In contrast, a similar derivation to that above shows that when $\zeta_{fc}(1+\mu_{fc})=1$, the price in market m will instead be

$$p_m = \phi\left(mc_{fm} + (1-\mu_{fc})\left[\frac{\sum_{m\in\mathcal{M}_f}(b_{cm}-a_c)D_m(p_m)}{\sum_{m\in\mathcal{M}_f}D_m(p_m)}\right] + \mu_{fc}(b_{cm}-a_c)\right), \quad (18)$$

which generally equals the joint profit-maximizing price only if $\mu_{fc}=1$.[45]

4. ESTIMATION AND IDENTIFICATION

In this section, we discuss the estimation of our model's parameters and how they are identified (given our modeling assumptions) from patterns in the data. We estimate all of our parameters jointly in a single step; however, for exposition, we discuss our estimation procedure in two steps:

1. We estimate $\boldsymbol{\theta} \equiv \{\boldsymbol{\theta}_1, \boldsymbol{\theta}_2, \boldsymbol{\theta}_3\}$, where:

(a) $\boldsymbol{\theta}_1 \equiv \{\boldsymbol{\rho}, \boldsymbol{\nu}, \gamma^d, \gamma^b\}$, where $\boldsymbol{\rho} \equiv \{\rho_c^0, \rho_c^1\}_{\forall c}$ and $\boldsymbol{\nu} \equiv \{\nu^{\mathrm{S}}, \nu^{\mathrm{NS}}\}$, determines household viewership decisions by governing the distribution of γ_{ict}, how fast marginal utilities from viewership decay, and the viewership utility reductions due to black-outs and distance to teams' stadiums;

(b) $\boldsymbol{\theta}_2 \equiv \{\beta^v, \boldsymbol{\beta}^x, \boldsymbol{\rho}^{\mathrm{sat}}, \alpha\}$, where $\boldsymbol{\rho}^{\mathrm{sat}} \equiv \{\rho^{\mathrm{sat}}_{\mathrm{DirecTV}}, \rho^{\mathrm{sat}}_{\mathrm{Dish}}\}$, determines household distributor choice;

(c) $\boldsymbol{\theta}_3 \equiv \{\mu, \zeta^I, \zeta^E, \sigma^2_\omega\}$ are parameters that affect firm incentives when pricing, bargaining, and determining carriage of channels. Recall that the parameter μ governs the extent to which integrated channels and distributors internalize profits across upstream and downstream units. Finally, σ^2_ω is the variance of an error term that influences MVPDs' carriage decisions in a manner that we discuss below.

2. We estimate $\{\underline{\lambda}_R^{\mathrm{Phil}}, \underline{\lambda}_R^{\mathrm{SD}}\}$, representing separate lower bounds for our rival foreclosure parameter in each of the markets in which RSNs took advantage of the terrestrial loophole (i.e., Philadelphia and San Diego).

To capture the impact of program access rules, we assume that $\lambda_R = 0$ in non-loophole markets. That is, we assume that the program access rules effectively require integrated firms to ignore any foreclosure incentives in dealing with non-integrated rivals.[46]

Our estimation procedure conditions on the ownership structures of firms that are observed in the data. We maintain the assumption that the integration status of a channel or distributor does not directly affect viewership utility or distributor demand, and is not correlated with either measurement error (e.g., in affiliate fees or markups) or market-level profit disturbances considered by firms when bargaining or making pricing or carriage

[45]Note that, consistent with our discussion above, (18) does yield a joint profit-maximizing price when b_{cm} is the same for all m, or when f is only active in a single market.

[46]We take this approach as a simple approximation to capture the effects of program access rules for both estimation and counterfactual simulation. In practice in markets subject to program access rules, an integrated channel could attempt to deny access to a rival distributor at the risk of triggering a binding arbitration process in which the negotiated affiliate fees with other distributors might be used to determine the arbitrated price. Explicitly modeling this process is beyond the scope of the current analysis, and we leverage the assumption that $\lambda_R = 0$ when PARs are enforced for tractability. Furthermore, we do not attempt to estimate a value of $\lambda_R \geq 0$ in markets where program access rules are in effect given the absence of variation in the data that we believe would allow us to identify such a parameter.

decisions.[47] If these assumptions are violated, then this paper's predictions for the effects of vertical integration may be biased as these predictions would not account for unobservable factors that led to observed ownership structures. For example, if a channel and distributor are integrated for reasons outside our model (or in anticipation of positive profit shocks), then counterfactually demerging that pair may understate the benefits of integration. Likewise, if a channel and distributor are not integrated because of unmodeled costs of integration, counterfactually merging them would overstate the benefits of integration.

4.1. *Estimation of Parameters* $\boldsymbol{\theta}_1, \boldsymbol{\theta}_2, \boldsymbol{\theta}_3$

4.1.1. *Moments Used in Estimation*

We estimate the model parameters via GMM, using the following moments.

Household Viewership. For every RSN and 38 national channels in each year, we use the difference between the following viewership moments observed in the data and predicted by the model:[48]

1. summing across markets, the mean viewership for each channel-year;
2. summing across markets, the number of households with zero viewership for each channel-year.[49]

Household Distributor Choice. For every year and market, we assume that the unobservable characteristic for each distributor's bundle is orthogonal to a vector of instruments: that is, $E[\xi_{fmt}(\boldsymbol{\theta})\boldsymbol{Z}_{mt}] = 0$, where the expectation is taken across all markets, firms, and years. For $\boldsymbol{Z}_{mt}$, we include: firm-state and year dummy variables $\boldsymbol{x}_{fmt}$; the maximum fraction of teams carried by the relevant RSNs in the market that are not blacked out (to instrument for bundle utility v^*_{fmt}); and the satellite tax within the market, interacted with an indicator for whether the bundle is offered by a cable or satellite distributor (to instrument for bundle prices p_{fmt}).[50] We recover $\xi_{fmt}(\boldsymbol{\theta})$ using the standard Berry, Levinsohn, and Pakes (1995) inversion to match observed and predicted market shares (at each f, m, and t).

Distributor Bargaining, Pricing, and Carriage. First, for any $\boldsymbol{\theta}$, the vector of affiliate fees $\{\tau_{fct}\}$ and bundle-specific marginal costs $\{mc_{fmt}\}$ can be directly computed using the optimal pricing and bargaining conditions given by (5) and (10) (see Appendix S.B.2 of the Supplemental Material 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 which we form using only 2007 data and values:

[47]This does not rule out the possibility that integrated channels may differ in quality from non-integrated channels (e.g., have different values of $\boldsymbol{\rho}_c$), as we estimate time varying channel taste parameters.

[48]To avoid re-solving the viewership problem for every household for every evaluation of a candidate parameter vector, we follow the importance sampling approach of Ackerberg (2009). See Appendix S.B.3 of the Supplemental Material for further details.

[49]The MRI/Simmons data provide an estimate of the probability that a channel is never watched for national channels. We regress this probability on viewership, and use the estimated relationship to predict the probability that an RSN is never watched.

[50]The satellite tax changes that we use, by state year and percentage increase, are: CT 2003, 5%; FL 2002, 10%; KY 2006, 5%; MA 2009, 5%; NC 2003, 7%; OH 2003, 6%; and UT 2003, 5%. We discuss these instruments further in Section 5.2 and in footnote 67.

1. *Average affiliate fees*: For each RSN active in 2007 and four national channels (ABC Family, ESPN, TNT, and USA), we minimize the difference between the model's predicted average affiliate fees across MVPDs and observed average affiliate fees: $E_f[\tau_{fct}(\boldsymbol{\theta})] - \tau^o_{ct}$ (where variables with an o superscript denote values of those objects that are observed in the data). We weight estimated affiliate fees by national MVPD market shares conditional on observed carriage of the channel to approximate expectations across MVPDs.

Deviations in these and the next set of moments for implied markups reflect both measurement error in the data and sampling error, as our predictions are computed using a subset of U.S. markets.

2. *Implied markups*: For each distributor $f \in \{Comcast, DirecTV, Dish\}$, we minimize the difference between the model's predicted MVPD price-cost margin and those observed in the data: $E_m[(p^o_{fmt} - mc_{fmt}(\boldsymbol{\theta}))/p^o_{fmt}] - markup^o_{ft}$.

3. *RSN carriage*: Equation (6) implies that every cable distributor f chooses the optimal set of channels (from among those with which it has agreements) to include in each market m's bundle. We assume that distributor f's true per household profits (not per subscriber) in market m are given by $\tilde{\pi}^M_{fmt}(\cdot)$, where

$$\tilde{\pi}^M_{fmt}(\mathcal{B}_{mt}, \cdot) \equiv \left[\pi^M_{fmt}(\mathcal{B}_{mt}, \cdot) - \omega_{fmt}(\mathcal{B}_{fmt})\right], \tag{19}$$

and $\pi^M_{fmt}(\mathcal{B}_{mt}, \cdot)$ represents our (the econometrician's) estimate of a firm's per household profits. The term $\omega_{fmt}(\mathcal{B}_{fmt})$ represents a mean-zero i.i.d. bundle-distributor-market-time specific disturbance; we assume that $\omega_{fmt}(\cdot) \sim N(0, \sigma^2_\omega)$.[51]

If channel c has negotiated an agreement with some firm f (i.e., f carries c on its bundles in some non-empty set of markets), then firm f's optimal carriage decision given by (6) implies that

$$\begin{aligned} &\left(\left[\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt} \cup fc, \cdot)\right] - \left[\Delta_{fc}\omega_{fmt}(\mathcal{B}_{fmt} \cup fc, \cdot)\right]\right) \geq 0 \quad \forall m : c \in \mathcal{B}_{fmt}, \\ &\left(\left[\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt} \cup fc, \cdot)\right] - \left[\Delta_{fc}\omega_{fmt}(\mathcal{B}_{fmt} \cup fc, \cdot)\right]\right) \leq 0 \quad \forall m : c \notin \mathcal{B}_{fmt}, \end{aligned} \tag{20}$$

where $[\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt}, \cdot)] \equiv \pi^M_{fmt}(\mathcal{B}_{mt}, \cdot) - \pi^M_{fmt}(\mathcal{B}_{mt} \setminus fc, \cdot)$, $[\Delta_{fc}\omega_{fmt}(\mathcal{B}_{fmt})] \equiv \omega_{fmt}(\mathcal{B}_{fmt}) - \omega_{fmt}(\mathcal{B}_{fmt} \setminus fc)$, and $\mathcal{B}_{mt} \cup fc$ denotes the set of all bundles $\mathcal{B}_{mt}$ where c is added to bundle f.[52] That is, these inequalities imply that in any market in which c is carried by f, f obtains higher profits from carrying than by dropping c (holding fixed prices and carriage decisions of other firms); similarly, in any market where c is not carried, f obtains higher profits from not carrying than by carrying c.

