The Welfare Effects of Vertical Integrationin Multi-Channel Television Markets (ECMA 2018)

Crawford, Lee, Whinston, and Yurukoglu

- Lot in here!
- Welfare effects of Vertical Integration
  - Efficiency enhancing:
    - eliminate double marginalization
    - potentially align investment incentives
  - Forclosure of rival can lead to distortions
- State-of-the-art piece of work
  - Lot of heavy-lifting empirical work

Context: Cable Industry/Ownership of Regional Sports Networks

- Industry 2000-2010
  - Base case: 1 local cable + 2 satellite (Dish+DirectTV)
    - these are MVPD (multi-channel vido program distributors)
  - Channels
    - National (ESPN ($4 month), Disney, etc
    - Regional Sports Neworks, local sports teams
      - Comcast Phila $2.85 a month

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

Regulatory Policy:

Program Access Rules for satellite

terrestrial loophole (Comcast sportsnet, San Diego MLB)

Data

- Downstream prices, quantities, characteristics of cable and satellite bundles
  - Neilsen FOCUS # of subscribers,etc, market level
  - Household data (Mediamark Research and Intelligence MRI+Simmons)
  - some kind of averaging between 2 for shares
  - Market: set of zip codes served by a cable system
  - figure out the RSN relevant channels for each market
  - work hard to get prices, grind it out on internet+TNS bill harvesting

TABLE A.I

SAMPLE STATISTICS—PRICES, MARKET SHARES, AND CHANNELS[a]

		Unweighted				Weighted by HHs			
	# Obs	Mean	StdDev	Min	Max	Mean	StdDev	Min	Max
Total Markets	6,928	6,928							
Average Households (millions)	6,928					39.7			
Cable									
Year	6,928	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,928	$50.67	$10.31	$8.67	$130.96	$52.20	$8.86	$8.67	$130.96
Market Share	6,928	0.628	0.162	0.001	0.965	0.639	0.135	0.001	0.965
Cable Networks	6,928	67.0	18.1	0	101	72.1	14.8	0	101
RSNs	6,928	1.6	0.8	0	5	1.8	0.9	0	5
Total Channels	6,928	68.6	18.4	0	103	73.8	15.0	0	103
DirecTV									
Year	6,928	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,928	$52.76	$6.36	$46.05	$76.73	$52.66	$6.08	$46.05	$76.73
Market Share	6,928	0.090	0.060	0.002	0.499	0.091	0.063	0.002	0.499
Cable Networks	6,928	79.4	10.4	66	97	79.8	10.2	66	97
RSNs	6,928	1.9	1.0	0	7	1.9	1.0	0	7
Total Channels	6,928	84.3	10.9	69	107	84.7	10.7	69	107
Dish									
Year	6,928	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,928	$53.43	$4.81	$44.28	$68.33	$53.47	$4.63	$44.28	$68.33
Market Share	6,928	0.062	0.054	0.000	0.472	0.058	0.052	0.000	0.472
Cable Networks	6,928	69.4	13.3	54	91	70.0	13.1	54	91
RSNs	6,928	1.8	0.9	0	6	1.7	0.8	0	6
Total Channels	6,928	73.7	13.9	56	99	74.4	13.6	56	99

- channel viewership data
    - MRI and Simmons Data
- channel affiliate fees and advertisting revenues
    - SNL Kagan

TABLE A.II

NATIONAL CABLE CHANNELS: AFFILIATE FEES AND VIEWERSHIP[a]

