Do Bigger Firms Get Better Terms? Evidence from Pay TV

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Abstract

We employ a unique, transaction-level dataset of program licensing by Multichannel Video Programming Distributors (MVPDs) to study the relationship between firm size and bargaining leverage. We find per-subscriber-per-month licensing fees paid by MVPDs to program suppliers decrease significantly with MVPD size but increase significantly with program supplier size, consistent with the bargaining leverage hypothesis. These results are robust across a variety of specifications suggested by Nash bargaining theory. In particular, we control for contract vintage, distributor quality and competitive intensity.

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1 Introduction

Comcast, the largest cable television operator in the U.S., announced in February 2014 its intention to acquire Time Warner Cable (TWC), the second largest operator. Cable multiple-system operators (MSOs) like Comcast and TWC, together with the direct broadcast satellite (DBS) providers DirecTV and Dish, and "overbuilders" such as telephone company ATT U-verse and Verizon FIOS, are all commonly referred to as multi-channel video programming distributors (MVPDs). MVPDs are the primary distributors of programming to pay television subscribers, of which there were about 100 million in the U.S. in 2014. At the time of the proposed Comcast-TWC merger, MVPDs were facing nascent competition from online video distributors (OVDs) such as Netflix, Sling TV and PlayStation Vue. OVDs bypass traditional distribution by delivering content over broadband internet connections. The Antitrust Division of the U.S. Department of Justice (DOJ) and the Federal Communications Commission (FCC) jointly conducted an intensive 14-month investigation of the proposed merger. After both agencies expressed serious concerns, Comcast announced in April 2015 that it was abandoning the transaction.[1]

William Rogerson, who was Senior Economist overseeing analysis of the proposed merger for the FCC, provides in Rogerson (2018) a detailed discussion of several theories of competitive harm that were explored by the agencies, all of which centered on potential threats to OVD competition from the proposed merger. We focus on one of these theories: that the merged firm, having become a larger distributor of programming, would thereby gain bargaining leverage against program suppliers and could wield this leverage to induce the suppliers either not to deal with OVDs altogether, or to raise the programming costs of OVDs. As Chipty and Snyder (1999); Raskovich (2003) show, however, bigger firms do not necessarily gain bargaining leverage from increased size as a matter of theory; this is an empirical question.

We address this question by exploiting a unique, transaction-level dataset of program licensing fees in pay television, obtained over the course of the antitrust and regulatory investigations into the Comcast-TWC merger. We posit that, controlling for other factors, a negative relationship between MVPD size and program license fees would reveal that size confers bargaining leverage to MVPDs. We likewise posit that a positive relationship between programmer size and license fees would reveal that size confers bargaining leverage to program suppliers. Our panel data[2] spans a large set of basic cable channels, running the gamut of program supplier size, together with a substantial number of MVPDs, likewise of widely varying size. In total we have 2,212 channel-MVPD-year observations in our

[1]See Comcast Corporation Abandons Proposed Acquisition of Time Warner Cable After Justice Department and the Federal Communications Commission Informed Parties of Concerns, press release, US Department of Justice Office of Public Affairs, April 24, 2015. Available for download at: https://www.justice.gov/opa/pr/comcast-corporation-abandons-proposed-acquisition-time-warner-cable-after-justice-department.

[2]Confidentiality considerations preclude us from disclosing our source(s). We have suppressed several summary statistics and limited discussion of the data to preserve confidentiality.

data, covering the period 2010-2014. For each channel-MVPD-year triple, we have the per-subscriber license fee paid by the MVPD to the program supplier and the year in which the associated carriage contract was signed. For a subset of channel-MVPD pairs, we have further information on MVPD quality characteristics related to the advertising revenue per subscriber the MVPD delivers to program suppliers. Finally, for every MVPD in our sample we have information on the share of pay TV subscribers the MVPD commands within its own territorial footprint, which we take to be a proxy for the intensity of competition the MVPD faces from rivals, e.g. from DBS and overbuilders as rivals to cable MSOs.[3] Controlling for other factors, we find robust evidence that per-subscriber-per-month license fees decline with MVPD size and increase with program supplier size, consistent with the bargaining leverage hypothesis.