Given our assumptions on the distribution of $\omega_{fmt}(\cdot)$, it follows that

$$\Pr(c \in \mathcal{B}_{fmt}) = \Phi\left(\left[\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt} \cup fc, \cdot)\right]/(2\sigma_\omega)\right), \tag{21}$$

where Φ is the standard normal cumulative distribution function.

We construct several moments based on the model's predicted carriage probabilities. First, we construct moments based on indirect inference (cf. Gouriéroux and Monfort (1996)) that match the predicted to observed relationship between carriage of a relevant

[51] We interpret $\omega_{fmt}(\cdot)$ as the difference between our estimated profits and those used by a local system operator when determining carriage decisions; we assume that these disturbances are not accounted for by a distributor when pricing or bargaining with channels.

[52] In cases where $c \in \mathcal{B}_{fmt}$, this definition implies that $\mathcal{B}_{mt} \cup fc = \mathcal{B}_{mt}$.

RSN by a system and (i) the ownership share of the RSN by the system's MVPD, (ii) the distance of the system to the RSN's teams' stadiums, and (iii) the fraction of teams on the RSN that are not blacked out. Table I presents the results of a linear probability regression predicting whether a cable system carries a relevant RSN in our data. We find that carriage of an RSN by a cable system is increasing with the share of the RSN owned by the system's MVPD, and decreasing in the distance between the system and the RSN's teams' stadiums and in the fraction of teams that are blacked out. We perform the same regression using the predicted carriage probabilities from our model, and match the estimated coefficients for vertical integration, distance, and the fraction of teams not blacked out from this regression to the coefficients in specification (4) in Table I.[53]

Second, we calculate the probability that an RSN is carried by a cable distributor in a relevant market, and match the probability that is observed in the data to that predicted by our model via (21).[54] Third, we set $\partial\mathcal{L}_{\text{carriage}}/\partial\sigma_\omega = 0$, where $\mathcal{L}_{\text{carriage}}$ is the predicted log-likelihood of the observed market-level RSN carriage decisions by cable MVPDs, given by

$$\mathcal{L}_{\text{carriage}} = \sum_{c\in\mathcal{C}_t^R}\sum_{fm:c\in\mathcal{A}_{ft}}\big(1_{\{c\in\mathcal{B}_{fmt}\}}\times\log\Pr(c\in\mathcal{B}_{fmt}) + 1_{\{c\notin\mathcal{B}_{fmt}\}}\times\log\Pr(c\notin\mathcal{B}_{fmt})\big),$$

where $\mathcal{C}_t^R$ denotes the set of RSNs, and $\mathcal{A}_{ft}$ are the set of channels available to MVPD f.

Run in Model

TABLE I

REGRESSION OF RSN CARRIAGE ON INTEGRATION STATUS, DISTANCE, AND BLACKOUT PERCENTAGE[a]

	(1)	(2)	(3)	(4)
VI Ownership Share	0.404***	0.435***	0.293***	0.171**
	(0.0674)	(0.0837)	(0.110)	(0.0852)
% Teams Not Blacked Out	0.412***	0.399***	0.429***	0.477***
	(0.0494)	(0.0586)	(0.109)	(0.107)
Avg. Distance to RSN's Stadiums	−0.559***	−0.630***	−0.838***	−0.795***
(10^3 mi)	(0.100)	(0.117)	(0.238)	(0.284)
Years	2000–2010	2007	2007	2007
Systems	All Systems	All Systems	Has P Q	Has P Q
Has Deal	No	No	No	Yes
Observations	154,121	12,246	1,132	1,052
R-squared	0.615	0.616	0.670	0.639

[a] Linear probability regression where the dependent variable is whether a cable system carries an RSN in a relevant market in 2007. Specifications differ by sample used, where "Has P Q" restricts attention to systems for which price and quantity data are available, and "Has Deal" restricts attention to system-RSN pairs where the MVPD has a deal with the RSN (i.e., carries the RSN on at least one other system). All specifications use DMA, RSN, and (when appropriate) year fixed effects. Inclusion of system demographic controls (race, population density, average income, household ownership) did not appreciably change point estimates. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Standard errors are reported in parentheses, and are clustered by DMA.

[53] We focus on the "Has Deal" specification as our model does not predict the probability of carriage for a system if the MVPD and channel do not have a deal.

[54] For example, if there are only two RSNs A and B, and A is carried on cable in 30/40 of A's relevant markets, and B is carried on cable in 25/60 of B's relevant markets, the probability that an RSN is carried by a cable distributor in a relevant market is 0.55.

4.1.2. *Identification*

We now provide a discussion of variation in the data that help identify the parameters of our model (given the assumptions and moment restrictions that we employ).

Viewership and Distributor Choice Parameters ($\boldsymbol{\theta}_1$, $\boldsymbol{\theta}_2$). We believe that our estimate of $\boldsymbol{\rho}$, the parameters that govern the distribution of channel tastes, is determined primarily by viewing behavior: that is, channels watched by a larger fraction of households will tend to have higher values of ρ_c^0 (the probability that a channel delivers positive utility), and those that, conditional upon being watched, are watched more often will tend to have higher values of ρ_c^1 (the mean of the taste distribution). Since we do not possess ratings for RSNs at the market level, we believe black-out and distance parameters (γ^b and γ^d) are determined from other sources; we defer discussion of these parameters until the end of this subsection.

We believe that variation in bundle market shares as observed bundle characteristics and prices change is the primary source of information about parameters governing household bundle choice (α, $\boldsymbol{\beta}^x$, and $\boldsymbol{\beta}^v$). Table A.I summarizes the variation in prices and channel carriage across markets. State satellite taxes are used as an instrument for price, and the fraction of blacked-out teams on RSNs in each relevant market is used as an instrument for viewership utility (as firms may respond to local demand shocks when determining carriage). We believe that observed cable and satellite pricing margins provide the main source of identification for satellite preference heterogeneity ($\boldsymbol{\rho}^{\text{sat}}$).[55]

We supplement bundle market share variation with observed average affiliate fees for each channel. Our model predicts that a channel obtains higher affiliate fees if its presence has a greater impact on households' viewership utility when determining bundle choice (see (2)), as this implies that the channel generates larger gains from trade with distributors. Thus, observed affiliate fees provide information regarding the distribution of channel tastes and their scaling into viewership utility. In particular, we believe that the observed relationship between affiliate fees and ratings is the primary source of information for our "decay" parameters (ν_c^{S} for sports channels and ν_c^{NS} for non-sports channels). Our choice to allow different values of decay parameters for sports and non-sports channels is motivated by the data, illustrated in Figure 3. Sports channels have consistently higher negotiated affiliate fees than non-sports channels with similar ratings; our model is able to match this pattern by attributing a higher initial utility γ_{ic} and a higher decay rate ν^{S} to a sports channel that has the same ratings as a non-sports channel.[56]

Bargaining, Pricing, and Carriage Parameters ($\boldsymbol{\theta}_3$). The Nash bargaining parameters $\{\zeta^E, \zeta^I\}$ relate negotiated affiliate fees to distributor and channel gains from trade. If the external Nash bargaining parameter $\zeta^E = 0$ (so that distributors obtain no surplus when negotiating with a non-integrated channel), the bargaining first-order conditions given by (11) imply that affiliate fees between any distributor and non-integrated channel would

[55]Under a standard logit demand system without preference heterogeneity, there is a strict relationship between product market shares and price elasticities; in these models, allowing for product-level preference heterogeneity can assist in rationalizing larger observed markups by reducing implied price elasticities for given market shares.

[56]For computational reasons, during estimation we restrict ν^{S} to lie on a discrete grid while allowing all other parameters to vary freely; see Appendix S.B.3 of the Supplemental Material for further details and robustness tests. See also the discussion in the appendix of Crawford and Yurukoglu (2012) which examines a variant of this model using Monte Carlo simulation.