	Affiliate Fees					Viewership					
	Kagan					Nielsen Ratings		Combined MRI / Simmons			
	Years	Mean	StDev	Min	Max	Obs	Mean	Obs	Mean	SDev	Frac > 0
ABC Family Channel	11	$0.19	$0.02	$0.16	$0.22	747	0.418	277,535	0.344	1.149	0.176
AMC	11	$0.22	$0.02	$0.20	$0.25	747	0.491	277,535	0.351	1.183	0.156
Animal Planet	11	$0.07	$0.01	$0.06	$0.09	747	0.275	277,535	0.344	1.108	0.203
A&E	11	$0.21	$0.03	$0.16	$0.26	747	0.664	277,535	0.472	1.373	0.230
BET	11	$0.14	$0.02	$0.11	$0.17	747	0.382	277,535	0.184	1.017	0.070
Bravo	11	$0.15	$0.03	$0.11	$0.20	747	0.277	277,535	0.169	0.804	0.092
Cartoon Network	11	$0.14	$0.03	$0.08	$0.18	747	0.989	277,535	0.231	1.098	0.106
CMT	11	$0.06	$0.02	$0.01	$0.08	747	0.142	277,535	0.120	0.732	0.067
CNBC	11	$0.24	$0.04	$0.16	$0.30	747	0.217	277,535	0.313	1.185	0.170
CNN	11	$0.43	$0.05	$0.35	$0.52	747	0.550	277,535	0.701	1.744	0.319
Comedy Central	11	$0.11	$0.02	$0.08	$0.14	747	0.449	277,535	0.280	0.997	0.162
Discovery Channel	11	$0.27	$0.04	$0.22	$0.35	747	0.535	277,535	0.628	1.462	0.327
Disney Channel	11	$0.81	$0.06	$0.75	$0.91	747	1.171	277,535	0.246	1.074	0.116
E! Entertainment TV	11	$0.19	$0.02	$0.15	$0.21	747	0.315	277,535	0.201	0.788	0.137
ESPN	11	$2.81	$1.12	$1.14	$4.34	747	0.836	277,535	0.675	1.767	0.257
ESPN 2	11	$0.37	$0.14	$0.17	$0.58	747	0.262	277,535	0.334	1.220	0.151
ESPN Classic Sports	11	$0.14	$0.03	$0.10	$0.18	636	0.037	277,535	0.072	0.521	0.047
Food Network	11	$0.06	$0.03	$0.03	$0.14	747	0.411	277,535	0.396	1.364	0.175
Fox News Channel	11	$0.32	$0.18	$0.17	$0.70	747	0.785	277,535	0.697	1.961	0.267
FX	11	$0.34	$0.06	$0.27	$0.43	747	0.463	277,535	0.258	0.976	0.137
Golf Channel	11	$0.20	$0.05	$0.13	$0.26	580	0.065	277,535	0.084	0.633	0.041
Hallmark Channel	11	$0.04	$0.02	$0.01	$0.06	699	0.307	225,618	0.301	1.268	0.088
Headline News	—	—	—	—	—	747	0.214	277,535	0.278	0.983	0.173
HGTV	11	$0.08	$0.04	$0.03	$0.14	747	0.500	277,535	0.397	1.446	0.162
History Channel	11	$0.18	$0.04	$0.13	$0.23	747	0.531	277,535	0.531	1.462	0.251
Lifetime	11	$0.21	$0.06	$0.13	$0.29	747	0.679	277,535	0.554	1.650	0.199
MSNBC	11	$0.14	$0.02	$0.12	$0.17	747	0.343	277,535	0.330	1.181	0.182
MTV	11	$0.27	$0.05	$0.20	$0.35	747	0.568	277,535	0.235	0.983	0.127

Model

We index consumer households by i, markets by m, and time periods by t. There are a set of "downstream" multichannel video programming distributors (MVPDs) $\mathcal{F}_t$ and "upstream" channels $\mathcal{C}_t$ active in each period t. The set of MVPDs active in a given market-period is denoted $\mathcal{F}_{mt}$. We will assume that each such MVPD $f \in \mathcal{F}_{mt}$ offers a single bundle of channels $\mathcal{B}_{fmt} \subseteq \mathcal{C}_t$ in market m and period t, where a household subscribing to this bundle pays a price p_{fmt} and has access to all channels $c \in \mathcal{B}_{fmt}$.[23] Since we assume that distributors offer only one bundle, f denotes both the distributor and the bundle it offers for a given market-period.

We assume that in each period t (a year in our empirical work), decisions are made according to the following timing: in *stage 1*, channels and distributors bargain bilaterally to decide affiliate fees, and distributors set prices and make carriage decisions for each market in which they operate; in *stage 2*, households choose which MVPD, if any, to subscribe to in their market; and in *stage 3*, households view television channels.[24] We now provide details of each stage and further assumptions, proceeding in reverse order of timing.

Simultaneous move every where you look!