Our modeling framework is based on the classic work of Nash (1950), which provides the axiomatic derivation of the Nash bargaining solution, and the seminal work of Horn and Wolinsky (1988), which first applied the Nash bargaining solution to analyzing merger effects.[4] In a growing body of more recent research, downstream Nash-Bertrand competition in output prices is modeled in addition to upstream Nash bargaining over input prices. The resulting two-stage game, which yields a Nash equilibrium in Nash bargains, is commonly called "Nash-in-Nash." In the Nash-in-Nash framework, the outcome of negotiations for each pair of trading partners is the Nash bargaining solution, in which the bilateral surplus from trade is split between the parties according to their bargaining powers. These negotiations are modeled as occurring simultaneously across buyer-seller pairs. Bargainers' expectation of the bilateral surplus they will reap in reaching agreement typically depends on their beliefs about the outcomes of other negotiations. These beliefs are assumed to be mutually consistent and fulfilled in equilibrium: every bargainer believes that every bargaining outcome will be the Nash bargaining solution given all other such bargaining outcomes.[5] The Nash-in-Nash approach has gained prominence in empirical analyses of industries such as multichannel pay TV, the focus of our study, as well as health care (see e.g. Crawford and Yurukoglu (2012); Crawford et al. (2018); Gowrisankaran, Nevo and Town (2014); Ho and Lee (2017)). We pursue a much simplified, reduced-form alternative to the Nash-in-Nash approach, in that we do not explicitly model the downstream pricing game, but incorporate the effect of anticipated downstream competition into the upstream bargaining game through the bargainers' disagreement outcomes.

The remainder of the paper is organized as follows. We describe the institutional and economic setting of the pay TV industry in Section 2, then present our basic model. In Section 3, we describe our data and discuss our identification strategy. We present empirical results in Section 4 and Section 5 concludes.

[3]For DBS providers as MVPDs, we take the entire U.S. to be the territorial footprint.

[4]See also Chipty and Snyder (1999) and Raskovich (2003).

[5]Collard-Wexler, Gowrisankaran and Lee (2019) find necessary and sufficient conditions for existence of equilibrium in an alternating-offers bargaining game with multiple buyers and sellers.

2 Institutional and Economic Setting

The multichannel pay TV industry offers an attractive setting in which to study whether size confers bargaining leverage, given that program production and distribution costs are largely fixed. In many industries, scale economies (in either production or distribution) underlie volume discounts (on either the buy or sell sides). In pay TV, the incremental cost of serving a viewer of a given television program is essentially zero. In the absence of confounding scale effects on cost, bargaining leverage effects can be distinguished more cleanly.

Ideally, empirical analyses of the determinants of bargaining leverage are conducted on transaction-level data, associating distinct negotiated prices with individual buyer-seller pairs. An inexhaustive list of such analyses includes the natural gas industry (Hubbard and Weiner, 1991), new car purchases (Goldberg, 1996; Morton, Zettelmeyer and Silva-Risso, 2001; Busse and Silva-Risso, 2010), existing home purchases (Harding, Rosenthal and Sirmans, 2003), corporate mergers (Ahern, 2012), wholesale pharmaceuticals (Ellison and Snyder, 2010), medical devices (Grennan, 2013), and hospital reimbursements (Town and Vistnes, 2001; Sorensen, 2003; Wu, 2009; Gowrisankaran, Nevo and Town, 2014; Lewis and Pflum, 2015; Ho and Lee, 2017). In multichannel pay TV, however, transaction-level data has generally been unavailable, posing challenges for the study of bargaining leverage in this industry.

Two prominent studies of bargaining leverage in pay TV, Ford and Jackson (1997) and Chipty and Snyder (1999), both employ aggregate data and reach opposite conclusions about the size-leverage relationship. Ford and Jackson (1997) find a negative relationship between the size of cable MSOs and their programming costs, whereas Chipty and Snyder (1999) find evidence for a negative size-leverage relationship.

Ford and Jackson (1997) use data on the aggregate programming costs of cable multiple system operators (MSOs) and MSO subscriber counts, finding a negative relationship between size and programming costs. This is consistent with larger MSOs wielding greater leverage over program suppliers. The Ford and Jackson (1997) analysis may be confounded, however, by a composition effect. The early era the authors study was one of constrained distribution capacity. Larger MSOs tended to have more channel capacity and carried more channels,[6] suggesting that average channel quality may have declined with MSO size.[7]

Chipty and Snyder (1999) regress a channel's gross advertising revenues onto a polynomial function of the total number of subscribers reached by the channel. In the relevant upper range, Chipty and Snyder (1999) find gross advertising revenues to be convex in the

[6]It is common in the trade press to use "channel" and "cable network" interchangeably, despite the fact that a given network can have a different channel positions on different MVPDs. We likewise use these terms interchangeably, unless otherwise specified.

[7]Crawford and Yurukoglu (2012) and Crawford et al. (2018) likewise use aggregate data: channel licensing revenues aggregated across all distributors carrying the channel. These two studies do not treat the relationship between distributor size and bargaining leverage over program suppliers, focusing instead on bundled pricing and vertical integration, respectively.

number of subscribers reached by the channel. Chipty and Snyder (1999) infer from this result that MVPD bargaining leverage over programmers decreases as the MVPD's subscriber base grows. Although we have replicated the qualitative results of Chipty and Snyder (1999) using more recent data (results not reported here), we further find that the convex relationship between subscriber counts and advertising revenues is driven primarily by variation in channel quality.[8] A plausible explanation is that more popular channels both reach greater numbers of subscribers and command disproportionately greater advertising revenues, consistent with the stylized fact that prices for advertising spots are convex in a program's Nielsen ratings.