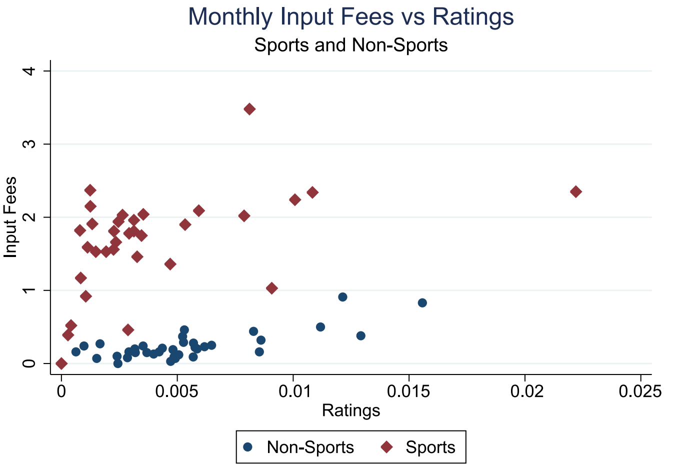


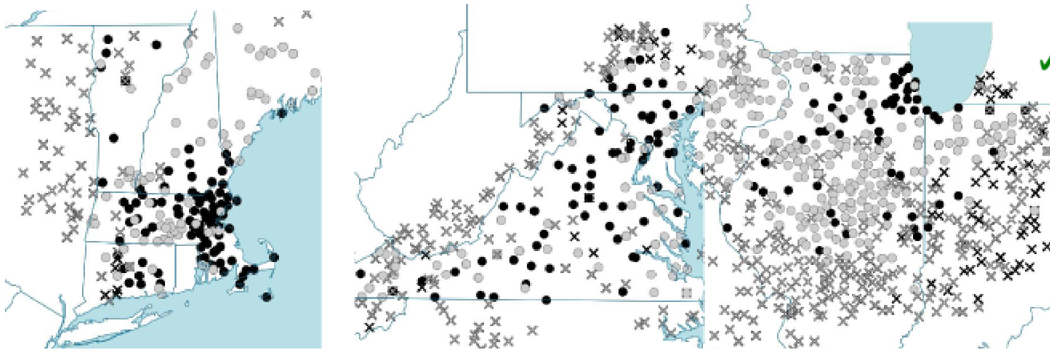
FIGURE 3.—Negotiated monthly affiliate fees and viewership ratings.

be determined solely by the distributor's gains from trade; fees would not be affected by advertising revenues or factors entering solely the channel's gains from trade. Thus, controlling for viewership, we believe that the extent to which average affiliate fees for non-integrated channels vary with advertising revenues (and the estimated joint gains from trade with distributors) provides information about the value of ζ^E.

Next, although the internalization parameter μ enters into the computation of several moments (including any moment based on affiliate fees or marginal costs), we expect that its value is primarily determined by our RSN Carriage moments and the higher observed carriage rates between integrated distributors and channels (captured in the regressions in Table I): as μ increases (holding all other parameters fixed), our model predicts that distributors have a greater incentive to carry an integrated channel for a fixed contribution of the channel to downstream profits. We believe that black-out and distance parameters, γ^b, γ^d, are determined in a similar fashion to μ. In addition, given μ and ζ^E, the level of average affiliate fees for integrated channels should then provide information about the value of the internal Nash bargaining parameter ζ^I. While the internally negotiated affiliate fee between an integrated distributor and channel is not directly observed, it can be recovered from the channel's average affiliate fees across all distributors (which is observed) and its average affiliate fee from non-integrated distributors only (which is a function of μ, ζ^E, and the channel's gains from trade from those distributors).

An example of the variation in the data that we leverage is illustrated in Figure 4, which presents the integrated and non-integrated carriage of a Comcast integrated RSN in three different regions of the United States. In these regions, cable systems in markets close to the RSN's teams' stadiums almost always carry the RSN; systems far away most often do not. However, in markets located a moderate distance away, these RSNs are much more likely to be carried on Comcast-owned systems than on non-integrated systems.[57] These

[57]For example, in Figure 4(a), all Comcast systems in northern Vermont carry CSN New England (black dots), whereas most non-Comcast systems (gray dots for systems that carry the RSN, and gray X's for those that do not) do not carry CSN New England. In Figures 4(b) and 4(c), non-carriage by non-Comcast systems occurs much closer to the RSN's teams' stadiums than for Comcast systems: there is a higher ratio of gray X's to gray dots near Washington, D.C. and Chicago than of black X's (non-carriage by Comcast systems) to black dots.



(a) CSN New England (b) CSN Mid-Atlantic (c) CSN Chicago

FIGURE 4.—Carriage by Comcast and non-integrated cable MVPDs of three Comcast-integrated RSNs across cable systems in 2007. Dots represent carriage by a system, X's represent no carriage. Black markers represent Comcast systems, grey markers represent non-Comcast cable systems.

maps also indicate that non-carriage is much more likely in areas where the teams on the RSN are blacked out (as in New York for CSN New England, Pennsylvania for CSN Mid-Atlantic, and Michigan for CSN Chicago).

Finally, the variance of carriage disturbances σ_ω^2 affects only the value of our carriage moments. As this variance increases (holding all other parameters fixed), the predicted carriage probability for any channel approaches 1/2 as predicted carriage decisions become based purely on noise. We thus believe that lower values of σ_ω^2 indicate that our model's predicted changes in distributors' profits from carriage can be used to predict observed carriage decisions.[58]

4.2. *Estimation of Lower Bounds for Rival Foreclosure Parameter*

To recover lower bounds for our rival foreclosure parameter λ_R, we will use information provided by markets in which distributors are able to exclude competitors from carrying an integrated RSN channel—that is, terrestrial loophole markets. The markets we focus on are 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 distributors DirecTV and Dish.

Observe that because these two markets both had total exclusion of satellite distributors, we will only be able to estimate lower bounds on λ_R, which we will denote by $\underline{\lambda}_R^{\text{Phil}}$ and $\underline{\lambda}_R^{\text{SD}}$ for each market. Intuitively, for each market, the lower bound will be the lowest level of λ_R at which there are no mutual gains from trade between the RSN and either satellite distributor (i.e., the value of λ_R at which the gains from exclusion exceed the gains from carriage). In general, however, whether there are gains from trade between an RSN and a satellite distributor depends on the satellite firm's beliefs about whether, if it is supplied, the other satellite firm will also be supplied. In Appendix S.A of the Supplemental Ma-

[58]Note that our intuition behind the determination of μ relies on carriage rate *differences* between non-integrated and integrated firms, whereas σ_ω^2 relies on carriage rate *levels* for either non-integrated or integrated firms.

weak inequalities for non supply

terial, we show that a *necessary* condition for non-supply, *regardless of the satellite firm's beliefs*, is that the joint profit of the RSN c and the two satellite firms g and g' is reduced when both satellite firms have access to the RSN, which can be stated as

$$\begin{aligned}\sum_{m\in\mathcal{M}_c} \Big[\big[&\Delta_{gc,g'c}\Pi^M_{gmt}\big(\{\mathcal{B}^o_{mt}\cup\{gc,g'c\}\},\boldsymbol{p}^o_{mt},\tilde{\boldsymbol{\tau}};\hat{\mu}\big)\big]\dots\\ &+\big[\Delta_{gc,g'c}\Pi^M_{g'mt}\big(\{\mathcal{B}^o_{mt}\cup\{gc,g'c\}\},\boldsymbol{p}^o_{mt},\tilde{\boldsymbol{\tau}};\hat{\mu}\big)\big]\dots\\ &+\big[\Delta_{gc,g'c}\Pi^C_{cmt}\big(\{\mathcal{B}^o_{mt}\cup\{gc,g'c\}\},\boldsymbol{p}^o_{mt},\tilde{\boldsymbol{\tau}};\hat{\mu},\lambda_R\big)\big]\Big]\\ \le 0,&\end{aligned} \tag{22}$$

where $\mathcal{M}_c$ represents the set of c's relevant markets. The left-hand side of (22), which we refer to as the "three-party surplus," represents g, g', and c's joint gains from trade from both g and g' being supplied with channel c and carrying the channel in all of c's relevant markets, and $\tilde{\boldsymbol{\tau}}$ equals the predicted values of affiliate fees $\hat{\boldsymbol{\tau}}(\cdot)$ except that $\tilde{\tau}_{gct} = \tilde{\tau}_{g'ct} = 0$.[59]

For each of the loophole-market cable-integrated RSNs that do not contract with the satellite distributors (CSN Philadelphia and 4SD), we estimate the corresponding lower bound that holds for any beliefs held by a satellite firm about whether the RSN will also be supplied to the rival satellite firm by finding the lowest value of λ_R that makes (22) hold.[60,61]

Incentives for Exclusion

It is instructive at this point to discuss the competing forces that would induce a cable provider to withhold its integrated RSN from a satellite provider. This is equivalent to understanding why the gains created when satellite distributors are supplied with the RSN may be offset by the losses incurred by the integrated cable provider.

The primary gains-from-trade contemplated when a satellite distributor g is supplied with the RSN are through potential market expansion effects from carriage, that is, if consumers who previously did not subscribe to any MVPD now would if satellite were to carry the RSN. Each household that substitutes from the outside good to g would generate additional industry profit equal to the level of g's margins plus any additional advertising revenues generated by those households watching the RSN.

The primary losses generated by supplying g with the RSN would be incurred by the RSN's integrated cable distributor if households substituted away from the integrated cable provider to g. Although these consumers would generate profit for g, insofar as cable margins are higher than those of satellite providers (by 10+ percentage points in

[59]Specifically, we show that in an alternating offer bargaining game of the form studied by Collard-Wexler, Gowrisankaran, and Lee (2018), if the three-party-surplus is positive, then RSN c has a deviating pair of offers $\{\tilde{\tau}_{gc}, \tilde{\tau}_{g'c}\}$ to both satellite distributors that both will accept regardless of their beliefs over whether, if they are supplied, their rival will also be supplied, and that will increase c's profits. See Appendix S.A of the Supplemental Material for a formal derivation and discussion of the idea behind this result.

[60]The left-hand side of (22) is linear and decreasing in λ_R (see the definition of $\Pi^C_{cmt}(\cdot)$ from (8)).