(e.g., price setting holding available channels fixed, firms within company not coordinating with to each other, but potentially internalizing effects of actions)

3.2. *Stage 3: Household Viewing*

We assume that households solve a time allocation problem to determine viewership. In particular, household i in market m and period t subscribing to MVPD $f \in \mathcal{F}_{mt}$ allocates its time $\boldsymbol{w}_{ift} \equiv \{w_{ifct}\}_{c \in \mathcal{B}_{fmt} \cup \{0\}}$, where w_{ifct} is the time spent watching channel c (or devoted to non-television activities if $c = 0$), to solve

$$\max_{\boldsymbol{w}_{ift}} v_{ift}(\boldsymbol{w}_{ift}) = \sum_{c \in \mathcal{B}_{fmt} \cup \{0\}} \frac{\gamma_{ict}}{1 - \nu_c} (w_{ifct})^{1-\nu_c} \tag{1}$$

$$\text{s.t.:} \quad w_{ifct} \geq 0 \quad \forall c,$$

$$\sum_{c \in \mathcal{B}_{fmt} \cup \{0\}} w_{ifct} \leq T.$$

Parameters γ_{ict} and $\nu_c \in [0, 1)$ govern consumer tastes for each channel c, where γ_{ict} sets the level of marginal utility of household i from the first instant of watching the channel, and ν_c controls how fast this marginal utility decays with additional viewing. The parameter T represents the total time available to the household. We restrict ν_c to be equal for all non-sport channels and the outside-option, and equal for all sports channels (which include RSNs); that is, $\nu_c = \nu^{\mathrm{S}}$ if c is a sports channel, and $\nu_c = \nu^{\mathrm{NS}}$ otherwise.[25] We parameterize γ_{ict} as a function of channel-specific parameters $\boldsymbol{\rho}_c \equiv \{\rho_c^0, \rho_c^1\}$ as follows:

$$\gamma_{ict} = \begin{cases} \tilde{\gamma}_{ict} & \text{with probability } \rho_c^0, \text{ where } \tilde{\gamma}_{ict} \sim \text{Exponential}(\rho_c^1), \\ 0 & \text{with probability } 1 - \rho_c^0, \end{cases} \quad \forall c, t.$$

For RSNs, we scale $\tilde{\gamma}_{ict}$ by $\exp(\gamma^b b_{ict} + \gamma^d d_{ic})$, where $b_{ict} \in [0, 1]$ represents the fraction of teams carried on RSN c that are "blacked out" (i.e., unable to have games televised in household i's market), and d_{ic} is the average distance from household i to the stadiums of the teams shown on RSN c (measured in thousands of miles).[26] These terms allow for households to value an RSN differentially if the household cannot watch some of the carried sport teams, or if the household lives further away from the carried teams' stadiums.

3.3. *Stage 2: Household Distributor Choice*

Each period, household i considers characteristics of the bundle offered by each MVPD $f \in \mathcal{F}_{mt}$—including the utility from watching channels in the bundle—when determining which distributor, if any, to subscribe to. We specify household i's utility conditional on subscribing to f as

$$u_{ifmt} = \beta^v v^*_{ifmt} + \boldsymbol{\beta}^x \boldsymbol{x}_{fmt} + \beta^{\text{sat}}_{if} + \alpha p_{fmt} + \xi_{fmt} + \varepsilon_{ifmt}, \tag{2}$$

where v^*_{ifmt}, referred to as a consumer's *viewership utility* for the bundle offered by f, is

The probability that household i chooses distributor f in market m is obtained by integrating over $\boldsymbol{\varepsilon}_{it}$ for each household:

$$s_{ifmt} = \frac{\exp\left(\beta^v v^*_{ifmt} + \boldsymbol{\beta}^x \boldsymbol{x}_{fmt} + \beta^{\text{sat}}_{if} + \alpha p_{fmt} + \xi_{fmt}\right)}{1 + \sum_{g \in \mathcal{F}_{mt}} \exp\left(\beta^v v^*_{igmt} + \boldsymbol{\beta}^x \boldsymbol{x}_{gmt} + \beta^{\text{sat}}_{ig} + \alpha p_{gmt} + \xi_{gmt}\right)}. \tag{3}$$

The total market share for distributor f (in market m at time t) is then $s_{fmt} \equiv \int s_{ifmt}\, dH_{mt}(i)$, where $H_{mt}(i)$ is the joint distribution of household random coefficients $(\boldsymbol{\gamma}, \boldsymbol{\beta})$ in the market, and the demand for distributor f is $D_{fmt} \equiv N_{mt} s_{fmt}$, where N_{mt} is the number of television households in the market.