Our transaction-level data can help to resolve the contradictory findings of Ford and Jackson (1997) and Chipty and Snyder (1999) by better controlling for channel quality as well as programmer-specific and MVPD-specific variables affecting bilateral surplus.

Before turning to details of our modeling approach, we sketch features of the pay TV industry most salient to our analysis. MVPDs offer viewers bundles of cable network programming in exchange for monthly subscription fees. These fees account for the lion's share of MVPD revenues. Typically (at least) two programming tiers are offered: basic and expanded basic. Expanded basic contains a larger set of basic cable networks than does the basic tier, at a higher monthly subscription fee. In 2013, basic cable packages had 15-40 channels priced on average at $22.63 per month, whereas expanded basic tiers had 40-60 channels averaging $64.41 per month.[9] In addition to the two basic tiers, many MVPDs offered higher-priced tiers containing high-definition channels and sports, among other packages. In turn, MVPDs license this programming from cable networks, typically negotiating a licensing fee based on the number of subscribers having access to the programming. Licensing fees are typically the largest source of revenue for cable programming networks. The second major source of revenue for cable networks is advertising. The lion's share of advertising time per program hour is retained by the cable network, which sells this time to national and regional advertisers.

A carriage agreement between an MVPD and a cable network generates direct benefits for each party. Adding popular cable network programming to an MVPD's channel lineup boosts demand for the MVPD's subscription services, allowing the MVPD to raise subscription fees and capture subscribers from rival MVPDs. Adding an MVPD to a cable network's distribution broadens the programming's reach, delivering more advertising revenue to the cable network. Let R_{ij} denote the increment to MVPD i's subscription revenues from carrying cable network j, relative to the MVPD's disagreement outcome. Similarly, let A_{ij} be the increment to cable network j's advertising revenues from being carried by MVPD i, relative to the cable network's disagreement outcome. We will use as a resonable approximation that the bilateral surplus generated by i and j reaching a carriage agreement is $R_{ij} + A_{ij}$.

A carriage agreement does not necessarily give a cable network access to all of an MVPD's

[8]Quality being measured by either Nielsen ratings or by CPM, the cost (or price) of a 30-second advertising spot per thousand viewers reached by the channel.

[9]See FCC (2015), Table 5.

subscriber base; the number of subscribers reached is subject to negotiation. A cable network can be placed in the MVPD's basic cable tier or be relegated to the expanded basic tier or to some even higher-priced package. All of an MVPD's subscribers have access to its basic cable tier of programming, but not all MVPD subscribers opt into the more expensive programming tiers and packages. Let s_{ij} denote the proportion of MVPD i's subscriber base to which cable network j has access. Placing cable network j into MVPD i's basic cable tier (versus a higher-priced bundle) increases s_{ij} and so increases j's incremental advertising revenues A_{ij} from carriage by i. Doing so may, however, reduce the MVPD's subscription revenues R_{ij}. We posit that the parties choose s_{ij} cooperatively to maximize their bilateral surplus $R_{ij} + A_{ij}$. Having maximized their bilateral surplus by choice of s^*_{ij}, the MVPD and program supplier split this surplus according to the generalized Nash bargaining solution. The Nash Product, Π_{ij}, is given by

$$\Pi_{ij} = [R_{ij} - P_{ij}]^{\beta_{ij}}[A_{ij} + P_{ij}]^{(1-\beta_{ij})}, \tag{1}$$

where P_{ij} is the price of carriage (gross annual affiliate fees) paid by MVPD i to cable network j and the exponents $\beta_{ij} \in (0, 1)$ and $1 - \beta_{ij}$ are the bargaining powers of MVPD i and cable network j, respectively.[10] The Nash bargaining solution is the price P_{ij} that maximizes the Nash product Π_{ij}.

Taking the first derivative of equation 1 with respect to P_{ij} and dividing the result through by s^*_{ij} times 12 yields

$$p_{ij} = (1 - \beta_{ij})r_{ij} - \beta_{ij}a_{ij}, \tag{2}$$

where lower case letters indicate values per subscriber reached per month. Hereafter, we refer to the price p_{ij} as the monthly "per-sub fee" paid by MVPD i to cable network j. Equation 2 sets the stage for our empirical analysis, providing guidance on reduced-form specification as we seek to better understand the determinants of per-sub fees.

According to equation 2, MVPD size could influence p_{ij} through either β_{ij}, r_{ij} or a_{ij}. We briefly consider each possibility in turn.