[61]An alternative would be to assume that when approached by the RSN to negotiate supply, a satellite firm holds the belief that the rival satellite firm will not be supplied. The approach we employ instead provides a lower bound for λ_R that holds for any beliefs.

our data), any household that switched from cable to satellite as a result of supplying satellite with the RSN would reduce industry profit by this difference in margins.[62]

Consequently, factors that make exclusion of satellite by an integrated cable owner (for $\lambda_R > 0$) more likely include: (i) a smaller share of consumers that are not subscribers to any MVPD and lower advertising rates (thereby reducing the potential gains generated by market expansion); (ii) a larger cable "footprint" (market share) in the RSN's relevant market area; (iii) closer substitutability between satellite and cable distribution; and (iv) a larger differential between cable and satellite margins (all of which would exacerbate the losses from business stealing by satellite from cable). For all such factors, lower values of λ_R (closer to 0) cause any losses incurred by the RSN's integrated owner to be internalized less by the RSN when bargaining with g, reducing the likelihood of exclusion occurring.

5. RESULTS AND PARAMETER ESTIMATES

Estimates of selected key parameters of our model are reported in Table II. We discuss our estimates primarily through how they influence predicted moments relating to consumer viewership and subscription patterns, firm pricing and carriage decisions, and negotiated agreements.

TABLE II

ESTIMATES OF KEY PARAMETERS[a]

	Parameter	Description	Estimate	SE
Viewership	ν^{NS}	Viewership Decay, Non-sports	0.59	0.00
Parameters	ν^{S}	Viewership Decay, Sports	0.95	—
$\boldsymbol{\theta}_1$	γ^b	Fraction of Teams Blacked-out	−0.58	0.31
	γ^d (10^3 mi)	Distance	−0.93	0.27
Bundle Choice	α	Bundle Price	−1.00	0.44
Parameters	β^v	Bundle Viewership Utility	0.14	0.07
$\boldsymbol{\theta}_2$	$\rho^{sat}_{DirecTV}(10^2)$	DirecTV Exponential Parameter	0.42	0.23
	$\rho^{sat}_{Dish}(10^2)$	Dish Exponential Parameter	0.49	0.27
Pricing, Bargaining,	σ^2_ω	Variance of Carriage Shocks	0.00	0.00
Carriage and	ζ^E	Bargaining, External	0.28	0.03
Foreclosure Parameters	ζ^I	Bargaining, Internal	0.37	0.06
$\boldsymbol{\theta}_3$, $\underline{\lambda}_R$	μ	Internalization	0.79	0.09
	$\mu \times \underline{\lambda}_R^{Phil}$	Internalization & Rival Foreclosure, Philadelphia	1.11	0.14
	$\mu \times \underline{\lambda}_R^{SD}$	Internalization & Rival Foreclosure, San Diego	0.94	0.11

[a]Selected key parameters from the first and second step estimation of the full model, where parameter ν^S is estimated separately via a grid search (see Appendix S.B.3 of the Supplemental Material). Additional viewership parameters contained in $\boldsymbol{\theta}_1$ are reported in Appendix Table A.IV; state-firm and year fixed effects in $\boldsymbol{\theta}_2$ are not reported. Asymptotic GMM standard errors are computed using numerical derivatives and 1500 bootstrap draws of markets and simulated households to estimate the variance-covariance matrix of the moments. Estimates and standard errors for $\mu \times \underline{\lambda}_R^{Phil}$ and $\mu \times \underline{\lambda}_R^{SD}$ are for the lower bound of these parameters.

[62]Our timing assumptions rule out the possibility that an integrated channel contemplates the possibility of raising the rival g's price through "raising rivals' cost" effects (cf. Salop and Scheffman (1983)). However, for a single cable-integrated RSN whose rivals are satellite distributors that set a single national price, this effect would be small, as an increase in the RSN's affiliate fee would only affect satellite distributors' costs in a small portion of their markets (in 2007, no single RSN served more than 10.4% of any satellite distributors' potential customers).

5.1. *Viewership Parameters*

The willingness-to-pay (WTP) for each channel can be derived by computing the contribution of a given channel to bundle utility for each household (v^*_{ijt} in (2)), multiplying it by our estimates of parameters β^v/α to convert it into dollars, and averaging across households (as households have different tastes (γ_{ict}) for each channel, which are distributed according to parameters $\boldsymbol{\rho}$).[63] We report estimated values of these parameters and WTPs in 2007 for all channels in Appendix Table A.IV. We also depict the distribution of household WTPs for nine national channels, conditional on being positive, in Figure 5(a), with the fraction of households with positive valuations listed for each channel. Although most national channels have average WTP values below \$1 per month (and other than sports channel ESPN, none exceed \$2), the pattern is very different for RSNs: none are predicted to have average WTP values less than \$1 per month, and over 70% are greater than \$2.

Our estimates of the RSN distance-decay parameter γ^d and black-out parameter γ^b are negative, and imply that consumers derive less utility from watching an RSN both (i) the further they are from the teams carried on the RSN, and (ii) the greater the fraction of teams that are blacked out. We predict that increasing the average distance of a household from an RSN's teams' stadiums from 0 to 100 miles reduces that household's value of the channel by approximately 9%.[64] Figure 5(b) illustrates this pattern, and plots the predicted average WTP in 2007 for four different RSNs as the distance from a household to an RSN's teams' stadiums increases.[65] Similarly, we predict that subjecting half of the teams that an RSN normally broadcasts to black-out restrictions reduces consumers' valuation of the channel by 25%.

Finally, we estimate ν^{NS} to be different than ν^{S}. The lower estimated value of ν^{NS} implies that consumers' marginal utility from watching non-sports channels falls more slowly than for sports channels; in turn, this implies that consumers derive higher utility from sports channels than non-sports channels if they choose to spend the same amount of time spent watching each. Our model thus predicts that sports channels receive higher negotiated affiliate fees for the same viewership ratings, as depicted in Figure 5(c) for the year 2007.

5.2. *Distributor Choice Parameters*

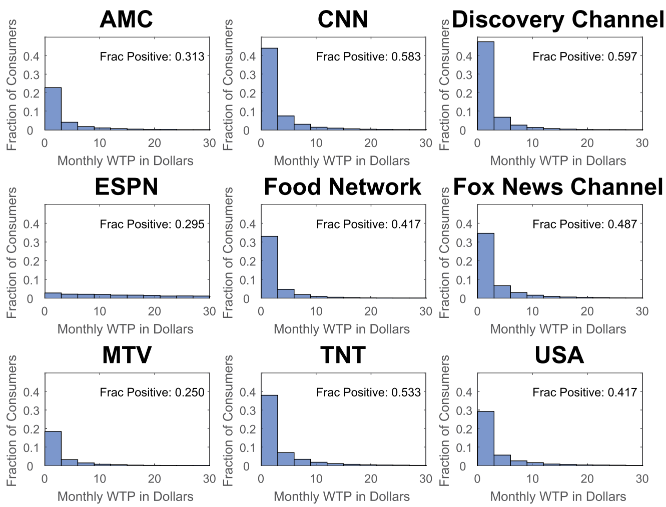
All reported coefficients in $\boldsymbol{\theta}_2$ are statistically significant at the 5% level, and have the expected sign: consumers negatively respond to price (α), and positively respond to the indirect utility they receive from a bundle's channels (β^v).

At the top of Table III, we report the average own- and cross-price elasticities that are predicted by our model. Demand for the average cable system is more inelastic (−1.7)

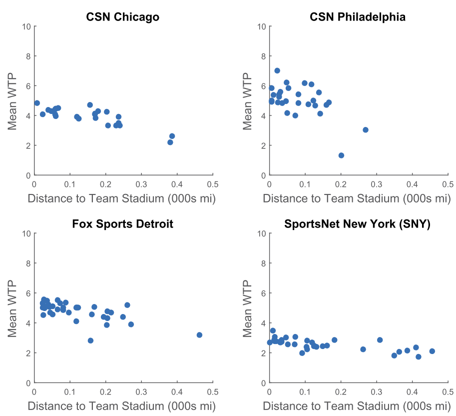
[63]We compute the average WTP for channels relative to a synthetic bundle that includes every national channel carried by at least 60% of systems in 2007, and by using 20,000 simulated households. When computing the WTP for an RSN c, we add the RSN to the synthetic bundle and use the average values of b_{ict} and d_{ic} across all markets that carry the RSN.

[64]As distance is measured in thousands of miles, being further away by 100 miles scales utility by $\exp(\hat{\gamma}^d \times 0.1)$.

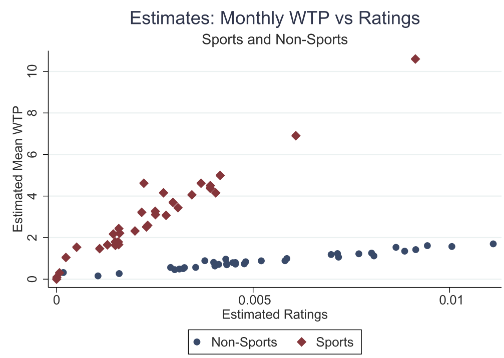
[65]Each point in Figure 5(b) corresponds to a market in which the RSN is carried in 2007, and the WTP for each market is computed by averaging over 160 simulated households per market using that market's value of b_{ict} and d_{ic}.



(a) Histograms of monthly WTP (conditional on being positive) for selected national channels.



(b) Mean WTP in a market versus distance to RSN's teams' stadiums, for four RSNs.



(c) Estimated monthly WTP versus estimated ratings for sports and non-sports channels.

FIGURE 5.—Predicted willingness-to-pay (WTP) for channels (2007 values).

than for satellite (−2.9 and −4.2), which is consistent with higher cable market shares and margins that are both observed in the data and predicted by our model.[66] Estimated values of $\rho^{sat}_{DirecTV}$ and ρ^{sat}_{Dish} indicate consumers have substantial heterogeneity in their valuation

[66]Our estimates can be compared to Goolsbee and Petrin (2004), who estimated household demand for satellite, basic cable, premium cable, and local antenna using 2001 data; they obtained an expanded basic cable own-price elasticity of −1.5, and an overall satellite own-price elasticity of −2.5. They did not observe cross-sectional variation in prices for satellite distributors, and relied on Slutsky symmetry to identify satellite price elasticities. Our estimated own-price elasticity for cable is similar, and the overall satellite own-price elasticity implied by our own- and cross-price elasticity estimates for DirecTV and Dish, computed at average market shares during our sample period (see Table A.I), is −3.2.