3.4.1. *Stage 1a. Distributor Pricing and Carriage*

Each period, every MVPD $f \in \mathcal{F}_t$ chooses prices and the channels offered in each of its bundles $\{p_{fmt}, \mathcal{B}_{fmt}\}_{\forall m: f \in \mathcal{F}_{mt}}$ to maximize its profits given negotiated affiliate fees $\boldsymbol{\tau}_t$. Profits for f across all markets are

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

where

$$\begin{aligned} \Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu) &= D_{fmt} \times \left(p^{\text{pre-tax}}_{fmt} - mc_{fmt}\right) \\ &\quad + \mu \times \left(\sum_{g \in \mathcal{F}_{mt}} \sum_{c \in \mathcal{B}_{gmt}} O^M_{fct} \times D_{gmt} \times (\tau_{gct} + a_{ct}) \right) \end{aligned} \tag{4}$$

Cable Pricing and Carriage. We will leverage necessary conditions on the optimality of cable MVPDs' pricing and carriage decisions in our estimation. Differentiating (4) with respect to p_{fmt} (and dividing by market size) yields the following pricing first-order condition:

$$\begin{aligned} \frac{\partial \Pi^M_{fmt}}{\partial p_{fmt}} &= \frac{s_{fmt}}{1 + \text{tax}_{fmt}} + \left(p^{\text{pre-tax}}_{fmt} - mc_{fmt}\right) \frac{\partial s_{fmt}}{\partial p_{fmt}} + \mu \times \left(\sum_{g \in \mathcal{F}_{mt}} \sum_{c \in \mathcal{B}_{gmt}} O^M_{fct} \frac{\partial s_{gmt}}{\partial p_{fmt}} (\tau_{gct} + a_{ct}) \right) \\ &= 0. \end{aligned} \tag{5}$$

Guy picking price taking channels as given

Cable Pricing and Carriage. We will leverage necessary conditions on the optimality of cable MVPDs' pricing and carriage decisions in our estimation. Differentiating (4) with respect to p_{fmt} (and dividing by market size) yields the following pricing first-order condition:

$$\frac{\partial \Pi^M_{fmt}}{\partial p_{fmt}} = \frac{s_{fmt}}{1+\text{tax}_{fmt}} + \left(p^{\text{pre-tax}}_{fmt} - mc_{fmt}\right)\frac{\partial s_{fmt}}{\partial p_{fmt}} + \mu \times \left(\sum_{g \in \mathcal{F}_{mt}} \sum_{c \in \mathcal{B}_{gmt}} O^M_{fct} \frac{\partial s_{gmt}}{\partial p_{fmt}} (\tau_{gct} + a_{ct})\right) = 0. \tag{5}$$

Guy picking channels taking prices as given

$$\mathcal{B}_{fmt} = \arg \max_{\mathcal{B}_f \subseteq \mathcal{A}_{ft}} \Pi^M_{fmt}\big(\{\mathcal{B}_f, \mathcal{B}_{-f,mt}\}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu\big), \tag{6}$$

where $\mathcal{A}_{ft} \subseteq \mathcal{C}_t$ is the set of channels available to MVPD f, that is, the set of channels for which f has reached an agreement.

Satellite: pick national price

Bargaining over Affiliate Fees. Step 1: What are the payoffs?

$$\Pi^{C}_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_{t}; \mu) = \sum_{g \in \mathcal{F}_{mt}: c \in \mathcal{B}_{gmt}} D_{gmt} \times (\tau_{gct} + a_{ct}) \ldots$$
$$+ \mu \sum_{g \in \mathcal{F}_{mt}} \Big\{ D_{gmt} \ldots \tag{7}$$
$$\times \Big(O^{C}_{gct} \times (p^{\text{pre-tax}}_{gmt} - mc_{gmt}) + \sum_{d \in \mathcal{B}_{gmt} \backslash c} O^{CC}_{cdt} \times (\tau_{gdt} + a_{gdt}) \Big) \Big\}.$$