Given the connection between Nash bargaining solutions and the subgame-perfect equilibria of alternating-offers bargaining games,[11] the bargaining power parameters β_{ij} could be interpreted as reflecting the relative discount rates, risk aversion or negotiating skill of the bargaining parties. Greater patience, tolerance for risk and negotiating skill confer a bargaining advantage that allows a bargainer to capture a larger share of the bilateral surplus. If larger firms (among both MVPDs and program suppliers) have better access to capital markets or are better able to diversify risk, bargaining power may covary with firm size. However, we have attempted to estimate values β_{ij} by maximum likelihood methods but found the likelihood function to be very flat and to have high standard error. This suggests that variation in bargaining power across programmer-MVPD pairs may not be a significant systematic factor driving variation in per-sub fees in our data. Our empirical analysis allows

[10] Without loss of generality, we set these exponents to sum to one.

[11] See Binmore, Rubinstein and Wolinsky (1986); Collard-Wexler, Gowrisankaran and Lee (2019).

for unequal bargaining power between MVPDs as a group and program suppliers as a group, but we essentially treat β as constant across pairs of bargainers.

We focus on "bargaining leverage" (as opposed to bargaining power, the exponent β) as the strength of a bargainer's disagreement outcome,[12] as reflected in r_{ij} and a_{ij}. Any factor that improves MVPD i's disagreement outcome with cable network j, thereby lowering r_{ij}, or worsens cable network j's disagreement outcome, thereby raising a_{ij}, will tend to reduce the per-sub fee p_{ij}, according to equation 2. We consider several possibilities:

First, higher-quality (more popular) programming tends to raise both r_{ij} and a_{ij}. Such programming commands both higher advertising rates and higher willingness-to-pay by subscribers for the MVPD's service. The former effect tends to raise per-sub fees while the latter tends to lower them. For the mature basic cable networks in our dataset, however, per-sub fees are always positive. This suggests that program carriage may generate more subscription revenues for the MVPD than it raises advertising revenues for the cable network, which in turn suggests that an higher program quality may have a net positive effect on negotiated per-sub fees. In any case, this is what we found empirically when we included CPM (the cost of an advertising spot per thousand viewers reached) as a quality control variable in per-sub fee regressions (results not reported here). In our reported results, we instead employ cable network (i.e.,channel) fixed effects to more broadly capture channel characteristics.

Second, MVPD distribution that is higher quality, in the sense of delivering to program suppliers more advertising revenue per subscriber reached by a given channel, tends to lower per-sub fees by raising a_{ij}. MVPDs differ in their distribution quality for reasons we discuss in the next section.

Third, larger MVPD subscriber counts may weaken a channel's leverage through a super-additive national-advertiser effect. National advertisers seek nationwide coverage for their advertising spots.[13] In losing access to an MVPD's subscribers, a cable network risks falling below minimum viable scale to attract some national advertisers. National advertisers differ in the subscriber-count thresholds they consider to be viable nationwide scale for a channel's reach. The larger is an MVPD, the greater the set of national advertisers whose business the cable network could lose if a carriage agreement with the MVPD were not reached. This suggests that MVPD size erodes a channel's bargaining leverage, especially with regard to large channels that serve national advertisers. If this were the case, we would expect a_{ij} to co-vary positively with MVPD size, especially among large cable networks, tending to reduce per-sub fees according to equation 2.

[12]Aviv Nevo, when he was Deputy Assistant Attorney General for Economics in the US Department of Justice, gave a speech Nevo (2014) in which he identified a distinction between bargaining power and bargaining leverage in the analysis of horizontal mergers. A post-merger increase in bargaining power, e.g. from lower discount rates for the merged firm, may affect post-merger prices but any such effect would be unrelated to a loss in competition. A post-merger increase in bargaining leverage, on the other hand, may derive from a loss in competition.

[13]To save on administrative costs and to strengthen the retention in memory of advertised messages through repetitive viewing, national advertisers avoid splintering their pay TV advertising expenditures across too many cable networks.

Fourth, larger size in a program supplier may weaken MVPD leverage through a similar superadditive effect. If, say, losing access to two popular channels would have more than twice the adverse effect on MVPD subscription revenues as losing one, a program supplier that owns a larger portfolio of channels will have the leverage to negotiate higher license fees.

Finally, we posit that the sharper the competition for subscribers an MVPD faces, the worse the MVPD's disagreement outcome will tend to be in bargaining with a program supplier. Losing access to popular programming by failing to reach a carriage agreement would have a greater adverse impact on the MVPD the more readily its subscribers would switch to rival MVPDs that do carry the programming. Thus we expect r_{ij} to covary positively with measures of the intensity of competition MVPD i faces, which corresponds to worsened MVPD bargaining leverage and higher per-sub fees.