TABLE III

ELASTICITIES AND MARGINS[a]

Elasticity of Row With Respect to Price of Column:	Cable	DirecTV	Dish
Cable	−1.69	0.30	0.19
DirecTV	2.16	−2.90	0.13
Dish	3.18	0.22	−4.15
Outside Option	5.52	0.26	0.16
Predicted Margins			
Mean Comcast Margin		0.66	
Mean DirecTV Margin		0.48	
Mean Dish Margin		0.45	
Logit Demand Price Coefficients			
OLS Logit Price Coefficient		−0.004** (0.002)	
IV Logit Price Coefficient		−0.080*** (0.025)	
Semi-Elasticity of Row With Respect to Removal of ESPN From column:	**Cable**	**DirecTV**	**Dish**
Cable	−18.90	3.86	2.36
DirecTV	54.82	−19.52	1.11
Dish	51.16	1.85	−19.67
Outside Option	17.27	0.22	0.14

[a]This table reports predicted mean price elasticities, predicted margins for Comcast and the two satellite distributors, the estimated price coefficient from a logit demand regression without (OLS) and with (IV) the use of price instruments (where standard errors clustered at market level), and semi-elasticities from dropping the national channel ESPN. For logit demand estimates, **, *** represent significance at the 5% and 1% levels.

for satellite bundles (a standard deviation of approximately $40 per month); as discussed earlier, such heterogeneity assists the model in matching observed Comcast, DirecTV, and Dish price-cost margins. The implied average predicted margins are given in the second panel of Table III.

To illustrate the efficacy of instruments described in the previous section (which include satellite taxes), the third panel of Table III reports the results from a logit demand regression.[67] Instrumenting for price yields a 22 times larger estimated price coefficient,

[67]For 20,784 firm-market-year bundles, the dependent variable is the log of the ratio of market shares for the bundle to the outside option, and the OLS regressors are firm-state and year fixed effects, channel fixed effects for all channels contained in the bundle, and price. The excluded instruments for price in the IV regression are the satellite tax within the market interacted with an indicator for whether the bundle is offered by a satellite or cable distributor, and the maximum fraction of teams not blacked out within the market across all RSNs for which the market is relevant. The F-statistic on the excluded instruments in the first stage regression of price is 425.4; the t-statistic for satellite taxes interacted with a satellite distributor indicator in the first stage price regression is 35; and the R^2 from the regression is 0.52. Additionally, an important input into distributor demand elasticities with respect to carriage is the coefficient on mean viewership utility in the distributor choice utility equation in (2). The first stage regression of v^*_{fmt} on the same set of instruments for price results in an F-statistic on the excluded instruments of 389.4; the t-statistic for the maximum fraction of teams not blacked out is 33; and the R^2 from the regression is 0.56.

consistent with the presence of a positive correlation between prices and unobservable bundle characteristics.

The bottom panel of Table III reports the semi-elasticity for MVPDs and the outside option given the removal of ESPN from each type of distributor (cable or either of the two satellite providers). For example, the removal of ESPN from DirecTV's bundles implies that its own market share would fall by 19.5%, while those for cable and Dish would increase by 3.9% and 1.8%, respectively. This implies that for every 1,000 households that would leave DirecTV if it lost access to ESPN, 920 would substitute to cable, 67 would substitute to Dish, and 13 would go to the outside option. These types of diversion figures, and in particular those to cable, play a central role in the incentives of an integrated cable provider to deny access to a rival satellite distributor.

5.3. *Pricing, Bargaining, Carriage, and Foreclosure Parameters*

We now discuss the parameters contained in $\boldsymbol{\theta}_3$ which govern a firm's pricing, bargaining, and carriage decisions, as well as our rival foreclosure parameter λ_R.

First, we estimate that the variance of firms' bundle-market-time specific profit shocks ($\hat{\sigma}^2_\omega$) is neither economically nor statistically significant. We estimate that channels capture more than half of the gains from trade when bargaining, although less with integrated distributors ($\hat{\zeta}^I = 0.38$) than non-integrated distributors ($\hat{\zeta}^E = 0.28$).

Our estimated value of μ indicates that firms internalize a substantial fraction, but not all, of the profits of other integrated units when making decisions. Only \$0.79 of each dollar of profit realized by its integrated partner is internalized when an integrated MVPD makes pricing and carriage decisions, or when integrated MVPDs and RSNs bargain with each other. The discussion in Section 3.4.3 suggested $\zeta_{fc} \times (1 + \mu_{fc})$ as a (rough) measure of the alignment of downstream carriage and pricing decisions with joint profit maximization for a channel and MVPD.[68] Our estimates imply that this quantity is 0.28 with non-integration, and 0.66 with a fully-integrated channel. This difference is statistically significant at standard confidence levels. Moreover, we reject both $\hat{\mu} = 1$ and $\hat{\zeta}^I \times (1 + \hat{\mu}) = 1$, indicating that integration does not lead to full joint profit maximization.

Our estimated lower bounds for $\mu \times \underline{\lambda}_R^{\text{Phil}}$ and $\mu \times \underline{\lambda}_R^{\text{SD}}$ are 1.11 and 0.94. Figure 6 graphs the total three-party surplus—given by the left-hand side of (22)—between the integrated channel and the two satellite distributors in the two loophole markets we examine (Philadelphia and San Diego). We see that for values of $\mu \times \lambda_R$ lower than 0.94, it is not an equilibrium for either channel to exclude both satellite distributors, as there would be a profitable deviation, for some negotiated set of affiliate fees, for the channel to be supplied. However, for values between approximately 0.94 and 1.11, we can rationalize exclusion in San Diego but not Philadelphia. Only for values of $\mu \times \lambda_R \geq 1.11$ does our model rationalize exclusion in both of these loophole markets. These results indicate that integrated channels' supply decisions vis-à-vis non-integrated rival distributors are significantly affected by foreclosure incentives; these weights placed on the benefits of rival foreclosure for the channel's integrated distributors are not statistically significantly different from 1.[69]

[68]Specifically, $\zeta_{fc} \times (1 + \mu_{fc}) = 1$ would lead to joint profit-maximizing carriage and pricing decisions when the MVPD operates in a single market.

[69]Given $\hat{\mu} = 0.79$, these estimates imply that $\underline{\lambda}_R^{\text{Phil}}$ is at least 1.4 and $\underline{\lambda}_R^{\text{SD}}$ at least 1.3, which corresponds to the integrated channel placing more weight on its integrated distributor's benefits from foreclosure than the channel and distributor place on each other's profits when pricing, making carriage decisions, and bargaining

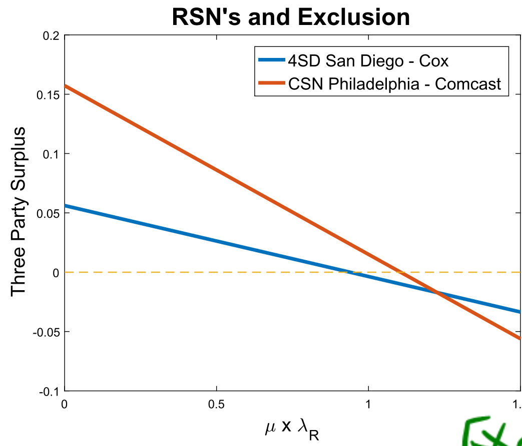


FIGURE 6.—Three-party surplus between the integrated cable MVPD, DirecTV, and Dish as a function of $\mu \times \lambda_R$ in Philadelphia and San Diego.

6. THE WELFARE EFFECTS OF VERTICAL INTEGRATION

In this section, we use our model's estimates to examine how vertical integration affects affiliate fee negotiations (including whether supply occurs at all), distributors' pricing and carriage decisions, and—ultimately—firm and consumer welfare. We focus on 26 RSNs that were active in 2007, 13 of which were (at least partially) integrated with a downstream distributor (10 with a cable MVPD, 3 with DirecTV).[70] Of these integrated RSNs, two—CSN Philadelphia and 4SD—were owned by cable distributors in "loophole" markets, and were not provided to satellite.

For each of these RSNs, we simulate market outcomes for the year 2007 that would have occurred in the RSN's relevant markets under the following three *integration scenarios*: (i) Non-integration, (ii) Integration with PARs, and (iii) Integration without PARs.[71] More specifically:

(i) *Non-Integration*: In this scenario, we assume that $\mu = 0$ and $\lambda_R = 0$ so that all firms behave as if they are non-integrated (i.e., no MVPD or channel internalizes the profits of any other unit).

(ii) *Integration with PARs*: In this scenario, if the RSN being examined is non-integrated in the data, we assign full ownership of the channel to the largest cable MVPD in that RSN's relevant markets; if the RSN is integrated, we do not change its ownership structure. We then assume that μ is equal to our estimated value $\hat{\mu} = 0.79$, but that $\lambda_R = 0$: that is, we assume that integrated distributors and channels partially internalize each other's profits when bargaining with each other over affilliate fees, and when the integrated distributor is pricing and making carriage decisions, but that program access

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with each other. However, we cannot reject the hypothesis that either of these values differ from 1: the 95% confidence interval for $\hat{\lambda}_R^{\text{Phil}}$ is [0.97, 1.93] and $\hat{\lambda}_R^{\text{SD}}$ is [0.82, 1.70].