However, if f and c are not integrated, c's profits in m are

$$\Pi^{C}_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_{t}; \mu, \lambda_R) = \sum_{g \in \mathcal{F}_{mt}: c \in \mathcal{B}_{gmt}} D_{gmt} \times (\tau_{gct} + a_{ct}) \ldots$$
$$+ \mu \sum_{g \in \mathcal{F}_{mt}} \Big\{ D_{gmt} \ldots$$
$$\times \Big(\lambda_R \times O^{C}_{gct} \times (p^{\text{pre-tax}}_{gmt} - mc_{gmt}) \ldots \tag{8}$$
$$+ \sum_{d \in \mathcal{B}_{gmt} \backslash c} O^{CC}_{cdt} \times (\tau_{gdt} + a_{gdt}) \Big) \Big\}.$$

Note prices market specific, but fees are not.

The parameter λ_R (multiplied by μ) thus captures the internalization of an integrated downstream MVPD's profits when an integrated channel bargains with a non-integrated

$$\Pi^C_{cmt} = \pi_{cmt} + \mu \times (\pi_{fmt} + \pi_{dmt})$$

(a) Internal Bargaining.

$$\Pi^C_{cmt} = \pi_{cmt} + \mu \times ((\lambda_R \times \pi_{gmt}) + \pi_{dmt})$$

(b) Bargaining with Rival MVPD.

FIGURE 2.—Examples of Π^C_{cmt} when c bargains with MVPD f.

Now use payoffs and Nash bargaining to get outcomes
(Nash-in-Nash, merger of noncooperative and cooperative gain theory)
Nontransferable utility (picking per unit fees)

Bargaining. We assume that, given channel c is carried on some of MVPD f's systems, the affiliate fee τ_{fct} between distributor f and channel c maximizes their respective bilateral Nash products *given the negotiated affiliate fees of all other pairs and the prices and bundles for all distributors*. In other words, affiliate fees $\boldsymbol{\tau}_t$ satisfy

$$\tau_{fct}(\boldsymbol{\tau}_{-fc,t}, \mathcal{B}_t, \boldsymbol{p}_t) = \arg\max_{\tau_{fct}} \underbrace{\Bigg[\sum_{m \in \mathcal{M}_{fct}} \big[\Delta_{fc} \Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \{\tau_{fct}, \boldsymbol{\tau}_{-fc,t}\}; \mu)\big]\Bigg]}_{\mathrm{GFT}^M_{fct}(\tau_{fct}, \cdot)}^{\zeta_{fct}}$$

$$\times \underbrace{\Bigg[\sum_{m \in \mathcal{M}_{fct}} \big[\Delta_{fc} \Pi^C_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \{\tau_{fct}, \boldsymbol{\tau}_{-fc,t}\}; \mu, \lambda_R)\big]\Bigg]}_{\mathrm{GFT}^C_{fct}(\tau_{fct}, \cdot)}^{1-\zeta_{fct}} \qquad (9)$$

$$\forall f, c \in \mathcal{A}_{ft},$$

where $\mathcal{M}_{fct} \equiv \{m : c \in \mathcal{B}_{fmt}\}$ denotes the set of markets in which c is carried on f's bundle, $\zeta_{fct} \in [0, 1]$ represents a firm-channel-time specific Nash bargaining parameter, and

$$\big[\Delta_{fc} \Pi^M_{fmt}(\mathcal{B}_{mt}, \cdot)\big] \equiv \big(\Pi^M_{fmt}(\mathcal{B}_{mt}, \cdot) - \Pi^M_{fmt}(\mathcal{B}_{mt} \setminus fc, \cdot)\big),$$
$$\big[\Delta_{fc} \Pi^C_{cmt}(\mathcal{B}_{mt}, \cdot)\big] \equiv \big(\Pi^C_{cmt}(\mathcal{B}_{mt}, \cdot) - \Pi^C_{cmt}(\mathcal{B}_{mt} \setminus fc, \cdot)\big),$$

where we denote by $\mathcal{B}_{mt} \setminus fc$ the set of all bundles in $\mathcal{B}_{mt}$ with channel c removed from bundle f. These last two terms represent the difference in either MVPD or channel profits

$$(1-\zeta_{fct}) \times \mathrm{GFT}^{M}_{fct}(\tau_{fct}, \cdot) = \zeta_{fct} \times \mathrm{GFT}^{C}_{fct}(\tau_{fct}, \cdot) \quad \forall f, c \in \mathcal{A}_{ft}, \tag{10}$$

which states that the equilibrium negotiated input fee τ_{fct} between channel c and distributor f equalizes their (weighted) gains-from-trade.[38]