3 Data and Identification

Our identification strategy is to seek "surplus shifters" that differentially affect the incremental per-subscriber MVPD revenues r_{ij} and advertising revenues a_{ij} from a carriage agreement, to better understand the determinants of per-sub fees p_{ij}. Our focus is on advertiser-supported basic cable channels. Our panel dataset, which spans the period 2010-2014, was obtained in the course of the antitrust and regulatory investigations of Comcast's proposed acquisition of Time Warner Cable.[14]

The data consists of 2,212 observations at the channel-MVPD-year level.[15] Descriptive statistics are reported in Table 1. These data are broadly representative of the multichannel pay TV industry. PERSUBFEE, the per-subscriber-per-month licensing fee paid by the MVPD, which is the dependent variable in (most of) our regressions, has mean \$0.53 across channel-MVPD pairs. This figure is in the middle of the pack of cable network license fees as reported by industry trade publications. In 2014, cable networks (channels) in our dataset accounted for well over two-thirds of all basic cable advertising revenues. Additionally, MVPDs in the dataset accounted for nearly the whole of U.S. subscribership in multichannel pay TV of about 100 million subscribers.[16]

Smaller channels are reasonably well represented in the data. Although the mean of

[14]For confidentiality reasons, we cannot divulge the source(s) of our data, and we limit reported summary statistics to ensure that no information on individual channel-MVPD transactions can be reverse-engineered.

[15]Where feasible, we use only data from January of each year, to control for potential seasonality. Because of differences in the way data was submitted or maintained, some variables are averaged over the year.

[16]Although the price effects of vertical integration are an important issue of great policy interest, we have excluded from the dataset channel-MVPD pairs for which the MVPD has an equity interest in the channel. This is for two reasons. First, the fees reported between vertically affiliated firms do not involve arm's-length negotiations and so are of questionable relevance. Second, vertical integration in our data is limited to an extremely small number of MVPDs. Adding a vertical integration dummy variable would not differ much from adding an MVPD fixed effect, carrying the risk of revealing information specific to a particular MVPD.

CHANSUBS, which is the total number of subscribers reached by a channel, is about 80 million, well over half of the channels in our dataset reach fewer than 60 million subscribers, some substantially fewer than that. PAIRSUBS, the number of a given MVPD's subscribers reached by a given channel, has a mean of 3.75 million across channel-MVPD pairs. Note that, for a given cable network (channel), summing its associated PAIRSUBS across all MVPDs that carry the channel yields its CHANSUBS.

SUBSHARE is a key independent variable in several of our reduced-form PERSUBFEE regressions. SUBSHARE is the ratio of PAIRSUBS to CHANSUBS, indicating the proportion of a given channel's total subscribers reached that is accounted for by a given MVPD. SUBSHARE is a relevant measure of MVPD "size," insofar as it reflects how dependent the channel's fortunes are on reaching a carriage agreement with the given MVPD. Across channel-MVPD pairs, mean SUBSHARE is 0.049. That is, on average an MVPD accounts for about 5% of a channel's total subscribers reached (i.e., its CHANSUBS).

There are two potential endogeneity concerns with using SUBSHARE to explain PERSUBFEEs. One is that SUBSHARE depends on what other carriage agreements the program supplier strikes. Failure to reach agreement with one MVPD would tend to change the value to the program supplier of reaching agreement with other MVPDs, as well as raise the SUBSHARE of those MVPDs. It is common knowledge, however, that failure to reach a mutually advantageous carriage deal is rare and of short duration in this industry. Failure to reach agreement is not a significant source of variation in our data. A second endogeneity concern is that a channel's placement among an MVPD's program packages (basic cable vs. extended basic), which affects SUBSHARE, may vary systematically with r_{ij} or a_{ij}. For example, MVPDs whose subscriber demographics are better matched with a channel's content will tend to have a higher r_{ij} and higher a_{ij}. In such cases, the channel may more likely be placed in the broader basic cable package, thereby raising SUBSHARE. The direction of bias (if any) is unclear. In any case, SUBSHARE is not the only measure of MVPD size we employ. As a robustness check, we also use MVPDSUBS, which is the MVPD's total U.S. subscriber count, and get qualitatively similar results.

PROGSIZE is a program supplier's (i.e., the channel owner's) share in aggregate advertising revenues of the basic cable network industry, inclusive of advertising revenue generated on all channels owned by the given program supplier. In cases of split ownership, where multiple program suppliers have partial financial interests in a given channel, we assign channel revenues according to equity shares. Mean PROGSIZE is 0.153, or about a 15% share of industry advertising revenues.

We have information on the vintage of the contract associated with every data point (channel-MVPD-year triple) in our panel. Data on contract year allows us to assess the claim that older contracts tend to have lower per-sub fees because of secular growth in demand for programming that was unanticipated at the time a multi-year contract was signed.[17] We use signing year fixed effects to control for this possibility.

[17]It is important to note, however, that yearly per-sub fee escalators based on industry trends in programming costs are a feature of many long-term carriage contracts. Such escalators, based on industry-wide

LIVE is a variable related to MVPD distribution quality. It is a measure of the proportion of program viewing on the MVPD that is live. In the time period of our sample, many digital video recorders (DVRs) allowed time-shifting viewers to fast-forward through advertisements. MVPDs varied in their subscribers' use of DVRs. Greater LIVE viewing tended to increase the value of advertising spots placed on the MVPD, thereby benefiting channels by raising a_{ij}. Again according to 2, we expect LIVE to correlate negatively with PERSUBFEE, all else equal.