[70]We exclude from our analysis three cable-integrated RSNs (CSN Northwest, Comcast/Charter Sports Southeast, and Cox Sports TV) and one independent RSN (YES) that did not supply satellite providers in markets where PARs were in effect, as our model does not explain this exclusion.

[71]We simulate the equilibrium under all three scenarios for each RSN, including whichever scenario occurred in the data for the RSN.

rules prevent the channels from considering the benefits of foreclosure to its integrated distributor when bargaining with rival distributors.

(iii) *Integration without PARs*: In our final scenario, we follow the same setup as in the "Integration with PARs" scenario, but assume that $\lambda_R = \hat{\underline{\lambda}}_R^{\text{Phil}}$, the larger of our two recovered lower bounds.[72] The RSN therefore internalizes the profits of its downstream integrated units when bargaining with other downstream distributors, and thus may find it unprofitable to supply downstream rivals.

For each integration scenario and each RSN, we solve for a set of bundle prices, carriage decisions, and negotiated affiliate fees that satisfy the necessary equilibrium conditions given by equations (5), (6), and (11). Under non-integration and integration with PARs (scenarios (i) and (ii)), we assume that all RSNs are supplied to all distributors.[73] Under scenario (iii), where channels are integrated but PARs are not in effect, we also solve for the RSN's equilibrium supply decision. To determine whether or not each rival distributor is supplied with the channel, we test which supply outcomes (e.g., if a cable integrated RSN supplies both, neither, or either one of the two satellite distributors) are consistent with equilibrium.[74]

In our main counterfactual results, we assume that a change in ownership for a single RSN does not cause national satellite prices to adjust, and we thus hold satellite prices fixed at observed levels. In Section 6.3, we also examine counterfactuals under the alternative assumption that satellite prices are determined at the DMA level, and may adjust across our integration scenarios. Further computational and implementation details are provided in Appendix S.B.4 of the Supplemental Material.

6.1. *Potential Effects*

Before proceeding, it is instructive to highlight the effects of vertical integration that are captured by our model and that we attempt to quantify. Our model emphasizes three main

[72]The value of λ_R must be at least $\hat{\underline{\lambda}}_R^{\text{Phil}}$ to rationalize the non-supply of the satellite distributors that we observe in both Philadelphia and San Diego. If $\lambda_R > \hat{\underline{\lambda}}_R^{\text{Phil}}$, foreclosure incentives would be larger than those considered here; we explore the effects of larger values of λ_R in Section 6.3.

[73]Aside from the two loophole RSNs, all other RSNs in our counterfactuals were provided to all distributors in 2007.

[74]At the set of affiliate fees, prices, and carriage decisions that satisfy the necessary equilibrium conditions under each potential supply outcome, for each cable-owned channel in scenario (iii) we test: (a) whether supplying both satellite providers is an equilibrium by examining if there are positive bilateral gains from trade between the RSN and each satellite provider given that the other satellite provider is supplied; (b) whether supplying only one satellite distributor is an equilibrium by examining if there are positive gains from trade between the RSN and the supplied satellite distributor given that the other satellite provider is not supplied, and if there are no bilateral gains from trade between the RSN and the non-supplied satellite distributor given that the other satellite provider is supplied; and (c) whether supplying neither satellite distributor is an equilibrium by examining if the *three-party-surplus* given by the left-hand side of (22) is negative. For all RSNs but two, exactly one supply outcome was robust to these tests. For two RSNs, exactly two supply outcomes satisfied these tests: for CSN Philadelphia, they were the non-supply of both satellite distributors and the supply of only DirecTV; for NESN, they were the non-supply of both or supply of both. We report results assuming that the outcome with the least supply is chosen (as this outcome maximized the integrated firms' profits given our parameter estimates). For each of the three RSNs owned by DirecTV, we determine supply by verifying that the bilateral surplus generated by the RSN's supply of each cable MVPD in the RSN's relevant markets as well as Dish Network is positive (where surpluses are computed at updated levels of affiliate fees, prices, and carriage decisions).

supply-side decisions: (i) negotiations over supply and affiliate fees between channels and distributors, and both (ii) channel carriage (conditional on supply) and (iii) bundle pricing by distributors.

Suppose, then, that MVPD f integrates with RSN c, and that there is a rival MVPD g. The following effects of vertical integration are admitted in our setting:

1. *Bargaining Effects and Foreclosure*: When integration occurs, there are effects on both internal and external bargaining. As discussed in Section 3.4.3, we expect the effective internal affiliate fee paid by the integrated distributor f to fall when integration occurs: that is, our 0.79 estimated value of μ indicates that the RSN and distributor f internalize (most of) each others' payoffs. Of course, in equilibrium, the internal affiliate fee is also affected by any changes in carriage and pricing as these can change both f and c's gains from trade.

The effects of integration on *external* bargaining will depend on whether PARs are in effect or not. When PARs are in effect, RSN c ignores any benefits to its integrated distributor f's profits from denying access to rival distributor g, just as if c was not integrated. However, the negotiated affiliate fee to g may still be affected by changes in f's carriage and prices, which can affect g's benefit from getting access to c, and by any change in the internal affiliate fee that c receives from f (which would alter how supply of g affects c's profit).

Finally, when c bargains with the rival MVPD g and PARs are *not* in effect, c internalizes the lost profit of its integrated downstream distributor f if g is supplied (since $\lambda_R > 0$). As a result, the gains-from-trade that accrue to c by supplying g are reduced from what they would be under either non-integration or in the presence of PARs, potentially leading to a higher negotiated affiliate fee τ_{gct} or—if gains-from-trade are eliminated altogether—non-supply. Again, however, any induced changes in carriage and pricing can also affect negotiated input fees.

2. *Carriage Effects*: When vertical integration occurs, the fact that μ is positive makes the integrated f internalize the effects of its carriage of RSN c on c's profit. As carriage is likely to increase c's profit due to the increase in affiliate fees earned from f (although an offsetting effect is that f's carriage of c may lower c's affiliate fee revenues earned from g by reducing g's market share), integration may lead f to increase carriage of RSN c. The net impact on carriage will also depend on equilibrium price adjustments and whether rival distributors are still supplied with the channel.

3. *Pricing Effects*: As with the carriage decision, an integrated f will internalize effects of its pricing on RSN c's profit. This is likely to push f toward charging a lower bundle price—that is, reducing double marginalization—as a lower price will increase f's market share, and hence the affiliate fees that c collects from f (although, as described above, there is a potentially offsetting effect from any reduced affiliate fees earned from g, as in Chen (2001)). In addition, changes in carriage will have a separate effect on f's pricing; for example, if carriage increases, the resulting increased bundle quality is likely to push f to increase prices in those markets where c is added to its bundle relative to what its prices would have been absent the carriage change.

Thus, while we expect integration to increase carriage and reduce double marginalization by integrated distributors, and the absence of PARs to increase foreclosure of and affiliate fees paid by rival distributors of integrated firms, confounding effects are present that may upset these expectations. Moreover, even if the directions of these effects are as expected, their magnitudes, and their overall impacts on consumer and aggregate welfare, remain empirical questions that our counterfactual simulations aim to address.

6.2. *Results*

6.2.1. *Individual RSN Results*

As an illustration of the kinds of effects we see for individual RSNs, Table IV reports market shares, channel carriage, cable prices, firm profits, and consumer and total welfare across our three different integration scenarios for three RSNs: CSN Philadelphia, a cable-integrated RSN located in a terrestrial loophole market; MSG, a cable-integrated RSN located in a non-loophole market; and NESN, a non-integrated RSN. Below each RSN name is the MVPD that owns the channel (or is assigned ownership under integration scenarios (ii) and (iii) if the RSN is non-integrated, denoted by a * next to the assigned owner's name), the number of households and the MVPD owner's "footprint" (the percentage of these households that the MVPD "passes" or plausibly could serve) in

TABLE IV

SIMULATED MARKET OUTCOMES FOR SELECTED RSNs[a]