Alternatively, letting $\mu_{fct} \equiv \mu \times O_{fct}$, observe that

$$\mathrm{GFT}^{M}_{fct}(\tau_{fct}, \cdot) = \mathrm{GFT}^{M}_{fct}(0, \cdot) - (1-\mu_{fct}) \sum_{m \in \mathcal{M}_{fct}} D_{fmt}\tau_{fct}$$

and

$$\mathrm{GFT}^{C}_{fct}(\tau_{fct}, \cdot) = \mathrm{GFT}^{C}_{fct}(0, \cdot) + (1-\mu_{fct}) \times \sum_{m \in \mathcal{M}_{fct}} D_{fmt}\tau_{fct},$$

where we omit the arguments of D_{fmt} for convenience. Thus, we can rewrite (10) as

$$\left[(1-\mu_{fct})\tau_{fct}\right] \times \sum_{m \in \mathcal{M}_{fct}} D_{fmt} = (1-\zeta_{fct}) \times \mathrm{GFT}^{M}_{fct}(0, \cdot) - \zeta_{fct} \times \mathrm{GFT}^{C}_{fct}(0, \cdot), \tag{11}$$

Example: Non-Integrated Bargaining. Consider the case in which MVPD f and channel c are both non-integrated entities that bargain with one another in period t. The negotiated affiliate fee τ_{fct} that satisfies the Nash bargaining solution given by (11) solves

$$\sum_{m\in\mathcal{M}_{fct}} D_{fmt}\tau_{fct} = (1-\zeta_{fct}) \underbrace{\sum_{m\in\mathcal{M}_{fct}} \left([\Delta_{fc}D_{fmt}]\left(p^{\text{pre-tax}}_{fmt} - mc_{fmt\setminus fc}\right)\right)}_{\text{GFT}^M_{fct}(0,\cdot)}$$
$$- (\zeta_{fct}) \underbrace{\sum_{m\in\mathcal{M}_{fct}} \left(D_{fmt}a_{ct} + \sum_{g\neq f: c\in\mathcal{B}_{gmt}} [\Delta_{fc}D_{gmt}](\tau_{gct} + a_{ct})\right)}_{\text{GFT}^C_{fct}(0,\cdot)}, \tag{12}$$

Our model also assumes that bargaining over affiliate fees happens simultaneously with distributors making carriage and pricing decisions. This assumption greatly simplifies the estimation and computation of our model. For example, we leverage the simultaneity of bargaining and pricing in deriving (11), as there is no anticipated change in p_{fmt} if τ_{fct} changes. Formally, one can think of separate divisions of the distributor engaging in different functions or actions: for example, a central division bargains over affiliate fees, while distinct agents within each local office determine pricing and carriage. Similarly, for a vertically integrated entity, separate divisions handle bargaining by the upstream unit, and pricing and carriage by the downstream unit. Such timing assumptions have been used in Nocke and White (2007), Draganska, Klapper, and Villas-Boas (2010), and Ho and Lee (2017).[40] An alternative timing assumption, more typical in the literature on vertical contracting, would be to assume that affiliate fees are first negotiated, and then distributor prices and bundles are chosen. This might, depending on the observability of agreements, alter firms' perceptions of the payoffs from off-equilibrium-path actions: for example, when bargaining, firms would anticipate different bundle prices and carriage decisions to be chosen immediately if off-equilibrium-path affiliate fees or disagreement were realized. While this alternative timing assumption might be more realistic in our setting, and would lead to different parameter estimates, these parameter estimates would still be determined by trying to match the same patterns in the data—for example, average affiliate fees as well as downstream prices and carriage choices, both with and without integration—as do our estimates; as such, the extent to which our timing assumption might affect the conclusions from our counterfactuals, and the direction of any such bias, is unclear.[41] In summary, we believe our approach to be a reasonable approximation with substantial computational benefits.[42]

ated while conditioning on equilibrium bundle prices and carriage. In the case in which a distributor-channel pair is not integrated, this can lead to double marginalization and inefficient carriage, so that their joint profit is not maximized, the extent of which depends on the external bargaining parameter ζ^E. When instead the distributor is integrated with the channel, the extent of inefficiency will depend on both the internalization parameter μ and the internal bargaining parameter ζ^I (and the extent of the ownership interest). The following example illustrates these points more concretely.