MVPDSHARE is an MVPD's share in pay TV subscribers residing within its territorial footprint, which we compute as the MVPD's pay-TV-population-weighted average share across zipcodes within its footprint. We take MVPDSHARE to reflect the intensity of competition the MVPD faces, positing that a higher share tends to correspond with a smaller loss of subscribers switching to rivals in case the MVPD fails to reach a carriage agreement with a popular channel. We thus expect a higher MVPDSHARE to reflect a better disagreement outcome for the MVPD, hence a lower r_{ij} and a higher PERSUBFEE, all else equal. We also instrument for MVPDSHARE using LATITUDE and other variables, and get similar results. LATITUDE is the weighted average geographic latitude of the MVPD's footprint, using zip code subscriber counts as weights. For cable MSOs, LATITUDE is correlated with the likelihood that DBS is an available alternative service for subscribers. The higher the geographic latitude, the lower on the horizon would a line-of-sight be to the satellite in geosynchronous orbit, hence the more likely that access could be blocked by an obstruction. We also include another instrument, LATITUDExSATELLITE, which is the LATITUDE variable interacted with the dummy variable SATELLITE equal to one if the MVPD is a satellite operator (DBS) and zero otherwise.

4 Empirical Results

We begin by performing ordinary least squares (OLS) regressions of PERSUBFEE on the MVPD size variable SUBSHARE and one or more control variables. Results are reported in 2. Consistent with the bargaining leverage hypothesis, SUBSHARE has negative sign across the first five specifications in 2, with coefficients that are quantitatively similar and all statistically significant at the 1% level. We then undertake a variety of further robustness checks in Tables 3 and 4, finding the negative relationship between PERSUBFEE and MVPD size to be robust to variations in how that size is measured and to functional form.

In column 1 of Table 2, we report results from our simplest specification, which includes only channel fixed effects alongside SUBSHARE. These fixed effects control for all channel-specific characteristics, notably the channel's popularity.[18] The SUBSHARE coefficient in this specification is -0.727. This implies that a one standard deviation increase of 0.064 in

programming cost indices, plausibly mitigate contract vintage effects.

[18]We also tried specifications (not reported here) with Nielsen ratings and advertising costs per thousand viewers reached as quality proxies for the channel. In these specifications, we obtained qualitatively similar results on SUBSHARE.

SUBSHARE is associated with a PERSUBFEE reduction of about \$0.046 cents, or about 9% evaluated at the sample mean.

In column 2, to control for possible vintage effects we add year fixed effects for the year in which the PERSUBFEE-determining carriage contract was signed. As compared with column 1, the point estimate on SUBSHARE is actually slightly larger in absolute value at -0.801, which is inconsistent with a contract vintage effect. In fact the set of contract fixed effects are jointly insignificant. For that regression the F-statistic on the set of contract vintage fixed effects is $F_{14,2033} = 0.99$.

The specification in column 3 of Table 2 adds two more explanatory variables: PROGSIZE and CHANSUBS. These control for potential size effects on the program supplier side. Both are positive, but only PROGSIZE is statistically significant,[19] at the 1% level.[20] This again is consistent with the hypothesis that size confers bargaining leverage, but on the content side. The point estimate implies that a one standard deviation increase in PROGSIZE, of about 3.8 percentage points, is associated with a PERSUBFEE increase of \$0.29, a 54% increase evaluated at the sample mean. Intuitively, PROGSIZE is a more salient measure of bargaining leverage on the program supplier side than CHANSIZE; a program supplier could better wield its leverage by threatening to withhold all of its channels from an MVPD.

Column 4 of Table 2 adds MVPDSHARE to the specification, to control for the role downstream competition plays in upstream bargaining. MVPDSHARE is negatively related to PERSUBFEE, consistent with the idea that an MVPD facing less intense competition for subscribers in its footprint is in a better bargaining position vis-a-vis program suppliers. MVPDSHARE may be endogenous, however, through omitted variable bias. For example, MVPDs with better managerial talent may both win more subscribers downstream and drive better licensing bargains upstream.

To address this possibility, in column 5 of Table 2 we instrument for MVPDSHARE using LATITUDE, as well as introduce an interaction term for whether the MVPD is one of the two DBS companies. The DBS companies deliver their MVPD service from satellites to receiving dishes located at customers' residences. A DBS service is available to a residence, hence poses a competitive constraint on land-based MVPDs, only if there is a direct line of sight to the satellite. These satellites are in geosynchronous orbit 22,000 kilometers above the equator. Given the earth's curvature, the higher (more northerly) the latitude of the customer's residence, the lower on the horizon will the satellite appear and the more likely that direct line of sight may be obstructed.[21] We expect (and find) that LATITUDE covaries positively with MVPDSHARE for land-based MVPDs (cable MSOs and telco providers) but covaries negatively for DBS firms. Note that the IV specification in column 5 yields virtually

[19]We tested whether the insignificance of CHANSUBS is due to collinearity with PROGSIZE. The correlation is only 0.289 in our sample. This is unsurprising given that program suppliers own channels of widely varying size.

