel video programming distributors (MVPDs) $\mathcal{F}_t$ and "upstream" channels $\mathcal{C}_t$ active in each period. MVPDs create and maintain a distribution network and perform retail activities such as billing, packaging, and technical support. Examples include Comcast, Time Warner Cable, Cox, Cablevision, RCN, DirecTV, Verizon FioS, AT&T U-Verse, and municipal cable companies.

Let the set of MVPDs active in a given market-period be denoted $\mathcal{F}_{mt}$. We will assume that each distributor $f \in \mathcal{F}_{mt}$ in each period offers a single "bundle" in market m, where a household subscribing to this bundle pays a price p_{fmt} and has access to a set of channels $\mathcal{B}_{fmt} \subseteq \mathcal{C}_t$.[11]

We assume the following timing: in **stage 1** channels and distributors bargain bilaterally to decide input costs, and distributors also simultaneously set prices and make carriage decisions for each market in which they operate; in **stage 2** households in each market m choose which firm, if

[11] In the previous section we discussed how we deal with firms within a market offering multiple bundles.

any, to subscribe to; and in **stage 3** households view television channels. We now provide details of each stage and further assumptions, proceeding in reverse order of timing.

3.1 Stage 3: Household Viewing

Household i in market m and period t subscribing to firm $j \in \mathcal{F}_{mt}$ allocates its time between watching available channels ($\{c\} \subseteq \mathcal{B}_j$) and non-television activity (denoted by $c = 0$) to solve:

$$\begin{aligned} \max_{\boldsymbol{t}_{ij}} v_{ij}(\boldsymbol{t}_{ij}) \quad &= \quad \sum_{c \in \mathcal{B}_j \cup \{0\}} \frac{\gamma_{ict}}{1-\nu_{ic}} (t_{ijc})^{1-\nu_{ic}} \\ s.t.: \quad & \quad t_{ijc} \geq 0 \; \forall \; c \\ & \quad t_{ijc} = 0 \; \forall \; c \notin \{\mathcal{B}_j \cup \{0\}\} \\ & \quad \sum_{c \in \mathcal{B}_j \cup \{0\}} t_{ijc} \leq T \end{aligned} \tag{1}$$

Parameters γ_{ict} and ν_{ic} are household i's taste parameters for channels, where γ_{ict} sets the level of marginal utility of household i from the first instant of watching channel c, and ν_{ic} controls how fast this marginal utility decays in the amount of time watched. We restrict ν_{ic} to be equal, for a given consumer, for all non-sport channels and the outside-option, and equal for all sports channels (which include RSNs). We assume the distribution of each of the two components of ν (sports and non-sports) are normal (truncated below zero and above one) with parameters $\boldsymbol{\Sigma}^{\nu}$, and do not vary over time.

We parameterize $\boldsymbol{\gamma}_{it} \equiv \{\gamma_{ict}\}_c$, a $C_t \times 1$ vector of household channel preferences, as:

$$\boldsymbol{\gamma}_{it} \quad \equiv \quad \boldsymbol{\chi_{it}} \cdot \tilde{\boldsymbol{\gamma}}_{it}$$

where $\boldsymbol{\chi_{it}}$ is a vector whose components χ_{ict} are Bernouilli random variables (i.e., 0 or 1) that equals 0 with probability ρ_{ct}, $\tilde{\boldsymbol{\gamma}}_{it}$ is a vector where each component $\tilde{\gamma}_{ict}$ is drawn from an exponential distribution with parameter σ^{γ}_{ct}.

For RSNs, we scale $\tilde{\gamma}_{ict}$ by $\exp(-\gamma^b b_{ict} - \gamma^d d_{ic})$, where and $b_{ict} \in [0, 1]$ represents the fraction of teams carried on RSN c that are "blacked-out" (i.e., unable to have games televised in household i's market due to restrictions imposed by the team's league) and d_{ic} is the average distance from household i to the stadiums for the teams shown on RSN c (measured in thousands of miles).[12] These terms allow for households to value an RSN differentially if the household cannot watch some of the carried sport teams, or if the household lives further away from the carried teams' stadiums.

3.2 Stage 2: Household Bundle Choice

Household i weighs the utility it would receive from watching the channels in the bundle offered by each firm j against the price of the bundle and other characteristics to decide which firm, if any,

[12] We focus only on blackout restrictions for MLB, NBA, and NHL teams.

to subscribe to. We specify household i's indirect utility conditional on subscribing to firm j as:

$$u_{ijt} \quad = \quad \beta^v v^*_{ijt} + \boldsymbol{\beta}^x \boldsymbol{x}_{jt} + \beta^{sat}_{ij} + \alpha p_{jt} + \xi_{jt} + \epsilon_{ijt} \tag{2}$$

where v^*_{ij} is the indirect utility from the time allocation problem in (1), $\boldsymbol{x}_{jt}$ are observable non-price characteristics of bundle j such as year dummy variables and firm dummy variables, p_{jt} is the per-month subscription fee for bundle j, and ξ_{jt} is a scalar unobservable demand shock for bundle j. Each consumer has a random preference for each satellite provider, β^{sat}_{ij}, which is drawn from an independent exponential distribution with parameter ρ^{sat}_j; $\beta^{sat}_{ij} = 0$ if j is a cable bundle. We assume that ϵ_{ijt} is distributed Type I extreme value, that the outside option of no bundle is normalized to $u_{i0} = 0$, and that each household chooses the bundle with the highest value of u_{ij}.

The probability that household i subscribes to bundle j in market m is:

$$s_{ijmt} = \frac{\exp(\beta^v v^*_{ijt} + \boldsymbol{\beta}^x \boldsymbol{x}_{jt} + \beta^{sat}_{ij} + \alpha p_{jt} + \xi_{jt})}{1 + \sum_{k \in \mathcal{F}_{mt}} \exp(\beta^v v^*_{ikt} + \boldsymbol{\beta}^x \boldsymbol{x}_{kt} + \beta^{sat}_{ik} + \alpha p_{kt} + \xi_{kt})} \tag{3}$$

where the market share of each bundle j (offered by firm f in market m at time t) is thus $s_{jmt} \equiv \int_i s_{ijmt} dH_{mt}(i)$, where $H_{mt}(i)$ is the joint distribution of household random coefficients (γ, ν, α) in the market.

The demand for bundle j in market m is thus $D_{jmt} \equiv N_{mt} s_{jmt}$, where N_{mt} is the number of television households in m.

3.3 Stage 1: Input Cost Bargaining, Distributor Pricing, and Bundling

In Stage 1, all distributors and channel conglomerates bargain over input prices $\{\tau_{fct}\}_{\forall f,c}$, where τ_{fct} represents the carriage fee that distributor f pays the owner of channel c for each of f's household subscribers that receives channel c. Simultaneously, all distributors choose the prices and composition of each of its bundles.[13] That is, we assume that bargaining occurs simultaneously with distributor pricing.[14,15] We assume that both input prices, bundle prices, and bundle compositions are optimal with respect to each other in equilibrium.

[13] A given distributor f often operates in many markets, and is choosing prices and bundle composition in each of these markets.

[14] See also Nocke and White (2007) and Draganska et al. (2010) who use a similar timing assumption. Formally, one can think of separate agents of the distributor bargaining and making the pricing and bundle composition decisions. We leverage this assumption to simplify the computation and estimation of our model.

[15] An alternative timing assumption would be to assume that input prices are first negotiated, and then distributor prices and bundles are chosen. This would adjust firms perceptions of off-equilibrium actions: e.g., when bargaining, firms would anticipate different bundle prices to immediately be set if off-equilibrium input costs or disagreement were realized. However, there may be reasons to believe that such a rapid response is unrealistic. Absent a fully specified dynamic model of firm bargaining and pricing, which is outside the scope of the current analysis, we believe the approach taken here to be a reasonable approximation.

3.3.1 Stage 1a. Distributor Pricing and Bundling

Every distributor $f \in \mathcal{F}_t$ chooses prices and bundles $\{p_{fmt}, \mathcal{B}_{fmt}\}_{\forall m: f \in \mathcal{F}_{mt}}$ to maximize its profits given anticipated negotiated input fees $\boldsymbol{\tau}_t \equiv \{\tau_{fct}\}_{\forall f,c}$. Profits for f across all markets are:

$$\Pi^M_{ft}(\{\mathcal{B}_{mt}\}_m, \{\boldsymbol{p}_{mt}\}_m, \boldsymbol{\tau}_t; \mu) \quad = \quad \sum_{m: f \in \mathcal{F}_{mt}} \Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu)$$

where:

$$\Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu) \quad = \quad D_{fmt}\Big(p_{fmt} - mc_{fmt}\Big) + \mu \sum_{c \in \mathcal{V}_{ft}} \text{Ф}_{fct}\Big(\sum_{g \in \mathcal{F}_{mt}: c \in \mathcal{B}_{gmt}} D_{gmt}(\tau_{gct} + a_{cmt})\Big) \tag{4}$$

We denote by $\mathcal{B}_{mt} \equiv \{\mathcal{B}_{jmt}\}_{j \in \mathcal{F}_{mt}}$ and $\boldsymbol{p}_{mt} \equiv \{p_{jmt}\}_{j \in \mathcal{F}_{mt}}$ the set of bundles and associated prices offered in the market, and by a_{cmt} the expected advertising revenue obtained by channel c per subscriber to a bundle offering c.

The first component of an MVPD's profit function in a given market m, given by (4), is standard: each bundle has a price and a marginal cost (mc_{fmt}) that determine margins, and this is multipled by demand. We assume that each MVPDs' marginal cost can be decomposed into the sum of the per-subscriber fees that f must pay to each channel c in the bundle, and a bundle-specific cost shock that is the sum of non-channel related marginal costs, ω_{fmt}: i.e., $mc_{fmt} \equiv \sum_{c \in \mathcal{B}_{fmt}} \tau_{fct} + \omega_{fmt}$.[16] The second component of the profit function is non-standard, and represents the degree to which a vertically integrated downstream unit values the profits that accrue to its upstream (i.e., channel) units. These terms include per-subscriber fees and advertising revenues that accrue to integrated upstream channels from its own viewers as well as from viewers of other distributors.[17] The parameter $\mu \in [0,1]$ represents the extent to which a downstream MVPD f internalizes upstream input fees and advertising revenues from all channels $c \in \mathcal{V}_{ft}$, where $\mathcal{V}_{ft}$ represents the set of channels owned by MVPD f in period t.[18] The term Ф_{fct} represents MVPD f's ownership share of channel c at time t.[19]

In the absence of any frictions, μ would be equal to one; this would imply that the downstream firm perfectly internalizes integrated upstream unit profits, and its strategic decisions maximize total firm profit. Parameter μ could also be less than one, potentially representing divisionalization that could arise from ignorance, poor management, optimal compensation under informational frictions, or any other conflict between managers of different divisions within the same firm.

[16] Cost shocks include variable costs such as technical service labor costs or gas costs that are incurred on a per-subscriber basis.

[17] We omit portions of integrated channels' profits which are not affected by f's pricing and carriage decisions, as they do not affect the analysis.

[18] For our analysis, we only include in $\mathcal{V}_{ft}$ the set of integrated RSNs. We will assume that $c \in \mathcal{V}_{ft}$ (and hence, c is integrated with f) if MVPD f owns any percentage of channel c in period t.

[19] In the case that a third party has an x% stake in MVPD f and y% stake in channel c at time t, we assume that $\text{Ф}_{fct} = x\% \times y\%$.

Optimal Pricing and Bundling. We will leverage necessary conditions on the optimality of MVPD pricing and bundling decisions in our estimation. Differentiating (4) with respect to p_{jmt} (and dividing by market size) yields the following pricing FOC:

$$\frac{\partial \Pi^M_{fmt}}{\partial p_{fmt}} = s_{fmt} + \left(p_{fmt} - mc_{fmt}\right)\frac{\partial s_{fmt}}{\partial p_{fmt}} + \sum_{g \in \mathcal{F}_{mt}} \Big(\sum_{c \in \mathcal{B}_{gmt} \cap \mathcal{V}_{ft}} \mu \times \Phi_{fct}(\tau_{gct} + a_{cmt}) \Big) \frac{\partial s_{gmt}}{\partial p_{fmt}} \tag{5}$$

In addition, we assume that the set of channels offered by each MVPD f in each market m satisfies:

$$\mathcal{B}_{fmt} = \arg\max_{\mathcal{B}_f} \Pi^M_{fmt}(\{\mathcal{B}_f, \{\mathcal{B}_{gmt}\}_{g \neq f}\}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu) \tag{6}$$

Satellite Pricing and Bundling. If distributor f is a satellite MVPD (DirecTV or Dish), we assume that the distributor sets a single national price and bundle. We assume that the bundle offered by a satellite MVPD in any given market may differ from the national bundle only in the set of RSN channels that are offered.

3.3.2 Stage 1b: Bargaining over Input Prices

Before describing how input fees are determined, we specify the profits each channel c contemplates when bargaining with MVPD f in market m as:

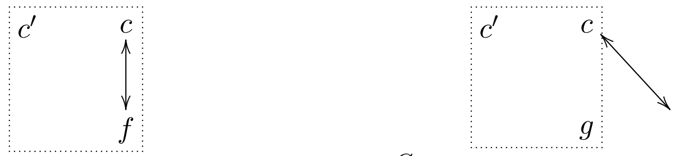
$$\begin{aligned} \Pi^C_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu, \lambda_R) = \sum_{g \in \mathcal{F}_{mt} : c \in \mathcal{B}_{gmt}} D_{gmt} \Bigg(& \tau_{gct} + a_{cmt} \\ & + \mu \times \lambda_{R:fct} \Big(\Phi_{gct}(p_{gmt} - mc_{gmt}) + \sum_{d \in \mathcal{B}_{gmt} \setminus c} \Phi^C_{cdt}(\tau_{gdt} + a_{gdt}) \Big) \Bigg) \end{aligned} \tag{7}$$

The first line reflects input fees and advertising revenues obtained from each bundle the channel is available on; the second line incorporates potential profits of an integrated downstream MVPD, as well as profits from other channels also owned by the same owner of channel c. We denote by Φ^C_{cdt} the common ownership percentage of two channels c and d.

Both terms on the second line are multiplied by μ and $\lambda_{R:fct}$, where:

$$\lambda_{R:fct} = \begin{cases} 1 & \text{if } f \text{ and } c \text{ are integrated (i.e., } \Phi_{fct} > 0) \text{ ,} \\ \lambda_R & \text{if } f \text{ and } c \text{ are not integrated .} \end{cases}$$

We assume that $\lambda_{R:fct} = 1$ if c is owned by f and is bargaining with f; this implies that a channel and distributor that are integrated with each other place equal weight (given by μ) on each other's profits when bargaining with each other. However, if c is integrated but bargaining with a rival distributor (i.e., the MVPD that c is bargaining with, f, is not an owner of c), then $\lambda_{R:fct} = \lambda_R$, where $\lambda_R \in [0, 1]$; thus λ_R governs the extent to which an integrated upstream unit recognizes and internalizes the effects of foreclosing the rival MVPD on the profits of its other integrated units.



$\Pi^C_{cmt} = \pi_{cmt} + \mu(\pi_{fmt} + \pi_{c'mt})$

(a) Internal Bargaining.

$\Pi^C_{cmt} = \pi_{cmt} + \mu\lambda_R(\pi_{gmt} + \pi_{c'mt})$

(b) Bargaining with Rival MVPD.

Figure 1: Examples of Π^C_{cmt} when c bargains with MVPD f.

In Figure 1, we provide an illustration of how channel c's perceived profits when bargaining with MVPD f may change depending on whether or not it is integrated with f. In Figure 1a, c is integrated with MVPD f and another channel c' (represented by the dashed square); in this case, c will consider when bargaining with f its own profits (denoted by π_{cmt}), consisting of input fees and advertising revenues, as well as profits of its integrated distributor f and channel c' (denoted by π_f and $\pi_{c'}$) weighted by μ. We assume that π_{fmt} includes f's subscription revenues net its costs; profits $\pi_{c'mt}$ include c''s input fees and advertising revenues. In Figure 1b, c is integrated with another MVPD g and c'; in this case, c will consider when bargaining with f (a rival MVPD) its own profits π_{cmt}, and those of its integrated units π_{fmt} and $\pi_{c'mt}$ weighted by $\mu\lambda_R$.