Example: bargaining, double marginalization and VI

Let $\mu_{fc} \equiv \mu \times O_{fc}$, and let $\phi_m(mc)$ be the monopoly price in market m for an independent monopolist distributor whose marginal cost is mc. Then, given τ, MVPD f will set bundle price

$$p_m = \phi_m\big(mc_{fm} + (1 - \mu_{fc})\tau - \mu_{fc}a_c\big) \tag{13}$$

in each market m. In effect, f prices using the effective marginal cost $mc_{fm} + (1 - \mu_{fc})\tau - \mu_{fc}a_c$ which counts only $(1 - \mu_{fc})$ of every dollar paid to c in affiliate fees (making the *effective* affiliate fee only $(1 - \mu_{fc})\tau$), and also counts as a benefit fraction μ_{fc} of every ad dollar channel c receives because of f's subscribers.

Next, given the bundle prices $\{p_m\}_{m\in\mathcal{M}_f}$, consider the bargaining between distributor f and channel c when f's bargaining parameter is ζ_{fc}. The gains from trade (at an affiliate fee of zero) for MVPD f and channel c, respectively, are

$$\mathrm{GFT}_f^M(0,\cdot) = \left[\sum_{m\in\mathcal{M}_f}(p_m - mc_{fm})\Delta D_m(p_m)\right] + \mu_{fc}a_c\left[\sum_{m\in\mathcal{M}_f} D_m(p_m)\right]$$

and

$$\mathrm{GFT}_c^C(0,\cdot) = a_c\left[\sum_{m\in\mathcal{M}_f} D_m(p_m)\right] + \mu_{fc}\left[\sum_{m\in\mathcal{M}_f}(p_m - mc_{fm})\Delta D_m(p_m)\right],$$

$\sum_{m\in\mathcal{M}_f} D_m(p_m)$, the negotiated effective affiliate fee (when $\mu \neq 1$) is

$$(1-\mu_{fc})\tau = \big(1-\zeta_{fc}(1+\mu_{fc})\big)\left[\frac{\sum_{m\in\mathcal{M}_f}(p_m - mc_{fm})\Delta D_m(p_m)}{\sum_{m\in\mathcal{M}_f} D_m(p_m)}\right] + \big(\mu_{fc}(1-\zeta_{fc}) - \zeta_{fc}\big)a_c. \tag{14}$$

Double marginalization and efficiency in the integrated firm. Joint profit maximization for f and c requires that the bundle price in each market $m \in \mathcal{M}_f$ be

$$p^*_m = \phi(mc_{fm} - a_c), \tag{15}$$

which has the downstream bundle price set considering both downstream marginal costs mc_f and upstream ad revenues a_c. Examining (13), we see that joint profit maximization is achieved if $\mu_{fc} = 1$. When instead $\mu_{fc} \neq 1$—which can occur if the internalization parameter $\mu < 1$ or ownership $O_{fc} < 1$—the extent of inefficiency depends on *both* μ_{fc} and the bargaining parameter ζ_{fc}. To see this, note that (13) and (14) together imply that the price in each market m will satisfy the fixed point condition

$$p_m = \phi\left(mc_{fm} + [1-\zeta_{fc}(1+\mu_{fc})]\left[\frac{\sum_{m\in\mathcal{M}_f}(p_m - mc_{fm})\Delta D_m(p_m)}{\sum_{m\in\mathcal{M}_f} D_m(p_m)}\right] - \zeta_{fc}(1+\mu_{fc})a_c\right). \tag{16}$$

Of course:

mc_f and upstream ad revenues a_c. Examining (13), we see that joint profit maximization is achieved if $\mu_{fc} = 1$. When instead $\mu_{fc} \neq 1$—which can occur if the internalization pa-

Also

Thus, joint profit maximization is achieved provided that $\zeta_{fc}(1 + \mu_{fc}) = 1$. For example, joint profit maximization can occur in the case of non-integration ($O_{fc} = 0$) provided that $\zeta_{fc} = 1$, that is, if f has all the bargaining power (in which case, $\tau = -a_c$). More generally,