[20]We drop CHANSIZE from later regressions.

[21]In addition to latitude, Goolsbee and Petrin (2004) use local variance in topography, whether the residence is a detached house or an apartment and other variables in instrumenting for the availability of DBS service.

identical results to those of column 4, suggesting the absence of a substantial endogeneity problem.[22]

Column 6 of Table 2 adds both an MVPDSHARE squared term and LIVE as regressors, run on the small subset of channels for which we have information on live viewing as measured by LIVE. LIVE is negative (as expected) and significant at the 5% level. The sign and significance of the coefficient on SUBSHARE comports with previous findings. The smaller magnitude of the SUBSHARE coefficient in this regression, -0.410, is due primarily to subsample selection.[23]

We present the results from robustness checks in Table 3. In these regressions we use different measurements of the treatment and control variables to check whether the size-leverage relationships reported in Table 2 are sensitive to our choice of MVPD size measure or artifacts of our modeling decisions. The specification in column 1 of Table 3 is a log-log version of that in column 3 of Table 2. The point estimate on the natural log of SUBSHARE indicates that a doubling in SUBSHARE (from 4.9% to 9.8%, evaluated at the mean) corresponds to about a 2.5% reduction in PERSUBFEE. This is only about one-third of the PERSUBFEE reduction implied by the linear SUBSHARE specifications in Table 2.

In column 2 of Table 3, the size variable is the natural log of MVPDSUBS. The size coefficient is once again negative and statistically significant at the 1% level. Evaluated at sample means, the point estimate implies that a doubling in MVPDSUBS (from 4.9 million to 9.8 million subscribers) corresponds to 2.6% reduction in PERSUBFEE. This roughly matches the implied change from the log-log SUBSHARE specification in column 1 of Table 3, but again is only about one-third of the change implied by the linear specifications in Table 2.

Column 3 of Table 3 reports the result for the linear MVPDSUBS specification, which again shows a negative coefficient that is statistically significant at the 1% level. The point estimate implies that a doubling in MVPDSUBS (from 4.8 million to to 9.6 million subscribers) corresponds to 5.6% reduction in PERSUBFEE. This is somewhat smaller than the implied change from the linear SUBSHARE specifications in Table 2, but is about double the change implied by the log MVPDSUBS specifications.

In column 4 of Table 3, we add an MVPDSUBS squared term to a linear MVPDSUBS term. The linear coefficient is once again negative and significant at the 1% level. The squared term is positive but insignificant at the 5% level. This specification implies a reduction in PERSUBFEE from a doubling in MVPDSUBS that is similar to that in column 3 of Table 3.

As a further check on the shape of the relationship between PERSUBFEE and MVPDSUBS, we divide our data into three sub-samples based on the magnitude of PAIRSUBS: one to

[22] We test for this using the Durbin-Wu-Hausman test. The p-statistic is 0.628, indicating that OLS is a consistent estimator in this case. Given this result, we dispense with instrumenting for MVPDSHARE in the robustness checks we perform in later tables.

[23] The same regression run on this subset of 250 observations but without including LIVE gives an estimate of -0.362 on SUBSHARE.

five million MVPD-channel subscribers, five to 10 million, and 10 million and above (the excluded group is zero to one million). The coefficients for these category variables are reported in column 5 of Table 3. Point estimates increase with the size category but only the 10 million+ category is statistically significant at more than the 5% level. This suggests that the negative relationship between MVPDSUBS and PERSUBFEE may be driven by the very largest MVPDs. The coefficient on the 10 million+ size category suggests that moving from the smallest size category (the excluded group of below 1 million) to the largest category corresponds to about an $0.08 reduction in PERSUBFEE, equal to about 16% of the mean value of PERSUBFEE across the entire sample.

5 Conclusion

We apply a simple, reduced-form model of bilateral Nash bargaining between MVPDs and program suppliers to a unique, transaction-level dataset from the multichannel pay TV industry. We find robust evidence that per-subscriber program license fees tend to decline with MVPD size but tend to increase with program supplier size, consistent with the hypothesis that size enhances bargaining advantage on both the buyer and seller sides. Other explanatory variables likewise have effects consistent with bargaining leverage. Greater live viewing of programming by an MVPD's subscribers, which improves the MVPD's distribution quality for program suppliers by enhancing the impact of advertisements, tends to reduce per-subscriber fees. Less intense competition for subscribers downstream improves MVPD bargaining leverage vis-a-vis program suppliers, implying smaller MVPD losses in case of failure to reach a carriage agreement, and so tends to reduce per-subscriber fees. Overall, our results lend further support to the usefulness of Nash bargaining theory in empirical applications.