The parameter λ_R captures the extent to which an upstream unit has incentives to foreclose access to the RSN to a rival distributor and lower the rivals' bundle quality (thereby shifting demand to the integrated distributor), an effect analogous to the "raising-rivals'-cost" effect discussed in Salop and Scheffman (1983) and Krattenmaker and Salop (1986). We thus refer to λ_R as our "rival-foreclosure" or "raising-rivals'-costs" (RRC) parameter. The indicator variable $\mathbb{1}_{c\in\mathcal{V}_{gt}}$ (which equals 1 if c is owned by MVPD g) multiplies the margins accruing to a potentially integrated downstream unit; the indicator variable $\mathbb{1}_{\exists h:c,d\in\mathcal{V}_{ht}}$ (which equals 1 if channels c and d are both owned by the same MVPD) captures input fees and advertising revenues to other channels owned by the same parent MVPD.

We assume that, given channel c is carried on some of MVPD f's systems, the input cost τ_{fct} between distributor f and channel c maximizes their respective bilateral Nash products *given the expected negotiated input costs of all other pairs and the expected prices and bundles for all distributors*:

$$\hat{\tau}_{fct}(\boldsymbol{\tau}_{-fc,t}, \mathcal{B}_t, \boldsymbol{p}_t) = \arg\max_{\tau_{fct}} \Bigg[\underbrace{\sum_m [\Delta_{fc}\Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \{\tau_{fct}, \boldsymbol{\tau}_{-fc,t}\}; \mu)]}_{GFT^M_{fct}} \Bigg]^{\zeta_{fct}} \tag{8}$$
$$\times \Bigg[\underbrace{\sum_m [\Delta_{fc}\Pi^C_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \{\tau_{fct}, \boldsymbol{\tau}_{-fc,t}\}; \mu, \lambda_R)]}_{GFT^C_{fct}} \Bigg]^{1-\zeta_{fct}}$$

where:

$$[\Delta_{fc}\Pi^M_{fmt}(\mathcal{B}_{mt},\cdot)] \equiv \left(\Pi^M_{fmt}(\mathcal{B}_{mt},\boldsymbol{p}_{mt},\{\boldsymbol{\tau},\boldsymbol{\tau}_{-fc,t}\};\cdot) - \Pi^M_{fmt}(\mathcal{B}_{mt}\setminus fc,\boldsymbol{p}_{mt},\boldsymbol{\tau}_{-fc,t};\cdot)\right)$$
$$[\Delta_{fc}\Pi^C_{cmt}(\mathcal{B}_{mt},\cdot)] \equiv \left(\Pi^C_{cmt}(\mathcal{B}_{mt},\boldsymbol{p}_{mt},\{\boldsymbol{\tau},\boldsymbol{\tau}_{-fc,t}\};\cdot) - \Pi^C_{cmt}(\mathcal{B}_{mt}\setminus fc,\boldsymbol{p}_{mt},\boldsymbol{\tau}_{-fc,t};\cdot)\right)$$

We denote by $\mathcal{B}_{mt}\setminus fc$ the set of all bundles $\mathcal{B}_{mt}$ in which we remove channel c from all bundles offered by MVPD f. Thus, these terms represent the difference in either MVPD or channel profits in market m if f no longer carried channel c. We will refer to GFT^M_{fct} and GFT^C_{fct}, which is the sum of these terms across all markets, as the *gains from trade* (or *bilateral surplus*) for MVPD f and channel c coming to an agreement.

This bargaining solution in which each pair of distributors and channels agree upon a set of input fees which maximize the Nash product of their gains from trade is motivated by the model put forth in Horn and Wolinsky (1988), and used by Crawford and Yurukoglu (2012) to model negotiations between MVPDs and channel conglomerates.[20] Each MVPD and conglomerate negotiate a single input fee per channel that applies to all markets.

We can write the FOC of (8) for each channel c bargaining with MVPD f as:

$$\zeta_{fct}GFT^C_{fct}(\frac{\partial GFT^M_{fct}}{\partial \tau_{fct}}) + (1-\zeta_{fct})GFT^M_{fct}(\frac{\partial GFT^C_{fct}}{\partial \tau_{fct}}) = 0 \tag{9}$$

where the derivative terms in (9) are:

$$\frac{\partial GFT^M_{fct}}{\partial \tau_{fct}} = \sum_m \frac{\partial \Pi^M_{fmt}}{\partial \tau_{fct}} = (-1 + (\mu \times \phi_{fct})) \sum_{m\in\mathcal{M}_{fct}} D_{fmt}$$
$$\frac{\partial GFT^C_{fct}}{\partial \tau_{fct}} = \sum_m \frac{\partial \Pi^C_{cmt}}{\partial \tau_{fct}} = (1 - (\mu \times \lambda_{R:fct} \times \phi_{fct})) \sum_{m\in\mathcal{M}_{fct}} D_{fmt}$$

and $M_{fct} \equiv \{m : c \in \mathcal{B}_{fmt}\}$ denotes the set of markets where c is on f's bundle. As we have assumed that $\lambda_{R:fct} = 1$ whenever $\phi_{fct} > 0$ (i.e., f and c are integrated and bargaining with one another), it follows that $\partial GFT^M_{fct}/\partial\tau_{fct} = -\partial GFT^C_{fct}/\partial\tau_{fct}$. We can thus re-write the FOC as:

$$GFT^C_{fct} = \Psi_{fct}GFT^M_{fct} \tag{10}$$

where $\Psi_{fct} \equiv (1-\zeta_{fct})/\zeta_{fct}$.

This bargaining solution is not defined if $\mu \times \phi_{fct} = 1$; under this case, f and c would perfectly internalize each other's profits when bargaining with one another, and the negotiated τ_{fct} would be indeterminate. Also, in deriving our first-order condition, we are leveraging the assumption that distributor bundle prices are set simultaneously with input costs, and there is no anticipated

[20]See also Grennan (2013), Gowrisankaran et al. (forthcoming), Ho and Lee (2013), and Collard-Wexler et al. (2014).

change in p_{fmt} if τ_{fct} changes. Nonetheless, in equilibrium, both distributor pricing FOCs given by (5) and input cost bargaining FOCs given by (10) will hold for realized values of prices and input costs.

Example. Consider the case in which MVPD f and channel c are both non-integrated entities that bargain with one another in period t. The negotiated input fee τ_{fct} that satisfies the Nash bargaining FOC given by (10) solves:

$$\sum_{m\in\mathcal{M}_{fct}} D_{fmt}\tau_{fct} = (1+\Psi_{fct})^{-1} \sum_{m\in\mathcal{M}_{fct}} \Bigg(\Big(\Psi_{fct}[\Delta_{fc}D_{fmt}](p_{fmt} - mc_{fmt} + \tau_{fct}) \Big) - \Big(D_{fmt}a_{cmt} + \sum_{g\neq f: c\in\mathcal{B}_{gmt}} [\Delta_{fc}D_{gmt}]\big(\tau_{gct} + a_{cmt}\big) \Big) \Bigg) \tag{11}$$

The LHS of this expression is the total payment made by f to c, and the RHS is a fraction of the gains from trade due to agreement: the first term on the RHS represents f's increased profits (net of payments to c) due to more subscribers induced by the carriage of channel c, and the remaining terms represents (the negative of) c's gains from being carried on f. Intuitively, the more f gains from the relationship, the higher the total payment that is made; the more c gains from the relationship, the lower the total payment. If f and c's Nash bargaining parameters were equal, then $(1+\Psi_{fct})^{-1} = 1/2$ and these gains from trade would be split in half.

The Role of λ_R. In our model, λ_R captures the internalization of an integrated downstream MVPD's profits when an integrated channel bargains with another distributor. Consider channel c owned by MVPD f bargaining with rival distributor g (e.g., a satellite distributor). When $\lambda_R > 0$, c's desire to the increase downstream profits of f lowers c's gains from trade when bargaining with the non-integrated rival distributor g compared to when $\lambda_R = 0$. This may lead to the elimination of overall gains from trade, and can result in non-supply of c to g. However, even if there are still positive gains from trade, since these gains will be lower for c when $\lambda_R > 0$, the bargaining process will lead to an increased input fee (τ_{gct}) for the rival distributor. Thus, even if g is still supplied with channel c, its costs are raised; in equilibrium, this can lead the rival to increase the price of its bundles to consumers.

4 Estimation and Identification

We estimate our model in two main stages.

In the first stage, we estimate $\boldsymbol{\theta} \equiv \{\boldsymbol{\theta}_1, \boldsymbol{\theta}_2, \boldsymbol{\theta}_3\}$, where:

1. $\boldsymbol{\theta}_1 \equiv \{\Sigma^\nu, \boldsymbol{\rho}, \boldsymbol{\Sigma}^\gamma, \gamma^d, \gamma^b\}$, where $\boldsymbol{\Sigma}^\gamma \equiv \{\sigma^\gamma_{ct}\}_{\forall c}$ and $\boldsymbol{\rho} \equiv \{\rho_{ct}\}_{\forall c,t}$, determines household viewership decisions. The first parameter of $\boldsymbol{\theta}_1$, Σ^ν, governs the distribution of household "decay"

parameters, and the remaining parameters govern the distribution of $\boldsymbol{\gamma}$ (household tastes for channels).

2. $\boldsymbol{\theta}_2 \equiv \{\beta^v, \boldsymbol{\beta}^x, \boldsymbol{\rho}^{sat}, \alpha\}$, where $\boldsymbol{\rho}^{sat} \equiv \{\rho^{sat}_{DirecTV}, \rho^{sat}_{Dish}\}$, determines household bundle choice.

3. $\boldsymbol{\theta}_3 \equiv \{\mu\}$ represents the extent to which integrated conglomerates and distributors internalize profits across upstream and downstream units when pricing, bargaining, and choosing other strategic variables.

Initially, we assume that $\Psi_{fct} = 1/2\ \forall f, c, t$, and that distributors and channels have the same Nash bargaining parameters.

In the second stage, we estimate our RRC parameter, λ_R.

Program Access Rules. To partially capture the impact of program access rules, we will assume that $\lambda_R = 0$ in non-loophole markets and estimate our first stage parameters using only these markets. We then estimate λ_R using only the markets in our data in which the terrestrial loophole was used by RSNs (i.e., Philadelphia and San Diego).

4.1 First Stage Estimation

4.1.1 Moments used in Estimation

We estimate the model parameters via GMM, using the following moments derived from the model described in the previous section.

Household Viewership. We use the difference between the following viewership moments observed in the data and predicted by the model:

1. Summing across markets, the mean viewership for each channel-year;

2. Summing across markets, the number of households with zero viewership for each (non-RSN) channel-year;

3. For each of five demographic groups, averaged across all RSN-years, the ratio of the mean viewership of a given demographic group compared to the overall unconditional viewership for an RSN channel-year.

Household Bundle Choice. Moments from the household bundle decision include:

1. We assume that each bundle's unobservable characteristic is orthogonal to a vector of instruments: i.e., $E[\xi_{fmt}(\boldsymbol{\theta})\boldsymbol{Z}^{\xi}_{mt}] = 0$, where the expectation is taken across all markets, firms, and years. For $\boldsymbol{Z}_{mt}$, we include bundle observable characteristics $\boldsymbol{x}_{fmt}$ and predicted indirect utility of channel viewing v^*_{fmt} for the mean consumer; it also includes the satellite tax within the market to instrument for p^o_{fmt}. We recover $\xi_{fmt}(\boldsymbol{\theta})$ using the standard Berry et al. (1995) inversion.

2. We match the covariance of cable vs. satellite subscription (0 or 1) with household income by market, averaged across all markets and years.

Distributor Pricing, Bundling, and Bargaining. First, for any $\boldsymbol{\theta}$, the vector of input costs $\{\tau_{fct}\}$ and bundle-specific marginal costs $\{mc_{fmt}\}$ can be directly computed using the pricing and bargaining FOCs given by (5) and (10) (see Appendix for further details). We use these predicted values of $\{mc_{fmt}(\boldsymbol{\theta})\}$ and $\{\tau_{fct}(\boldsymbol{\theta})\}$ in constructing the next set of moments:

1. **Average Input Costs**: the model's predicted average input costs across MVPDs for each channel should match observed average input costs:

$$E_f[\tau_{fct}(\boldsymbol{\theta})] - \tau^o_{ct} = 0 \qquad \forall c \in \mathcal{C}_t \ .$$

   We assume that any deviations reflect measurement error in τ_c, which are minimized. There are C_t moments per year for estimation, which we construct by weighting estimated input costs by MVPD market shares to approximate expectations across MVPDs.

2. **Implied markups**: the model's predicted price-cost markups should match those observed in the data (which we observe for Comcast, DirecTV, and Dish for 2007):[21]

$$E_m[(p^o_{fmt} - mc_{fmt}(\boldsymbol{\theta}))/p^o_{fmt}] = markup^o_{ft} \qquad \forall f \in \{Comcast, DirecTV, Dish\} \ .$$

3. **Bundle Optimality and Carriage**: Equation (6) implies that every distributor f chooses the optimal set of channels to include in each bundle in each market m. We will assume that distributor f's true per-household profits in market m are given by $\tilde{\pi}^M_{fmt}(\cdot)$, where:

$$\tilde{\pi}^M_{fmt}(\mathcal{B}_{mt}, \cdot) \equiv [\pi^M_{fmt}(\mathcal{B}_{mt}, \cdot) - \nu^1_{fmt}(\mathcal{B}_{fmt})] + \sum_{c \in \mathcal{B}} \nu^2_{fct} \ . \tag{12}$$

   and $\pi^M_{fmt}(\mathcal{B}_{mt}, \cdot)$ represents our (the econometrician's) estimate of a firm's per-household profits. We introduce two types of disturbances in this definition: the first, $\nu^1_{fmt}(\cdot)$, represents a distributor-market-time specific disturbance which captures potential measurement or specification error between our estimate of a firm's profits and that observed by the firm; the second, ν^2_{fct}, is a distributor-channel-time specific disturbance that is known to the distributor when making its carriage decision (but realized subsequent to the bargaining stage), unobserved to the econometrician, and may include non-measured per-household fixed incentives or costs of carrying a channel.[22]

   Now consider firm f and channel c that have negotiated an agreement: i.e., f carries c on some bundles in some non-empty set of markets. For any m, m' such that $c \in \mathcal{B}_{fmt}$, $c \notin \mathcal{B}_{fm't}$,

[21]These values are [XX, YY, ZZ], which come from 2007 10K annual reports...

[22]We assume that these disturbances enter linearly into both distributor and channel profits when bargaining so that realizations of these disturbances do not influence the determination of equilibrium input costs.

a firm's optimal bundling decision given by (6) implies that:

$$\Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fmt},\cdot)] - \Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fm't} \cup fc,\cdot)] + (\Delta_{fc}[\nu^1_{fm't}(\mathcal{B}_{m't} \cup fc,\cdot)] - \Delta_{fc}[\nu^1_{fmt}(\mathcal{B}_{mt})]) \geq 0$$

where the ν^2 disturbances cancel out.

We assume that $\{\nu^1_{fcmt}(\cdot)\}$ is a mean-zero i.i.d. disturbance across firms, channels, markets, and time. Then for each firm f and RSN c with agreement,

$$E_{m \in \mathcal{M}^+_{fct}}\Big[\Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fmt},\cdot)] - \Delta_{fc}[\pi_{f,m'(m),t}(\mathcal{B}_{f,m'(m),t} \cup fc)]\Big] \geq 0 \qquad \forall f, c$$
$$E_{m \in \mathcal{M}^-_{fct}}\Big[-\Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fmt} \cup fc),\cdot)] + \Delta_{fc}[\pi_{f,m'(m),t}(\mathcal{B}_{f,m'(m),t})]\Big] \geq 0 \qquad \forall f, c$$

where $\mathcal{M}^+_{fct}$ denotes the set of markets in which f is active and carries channel c, $\mathcal{M}^-_{fct}$ denotes those markets in which f is active but does not carry c, and $m'(m)$ denotes a market that has the opposite carriage decision for firm f and c (i.e., if $c \in \mathcal{B}_{fmt}$, then $c \notin \mathcal{B}_{f,m'(m),t}$, and vice versa) and is the closest (in Euclidean distance) to market m in terms of (weighted) distance to the teams carried on RSN c and fraction of teams on c that are blacked out.[23] These inequalities imply that the summed change in f's per-household profits in market m and market m' (where f carries c either in m or m'), when reversing its observed carriage decisions in both markets and averaging across all markets m in which f either carries or doesn't carry c, is positive. If these inequalities did not hold, it would imply that f would have a profitable deviation by changing its carriage decisions for c in certain markets.