		(i) No VI	(ii) VI PARs (vs. No VI)		(iii) VI No PARs (vs. No VI)	
		Level	$\%\Delta_{\text{lvl}}$	$\%\Delta_{\text{WTP}}$	$\%\Delta_{\text{lvl}}$	$\%\Delta_{\text{WTP}}$
Cable Integrated RSNs						
CSN PHIL	Cable Mkt Share	0.64	0.8%		1.8%	
Comcast		[0.62, 0.65]	[0.2%, 2.4%]		[0.6%, 4.0%]	
Pop 4.25M	Sat Mkt Share	0.18	−0.5%		−10.4%	
Footprint 90%		[0.17, 0.19]	[−3.3%, −0.2%]		[−14.8%, −0.5%]	
WTP $4.99	Cable Carriage	0.95	1.6%		0.4%	
		[0.62, 0.97]	[0.0%, 53.8%]		[−6.2%, 52.9%]	
	Cable Prices	54.31	−0.5%		0.9%	
		[53.28, 55.42]	[−1.5%, 0.9%]		[−1.4%, 1.8%]	
Foreclose: 85%	Aff Fees to Sat	2.26	3.6%		—	
		[1.00, 2.64]	[−9.4%, 7.0%]		—	
	Cable + RSN Surplus	30.19	0.2%	0.9%	1.1%	6.5%
		[14.57, 32.67]	[0.0%, 2.4%]	[0.3%, 13.7%]	[0.4%, 3.3%]	[3.0%, 20.5%]
	Satellite Surplus	4.29	−0.9%	−0.8%	−2.1%	−1.8%
		[1.26, 4.70]	[−3.4%, −0.4%]	[−2.4%, −0.5%]	[−4.8%, −1.1%]	[−4.5%, −0.9%]
	Consumer Welfare	31.21	0.6%	3.9%	−2.9%	−18.1%
		[16.82, 34.81]	[0.2%, 2.0%]	[1.4%, 12.7%]	[−3.3%, 1.5%]	[−21.8%, 9.9%]
	Total Welfare	65.69	0.3%	4.0%	−1.0%	−13.4%
		[31.14, 71.73]	[0.1%, 1.9%]	[2.0%, 25.2%]	[−1.1%, 1.1%]	[−15.6%, 14.7%]
MSG	Cable Mkt Share	0.63	3.3%		3.3%	
Cablevision		[0.62, 0.67]	[0.3%, 4.8%]		[0.2%, 4.7%]	
Pop 11.7M	Sat Mkt Share	0.18	−4.3%		−4.3%	
Footprint 42%		[0.17, 0.18]	[−7.1%, −0.4%]		[−8.1%, −0.4%]	
Pred WTP $2.32	Cable Carriage	0.68	10.5%		10.5%	
		[0.67, 0.87]	[−2.5%, 18.5%]		[−3.1%, 18.5%]	
	Cable Prices	59.40	−2.4%		−2.4%	
		[56.80, 60.81]	[−3.5%, 0.0%]		[−3.5%, 0.2%]	
Foreclose: 1%	Aff Fees to Sat	1.22	−3.3%		22.4%	
		[0.42, 1.28]	[−5.9%, 10.4%]		[17.1%, 53.4%]	
	Cable + RSN Surplus	30.64	0.3%	4.4%	0.5%	6.8%
		[14.61, 34.12]	[−0.1%, 0.6%]	[−1.6%, 7.4%]	[0.0%, 1.3%]	[0.4%, 14.6%]
	Satellite Surplus	4.16	−4.2%	−7.5%	−5.5%	−9.9%
		[1.24, 4.48]	[−7.2%, −0.5%]	[−12.1%, −0.9%]	[−8.5%, −1.2%]	[−14.3%, −2.4%]
	Consumer Welfare	33.80	3.1%	44.6%	3.0%	44.3%
		[18.38, 38.14]	[0.3%, 4.3%]	[4.4%, 66.3%]	[−0.4%, 4.3%]	[−6.3%, 66.0%]
	Total Welfare	68.60	1.4%	41.4%	1.4%	41.2%
		[32.06, 76.01]	[0.1%, 1.9%]	[3.4%, 60.9%]	[0.1%, 1.9%]	[2.5%, 60.7%]

(*Continues*)

TABLE IV—*Continued*

		(i) No VI	(ii) VI PARs (vs. No VI)		(iii) VI No PARs (vs. No VI)	
		Level	$\%\Delta_{\text{lvl}}$	$\%\Delta_{\text{WTP}}$	$\%\Delta_{\text{lvl}}$	$\%\Delta_{\text{WTP}}$
Non-Integrated RSN						
NESN	Cable Mkt Share	0.61	7.6%		9.4%	
*Comcast		[0.59, 0.65]	[1.6%, 11.2%]		[2.7%, 12.5%]	
Pop 5.20M	Sat Mkt Share	0.13	−7.8%		−22.3%	
Footprint 85%		[0.12, 0.14]	[−12.6%, −1.8%]		[−26.5%, −7.2%]	
WTP $6.91	Cable Carriage	0.92	6.2%		3.6%	
		[0.68, 0.98]	[0.0%, 33.1%]		[−0.5%, 38.1%]	
	Cable Prices	56.73	−4.7%		−3.9%	
		[54.24, 57.88]	[−6.6%, −0.5%]		[−6.0%, 0.6%]	
Foreclose: 96%	Aff Fees to Sat	3.32	3.1%		—	
		[1.23, 3.79]	[−12.6%, 16.9%]		—	
	Cable + RSN Surplus	28.38	0.9%	3.6%	2.0%	8.2%
		[13.68, 31.36]	[0.1%, 2.4%]	[0.9%, 10.6%]	[0.7%, 4.0%]	[5.4%, 16.7%]
	Satellite Surplus	2.96	−8.3%	−3.5%	−10.9%	−4.7%
		[0.84, 3.24]	[−13.2%, −1.8%]	[−5.5%, −1.3%]	[−13.9%, −3.0%]	[−6.3%, −1.7%]
	Consumer Welfare	28.36	6.4%	26.5%	3.3%	13.5%
		[15.54, 31.97]	[1.4%, 10.0%]	[8.2%, 40.8%]	[−1.7%, 7.1%]	[−9.0%, 29.2%]
	Total Welfare	59.70	3.1%	26.5%	2.0%	17.0%
		[29.79, 65.84]	[0.5%, 5.1%]	[7.8%, 43.7%]	[−0.2%, 4.5%]	[−2.5%, 37.5%]

[a]Scenarios (i)–(iii) correspond to the integration scenarios described at the beginning of Section 6. Beneath the RSN name is either the name of the RSN's owner (observed or, if non-integrated, assigned, which is denoted by *), the number of television households in the RSN's relevant markets, the MVPD owner's footprint (% of households passed) in the RSN's relevant markets, and the estimated mean consumer WTP for the RSN. Scenario (i) reports household weighted averages over all relevant markets for each RSN, where all levels except for market shares and cable carriage are in $/household/month. Scenarios (ii) and (iii) report changes from scenario (i), where $\%\Delta_{\text{lvl}}$ (respectively, $\%\Delta_{\text{WTP}}$) represent changes from scenario (i) expressed as a percentage of changes in household weighted averages of levels (respectively, estimated mean consumer WTP for the channel). Affiliate fees to satellite are reported conditional on supply; missing values indicate foreclosure. 95% confidence intervals, constructed from 150 simulations, are reported below each figure; the fraction of simulations in which the RSN is predicted to foreclose at least one rival distributor under scenario (iii) is reported last under each RSN's name ("Foreclose: %"). Results for all other RSNs are contained in Appendix Tables A.V–A.VII.

the RSN's relevant markets, and the estimated mean consumer willingness-to-pay (WTP) for the RSN.

The values shown for scenario (i), corresponding to no vertical integration ("No VI"), are household weighted average levels across an RSN's relevant markets; with the exception of market shares and cable carriage, reported numbers are in dollars per household per month. For integration scenarios (ii) and (iii), "VI PARs" and "VI No PARs" respectively, we report changes from non-integration scenario (i) either as a percentage of non-integration levels (denoted $\%\Delta_{\text{lvl}}$) or as a percentage of the mean WTP for the RSN (denoted $\%\Delta_{\text{WTP}}$). A missing value for "Aff Fees to Sat" indicates that the RSN is predicted to be withheld from the two satellite distributors. Confidence intervals are constructed by taking 150 draws from the joint distribution of the estimated coefficients and recomputing the equilibrium for each draw. The fraction of the scenario (iii) draws for which the RSN is predicted to foreclose and not supply at least one rival distributor is also shown last under each RSN name ("Foreclose: %").

For each of the three RSNs shown in Table IV, vertical integration with PARs in effect leads the integrated distributor to increase carriage and reduce its bundle price at our point estimates, and in each case we can reject a zero effect for at least one of the carriage or price effects. Cable's market share increases in each case, and satellite's share decreases; as well, satellite surplus falls, consumer welfare increases, and total welfare rises (all such effects are statistically significant).

When integration occurs without PARs in effect, two of these three RSNs—CSN Philadelphia and NESN—deny access to both rival satellite producers. Despite this exclusion, only for CSN Philadelphia are the point estimates for the effects of vertical integration on consumer and total welfare negative, and for neither of these two RSNs can we reject zero net consumer and total welfare effects. For the third RSN, MSG, the two satellite distributors continue to have access to the RSN, although paying higher affiliate fees (22.4% higher according to our point estimates, and statistically significantly different from zero). For all three RSNs, vertical integration without PARs in effect lowers the satellite distributors' profits by between 2 and 11% (statistically significant in each case).

Results for all other RSNs are contained in Appendix Tables A.V–A.VII. Overall, the outcomes for different RSNs display considerable heterogeneity.

6.2.2. *Average Results*

We now turn to the average effects of vertical integration. Table V reports market outcomes for each of the three vertical integration scenarios, averaged across RSNs and weighted by the number of households in each RSN's relevant markets. The structure is the same as in Table IV, with the following adjustments. First, "Aff Fees to Rivals" represents the weighted average of the affiliate fees charged to the integrated MVPD's rival distributors (weighted by the number of households in each of the RSN's relevant markets), conditional on the channel being supplied to those distributors. These rival distributors are the two satellite distributors if the channel is cable-integrated; if instead the channel is DirecTV-integrated, these rivals are the cable distributors in the RSN's relevant markets and Dish. Second, "# Foreclosed" represents the number of RSNs that are not provided to at least one rival distributor for the case of integration without PARs in effect (integration scenario (iii)). Third, in the rightmost two columns, we report the weighted average change in predicted outcomes between scenarios (ii) and (iii); these changes are expressed both as percentages of scenario (ii) levels and of an RSN's estimated mean WTP, and isolate the impact of program access rules given integration. All reported percentages are the averages of percentage changes across RSNs, weighted by the number of households in each RSN's relevant markets.

Efficiency Effects: Reduction of Double Marginalization and Increased Carriage. We first focus on the potential efficiency gains from vertical integration. These are highlighted by the differences between integration scenario (ii) with PARs and non-integration scenario (i), reported in the second and third columns of Table V.

Across all RSNs, we predict that integration of a single RSN when PARs are in effect yields on average a (statistically significant) 9.4% increase in carriage of the RSN by cable distributors.[75] It also results on average in a (statistically significant) 1.2% decrease in cable prices (corresponding to an average $0.67 reduction in the price consumers pay).[76,77] As discussed in Section 6.1, pricing reductions arise primarily from the reduction

[75]This average includes carriage changes by cable operators for the three satellite-owned RSNs.