Table 1: Descriptive Statistics on Channel-MVPD-Year Level Data

Variable	Mean	Std. Dev.
PAIRSUBS	3.798	5.046
SUBSHARE	0.0491	0.0647
PERSUBFEE	0.532	1.023
MVPDSUBS	4.849	5.972
PROGSIZE	0.153	0.0375
CHANSUBS	80.37	22.199
LIVE	0.137	0.101
MVPDSHARE	0.324	0.152
LATITUDE	38.57	2.134
Observations	2,212	
Number of channels	65	

Notes: The panel dataset consists of 2,212 channel-MVPD-year tuples observed for the month of January when data is at a monthly level or year average for data reported at the yearly level. Data was collected from 2009 to 2014 as part of the investigation into the proposed merger of Comcast and Time Warner Cable.

Table 2: Per-Subscriber Fee Regressions

VARIABLES	(1) PERSUBFEE	(2) PERSUBFEE	(3) PERSUBFEE	(4) PERSUBFEE	(5) PERSUBFEE	(6) PERSUBFEE
SUBSHARE	-0.727***	-0.801***	-0.812***	-0.788***	-0.781***	-0.41***
	(0.0648)	(0.0715)	(0.0709)	(0.0707)	(0.0712)	(0.0797)
PROGSIZE			7.637***	7.667***	7.673***	-1.683
			(1.185)	(1.166)	(1.144)	(1.2771)
CHANSUBS			0.000126			
			(0.00186)			
MVPDSHARE				-0.114***	-0.152*	0.402***
				(0.0252)	(0.0813)	(0.122)
MVPDSHARE^2						-0.673***
						(0.157)
LIVE						-0.246**
						(0.0959)
Channel FE	Y	Y	Y	Y	Y	Y
Year FE	N	Y	Y	Y	Y	Y
Contract year FE	N	Y	Y	Y	Y	Y
Instrument for MVPDSHARE	N	N	N	N	Y	N
Observations	2,112	2,112	2,112	2,112	2,112	250
R-squared	0.972	0.974	0.974	0.975	0.975	0.951

Standard errors in parentheses

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

Notes: In column 5 MVPDSHARE is instrumented with the weighted by market size average latitude of the MVPD's footprint interacted with an indicator if the MVPD is a satellite television service. The first stage is reported in Table 4. Column 6 is run only on the subset of channels for which we have information on LIVE. The smaller in magnitude coefficient on SUBSHARE in this regression is due primarily to the selection of channel-mvpd-year tuples for which we have information on LIVE and not the correlation structure between LIVE, SUBSHARE, and PERSUBFEE. We make this inference based on two pieces of evidence. The same regression on this subset of 250 observations run without including LIVE gives a coefficient estimate of -0.362 on SUBSHARE. Furthermore, estimating the regression in column 6 but replacing missing values of LIVE in the sample with the sub-sample average and including a dummy variable regressor for instances of previous missing values of LIVE gives a result of -0.877 on SUBSHARE that is significant at the 5 % level. The coefficient on the missing value of LIVE regressor is insignificant.

Table 3: Per-Subscriber Fee Regressions: Robustness Checks

VARIABLES	(1) Log PERSUBFEE	(2) Log PERSUBFEE	(3) PERSUBFEE	(4) PERSUBFEE	(5) PERSUBFEE
Log SUBSHARE	-0.036***				
	(0.00414)				
Log MVPDSUBS		-0.0379***			
		(0.00474)			
MVPDSUBS			-0.00604***	-0.00797***	
			(0.000802)	(0.00281)	
MVPDSUBS^2				0.0000989	
				(0.000138)	
1 to 5 M subs					0.00453
					(0.0113)
5 to 10 M subs					0.0317*
					(0.0174)
10 M+ subs					-0.081***
					(0.014)
Observations	2,112	2,112	2,212	2,212	2,212
R-squared	0.937	0.937	0.974	0.974	0.974

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Logs are natural logs. Columns (1)-(3) use the main sample of 2,212 MVPD-programmer-year tuples. Programmer size, MVPDSHARE, and channel, year, and contract date fixed effects are included in all regressions but not listed in the table.

Table 4: First Stage: MVPDSHARE

	(1)
VARIABLES	MVPDSHARE
LATITUDE	0.0152***
	(0.00146)
LATITUDExSAT	-0.00388***
	(0.000374)
SUBSHARE	0.620***
	(0.0721)
PROGSIZE	0.0382
	(0.979)
Observations	2,212
R-squared	0.195

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Standard errors reported in parentheses. Year fixed effects, contract date fixed effects, and channel fixed effects are not reported in table. The F-statistic is $F_{81,2030} = 6.06$.

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