These inequalities motivate minimizing the following moments in estimation:

$$\frac{1}{\sum_{f \in \mathcal{F}_t} |\mathcal{M}^+_{fct}|}\left[\sum_{f \in \mathcal{F}_t} \sum_{m \in \mathcal{M}^+_{fct}} \Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fmt},\cdot)] - \Delta_{fc}[\pi_{f,m'(m),t}(\mathcal{B}_{f,m'(m),t} \cup fc,\cdot)]\right]_- \quad \forall c$$
$$\frac{1}{\sum_{f \in \mathcal{F}_t} |\mathcal{M}^-_{fct}|}\left[\sum_{f \in \mathcal{F}_t} \sum_{m \in \mathcal{M}^-_{fct}} -\Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fmt} \cup fc,\cdot)] + \Delta_{fc}[\pi_{f,m'(m),t}(\mathcal{B}_{f,m'(m),t},\cdot)]\right]_- \quad \forall c$$

where $[\cdot]_- \equiv \min\{\cdot, 0\}$ and $|\cdot|$ denotes the cardinality of the set. These sets of moments are similar to those used in Crawford and Yurukoglu (2012) and follows Pakes et al. (forthcoming).

4.1.2 Identification

We now provide an informal discussion of how the parameters of the model are identified from these moments.

The main parameters governing the distribution of γ_{ict} (i.e., $\Sigma^\gamma, \boldsymbol{\rho}$) are primarily identified from viewing behavior: e.g., channels watched more often have higher values of γ_{ict} and lower values

[23] The rationale for this matching procedure is to match markets with comparable magnitudes of profitability changes, and to be robust to the possibility that ν^2_{fct} might vary across very dissimilar markets.

of ρ_{ct}. However, since we do not possess ratings for channels at the system level, we identify the black-out and distance parameters γ^b, γ^d via the Bundle Optimality and Carriage moments; we defer the discussion on this until the end of this subsection when discussing identification of μ.

Parameters governing household bundle choice, $\boldsymbol{\beta}^x$ and $\boldsymbol{\beta}^v$, are identified from variation in bundle market shares as observed bundle characteristics and channel utility changes: i.e., across firms and years, and as channels are added and dropped from bundles. The satellite tax is an instrument for price, and is used to identify the price sensitivity coefficient α. Information contained in cable and satellite pricing margins helps identify the heterogeneity in preferences for satellite. In particular, the relationship between satellite and cable market shares has strict implications for predicted price elasticities (and hence implied markups) under a standard logit demand system without preference heterogeneity; inclusion of a random preference for satellite (parameterized by $\boldsymbol{\rho}^{sat}$) assists with rationalizing observed markups for a given satellite market share.

In addition to observing how bundle market shares vary based on channel composition (which has limited variation for some channels across markets), matching observed average input costs negotiated for each channel $\{\tau^o_{ct}\}$ to those predicted by the model $\{\tau_{fct}(\boldsymbol{\theta})\}$ is crucial. First, our model relates $\tau_{fct}(\boldsymbol{\theta})$ to the gains from trade created when channel c contracts with firm f: i.e., differences in f and c's profits (primarily realized from subscription and advertising revenues) when f drops c. Thus, our model attempts to rationalize a channel with higher observed input costs τ^o_{ct} by predicting that this channel creates greater surplus from carriage: this is partly through the term $\beta^v v^*_{ijt}$ in a household's bundle utility equation given by (2), which in turn is also a function of parameters governing the distribution of γ_{ict}, and how γ_{ict} is scaled to enter into utility by ν_{ic} (which has a distribution paramaterized Σ^ν)—i.e., a channel with a higher γ_{ic} and lower decay parameter ν_{ic} than another will contribute more to a viewer's utility from the same amount of time the channel is watched.

To anchor this in an example, consider a single market and bundle with two channels c and c', and a single household i. Assume that viewers watch c' twice as long as c. This could be induced by many potential combinations of $(\gamma_{ic}, \nu_{ic}, \gamma_{ic'}, \nu_{ic'})$; e.g., $\gamma_{ic'}$ could be higher than γ_{ic} and $\nu_{ic} = \nu_{ic'}$. If this were true, however, then c' should obtain higher negotiated input costs as it would be predicted to generate a higher surplus for a viewer, and hence there would be higher gains from trade from carriage of c' than c. However, if input costs are observed to be the same for the two channels despite the difference in viewership, then the model would predict that the rate of "decay" for channel c, ν_{ic}, was in fact higher than $\nu_{ic'}$ (thereby allowing c to generate the same utility for consumers—and hence same negotiated input costs—for a shorter amount of time watched).

Now add to this example two additional markets: one market only has channel c available, and another only has channel c'. If viewership patterns for these channels in the new markets were similar to those in the first market, then variation in market shares for cable across these markets as the channel composition of the bundles changed would inform the value of β^v.

In a sense, the parameters governing the distributions of γ_{ic} and ν_{ic} help the model rationalize

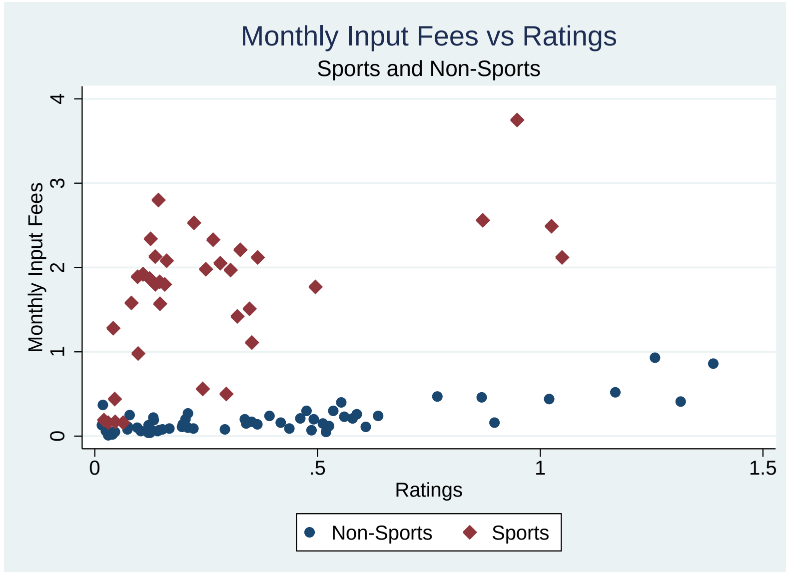


Figure 2: Negotiated monthly input fees and viewership ratings.

variation in both negotiated input costs and the market share of bundles as (both the mean and variance of observed) *viewership* of channels changes across markets, controlling for channel carriage; on the other hand, β_v helps the model rationalize variation in market share of bundles as *channel carriage* changes across markets, holding fixed patterns of viewership for these channels.

The reason that we allow for consumers to possess two different "decay" parameters ν_{ic} for sports and non-sports channels is motivated by the data, illustrated in Figure 2. Sports channels have consistently higher negotiated input fees than non-sports channels with similar viewership patterns (ratings), in cases receiving payments an order of a magnitude higher. Our model rationalizes this by assigning a higher decay rate to sports channels, which predicts higher utility delivered to consumers for a given amount of time the channel is watched; thus, sports channels are able to negotiate higher input fees as they create greater gains-from-trade upon agreement with an MVPD.

Although the internalization parameter μ enters into the computation of several moments (including any moment based off of recovered values of $\tau_{fct}(\boldsymbol{\theta})$ and $mc_{fmt}(\boldsymbol{\theta})$), it will primarily be identified off of the Bundle Optimality and Carriage moments. In particular, as μ increases, distributors have a greater incentive to carry an integrated channel for a fixed value $\tau_{fct}(\cdot)$; hence, the model will help to rationalize higher carriage rates between integrated distributors and channels (which is observed in the data). Similarly, we identify our black-out and distance parameters, γ^b, γ^d, in a similar fashion. An example of the variation in the data that we leverage is illustrated in Figure 3: for both Comcast SportsNet Chicago and Comcast SportsNet Mid-Atlantic, non-carriage by the integrated distributor (Comcast) is less likely than non-carriage by non-integrated distributors, and non-carriage overall is more likely as the system is further from the RSN's teams' stadiums and when teams on the RSN are blacked out (as in Michigan for CSN Chicago, and in Pennsylvania for CSN Mid-Atlantic). Table 1 summarizes this relationship across all RSN's and distributors in our

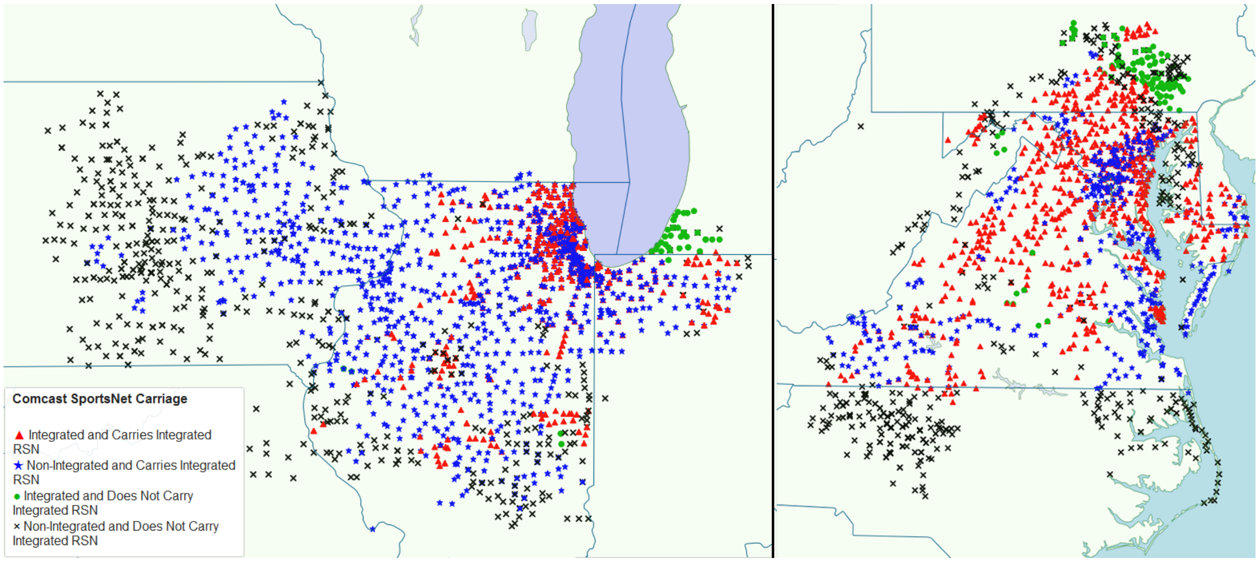


Figure 3: Carriage by integrated and non-integrated MVPDs of CSN Chicago (left) and CSN Mid-Atlantic (right)

sample: carriage of an RSN by a cable system is strongly increasing with the RSN and distributor being integrated, and strongly decreasing in the distance between the system and the RSN's teams' stadiums and in the fraction of teams that are blacked out.

4.2 Second Stage Estimation

4.2.1 Recovery of λ_R

To recover our RRC parameter λ_R, we will use information provided by markets in which distributors are able to exclude competitors from carrying an integrated RSN channel—i.e., terrestrial loophole markets. The markets we focus on will be Philadelphia and San Diego, the channels in question CSN Philadelphia (owned by Comcast) and 4SD (owned by Cox), and the competitors excluded from carriage are satellite providers DirecTV and Dish.

To describe our approach, consider a channel c that is integrated with distributor f that is "relevant" (i.e., offered and plausibly available to some set of distributors) in markets $\mathcal{M}_c$. If we observe that channel c does not contract with distributor $g \neq f$, we will assume that λ_R must have been sufficiently large that c and g not contracting with one another is an equilibrium outcome. A *necessary* condition for this is that there is no input fee $\tilde{\tau}_{gct}$ such that c and g would both find it

Table 1: Regression of RSN Carriage on Integration Status and Distance

RSN Carriage Regression			
	Coeff.	SE	t
Integrated with RSN	0.143	0.026	5.46
Distance to RSN (mi)	-0.001	0.000	-11.08
N MLB Teams on RSN	0.070	0.019	3.62
N NBA Teams on RSN	0.065	0.021	3.15
N NHL Teams on RSN	0.210	0.028	7.49
RSN-Year FE	Yes		
MSO FE	Yes		
DMA FE	Yes		
R-squared	=	0.5704	
N	=	11063	

Notes: Linear probability regression where the dependent variable is whether a system carries an RSN in a given year. SE's are clustered by RSN-year.

profitable to contract with one another:

$$\sum_{m \in \mathcal{M}_c} \Bigg[\Big(\underbrace{\Pi^M_{gmt}(\{\mathcal{B}^o_{mt} \cup gc\}, \boldsymbol{p}^o_{mt}, \{\tilde{\tau}_{gct}, \hat{\boldsymbol{\tau}}_{-gct}\}; \hat{\mu})}_{\text{MVPD } g\text{'s profits in } m \text{ with } c} - \Pi^M_{gmt}(\mathcal{B}^o_{mt}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}_{-gct}; \hat{\mu}) \Big) \tag{13}$$

$$+ \Big(\underbrace{\Pi^C_{cmt}(\{\mathcal{B}^o_{mt} \cup gc\}, \boldsymbol{p}^o_{mt}, \tilde{\tau}_{gct}; \hat{\mu}, \lambda_R)}_{c\text{'s profits in } m \text{ when supplying MVPD } g} - \Pi^C_{cmt}(\mathcal{B}^o_{mt}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}_{-gct}; \hat{\mu}, \lambda_R) \Big) \Bigg] \leq 0 \;\forall\; \tilde{\tau}_{gct}$$

where the o superscript denotes observed variables, $\{\mathcal{B}^o_{mt} \cup gc\}$ denotes the set of observed bundles with the modification that g carries c on all of its bundles (in the relevant markets), $\hat{\cdot}$ are estimated values from the first-stage estimation, and $\hat{\boldsymbol{\tau}}_{-gct}$ represents all input fees except those between g and c.[24] If (13) holds for all values of $\tilde{\tau}_{gct}$, the solution to the Nash Bargain between g and c given by (8) is not defined.

Since we are evaluating a deviation in a model in which bundle composition, bundle prices, and input fees are simultaneously determined, when computing "counterfactual" profits from agreement between channel c and distributor g (the terms with underbraces in (13)), we will hold fixed bundle prices and the channels carried when evaluating counterfactual profits upon carriage of c by g.[25] Furthermore, in the case where g is a satellite distributor, it must carry c in all of the relevant markets. In that case, condition (13) holds at any $\tilde{\tau}_{gct}$ if and only if the joint profits of the two

[24]To be precise, input fees are not directly estimated; instead, we compute their implied values at the estimated parameters $\hat{\boldsymbol{\theta}}$: i.e., $\hat{\boldsymbol{\tau}} \equiv \boldsymbol{\tau}(\hat{\boldsymbol{\theta}})$, where $\boldsymbol{\tau}(\cdot)$ is the solution to the Nash bargaining FOCs given by (10).

[25]The condition that there does not exist a deviation to carriage is not the same as testing whether carriage of c by g would comprise an equilibrium outcome, as this test would require (among other things) computing equilibrium prices and input fees conditional on carriage of c by g being known and anticipated by all firms in the market.

parties is larger with non-supply. We thus can test whether (13) holds for $\tilde{\tau}_{gct} = 0$ to determine whether or not a deviation for c to supply g is profitable for both parties.