[76]The values reported for scenarios (ii) and (iii) in Tables IV and V are the (household weighted) averages of percentage changes, not the percentage change in the average levels. Thus, the average $0.67 decrease in price that we describe here does not equal the product of the values in the first and second columns of Table V.

[77]Though integration of most RSNs yields less than a 1% decrease in cable prices, there are several cases where price decreases are larger: for example, integrating NESN with Comcast, reported in the bottom panel of Table IV, results in average cable prices falling by nearly 5% (corresponding to an average reduction in the price consumers pay of $2.67) due to NESN's high estimated affiliate fees to Comcast (predicted to be approximately $4.70 per month).

TABLE V

AVERAGE SIMULATED MARKET OUTCOMES ACROSS ALL RSNs[a]

	(i) No VI	(ii) VI PARs (vs. No VI)		(iii) VI No PARs (vs. No VI)		(iii) VI No PARs (vs. VI PARs)	
	Level	$\%\Delta_{\text{lvl}}$	$\%\Delta_{\text{WTP}}$	$\%\Delta_{\text{lvl}}$	$\%\Delta_{\text{WTP}}$	$\%\Delta_{\text{lvl}}$	$\%\Delta_{\text{WTP}}$
All RSNs							
Cable Mkt Share	0.60	2.1%		2.2%		0.1%	
	[0.59, 0.62]	[0.4%, 2.6%]		[0.4%, 2.6%]		[−0.2%, 0.3%]	
Sat Mkt Share	0.20	−2.0%		−2.7%		−0.8%	
	[0.20, 0.21]	[−2.6%, −0.4%]		[−4.1%, −0.8%]		[−2.6%, −0.0%]	
Cable Carriage	0.72	9.4%		8.6%		−0.7%	
	[0.66, 0.80]	[3.1%, 21.5%]		[0.8%, 19.1%]		[−4.4%, 0.9%]	
Cable Prices	55.10	−1.2%		−1.1%		0.1%	
	[54.25, 55.90]	[−1.5%, −0.1%]		[−1.4%, −0.0%]		[0.0%, 0.3%]	
Aff Fees to Rivals[b]	1.36	−0.7%		17.1%		18.0%	
	[0.54, 1.45]	[−3.2%, 4.4%]		[11.0%, 28.5%]		[12.1%, 28.6%]	
Cable + RSN Surplus	23.04	0.3%	3.1%	0.6%	5.0%	0.2%	1.9%
	[11.13, 25.17]	[0.1%, 0.6%]	[1.4%, 5.4%]	[0.2%, 0.9%]	[2.6%, 8.1%]	[0.1%, 0.5%]	[0.5%, 4.2%]
Satellite Surplus	5.10	−2.2%	−4.3%	−3.2%	−6.0%	−1.0%	−1.7%
	[1.56, 5.51]	[−3.1%, −0.5%]	[−6.7%, −0.3%]	[−3.9%, −1.0%]	[−8.4%, −1.1%]	[−1.3%, −0.4%]	[−2.5%, −0.6%]
Consumer Welfare	30.99	1.5%	18.0%	1.3%	16.2%	−0.2%	−1.7%
	[16.15, 34.47]	[0.3%, 1.8%]	[5.5%, 23.8%]	[−0.1%, 1.5%]	[−1.3%, 20.4%]	[−0.7%, −0.1%]	[−8.4%, 0.0%]
Total Welfare	59.13	0.7%	16.8%	0.6%	15.3%	−0.1%	−1.5%
	[27.59, 64.41]	[0.1%, 0.9%]	[5.4%, 22.2%]	[0.0%, 0.8%]	[0.8%, 18.7%]	[−0.2%, −0.0%]	[−6.4%, 0.1%]
# Foreclosed:				4/26 [0, 9]			

[a] Average simulated market outcomes across the 26 RSNs in our analysis, weighted by the number of households in each RSN's relevant markets. Percentages are the averages of percentage changes across RSNs, weighted by the number of households in each RSN's relevant markets. "# Foreclosed" reports the number of RSNs that are not provided to rival distributors under (iii) VI No PARs. See Table IV and main text for additional details.

[b] "Aff Fees to Rivals" represents average affilliate fees (to the satellite MVPDs for cable-integrated RSNs, and to cable MVPDs and the rival satellite distributor for satellite-integrated RSNs) *conditional on supply* in each relevant scenario.

TABLE VI

WELFARE CHANGES FROM FORECLOSURE[a]

Percentage Change in Levels Between (ii) VI PARs and (iii) VI No PARs		
	%Δ Consumer Welfare	%Δ Total Welfare
Are Rival Distributors Excluded	−1.95***	−0.72***
	(0.53)	(0.22)
N	3,900	3,900
R^2	0.52	0.52

[a]Regression where the dependent variable is the percentage change in either consumer or total welfare in levels between integration scenarios (ii) and (iii) (with and without PARs in effect). Each observation is an RSN-counterfactual simulation (26 × 150). Specifications include RSN fixed effects. Standard errors clustered at RSN level, and *** represents significance at the 1% level.

of double marginalization. However, there are offsetting effects that may mitigate downward pricing incentives: integrated distributors now internalize affiliate fees paid by rival MVPDs, and (as we have noted) carriage of the RSN by cable providers increases when the channel is integrated (thereby increasing the utility delivered by bundles in certain markets). Even so, cable prices fall on average.[78]

We find that joint RSN and integrated cable surplus increases on average when moving from non-integration to integration with PARs: when a cable MVPD is integrated (and since $\hat{\mu}$ is greater than 0), its pricing and carriage decisions will partially internalize RSN profits (even if, under PARs, the channel does not act upon rival foreclosure incentives). Satellite surplus, on average across all RSNs, falls by 2.2% when RSNs are integrated with PARs in effect.[79] Consumer welfare and total welfare increase by, on average, 1.5% and 0.7%, respectively (18.0% and 16.8%, respectively, as percentage gains of WTP for the RSN). The change in total welfare represents an average increase of $0.43 per household per month. Each of these changes is statistically significant.

We find that consumer welfare gains arise primarily from lower cable prices: if we hold cable prices fixed at non-integrated levels and recompute equilibrium outcomes (including carriage and affiliate fees) under integration with PARs, average consumer welfare gains across all RSNs are 0.3%; holding fixed carriage rates at non-integrated levels and recomputing equilibrium outcomes yields average consumer welfare gains of 1.5%.[80]

Foreclosure Effects: Raising Rivals' Costs and Exclusion. The comparison of scenarios (ii) and (iii), shown in the last two columns of Table V, provides the impact of removing PARs given that RSNs are integrated, and isolates the impact of foreclosure incentives on market outcomes. Allowing foreclosure is predicted to reduce both consumer and total welfare from the integration scenario with PARs by 0.2% and 0.1%, respectively; both are

[78]In fact, we find that average cable prices do not increase for any individual RSN upon integration in the presence of PARs.

[79]This percentage includes both cable and satellite integration of RSNs, although it is primarily reflecting cable ownership of RSNs. In Appendix Table A.VI, we report market outcomes for the three satellite-integrated RSNs.

[80]These partial effects, calculated from the same non-integration baseline, do not sum to the total equilibrium effect when prices, carriage, and affiliate fees adjust.

TABLE VII

PROBABILITY OF EXCLUSION[a]

	Exclusion of Rival Distributors by Integrated RSN (Without PARs)
Footprint of Integrated Owner	0.67**
	(0.25)
WTP for RSN	0.07
	(0.05)
N	26
R^2	0.29

[a]Linear probability regression where the dependent variable is whether rival distributors are denied access to an RSN under integration scenario (iii) without PARs. Each observation is an RSN. Specification includes a fixed effect for whether the RSN owner is a cable operator. ** represents significance at the 5% level.

statistically significant, and represent average changes of 1.7% and 1.5% as a percentage of the WTP for the RSN.

The reduction in welfare from the absence of PARs stems primarily from two effects. The first occurs when an RSN is completely withheld from rival MVPDs. Though we predict that none of the three DirecTV-owned RSNs would choose to exclude cable providers, we predict that 3 out of the 10 RSNs integrated with a cable provider in the data (the two loophole RSNs and CSN New England) and one previously non-integrated RSN (NESN) would exclude both satellite distributors.[81] Conditional on integration occurring, exclusion of a rival distributor is associated with a negative change in welfare: Table VI reports results from a regression of the change in consumer and total welfare between VI scenarios with and without PARs on whether or not rival distributors are denied access to the RSN. Results indicate that the exclusion of rival distributors is associated with a 1.9% and 0.7% reduction in consumer and total welfare, which roughly equals the predicted average welfare gains from integration with PARs ($\%\Delta_{\text{lvl}}$ in scenario (ii)).

To examine when exclusion is more likely to occur, Table VII reports results from a linear probability regression of whether rival distributors are denied access to an RSN when PARs are not in effect; the footprint, or percentage of households in the RSN's relevant markets that the integrated distributor can serve, is positive and statistically significant. This is consistent with the discussion in Section 4.2 (i.e., larger cable footprints increase the potential losses incurred by an integrated cable provider from supplying the RSN to rival satellite distributors), and reflects the fact that the cable owners for the four RSNs that are predicted to foreclose satellite distributors all have greater than an 85% footprint.

The second effect that reduces welfare arises when an integrated RSN still supplies rival distributors but raises their affiliate fees, which in turn affects downstream distributor pricing and carriage. Table V indicates that affiliate fees for integrated RSNs charged to rivals, conditional on supply, increase on average by a statistically significant 18.0% from the levels predicted when PARs are in effect.[82] Even though we have assumed that satel-

[81]The 95% confidence interval for the number of RSNs that exclude is [0, 9].

[82]In some cases, this increase represents an increase of nearly $0.50 per month per subscriber, as with CSN Mid-Atlantic (see Table A.V).