Multilateral Deviations. Alternatively, we may believe that it is not feasible for an integrated channel c to be withheld by its cable owner f from one satellite provider, s, but provided to the other satellite provider, s'. This can be motivated by regulation or legal constraints. In such a case, the previous bilateral analysis may not be appropriate. Instead, we will determine whether, at the observed set of bundles, input costs, and bundle prices, there are no gains from trade between c and *both* satellite providers s and s' (thereby ruling out the presence of this profitable deviation):

$$\sum_{m\in\mathcal{M}_c}\Bigg[\Big(\Pi^M_{smt}(\{\mathcal{B}^o_{mt}\cup\{sc,s'c\}\},\boldsymbol{p}^o_{mt},\tilde{\boldsymbol{\tau}};\hat{\mu})-\Pi^M_{smt}(\mathcal{B}^o_{mt},\boldsymbol{p}^o_{mt},\hat{\boldsymbol{\tau}}_{-\{sct,s'ct\}};\hat{\mu})\Big)$$
$$+\Big(\Pi^M_{s'mt}(\{\mathcal{B}^o_{mt}\cup\{sc,s'c\}\},\boldsymbol{p}^o_{mt},\tilde{\boldsymbol{\tau}};\hat{\mu})-\Pi^M_{s'mt}(\mathcal{B}^o_{mt},\boldsymbol{p}^o_{mt},\hat{\boldsymbol{\tau}}_{-\{sct,s'ct\}};\hat{\mu})\Big)$$
$$+\Big(\Pi^C_{cmt}(\{\mathcal{B}^o_{mt}\cup\{sc,s'c\}\},\boldsymbol{p}^o_{mt},\tilde{\boldsymbol{\tau}};\hat{\mu},\lambda_R)-\Pi^C_{cmt}(\mathcal{B}^o_{mt},\boldsymbol{p}^o_{mt},\hat{\boldsymbol{\tau}}_{-\{sct,s'ct\}};\hat{\mu},\lambda_R)\Big)\Bigg]\leq 0\ , \tag{14}$$

where the three lines represent s, s', and c's gains from trade from both s and s' being supplied with channel c, and $\tilde{\boldsymbol{\tau}}$ is equal to $\hat{\boldsymbol{\tau}}$ except that $\tilde{\tau}_{sct} = \tilde{\tau}_{s'ct} = 0$. As in the case of bilateral deviations before, we test whether or not (14) holds when the negotiated input fees between s and c and between s' and c equal 0.

Although bargains are happening simultaneously, we are assuming that both s and s' believe that if one of them was offered channel c, both satellite providers would be offered the channel. This is consistent if all parties are aware of the constraints imposed under this scenario.[26]

We estimate a lower bound of λ_R, denoted $\widehat{\underline{\lambda_R}}$ by finding the lowest value that ensures that either (13) or (14) hold for all channel-distributor pairs that do not contract in the loophole markets.[27]

4.2.2 Recovery of ν^2

Although not necessary to interpret our main model estimates, the recovery of unobserved firm-channel specific carriage disturbances ν^2_{fc} will be useful to test the robustness of our analyses.

Again, consider a given distributor f with an agreement with channel c. Taking expectations over (6) implies that:

$$-E_{m\in\mathcal{M}^+_{fct}}\Big[\Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fmt},\cdot)]\Big]\leq\nu^2_{fct}\leq -E_{m\in\mathcal{M}^-_{fct}}\Big[\Delta_{fc}[\pi_{fmt}(\mathcal{B}_{fmt}\cup fc,\cdot)]\Big]\qquad\forall f,c$$

[26] This is similar to assuming "symmetry beliefs" (McAfee and Schwartz, 1994) in that satellite distributors anticipate that either both are supplied or both are excluded from c when receiving an off-equilibrium offer; however, we do not impose the restriction that satellite distributors anticipate receiving the same input fee for carriage. In our model, since prices and carriage are simultaneously determined, the input fee offered to s' does not affect s's profits and hence its decision to .

[27] For now, we will assume away the specification error introduced in (12): i.e., $\nu^2_{gct} = 0$.

Table 2: Estimates of Key Parameters

	Parameter Estimate	SE
ν_{sports}	0.60	
$\nu_{non-sports}$	0.94	
γ_d (Distance Decay)	-6.034	
α_0	-0.127	
β_v	0.016	
$\beta^{sat}_{DirecTV}$	11.594	
β^{sat}_{Dish}	15.886	
ρ^{sat}	0.139	
μ	0.90	
$\underline{\lambda_r}$	0.79	

Notes: Key parameters from the first and second stage estimation of the full model.

which provides a set of bounds for ν^2_{fct}.

We will assume a parametric distribution over $\boldsymbol{\nu}^2 \equiv \{\nu^2_{fct}\}_{fct}$: i.e., $\nu^2_{fct} \sim N(\upsilon_1, \upsilon_2)$, and estimate $\boldsymbol{\upsilon} \equiv \{\upsilon_1, \upsilon_2\}$ using MLE (conditional on all the bounds being non-empty).

5 Results

Estimates of the key parameters of our model are reported in Table 2. We discuss our estimates primarily through how they influence predicted moments relating to (i) viewership patterns, (ii) consumer bundle choices and implied firm pricing decisions, (iii) negotiated input fees, and (iv) carriage and bundling decisions.

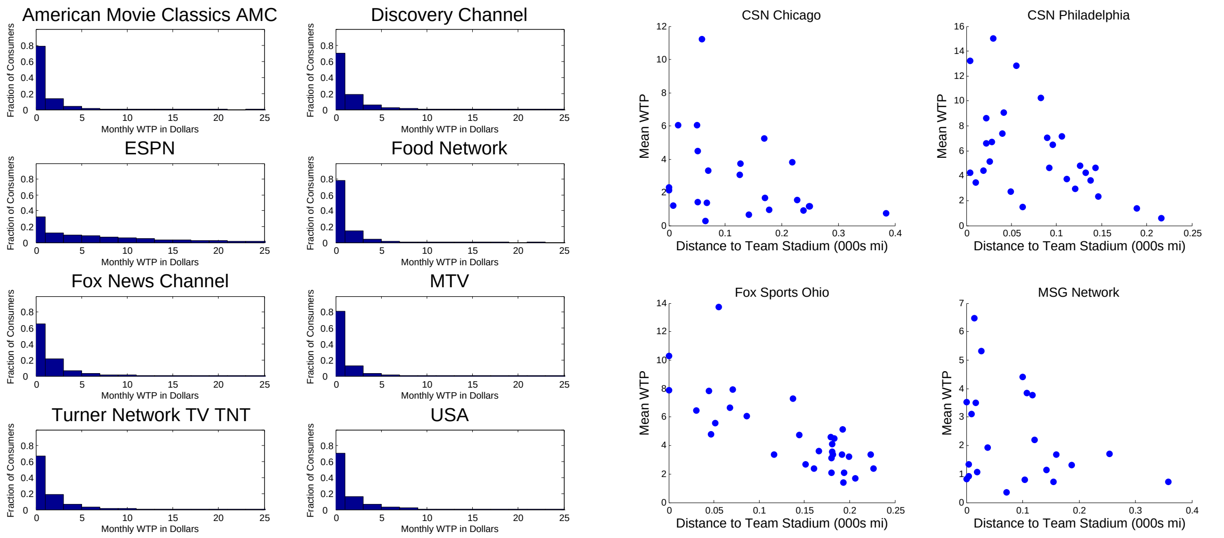
5.1 Channel Valuations

Our model predicts the willingness-to-pay (WTP) for each channel by household by computing the contribution of a given channel to bundle utility (υ^*_{ijt} in (2)), and multiplying it by our estimates of β^v/α_i to convert it into dollars.

The distribution of household WTP for 8 national channels is provided in Figure 4a. In Appendix B, Table 10 reports WTP estimates for all national channels and Table 11 reports WTP estimates for the RSNs.

Our estimate of the RSN distance-decay is negative, and implies that consumers derive less utility from watching a RSN the further they are from the stadium of the main team carried by that RSN: a household 100 miles away from a channel's main team stadium values that channel only 55% ($\exp(-6.034 \times 0.1)$) as much as a household right next door to the stadium. Figure 4b illustrates this pattern, and plots the predicted mean WTP of households for 4 different RSNs as the distance from a household to an RSN's team stadium increases.

Finally, we estimate different values of ν_{sports} and $\nu_{non-sports}$, where the higher value of ν_{sports} implies that consumers' marginal utility from watching sports channels falls faster than for non-



(a) Histograms of Monthly WTP.

(b) Mean WTP by Market-RSN as a function of distance from Market to RSN team stadiums.

Figure 4: Predicted WTP for channels.

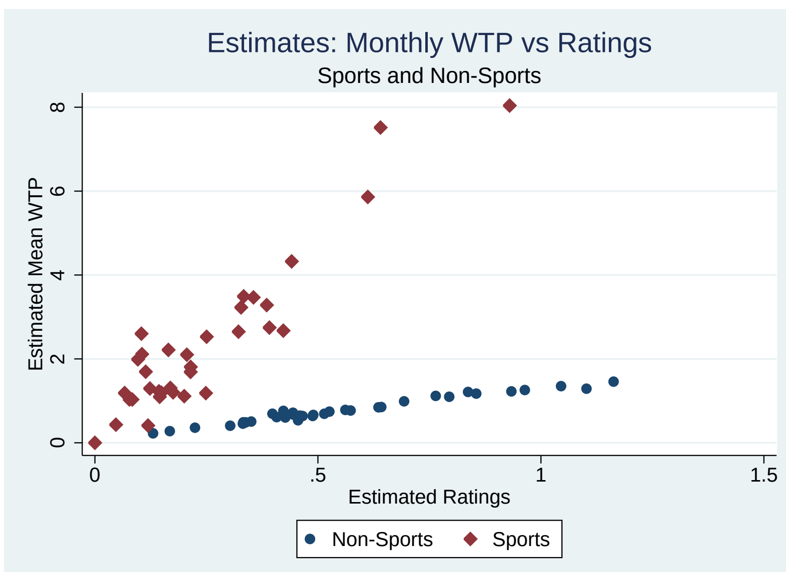


Figure 5: Estimated Monthly WTP vs Ratings for Sports and Non-Sports Channels

sports channels; in turn, this implies that consumers derive higher utility from sports channels than non-sports channels for the same amount of time spent watching each. Our model thus predicts that sports channels receive higher negotiated input fees for the same viewership ratings, as depicted in Figure 5.

5.2 Pricing and Bundle Choices

In Table 3, we report average predicted own and cross price elasticities and implied margins for cable and satellite MVPDs predicted by our model. Demand for the average cable system (-1.6) is

Table 3: Elasticities and Margins

Elasticity of row with respect to price of column:	Cable	DirecTV	Dish
Cable	-1.624	0.280	0.183
DirecTV	1.895	-2.629	0.111
Dish	2.603	0.189	-3.593
Mean Cable Margin	0.765		
Mean DirecTV Margin	0.539		
Mean Dish Margin	0.451		
OLS Logit Price Coefficient	-0.0046**	(t: -2.40)	
IV Logit Price Coefficient	-0.0987***	(t: -6.17)	

Notes: This table reports mean price elasticities and margins by cable/DirecTV/Dish, as well as the effect of the satellite tax instrument on the price coefficient in a logit demand system.

more inelastic than for satellite (-2.6 and -3.6), which is consistent with its larger market shares and higher predicted margins. The margins implied by the model are close to the observed Comcast (.67), DirecTV (.57), and Dish (.49) margins computed from each company's 2007 annual report.

In addition, the bottom panel of Table 3 reports the effect of instrumenting for bundle prices using the satellite tax instrument that was discussed in the previous section. In a logit demand system, instrumenting for price yields a 20 times larger estimated price coefficient, consistent with the presence of a positive correlation between price changes and unobservable bundle characteristics.

5.3 Internalization and RRC Parameters.

We now turn to the estimates and magnitudes of μ and λ_R.

Our estimated value of μ indicates that firms do internalize the profits of other integrated units when making decisions: i.e., when pricing and determining carriage on its bundles, an MVPD internalizes potential effects on input fees and advertising revenues accruing to integrated channels; and when bargaining internally, an integrated MVPD and channel face reduced double marginalization incentives. Insofar our estimated value of $\mu < 1$, however, such internalization is imperfect.

Our estimated lower bound for λ_R is .79, which indicates also a high level of internalization when an integrated channel bargains with rival MVPDs. Figure 6 graphs the total three party surplus between the integrated channel and the two satellite providers in the two loophole markets we examine (Philadelphia and San Diego). We see that for values of λ_R lower than .5, it is not an equilibrium for either channel to exclude both satellite providers as there would be a profitable deviation (for some negotiated set of input fees) for the channel to be supplied. However, for values of λ_R between approximately .5 and .79, we can rationalize exclusion in San Diego but not

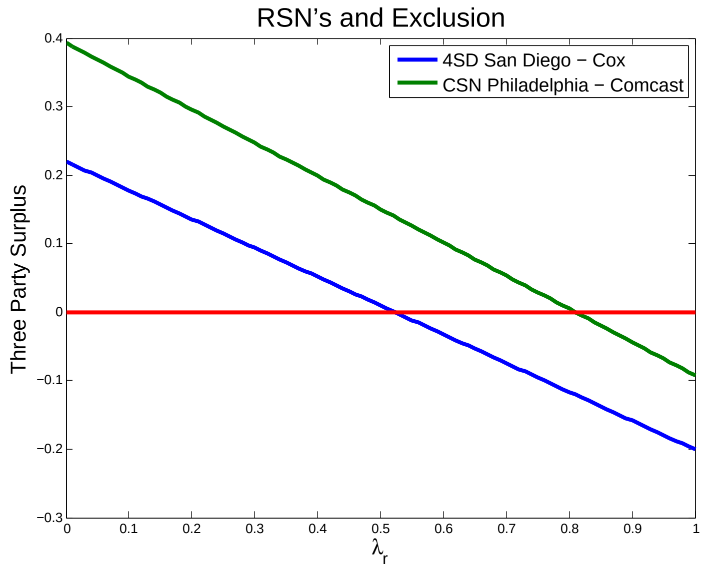


Figure 6: Three Party Surplus as a function of λ_r in Philadelphia and San Diego.

Philadelphia. Only for values of $\lambda_R \geq .79$ does our model rationalize exclusion in both of these loophole markets.

6 The Welfare Effects of Vertical Integration

In this section, we use estimates from our model to perform counterfactual exercises that illustrate how vertical integration affects input cost negotiations, distributors' pricing and carriage decisions, and—ultimately—firm and consumer welfare.

Focusing on the year 2007, we perform two counterfactuals. In our first counterfactual, we close the "terrestrial loophole" in Philadelphia and San Diego. In our second counterfactual, we explore the impact of relaxing program access rules in markets where the "terrestrial loophole" did not apply: we focus on the negotiations between integrated RSNs and rival MVPDs, and examine the extent to which the RSN would wish to deny access to other distributors. In both counterfactuals, we quantify the welfare impact of this change in carriage.

Future exercises (currently in progress) will control for adjustments in negotiated input fees and prices following a counterfactual change, and explore predicting market outcomes if MVPDs had to divest integrated RSNs (which is equivalent in our model to assuming that upstream and downstream units of integrated firms do not internalize each others incentives when making strategic decisions: i.e., setting $\mu = 0$).

Discussion. Before proceeding, it is useful to discuss the components of our model and the types of responses permitted in these exercises in order to understand the range of effects that we allow for when evaluating the impact of vertical integration.

There are three primary supply-side decisions our model emphasizes: carriage decisions, negotiations over input costs conditional on carriage, and bundle pricing. When an MVPD and a channel are integrated, our estimated value for $\hat{\mu} > 0$ implies that integrated downstream and upstream units (at least partially) internalize joint profits when making all of these decisions.

For exposition, assume that MVPD f integrates with channel c, and there is a rival MVPD g and another channel d. The following effects of vertical integration are admitted in our model:

I. When an integrated channel c bargains with a rival MVPD g (since $\widehat{\lambda_R} > 0$), c internalizes lost revenues to its integrated downstream MVPD f by supplying g (induced by making g a more competitive rival and taking customers from f); c may thus have a greater incentive to deny carriage to g than it would have if it were not integrated.

II. When an integrated MVPD f negotiates with other channels d, f internalizes viewership changes to its integrated channel c when it carries channel d on its own bundles; if c and d are substitutable, f may be willing to pay a lower negotiated input cost τ_{fdt} (and potentially have less of an incentive to carry d), as the gains from trade from f carrying d are partially mitigated by lost viewership and advertising revenues to c.

III. When an integrated MVPD f prices its bundles:

(a) f faces a lower perceived marginal cost as it internalizes payments made to c; hence, double marginalization incentives induced by linear input costs may be mitigated;

(b) f internalizes input costs paid by rival MVPD g to integrated channel c, thereby alleviating bundle pricing pressure and increasing in its "effective" marginal cost as f now partly benefits from customers lost to g (Chen, 2001).

The welfare effects of some of these incentives may be straightforward to sign ex ante; for others, it is not clear. Effect I, for instance, may likely lead to consumer welfare losses: if g loses access to c or pays a higher input price τ_{gct}, g's subscribers may receive less utility from their bundle of channels (from reduced choice or higher prices); f's prices may also increase in response.[28] Effect II, similarly, may have negative consumer welfare consequences if this leads to f (and g) increasing prices. However, effect III has two components with potentially opposite effects: whereas IIIa would favor lower bundle prices, IIIb serves to mitigate price competition and push prices higher.

At the moment, we focus on primarily the effects mentioned in I. In our current model, there are many potential responses that we have not yet (or cannot) explicitly control for. Most importantly, we have not modeled investment in channel and programming quality, which may increase upon integration due to the alignment of incentives between upstream and downstream firms, and the potential reduction of hold-up concerns surrounding counterparty specific investments.

[28] Upon g losing access to c, it is feasible that bundle prices may also fall due to either lower prices from g, or from lower prices from f due to lower negotiated input costs from d. Furthermore, consumers re-optimizing their bundle choice would also influence welfare predictions.

Table 4: Closing the Terrestrial Loophole in 2007

		Market Share			Surplus ($/month/capita)		
		exc.	w/o exc.	change	exc.	w/o exc.	change
4SD	Integrated Cable:	0.739	0.716	-3.10%	13.271	12.864	-3.06%
Cox	Satellite:	0.106	0.132	23.80%	0.975	1.205	23.57%
Pop. 1052705	Consumer:				29.921	30.304	1.28%
CSN Phil.	Integrated Cable:	0.646	0.612	-5.25%	10.915	10.421	-4.53%
Comcast	Satellite	0.159	0.199	25.19%	1.624	2.011	23.83%
Pop. 2762396	Consumer:				26.794	27.822	3.84%

Notes: This table presents changes in the model's predicted market shares and surplus under a counterfactual scenario where the integrated RSN is forced to supply satellite distributors in Philadelphia and San Diego. The owner of the channel in question and the population in each market is reported below the channel name. The columns "exc." and "w/o exc." indicate scenarios with exclusion and without exclusion of satellite. Surplus calcuations for integrated cable providers include surplus for the integrated RSN; all surplus figures are reported holding fixed existing input fees and prices, assuming that the new input fee between satellite and the previously excluded RSN is 0, and in units of $ per month per capita

Consequently, we view our counterfactuals as being only partial equilibrium results (both in their current as well as final form), and thus any interpretation of our findings must be made with this in mind.

6.1 Exercise 1: Closing the Terrestrial Loophole (Disallowing Exclusion in Exempted Markets)

Our first counterfactual simulates market outcomes in Philadelphia and San Diego when the integrated RSN channels are forced to serve the two satellite providers.[29] This would be equivalent to assuming that $\lambda_R < .59$ in both markets so that exclusion would not be desirable on the part of each RSN.

Results from this exercise are reported in Table 4. The two panels of the table report computed market outcomes in San Diego and Philadelphia if 4SD and CSN Philadelphia were supplied by their cable owners to both satellite providers Dish and DirecTV. Examining market shares, supplying satellite providers with the RSN would increase their market share by 3-4 percentage points (25%); almost all of this would be taken from cable, with less than a 1 percentage-point increase in total MVPD market share in each market. In both markets, consumer surplus would be predicted to increase by $0.40 and $1.00 per capita per month in SD and Philadelphia, corresponding to approximately $5M and $34M per year, respectively.

[29]These two markets were exempt from the FCC's Program Access Rules by the "terrestrial loophole" as their delivery system did not rely on satellite transmission.

6.2 Exercise 2: Removing Program Access Rules (Allowing Exclusion in All Markets)

Our second counterfactual simulates the market outcomes when MVPDs with integrated RSN channels are able to potentially exclude satellite distributors from carriage. As we have assumed that $\lambda_R = 0$ in these markets during estimation, we will here examine the negotiations between the integrated cable provider and satellite in these markets when $\lambda_R > 0$. In particular, having identified an estimate of the lower bound of $\widehat{\underline{\lambda_R}}$, we will explore how carriage decisions will change for values of $\lambda_R > \widehat{\underline{\lambda_R}}$.

We focus on RSN's which are vertically integrated with cable.[30] These RSN's are: Comcast SportsNet Bay Area, Comcast SportsNet California, Comcast SportsNet Chicago, Comcast SportsNet Mid-Atlantic, Comcast SportsNet Northeast, Comcast SportsNet Northwest, Comcast Charter Sports Southeast, Cox Sports TV (New Orleans), Madison Square Garden (integrated with Cablevision), Madison Square Garden Plus (integrated with Cablevision), and SportsNet NY (integrated with Time Warner Cable and Comcast).

For an integrated RSN channel c relevant in markets $\mathcal{M}_c$ carried by satellite provider s, and for a given $\lambda_R > \widehat{\underline{\lambda_R}}$, we will determine whether or not at the observed set of bundles, input costs, and bundle prices, there are no GFTs between c and *both* satellite providers s and s':

$$\sum_{m \in \mathcal{M}_c} \Bigg[\Big(\Pi^M_{smt}(\mathcal{B}^o_{mt}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}; \hat{\mu}) - \Pi^M_{smt}(\{\mathcal{B}^o_{mt} \setminus \{sc, s'c\}\}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}; \hat{\mu}) \Big)$$
$$+ \Big(\Pi^M_{s'mt}(\mathcal{B}^o_{mt}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}; \hat{\mu}) - \Pi^M_{s'mt}(\{\mathcal{B}^o_{mt} \setminus \{sc, s'c\}\}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}; \hat{\mu}) \Big)$$
$$+ \Big(\Pi^C_{cmt}(\mathcal{B}^o_{mt}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}; \hat{\mu}, \lambda_R) - \Pi^C_{cmt}(\{\mathcal{B}^o_{mt} \setminus \{sc, s'c\}\}, \boldsymbol{p}^o_{mt}, \hat{\boldsymbol{\tau}}; \hat{\mu}, \lambda_R) \Big) \Bigg] < 0 \,. \qquad (15)$$

where (15) differs from (14) in that here, the integrated channel is removed from the observed bundles in the data (as we are examining markets exempt from the loophole and potentially subject to PARs) as opposed being added.

Results. We report our findings in Table 5 for $\lambda_R = .79$ and $\lambda_R = 1$. We find that even when $\lambda_R = 1$, exclusion is not predicted in approximately half of our markets with an RSN owned by a cable MVPD (5 out of 11).[31] Figure 7 plots the three party surplus (integrated cable owner and the two satellite providers) for 6 cable-integrated RSNs for different values of λ_R; these gains are negative for 3 of the channels, thus implying that expanding the terrestrial loophole to other markets would potentially lead to exclusion by an integrated cable provider.

The main drivers that make exclusion less likely for a cable-integrated RSN is a larger market share of satellite and smaller coverage of the integrated cable provider; i.e., the larger is the

[30] We also check the Root Sports networks (Northwest, Pittsburgh, and Rocky Mountain) which are integrated with DirecTV. However, because cable's market share is so large, our estimated model predicts that DirecTV would not profit from refusing to provide Root Sports to cable.

[31] 3 other markets listed, in which exclusion is not predicted, are for RSNs channels owned by DirecTV.

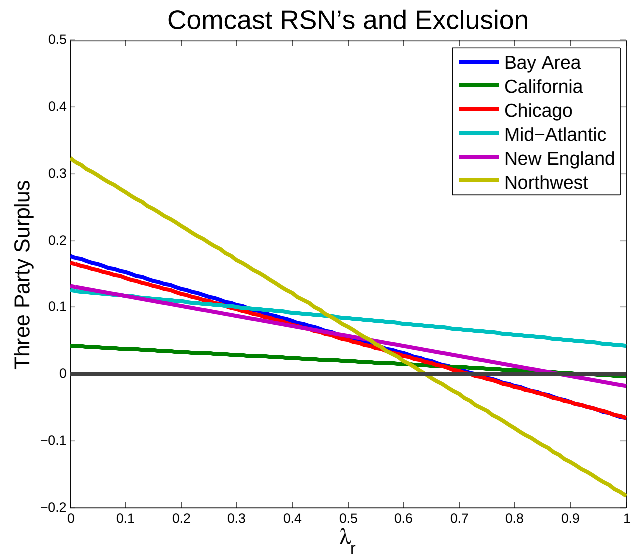


Figure 7: Three Party Surplus as a function of λ_r in for currently protected RSN's.

satellite share, the more that an RSN integrated with a cable provider would lose from excluding satellite in terms of foregone input fees and potential ad revenues; the smaller the integrated cable provider's share, the smaller would be the loss in subscription revenue borne by the RSN's integrated downstream distributor when consumers substitute to a satellite MVPD (due to satellite's lower margins).

These findings indicate that some channels owned by a cable provider would have an incentive to deny access to satellite if program-access rules were relaxed. To compute predicted welfare outcomes from this counterfactual, we examine each RSN channel and market in isolation, and hold fixed: (i) negotiated input prices and carriage decisions for all other channels; and (ii) bundle prices for all distributors in these markets. However, it is important to stress that if "opening up" the terrestrial loophole is a policy change that is anticipated by firms, in markets where carriage decisions of an RSN will change there will be potential equilibrium responses in all of these variables. Computing counterfactual equilibria is currently ongoing.

In Table 5 we also report market outcomes (shares and surplus) in each market if exclusion did occur: i.e., if the MVPD that owned each channel (reported below each channel in the table) excluded its rival distributors in each market. Unsurprisingly, in all markets with exclusion, satellite and consumer surplus is predicted to fall, as does satellite market share.

7 Concluding Remarks

This paper examined vertical integration of high value sports content in the US cable and satellite television industry. Our framework accounts for consumer choice over downstream distributors, consumer viewership decisions over content, downstream pricing and carriage decisions, and upstream-downstream bargaining over input fees. The framework allows for vertical integration to

Table 5: Removing Program Access Rules in 2007

	Exclusion?			Market Share			Surplus		
	$\lambda_R = .79$	$\lambda_R = 1$		w/o exc.	exc.	change	w/o exc.	exc.	change
CSN Bay Area	Yes	Yes	Int. Cable:	0.615	0.634	2.97%	8.202	8.461	3.16%
Comcast			Satellite	0.211	0.189	-10.45%	1.882	1.689	-10.26%
Pop. 5676023			Consumer:	-	-	-	25.178	24.294	-3.51%
CSN CA	No	Yes	Int. Cable:	0.605	0.609	0.67%	8.892	8.941	0.55%
Comcast			Satellite	0.212	0.207	-2.42%	1.899	1.853	-2.41%
Pop. 4623318			Consumer:	-	-	-	24.391	24.221	-0.70%
CSN Chicago	Yes	Yes	Int. Cable:	0.597	0.614	2.89%	6.861	7.103	3.52%
Comcast			Satellite	0.209	0.189	-9.36%	1.965	1.789	-8.98%
Pop. 5041614			Consumer:	-	-	-	23.885	23.307	-2.42%
CSN Mid-Atl.	No	No	Int. Cable:	0.662	0.674	1.68%	6.056	6.139	1.37%
Comcast			Satellite	0.165	0.152	-7.81%	1.644	1.519	-7.63%
Pop. 4423934			Consumer:	-	-	-	25.378	25.020	-1.41%
CSN NE	No	Yes	Int. Cable:	0.646	0.659	1.98%	9.040	9.205	1.83%
Comcast			Satellite	0.116	0.100	-13.10%	2.801	2.701	-3.59%
Pop. 4734329			Consumer:	-	-	-	22.532	22.215	-1.41%
CSN NW	Yes	Yes	Int. Cable:	0.598	0.632	5.70%	7.934	8.433	6.29%
Comcast			Satellite	0.254	0.217	-14.47%	2.206	1.889	-14.35%
Pop. 3275967			Consumer:	-	-	-	36.672	35.731	-2.57%
CSS	No	No	Int. Cable:	0.565	0.573	1.42%	6.330	6.384	0.85%
Comcast, Charter			Satellite	0.263	0.254	-3.61%	2.801	2.701	-3.59%
Pop. 10800000			Consumer:	-	-	-	30.381	30.096	-0.94%
Cox Sports TV	No	No	Int. Cable:	0.554	0.562	1.34%	4.060	4.064	0.10%
Cox			Satellite	0.208	0.200	-4.00%	1.977	1.902	-3.76%
Pop. 647210			Consumer:	-	-	-	24.552	24.289	-1.07%
MSG	No	No	Int. Cable:	0.687	0.697	1.45%	7.001	7.084	1.19%
Cablevision			Satellite	0.144	0.135	-6.11%	1.365	1.253	-8.23%
Pop. 11400000			RSN:	-	-	-	0.598	0.607	1.56%
MSG Plus	No	Yes	Int. Cable:	0.687	0.695	1.11%	6.816	6.916	1.47%
Cablevision			Satellite	0.144	0.135	-6.11%	1.365	1.283	-6.02%
Pop. 10800000			Consumer:	-	-	-	27.959	27.739	-0.79%
Root NW	No	No	Cable:	0.617	0.608	-1.40%	11.074	10.942	-1.19%
DirecTV			Int. Satellite	0.222	0.223	0.52%	1.066	1.085	1.79%
Pop. 3275967			Consumer:	-	-	-	32.936	32.151	-2.38%
Root Pitt.	No	No	Cable:	0.651	0.632	-2.84%	11.407	11.155	-2.21%
DirecTV			Int. Satellite	0.166	0.168	1.29%	1.367	1.380	0.98%
Pop. 8215501			Consumer:	-	-	-	25.704	24.588	-4.34%
Root Rocky Mtn.	No	No	Cable:	0.545	0.540	-0.91%	8.656	8.598	-0.68%
DirecTV			Int. Satellite	0.328	0.329	0.31%	1.736	1.752	0.90%
Pop. 4113810			Consumer:	-	-	-	37.914	37.596	-0.84%
SportsNet NY	No	No	Int. Cable:	0.687	0.693	0.86%	3.331	3.353	0.64%
Comcast, TWC			Satellite	0.144	0.137	-4.84%	1.365	1.301	-4.67%
Pop. 11400000			Consumer:	-	-	-	27.959	27.764	-0.70%

Notes: This table presents changes in the model's predicted market shares and surplus under a counterfactual scenario where Int. RSN's are permitted to refuse to deal with rivals. The MVPD listed under the channel name is the owner of the channel. The columns "exc." and "w/o exc." indicate scenarios with exclusion and without exclusion of satellite, and "change" reports the change. Surplus calculations for integrated MVPDs include surplus for the integrated RSN; all surplus figures are reported holding fixed exiting input fees and prices, and in units of $ per month per capita.

reduce double marginalization, to cause foreclosure of rivals to integrated content or to raise rivals' costs of integrated content, and for the possibility that divisions within the integrated firm do not perfectly internalize their actions on one another. We use the estimated model examine the effectiveness of regulatory policy towards integrated sports content. We find that relaxing regulations to allow exclusive dealing would result in foreclosure of cable integrated RSN's to satellite providers in a handful of large markets including Chicago and the San Francisco Bay Area. We predict such foreclosure would decrease consumer surplus by roughly one to two percent per capita as consumers with strong tastes for both satellite television and regional sports are unable to consume regional sports on satellite.

This research can be extended in a number of directions. First, measuring the strength of this set of effects in other industries would be important. Second, allowing for richer sets of behavior on both the efficiency side and the strategic side could be important. For example, do vertically integrated firms facilitate information sharing along the supply chain, and is this good or bad for consumers? Third, incorporating dynamic effects of vertical integration such as changes in investment incentives or post-merger entry would be an important step.

References

Asker, John. (2004), Measuring Advantages from Exclusive Dealing. Unpublished.

Berry, Steven, Levinsohn, James and Pakes, Ariel. (1995). 'Automobile Prices in Market Equilibrium', *Econometrica* 63(4), 841–890.

Chen, D. and Waterman, D. (2007). 'Vertical Ownership, Program Network Carriage, and Tier Positioning in Cable Television: An Empirical Study', *Review of Industrial Organization* 30(3), 227–251.

Chen, Yongmin. (2001). 'On vertical mergers and their competitive effects', *RAND Journal of Economics* 32(4), 667–685.

Chipty, Tasneem. (2001). 'Vertical Integration, Market Foreclosure, and Consumer Welfare in the Cable Television Industry', *American Economic Review* 91(3), 428–453.

Collard-Wexler, Allan, Gowrisankaran, Gautam and Lee, Robin S. (2014), Bargaining in Bilateral Oligopoly: An Alternating Offers Representation of the "Nash-in-Nash" Solution. NBER Working Paper 20641.

Conlon, Christopher T. and Mortimer, Julie H. (2013), All Units Discount: Experimental Evidence from the Vending Industry. Unpublished.

Crawford, Gregory S., Lee, Robin S., Vieira, Breno, Whinston, Michael and Yurukoglu, Ali. (2014), Channel 5 or 500? Vertical Integration, Favoritism, and Discrimination in Multichannel Television. Unpublished.

Crawford, Gregory S. and Yurukoglu, Ali. (2012). 'The Welfare Effects of Bundling in Multichannel Television Markets', *American Economic Review* 102(2), 643–685.

Draganska, Michaela, Klapper, Daniel and Villas-Boas, Sofia B. (2010). 'A Larger Slice or a Larger Pie? An Empirical Investigation of Bargaining Power in the Distribution Channel', *Marketing Science* 29(1), 57–74.

FCC. (2012), Report and Order in MB Docket Nos. 12-68, 07-18, 05-192; Further Notice of Proposed Rulemaking in MB Docket No. 12-68; Order on Reconsideration in MB Docket No. 07-29, Technical report. FCC 12-123, released October 5, 2012.

Gowrisankaran, Gautam, Nevo, Aviv and Town, Robert. (forthcoming). 'Mergers When Prices Are Negotiated: Evidence from the Hospital Industry', *American Economic Review* .

Grennan, Matthew. (2013). 'Price Discrimination and Bargaining: Empirical Evidence from Medical Devices', *American Economic Review* 103(1), 147–177.

Grossman, S. and Hart, O. (1986). 'The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration', *Journal of Political Economy* 94, 691–796.

Hart, Oliver and Tirole, Jean. (1990). 'Vertical Integration and Market Foreclosure', *Brookings Papers on Economic Activity. Microeconomics* 1990, 205–286.

Hastings, J. and Gilbert, R. (2005). 'Market Power, Vertical integration and the Wholesale Price of Gasoline', *Journal of Industrial Economics* 53(4), 469–492.

Ho, Kate and Lee, Robin S. (2013), Insurer Competition and Negotiated Hospital Prices. NBER Working Paper 19401.

Horn, Hendrick and Wolinsky, Asher. (1988). 'Bilateral Monopoly and Incentives for Merger', *The RAND Journal of Economics* 19, 408–419.

Hortacsu, Ali and Syverson, Chad. (2007). 'Cementing Relationships: Vertical Integration, Foreclosure, Productivity, and Prices', *Journal of Political Economy* 115(2), 250–301.

Houde, Jean-Francois. (2012). 'Spatial Differentiation and Vertical Mergers in Retail Markets for Gasoline', *American Economic Review* 102(5), 2147–2182.

Krattenmaker, Thomas G. and Salop, Steven C. (1986). 'Anticompetitive Exclusion: Raising Rivals' Costs to Achieve Power over Price', *The Yale Law Journal* 2, 209–293.

Lee, Robin S. (2013). 'Vertical Integration and Exclusivity in Platform and Two-Sided Markets', *American Economic Review* 103(7), 2960–3000.

McAfee, R. Preston and Schwartz, Marius. (1994). 'Opportunism in Multilateral Vertical Contracting: Nondiscrimination, Exclusivity, and Uniformity', *American Economic Review* 84(1), 210–230.

Nocke, Volker and White, Lucy. (2007). 'Do Vertical Mergers Facilitate Upstream Collusion', *American Economic Review* 97(4), 1321–1339.

Ordover, J., Saloner, G. and Salop, S. (1990). 'Equilibrium Vertical Foreclosure', *American Economic Review* 80, 127–142.

Pakes, Ariel, Porter, Jack, Ho, Kate and Ishii, Joy. (forthcoming). 'Moment Inequalities and Their Application', *Econometrica* .

Perry, Martin K. (1990), Vertical Integration: Determinants and Effects, *in* **Richard Schmalensee and Robert Willig**., eds, 'Handbook of Industrial Organization', Vol. 1, North Holland, Amsterdam.

Riordan, Michael H. (2008), Competitive Effects of Vertical Integration, *in* **Paolo Buccirossi**., ed., 'Handbook of Antitrust Economics', MIT Press, Cambridge, MA.

Salop, Steven C. and Scheffman, David T. (1983). 'Raising Rivals' Costs', *American Economic Review* 73(2), 267–271.

Spengler, Joseph J. (1950). 'Vertical integration and antitrust policy', *The Journal of Political Economy* pp. 347–352.

Suzuki, Ayako. (2009). 'Market foreclosure and vertical merger: A case study of the vertical merger between Turner Broadcasting and Time Warner', *International Journal of Industrial Organization* 27(4), 523–543.

Villas-Boas, Sofia B. (2007). 'Vertical Relationships between Manufacturers and Retailers: Inference with Limited Data', *Review of Economic Studies* 74(2), 625–652.

Waterman, D. H. and Weiss, A. A. (1996). 'The Effects of Vertical Integration between Cable Television Systems and Pay Cable Networks', *Journal of Econometrics* 72(1-2), 357–95.

Willamson, Oliver. (1985), *The economic institutions of capitalism*, New York, NY.

A Further Estimation and Computational Details

A.1 Solving for Negotiated Input Fees and Bundle Marginal Costs

We will omit the subscript on Ψ_{fct} for the expressions in this subsection.

Consider MVPD f bargaining with channel c over input fee τ_{fct}. Closed form expressions for MVPD and channel "GFT" terms defined in (8) can be derived as follows:

$$GFT^{M}_{fct} = \sum_{m \in \mathcal{M}_{fct}} \Bigg[\Big[\mu_{fct} D_{fmt} - D^{\setminus fc}_{fmt}\Big] \tau_{fct} + \mu_{fct} (D_{fmt} + \sum_{g \neq f : c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}]) a_{cmt} + \mu_{fct} \sum_{g \neq f : c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] \tau_{gct} + \sum_{d \in \mathcal{V}_{ft} \setminus c} \sum_{g \in \mathcal{F}_{mt} : d \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] \mu_{fdt} (\tau_{gdt} + a_{dmt}) + [\Delta_{fc} D_{fmt}] \Big(p_{fmt} - mc_{fmt} \Big) \Bigg] \tag{16}$$

$$GFT^{C}_{fct} = \sum_{m \in \mathcal{M}_{fct}} \Bigg[(D_{fmt} - \mu_{fct} D^{\setminus fc}_{fmt}) \tau_{fct} + (D_{fmt} + \sum_{g \neq f : c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}]) a_{cmt} + \sum_{g \neq f : c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] (\tau_{gct}) + \sum_{g \in \mathcal{F}_{mt}} \lambda_{R:fct} [\Delta_{fc} D_{gmt}] \sum_{d \in \mathcal{B}_{gmt} \setminus c} \mu^{C}_{cdt} (\tau_{gdt} + a_{dmt}) + \sum_{g \in \mathcal{F}_{mt}} \mu_{gct} \lambda_{R:fct} [\Delta_{fc} D_{gmt}] \Big(p_{gmt} - mc_{gmt} \Big) \Bigg] \tag{17}$$

where: $D^{\setminus fc}_{fmt}$ is the demand for f in market m if it dropped channel c; $\lambda_{R:fct} = \lambda_R$ if f and c are not integrated, and $\lambda_{R:fct} = 1$ otherwise; $\mu_{fct} = \mu \times \Phi_{fct}$; and $\mu^{C}_{cdt} = \mu \times \Phi^{C}_{cdt}$.

Assume now that c is either non-integrated or integrated with either f or f'. Using (16) and (17), the Nash Bargaining FOC given by (10) ($GFT^{C}_{fct} = \Psi GFT^{M}_{fct}$) for f and c bargaining can be expressed as:

$$\begin{aligned} &\tau_{fct} \sum_{m \in \mathcal{M}_{fct}} \Big[D_{fmt} (1 - \Psi \mu_{fct}) + D^{\setminus fc}_{fmt} (\Psi - \mu_{fct}) \Big] + \sum_{g \neq f : c \in \mathcal{B}_{gmt}} \tau_{gct} \sum_{m \in \mathcal{M}_{fct}} (1 - \Psi \mu_{fct}) [\Delta_{fc} D_{gmt}] \\ &+ \sum_{g \in \mathcal{F}_{mt}} \sum_{d \in \mathcal{B}_{gmt} \setminus c} \tau_{gdt} (\mu^{C}_{cdt} \lambda_{R:fct} - \Psi \mu_{fdt}) \sum_{m \in \mathcal{M}_{fct}} [\Delta_{fc} D_{gmt}] \\ &+ (\Psi - \mu_{fct}) \sum_{m \in \mathcal{M}_{fct}} mc_{fmt} [\Delta_{fc} D_{fmt}] - \mu_{f'ct} \lambda_R \sum_{m \in \mathcal{M}_{fct}} mc_{f'mt} [\Delta_{fc} D_{f'mt}] = \\ &\sum_{m \in \mathcal{M}_{fct}} \Big[(\Psi - \mu_{fct}) [\Delta_{fc} D_{fmt}] p_{fmt} - \mu_{f'ct} \lambda_R [\Delta_{fc} D_{f'mt}] p_{f'mt} \Big] \\ &- \sum_{m \in \mathcal{M}_{fct}} \Bigg[a_{cmt} \Big((1 - \Psi \mu_{fct}) D_{fmt} + (1 - \Psi \mu_{fct}) \sum_{g \neq f : c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] \Big) \\ &+ \sum_{g \in \mathcal{F}_{mt}} \sum_{d \in \mathcal{B}_{gmt} \setminus c} a_{dmt} (\mu^{C}_{cdt} \lambda_{R:fct} - \Psi \mu_{fdt}) ([\Delta_{fc} D_{gmt}]) \Bigg] \end{aligned} \tag{18}$$

which will hold for all MVPD-channel (f, c) pairs.

We can also re-express the optimal prices set by each MVPD given by the pricing FOC in (5) as:

$$\Big[\sum_{g \in \mathcal{F}_{mt}} \frac{\partial s_{gmt}}{\partial p_{fmt}} \sum_{c \in \mathcal{B}_{gmt}} \mu_{fct} \tau_{gct} \Big] - \frac{\partial s_{fmt}}{\partial p_{fmt}} mc_{fmt} = - \Big[s_{fmt} + \frac{\partial s_{fmt}}{\partial p_{fmt}} p_{fmt} + \sum_{g \in \mathcal{F}_{mt}} \frac{\partial s_{gmt}}{\partial p_{fmt}} \sum_{c \in \mathcal{B}_{gmt}} \mu_{fct} a_{cmt} \Big] \tag{19}$$

which will hold for all markets and firms active ($\forall m, f \in \mathcal{F}_{mt}$).

Using (18) and (19), which have expressed input fees and marginal costs on the LHS as a function of demand parameters, prices, and advertising rates, the vector of input fees and bundle marginal costs can be solved explicitly via matrix inversion.

Implementation. We first solve for $\{\tau_{fct}\}_{\forall f,t,c\in\mathcal{C}_t^{RSN}}$ for all RSNs and for $\{mc_{fmt}\}_{\forall fmt}$ using (18) and (19). Once these have been recovered, we use our estimates to recover $\{\tau_{fct}\}_{\forall ft,c\notin\mathcal{C}_t^{RSN}}$ for non-RSN channels, which we have assumed to be non-integrated (or not internalize integrated unit profits), via matrix inversion on the following:

$$\tau_{fct}\sum_{m\in\mathcal{M}_{fct}}\left[D_{fmt}+\Psi D_{fmt}^{\backslash fc}\right]+\sum_{g\neq f:c\in\mathcal{B}_{gmt}}\tau_{gct}\sum_{m\in\mathcal{M}_{fct}}[\Delta_{fc}D_{gmt}]= \tag{20}$$
$$\sum_{m\in\mathcal{M}_{fct}}\left[(\Psi)[\Delta_{fc}D_{fmt}](p_{fmt}-mc_{fmt})\right]+\sum_{g\in\mathcal{F}_{mt}}\sum_{d\in\mathcal{B}_{gmt}\backslash c}\mu_{fdt}\Psi\hat{\tau}_{gdt}\sum_{m\in\mathcal{M}_{fct}}[\Delta_{fc}D_{gmt}]$$
$$-\sum_{m\in\mathcal{M}_{fct}}\left[a_{cmt}\Big(D_{fmt}+\sum_{g\neq f:c\in\mathcal{B}_{gmt}}[\Delta_{fc}D_{gmt}]\Big)+\sum_{g\in\mathcal{F}_{mt}}\sum_{d\in\mathcal{B}_{gmt}\backslash c}a_{dmt}(-\Psi\mu_{fdt})([\Delta_{fc}D_{gmt}])\right]$$

At this stage, since we are focused on recovering estimated input costs for non-RSN channels c, it will be the case that $\mu_{fct}=0\ \forall ft, c\notin\mathcal{C}_t^{RSN}$. Also, the only input costs that enter into the calculation are for RSNs on the RHS of (20)); thus, when specifying f and c's bargain, we use estimates of these RSN input costs recovered in the first stage to account for changes in realized total input costs from f's other integrated channels.

A.2 Computation of Disagreement Payoffs

Computation of several moments requires estimating $\Delta_{fc}[\Pi^M_{fmt}(\mathcal{B}_{mt},\boldsymbol{p}_{mt},\{\hat{\boldsymbol{\tau}}_{fct},\boldsymbol{\tau}_{-fc,t}\})]$ and $\Delta_{fc}[\Pi^C_{cmt}(\mathcal{B}_{mt},\boldsymbol{p}_{mt},\{\hat{\boldsymbol{\tau}}_{fct},\boldsymbol{\tau}_{-fc,t}\};\lambda_R)]$ for each MVPD f and channel c that contract in each period. These "gains from trade" for each pair are comprised of agreement and disagreement profits.

Profits from agreement (as a function of $\boldsymbol{\theta}$) can be computed from observed prices and bundle composition using MVPD and Channel profits specified by (4) and (7). Profits from disagreement between MVPD f and channel c are recomputed in each market given the following assumptions:

1. Bundle composition does not change for other MVPDs: $\mathcal{B}'_{gmt}=\mathcal{B}_{gmt}\ \forall\ g\neq f$; bundles for MVPD f just drop c, but do not adjust otherwise;
2. Input prices $\hat{\tau}_{-fc,t}$ for all other MVPD-conglomerate pairs do not adjust;
3. Bundle prices for satellite and cable providers do not adjust.

The second and third assumptions are consistent with the timing of our game and the simultaneous determination of input and bundle prices.

A.3 Recomputing Counterfactual Equilibria when Channels are Added or Removed from Satellite

When we explore counterfactuals when a RSN channel c is either added or removed from satellite providers (and potentially un-integrated), we compute market outcomes when input and bundle prices are allowed to re-equilibrate. Note that this is different than in the previous subsection, where we explore the computation of disagreement points which occur off the equilibrium path, since here changes are anticipated by all players (e.g., if the terrestrial loophole were closed). We assume that:

1. satellite distributors either carry or do not carry c in all (relevant) markets, and (with national pricing) do not change the prices of its bundles;

2. cable systems may change their prices (since demand elasticities may be affected by changes in carriage) but do not change any carriage or bundling decisions;

3. input prices of RSNs (but not national channels) are allowed to adjust.

We compute the new counterfactual equilibrium where c is either now supplied or removed from satellite in a given period t as follows:

1. We recover estimates of non-RSN costs for each MVPD in the relevant markets:

$$\hat{mc}_{fmt}^{\backslash R} \equiv \hat{mc}_{fmt} - \sum_{c \in \mathcal{B}_{fmt}^{R}} \hat{\tau}_{fct} \qquad \forall m \in \mathcal{M}_c, f \in \mathcal{F}_{mt} \tag{21}$$

where $\mathcal{B}_{fmt}^{R}$ is the observed set of RSNs carried by f in market m.

2. Given new bundles $\{\mathcal{B}_{fmt}^{R,CF}\}$ and potentially new values for $\{\lambda_{R:fct}^{CF}, \mu_{fct}^{CF}\}$, we iterate on the following until we obtain convergence on counterfactual input prices $\{\tau_{fct}^{CF}\}$, bundle prices $\{p_{fmt}^{CF}\}$, bundle demands $\{D_{fmt}^{CF}\}$, and elasticities $\{\partial s_{fmt}^{CF}/\partial p_{gmt}\}$:

   (a) Solve for the values of $\{\tau_{fct}^{CF}\}_{c \in \mathcal{C}_t^{RSN}}$ given values of $\{D_{fmt}^{CF}\}$, $\{\partial s_{fmt}^{CF}/\partial p_{gmt}\}$, $\{\hat{mc}_{fmt}^{\backslash R}\}$, μ, λ_R, Ψ using the following system of equations:

$$\begin{aligned}
\tau_{fct}^{CF} \sum_{m \in \mathcal{M}_{fct}} \Big[(1+\Psi)(1-\mu_{fct}) D_{fmt}^{CF}\Big] + \sum_{g \neq f: c \in \mathcal{B}_{gmt}^{R,CF}} \tau_{gct}^{CF} \sum_{m \in \mathcal{M}_{fct}} (1 - \Psi\mu_{fct} - \mu_{gct}\lambda_R)[\Delta_{fc} D_{gmt}^{CF}] \\
+ \sum_{g \in \mathcal{F}_{mt}} \sum_{d \in \mathcal{B}_{gmt}^{R,CF} \backslash c} \tau_{gdt}^{CF} (\mu_{cdt}^{C} \lambda_{R:fct} - \Psi\mu_{fdt} - \mu_{gct}\lambda_R) \sum_{m \in \mathcal{M}_{fct}} [\Delta_{fc} D_{gmt}^{CF}] = \\
\sum_{m \in \mathcal{M}_{fct}} \Big[(\Psi - \mu_{fct})(p_{fmt}^{CF} - \hat{mc}_{fmt}^{\backslash R})[\Delta_{fc} D_{fmt}^{CF}] - \mu_{f'ct}\lambda_R (p_{fmt}^{CF} - \hat{mc}_{f'mt}^{\backslash R})[\Delta_{fc} D_{f'mt}^{CF}]\Big] \\
- \sum_{m \in \mathcal{M}_{fct}} \Bigg[a_{cmt} \Big((1 - \Psi\mu_{fct}) D_{fmt}^{CF} + (1 - \Psi\mu_{fct}) \sum_{g \neq f: c \in \mathcal{B}_{gmt}^{R,CF}} [\Delta_{fc} D_{gmt}^{CF}] \Big) \\
+ \sum_{g \in \mathcal{F}_{mt}} \sum_{d \in \mathcal{B}_{gmt}^{R,CF} \backslash c} a_{dmt} (\mu_{cdt}^{C} \lambda_{R:fct} - \Psi\mu_{fdt}) ([\Delta_{fc} D_{gmt}^{CF}]) \Bigg] \qquad \forall f, c
\end{aligned} \tag{22}$$

   where, again, f and f' represent the MVPDs with which c is potentially integrated.

   (b) Market by market, update bundle prices $\{p_{fmt}^{CF}\}$ for all cable distributors to maximize profits given new values of $\{\tau_{fct}^{CF}\}$. Update bundle demands $\{D_{fmt}^{CF}\}$ and elasticities $\{\partial s_{fmt}^{CF}/\partial p_{gmt}\}$ at the new computed prices.

B Additional Figures and Tables

Table 6: Regional Sports Networks Availability, Affiliate Fees, and Viewership

	Kagan Availability		Kagan Affiliate Fees					Nielsen Viewing			
	Systems Served	**HH Served**	**Years**	**Mean**	**StDev**	**Min**	**Max**	**Obs**	**All HH**	**Has DTV**	**Has Dish**
Comcast RSNs											
Comcast SportsNet Bay Area	137	4.7	11	$1.70	$0.53	$1.01	$2.52	720	0.41	0.45	0.33
Comcast SportsNet California	1,960	59.4	7	$0.91	$0.14	$0.75	$1.10	720	0.17	0.17	0.17
Comcast SportsNet Chicago	67	0.9	7	$2.02	$0.18	$1.90	$2.37	360	0.54	0.59	0.36
Comcast SportsNet Mid-Atlantic	23	1.7	11	$2.03	$0.74	$0.85	$3.10	1,440	0.13	0.09	0.03
Comcast SportsNet New England	15	1.0	11	$1.26	$0.32	$0.90	$1.89	1,080	0.27	0.30	0.17
Comcast SportsNet Northwest	137	4.7	4	$1.93	$0.09	$1.81	$2.04	—	—	—	—
Comcast SportsNet Philadelphia	135	10.0	11	$1.94	$0.61	$1.05	$2.85	360	0.91	0.06	0.05
Comcast SportsNet Southwest	335	5.7	—	—	—	—	—	—	—	—	—
Comcast/Charter Sports Southeast	194	6.2	11	$0.36	$0.09	$0.20	$0.50	3,600	0.04	0.00	0.00
The mtn	195	7.0	5	$0.20	$0.02	$0.19	$0.23	720	0.04	0.05	0.00
News Corp RSNs											
Fox Sports Arizona	106	3.7	11	$1.58	$0.50	$0.82	$2.28	—	—	—	—
Fox Sports Chicago	342	4.8	7	$1.45	$0.44	$1.08	$2.13	—	—	—	—
Fox Sports Detroit	284	5.3	11	$1.75	$0.45	$1.05	$2.34	360	1.02	0.94	0.68
Fox Sports Florida	152	6.7	11	$1.34	$0.33	$0.90	$1.95	2,160	0.14	0.12	0.12
Fox Sports Houston	48	3.3	—	—	—	—	—	—	—	—	—
Fox Sports Midwest	695	7.4	11	$1.42	$0.44	$0.57	$2.01	1,800	0.31	0.31	0.26
Fox Sports North	620	4.5	11	$1.97	$0.60	$1.15	$2.88	720	0.79	1.04	0.70
Fox Sports Ohio	306	7.0	11	$1.61	$0.49	$0.75	$2.42	2,160	0.34	0.31	0.29
Fox Sports South	905	15.3	17	$1.63	$0.52	$0.52	$2.17	3,600	0.13	0.08	0.07
Fox Sports Southwest	924	12.7	11	$1.68	$0.50	$0.80	$2.43	5,040	0.14	0.15	0.12
Fox Sports West	167	9.2	11	$1.80	$0.44	$0.87	$2.35	1,080	0.16	0.12	0.07
Fox Sports Wisconsin	136	2.2	—	—	—	—	—	—	—	—	—
Big Ten Network	1,960	59.4	—	—	—	—	—	—	—	—	—
Prime Ticket (New)	132	8.2	11	$1.52	$0.46	$0.60	$2.07	720	0.16	0.12	0.09
SportSouth (New)	532	11.3	11	$0.31	$0.13	$0.15	$0.52	—	—	—	—
Sun Sports	234	8.3	11	$1.36	$0.54	$0.55	$2.27	2,160	0.20	0.16	0.12
Liberty RSNs											
Root Sports Northwest	281	5.4	11	$1.73	$0.52	$0.70	$2.54	—	—	—	—
Root Sports Pittsburgh	316	4.5	11	$1.81	$0.53	$1.05	$2.55	—	—	—	—
Root Sports Rocky Mountain	479	5.4	11	$1.58	$0.42	$0.75	$2.06	—	—	—	—
Cablevision RSNs											
Madison Sq. Garden (MSG)	219	9.9	11	$1.82	$0.30	$1.45	$2.44	1,080	0.23	0.24	0.17
MSG Plus	165	7.5	11	$1.24	$0.15	$1.01	$1.61	360	0.07	0.05	0.06
Cox RSNs											
Channel 4 San Diego	15	1.0	11	$0.87	$0.26	$0.53	$1.32	360	0.48	0.03	0.00
Cox Sports Television	70	2.1	9	$0.55	$0.05	$0.50	$0.64	360	0.22	0.01	0.08
Time Warner RSNs											
Metro Sports Network	8	0.6	—	—	—	—	—	—	—	—	—
SportsNet New York	314	20.1	5	$1.91	$0.18	$1.71	$2.20	1,080	0.13	0.13	0.09
Independent/Other RSNs											
Altitude Sports & Entertainment	130	2.8	7	$1.99	$0.29	$1.70	$2.47	360	0.24	0.21	0.22
Bright House Sports Network	—	—	—	—	—	—	—	360	0.02	0.00	0.00
Empire Sports Network	87	1.9	—	—	—	—	—	—	—	—	—
Mid-Atlantic Sports Network (MASN)	109	5.2	6	$1.58	$0.12	$1.45	$1.77	1,440	0.13	0.10	0.13
New England Sports Network (NESN)	213	4.5	11	$1.99	$0.49	$1.30	$2.72	1,080	0.95	1.00	0.48
Royals Sports	18	0.2	6	$0.19	$0.02	$0.16	$0.21	—	—	—	—
SportsTime Ohio	196	9.0	5	$1.51	$0.17	$1.30	$1.73	720	0.33	0.40	0.20
Yankees Entertainment & Sports (YES)	304	15.8	9	$2.13	$0.41	$1.18	$2.62	1,440	0.27	0.30	0.00

Notes: Reported are availability, affiliate fees and average viewing of the major Regional Sports Networks (RSNs) in the United States. Affiliate fees are the monthly per-subscriber fees paid by cable and satellite distributors to television networks for the right to distribute the network's programming to subscribers. Availability and affiliate fee information is provided by SNL Kagan as part of its Media & Communications Package. RSN viewership is from Nielsen and covers 2000-2010.

Figure 8: RSN Ownership

Ownership Matrix	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Comcast													
Comcast SportsNet Bay Area	35/23/35	6/23/64	13/23/57	13/23/57	13/23/57	13/30/57	7/60/33	7/60/33	7/60/33	60/34	60/40	60/40	67/30
Comcast SportsNet California							100	100	100	100	100	100	100
Comcast SportsNet Chicago								30	30	30	30	30	30
Comcast SportsNet Mid-Atlantic	17/17	3/31	3/31	100	100	100	100	100	100	100	100	100	100
Comcast SportsNet New England	10/10/23	2/23/18	4/23/16	4/23/16	4/23/16	4/30/16	4/30/16	50/50	50/50	100	100	100	100
Comcast SportsNet Northwest										100	100	100	100
Comcast SportsNet Philadelphia	46	46	53	53	78	78	78	78	84	85	85	85	85
Comcast Sports Southwest												100	100
Comcast/Charter Sports Southeast		100	72	72	72	72	77/23	69/23	70/24	74/26	74/26	74/26	75/19
Mountain West Sports Network (the mtn)										30	30	30	30
News Corp													
Fox Sports Arizona	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	18/82	100	100	100
Fox Sports Chicago	35/23/35	6/23/64	13/23/57	13/23/57	13/23/57	13/30/57	13/30/57	100	100				
Fox Sports Detroit	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	18/82	100	100	100
Fox Sports Florida	10/10/23	1/14/6	7/45/33	7/45/33	7/60/33	7/60/33	7/60/33	18/82	18/82	16/84	100	100	100
Fox Sports Houston												100	100
Fox Sports Kansas City											100	100	100
Fox Sports Midwest	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Fox Sports North	-	-	-	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Fox Sports Ohio	20/45/20	3/45/37	7/45/33	7/45/33	7/60/33	7/60/33	7/60/33	18/82	18/82	16/84	100	100	100
Fox Sports South	44/44	7/81	8/80	10/78	11/77	13/75	14/74	15/73	17/71	17/71	88	88	88
Fox Sports Southwest	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Fox Sports West	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Fox Sports Wisconsin										18/82	100	100	100
Big Ten Network										49	49	49	51
Prime Ticket	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
SportSouth										100	100	100	100
Sun Sports	28/13/5/28	5/16/5/52	19/16/5/49	19/16/5/49	11/5/49	11/6/49	11/49	11/49	11/49	11/50	60	60	60
Liberty													
Root Sports Northwest	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Root Sports Pittsburgh	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Root Sports Rocky Mountain	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Cablevision													
Madison Square Garden Network (MSG)	20/45/40	3/45/37	7/45/33	7/45/33	7/45/33	7/60/33	7/60/33	100	100	100	100	100	100
MSG Plus	20/45/40	3/45/37	7/45/33	7/45/33	7/45/33	7/60/33	7/60/33	100	100	100	100	100	100
Cox													
Channel 4 San Diego	100	100	100	100	100	100	100	100	100	100	100	100	100
Cox Sports Television					100	100	100	100	100	100	100	100	100
Time Warner													
MetroSports (KC)	100	100	100	100	100	100	100	100	100	100	100	100	100
SportsNet New York									8/27	8/27	8/27	8/27	8/27
Independents / Other													
Altitude Sports & Entertainment							-	-	-	-	-	-	-
Empire Sports Network	100	100	100	100	100	100	100	100					
Mid-Atlantic Sports Network (MASN)								-	-	-	-	-	-
New England Sports Network (NESN)	-	-	-	-	-	-	-	-	-	-	-	-	-
Royals Sports						-	-	-	-	-			
SportsTime Ohio									-	-	-	-	-
Yankees Entertainment & Sports (YES)					-	-	-	-	-	-	-	-	-

Comcast	News	Liberty	Cablevision	Cox	Time Warner
Comcast/News	Comcast/Cablevision	Comcast/Charter	Comcast/TimeWarner	Liberty/News	Liberty/Cablevision/News

Notes: Reported are the vertical ownership stakes held by major distributors of cable and satellite television service in Regional Sports Networks (RSNs). This data was collected by hand from company stock filings and industry sources. The ownership share for each distributor is reported and individual owners (or combinations of owners) are color-coded according to the legend. Gray shading corresponds to a year in which the given RSN has not yet entered or has exited the market. White boxes correspond to years of active operation for an RSN without a vertical ownership affiliation.

Table 7: Sample Statistics - Prices, Market Shares, and Channels

		Unweighted				**Weighted by Households**			
	Obs	**Mean**	**StdDev**	**Min**	**Max**	**Mean**	**StdDev**	**Min**	**Max**
Total Markets	6,138	6,138							
Average Households (M)	6,138					31.5			
Cable									
Year	6,138	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,138	$51.40	$10.33	$8.67	$130.96	$53.02	$8.84	$8.67	$130.96
Market Share	6,138	0.624	0.161	0.005	0.965	0.630	0.137	0.005	0.965
Cable Networks	6,138	42.6	15.4	0	87	44.9	14.0	0	87
RSNs	6,138	1.6	0.9	0	5	1.8	0.9	0	5
Total Channels	6,138	44.2	15.9	1	90	46.6	14.5	1	90
DirecTV									
Year	6,138	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,138	$53.25	$6.57	$46.05	$76.73	$53.27	$6.34	$46.05	$76.73
Market Share	6,138	0.092	0.062	0.002	0.499	0.094	0.064	0.002	0.499
Cable Networks	6,138	80.5	10.3	66	97	81.2	10.1	66	97
RSNs	6,138	1.7	0.9	0	6	1.9	0.9	0	6
Total Channels	6,138	82.2	10.5	66	103	83.0	10.3	66	103
Dish									
Year	6,138	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,138	$53.89	$4.75	$44.28	$68.33	$53.96	$4.53	$44.28	$68.33
Market Share	6,138	0.064	0.055	0.000	0.406	0.059	0.052	0.000	0.406
Cable Networks	6,138	70.8	13.2	54	91	71.8	12.9	54	91
RSNs	6,138	1.6	0.8	0	5	1.7	0.7	0	5
Total Channels	6,138	72.4	13.3	54	96	73.5	13.0	54	96

Notes: Reported are the price, market share, and cable, Regional Sport Network (RSN), and total channels for each of the local cable operators and two national satellite providers serving each of our markets. Markets are defined as the set of continuous zip codes within a cable system facing the same portfolio of competitors. We exclude (the relatively few) markets facing competition between cable operators. All the data cover the years 2000-2010. To be included, we required information on each of price, market share, and channels. Cable system subscriber and channel information is from the Nielsen FOCUS dataset. Cable system price information is drawn from the Internet Archive, newspaper reports, and the TNS Bill Harvesting database. Satellite system channel and price information is drawn from the Internet Archive. Cable and satellite subscriber market shares are estimated from the MRI (2000-2007) and Simmons (2008-2010) household surveys. We restrict attention to those markets with at least 5 observations in any year. See the text for more details.

Table 8: Sample Statistics - National Cable Channel Affiliate Fees and Viewership, Part 1

	Affiliate Fees					**Viewership**					
	Kagan					**Nielsen**		**Combined MRI / Simmons**			
	Years	**Mean**	**StDev**	**Min**	**Max**	**Obs**	**Mean**	**Obs**	**Mean**	**SDev**	**Percent Positive**
Channels (A-L)											
ABC Family Channel	11	$0.19	$0.02	$0.16	$0.22	747	0.418	277,535	0.344	1.149	0.176
AMC	11	$0.22	$0.02	$0.20	$0.25	747	0.491	277,535	0.351	1.183	0.156
Animal Planet	11	$0.07	$0.01	$0.06	$0.09	747	0.275	277,535	0.344	1.108	0.203
A&E	11	$0.21	$0.03	$0.16	$0.26	747	0.664	277,535	0.472	1.373	0.230
BBC America	11	$0.09	$0.03	$0.03	$0.12	703	0.053	225,618	0.091	0.617	0.041
BET	11	$0.14	$0.02	$0.11	$0.17	747	0.382	277,535	0.184	1.017	0.070
Bio	11	$0.07	$0.03	$0.00	$0.11	447	0.082	98,567	0.104	0.618	0.023
Bloomberg Television	11	$0.04	$0.02	$0.02	$0.06	—	—	150,165	0.029	0.373	0.010
Boomerang	10	$0.05	$0.03	$0.00	$0.08	280	0.131	—	—	—	—
Bravo	11	$0.15	$0.03	$0.11	$0.20	747	0.277	277,535	0.169	0.804	0.092
Cartoon Network	11	$0.14	$0.03	$0.08	$0.18	747	0.989	277,535	0.231	1.098	0.106
CMT	11	$0.06	$0.02	$0.01	$0.08	—	—	277,535	0.120	0.732	0.067
CNBC	11	$0.24	$0.04	$0.16	$0.30	747	0.217	277,535	0.313	1.185	0.170
CNN	11	$0.43	$0.05	$0.35	$0.52	747	0.550	277,535	0.701	1.744	0.319
CNN en Espanol	—	—	—	—	—	463	0.013	—	—	—	—
CNN International	11	$0.11	$0.02	$0.09	$0.13	567	0.012	—	—	—	—
Comedy Central	11	$0.11	$0.02	$0.08	$0.14	747	0.449	277,535	0.280	0.997	0.162
Discovery Channel	11	$0.27	$0.04	$0.22	$0.35	747	0.535	277,535	0.628	1.462	0.327
Disney Channel	11	$0.81	$0.06	$0.75	$0.91	747	1.171	277,535	0.246	1.074	0.116
E! Entertainment TV	11	$0.19	$0.02	$0.15	$0.21	747	0.315	277,535	0.201	0.788	0.137
ESPN	11	$2.81	$1.12	$1.14	$4.34	747	0.836	277,535	0.675	1.767	0.257
ESPN 2	11	$0.37	$0.14	$0.17	$0.58	747	0.262	277,535	0.334	1.220	0.151
ESPN Classic Sports	11	$0.14	$0.03	$0.10	$0.18	636	0.037	277,535	0.072	0.521	0.047
ESPN deportes	—	—	—	—	—	280	0.035	—	—	—	—
ESPNews	11	$0.10	$0.06	$0.02	$0.17	636	0.043	277,535	0.143	0.782	0.084
ESPNU	6	$0.14	$0.03	$0.10	$0.17	280	0.037	—	—	—	—
Fine Living Network	—	—	—	—	—	55	0.003	150,165	0.025	0.324	0.009
FitTV	11	$0.05	$0.02	$0.02	$0.07	205	0.005	—	—	—	—
Flix	—	—	—	—	—	—	—	101,275	0.013	0.165	0.004
Food Network	11	$0.06	$0.03	$0.03	$0.14	747	0.411	277,535	0.396	1.364	0.175
Fox News Channel	11	$0.32	$0.18	$0.17	$0.70	747	0.785	277,535	0.697	1.961	0.267
Fuse	11	$0.06	$0.01	$0.05	$0.08	747	0.024	225,618	0.018	0.308	0.009
FX	11	$0.34	$0.06	$0.27	$0.43	747	0.463	277,535	0.258	0.976	0.137
G4	9	$0.07	$0.02	$0.05	$0.09	591	0.051	225,618	0.036	0.411	0.016
GSN	11	$0.07	$0.03	$0.04	$0.10	747	0.154	277,535	0.088	0.703	0.036
Golf Channel	11	$0.20	$0.05	$0.13	$0.26	580	0.065	277,535	0.084	0.633	0.041
Hallmark Channel	11	$0.04	$0.02	$0.01	$0.06	699	0.307	225,618	0.301	1.268	0.088
Headline News	—	—	—	—	—	747	0.214	277,535	0.278	0.983	0.173
HGTV	11	$0.08	$0.04	$0.03	$0.14	747	0.500	277,535	0.397	1.446	0.162
History Channel	11	$0.18	$0.04	$0.13	$0.23	747	0.531	277,535	0.531	1.462	0.251
HSN	—	—	—	—	—	580	0.038	252,217	0.044	0.395	0.031
IFC	11	$0.18	$0.01	$0.17	$0.19	—	—	277,535	0.045	0.424	0.023
Investigation Discovery	11	$0.04	$0.03	$0.00	$0.07	441	0.121	174,621	0.067	0.628	0.018
Lifetime	11	$0.21	$0.06	$0.13	$0.29	747	0.679	277,535	0.554	1.650	0.199
Lifetime Movie Network	11	$0.07	$0.03	$0.00	$0.09	328	0.185	225,618	0.250	1.174	0.068

Notes: Reported are affiliate fees and average viewing of the major cable television networks included in our demand system. Affiliate fees are the monthly per-subscriber fees paid by cable and satellite distributors to television networks for the right to distribute the network's programming to subscribers. Affiliate fee information is provided by SNL Kagan as part of its Media & Communications Package. Nielsen viewership data reports the average rating on each channel across between 44 and 56 Designated Market Areas (DMAs) between 2000 and 2010. MRI / Simmons viewership data reports the average viewership and the percent of households with any (positive) viewership of each channel by households in the MRI (2000-2007) and Simmons (2008-2010) household surveys.

Table 9: Sample Statistics - National Cable Channel Affiliate Fees and Viewership, Part 2

	Affiliate Fees					**Viewership**					
	Kagan					**Nielsen**		**Combined MRI / Simmons**			
	Years	**Mean**	**StDev**	**Min**	**Max**	**Obs**	**Mean**	**Obs**	**Mean**	**SDev**	**Percent Positive**
Channels (M-Z)											
MSNBC	11	$0.14	$0.02	$0.12	$0.17	747	0.343	277,535	0.330	1.181	0.182
MTV	11	$0.27	$0.05	$0.20	$0.35	747	0.568	277,535	0.235	0.983	0.127
MTV Hits	11	$0.01	$0.00	$0.01	$0.01	280	0.030	—	—	—	—
MTV Jams	11	$0.01	$0.01	$0.01	$0.02	280	0.038	—	—	—	—
MTV2	11	$0.03	$0.01	$0.01	$0.05	601	0.082	277,535	0.070	0.542	0.042
Nat Geo Wild	6	$0.07	$0.02	$0.04	$0.09	112	0.068	—	—	—	—
Nat Geo Channel	11	$0.17	$0.06	$0.00	$0.21	608	0.136	225,618	0.212	0.883	0.096
NBA TV	11	$0.31	$0.06	$0.19	$0.37	280	0.035	—	—	—	—
NBC Sports / Versus	8	$0.50	$0.33	$0.11	$0.85	55	0.047	—	—	—	—
NFL Network	4	$0.45	$0.09	$0.32	$0.53	56	0.027	—	—	—	—
NHL Network	11	$0.11	$0.06	$0.00	$0.18	376	0.082	—	—	—	—
Nickelodeon	11	$0.37	$0.05	$0.29	$0.47	747	1.555	277,535	0.200	0.991	0.096
NickToons TV	9	$0.05	$0.03	$0.00	$0.07	447	0.128	—	—	—	—
OWN	11	$0.06	$0.03	$0.00	$0.09	280	0.130	—	—	—	—
Outdoor Channel	11	$0.04	$0.01	$0.03	$0.05	—	—	174,621	0.068	0.594	0.021
Ovation	11	$0.06	$0.02	$0.03	$0.08	280	0.027	—	—	—	—
Oxygen	11	$0.07	$0.04	$0.00	$0.10	656	0.131	225,618	0.114	0.658	0.052
ReelzChannel	—	—	—	—	—	280	0.033	—	—	—	—
Science Channel	11	$0.04	$0.02	$0.00	$0.07	592	0.072	174,621	0.092	0.635	0.030
ShopNBC	—	—	—	—	—	280	0.025	—	—	—	—
SoapNet	11	$0.11	$0.05	$0.02	$0.15	656	0.135	174,621	0.109	0.833	0.022
Speed Channel	11	$0.17	$0.03	$0.11	$0.21	747	0.091	277,535	0.097	0.679	0.046
Style Network	11	$0.10	$0.04	$0.03	$0.14	646	0.063	225,618	0.040	0.416	0.019
Sundance Channel	11	$0.23	$0.04	$0.16	$0.27	—	—	174,621	0.037	0.397	0.012
SyFy	11	$0.17	$0.04	$0.12	$0.22	747	0.427	277,535	0.301	1.207	0.126
TBS	11	$0.37	$0.12	$0.19	$0.54	747	0.905	277,535	0.497	1.345	0.243
TechTV	4	$0.02	$0.01	$0.00	$0.03	47	0.006	51,917	0.012	0.202	0.002
The Hub	11	$0.04	$0.02	$0.01	$0.06	441	0.037	—	—	—	—
TLC	11	$0.16	$0.01	$0.14	$0.17	747	0.422	277,535	0.342	1.151	0.173
Toon Disney	—	—	—	—	—	376	0.146	177,590	0.096	0.644	0.034
Travel Channel	11	$0.07	$0.02	$0.04	$0.11	747	0.166	277,535	0.157	0.712	0.106
truTV	11	$0.09	$0.01	$0.08	$0.10	747	0.384	277,535	0.233	1.081	0.101
Turner Classic Movies	11	$0.22	$0.03	$0.16	$0.27	580	0.286	277,535	0.268	1.142	0.105
TNT	11	$0.83	$0.16	$0.55	$1.10	747	1.219	277,535	0.592	1.553	0.263
TV Guide Network	11	$0.03	$0.01	$0.02	$0.05	656	0.101	277,535	0.082	0.488	0.082
TV Land	11	$0.08	$0.03	$0.01	$0.12	376	0.412	277,535	0.190	0.979	0.086
TV One	7	$0.03	$0.03	$0.00	$0.08	280	0.129	123,885	0.050	0.572	0.008
USA	11	$0.46	$0.07	$0.36	$0.57	747	1.081	277,535	0.503	1.442	0.230
VH1	11	$0.12	$0.02	$0.09	$0.16	747	0.336	277,535	0.151	0.717	0.101
VH1 Classic	11	$0.05	$0.01	$0.02	$0.07	55	0.024	149,303	0.044	0.422	0.016
Weather Channel	11	$0.10	$0.01	$0.08	$0.12	747	0.234	204,189	0.380	0.879	0.266
WE	11	$0.09	$0.01	$0.07	$0.11	328	0.084	225,618	0.096	0.621	0.041

Notes: Reported are affiliate fees and average viewing of the major cable television networks included in our demand system. Affiliate fees are the monthly per-subscriber fees paid by cable and satellite distributors to television networks for the right to distribute the network's programming to subscribers. Affiliate fee information is provided by SNL Kagan as part of its Media & Communications Package. Nielsen viewership data reports the average rating on each channel across between 44 and 56 Designated Market Areas (DMAs) between 2000 and 2010. MRI / Simmons viewership data reports the average viewership and the percent of households with any (positive) viewership of each channel by households in the MRI (2000-2007) and Simmons (2008-2010) household surveys.

Table 10: Monthly WTP for Non-RSNs

Channel Name	Mean WTP	Fraction Positive	Mean Among Positive
ABC Family Channel	0.744	0.699	1.065
American Movie Classics AMC	0.770	0.627	1.228
Animal Planet	0.648	0.794	0.816
Arts Entertainment AE	0.846	0.791	1.069
BET	0.490	0.504	0.971
Bravo	0.360	0.504	0.715
Cartoon Network	1.212	0.598	2.027
CMT	0.226	0.500	0.452
CNBC	0.457	0.663	0.689
CNN	1.258	0.904	1.392
Comedy Central	0.692	0.704	0.983
Discovery Channel	1.119	0.852	1.313
Disney Channel	0.675	0.583	1.158
E Entertainment TV	0.407	0.545	0.747
ESPN	8.040	0.761	10.562
ESPN 2	3.283	0.595	5.521
ESPN Classic	2.113	0.670	3.152
Food Network	0.784	0.746	1.051
Fox News Channel	1.351	0.890	1.519
FX	0.639	0.641	0.997
Golf Channel	0.278	0.397	0.702
Hallmark Channel	0.694	0.595	1.166
Headline News	0.537	0.667	0.806
HGTV	0.853	0.703	1.213
History Channel	0.989	0.866	1.142
Lifetime	1.098	0.713	1.539
MSNBC	0.612	0.703	0.870
MTV	0.665	0.605	1.098
Nickelodeon	1.173	0.602	1.950
SyFy, Sci-Fi	0.718	0.755	0.950
TBS	1.226	0.828	1.480
TLC, The Learning Channel	0.603	0.692	0.872
truTV, Court TV	0.506	0.474	1.069
Turner Classic Movies	0.761	0.805	0.946
Turner Network TV TNT	1.458	0.800	1.824
USA	1.290	0.709	1.820
VH1	0.488	0.551	0.885
Weather Channel	0.640	0.945	0.677

Notes: This table presented estimated mean monthly willingness-to-pay in dollars for the non-RSN's. The first column is the unconditional mean. The second column is the fraction of consumers with positive valuations. The third column is the mean amongst those with positive valuations.

Table 11: Monthly WTP for RSNs

RSN Name	Mean WTP	Fraction Positive	Mean Among Positive
Altitude Sports Entertainment	1.164	0.593	1.962
Channel 4 San Diego, 4SD	3.685	0.903	4.080
CSN Bay Area, Fox SportsNet Bay Area, SportsChannel Pacific	2.690	0.884	3.042
CSN California	1.042	0.601	1.735
CSN Chicago	2.705	0.596	4.536
CSN Mid-Atlantic, Home Team Sports	1.094	0.588	1.861
CSN New England, Fox Sports Net New England, SportsChannel New England, Prism New England	2.541	0.602	4.222
CSN Northwest	3.095	0.591	5.233
CSN Philadelphia, SportsChannel Philadelphia, PRISM	7.079	0.800	8.851
ComcastCharter Sports Southeast CSS	1.005	0.602	1.671
Cox Sports Television	2.623	0.505	5.198
Fox Sports Detroit, Pro-Am Sports System PASS	2.498	0.606	4.123
Fox Sports Florida, SportsChannel Florida	1.669	0.685	2.435
Fox Sports Midwest, Prime Sports Midwest	1.194	0.704	1.697
Fox Sports North, Fox Sports Minn Wisc, Midwest Sports Channel	1.347	0.695	1.939
Fox Sports Ohio, SportsChannel Ohio	4.433	0.813	5.451
Fox Sports South, SportSouth Old	0.413	0.599	0.691
Fox Sports Southwest, Prime Sports Southwest, Home Sports Entertainment	1.194	0.798	1.496
Fox Sports West, Prime Ticket Old, Prime Sports West	2.004	0.578	3.467
MSG Plus, Fox Sports Net New York, SportsChannel New York	1.218	0.598	2.037
Madison Square Garden Network MSG	2.272	0.595	3.816
Mid-Atlantic Sports Network, MASN	1.945	0.707	2.752
New England Sports Network	5.678	0.800	7.095
Prime Ticket New, Fox Sports Net West 2	1.295	0.606	2.136
Root Sports Northwest, Fox Sports Northwest, Northwest Cable Sports, Prime Sports Northwest	1.657	0.605	2.739
Root Sports Pittsburgh, Fox Sports Pittsburgh, KBL	1.090	0.582	1.875
Root Sports Rocky Mountain, Fox Sports Rocky Mountain, Prime Sports Rocky Mountain	0.418	0.589	0.710
SportsNet New York	1.210	0.606	1.996
Sun Sports, Sunshine Network	1.893	0.597	3.171
Yankees Entertainment Sports YES	3.587	0.609	5.886

Notes: This table presented estimated mean monthly willingness-to-pay in dollars for the RSN's. The first column is the unconditional mean. The second column is the fraction of consumers with positive valuations. The third column is the mean amongst those with positive valuations.