Identifying and Estimating Margins with Vertical Contracting

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Introduction

- Competition policy, regulation, public policy ... need measurement of firms' product margins, firms' marginal costs of production:
    - for market power analysis
    - for counterfactual policy analysis
- Structural models estimation allows to perform counterfactual simulations and understand firms behavior
- Useful for analysis of merger, public policy, regulation of firms (price setting, contracting, advertising, and other strategic tools)
- Recent developments to identify and estimate margins when vertical contracting affects price equilibrium
- Needs the identification and estimation (jointly or separately) of demand and supply models

Structural Estimation in Empirical IO

- Demand models
  - Lot of research since twenty years on getting robust methods of identification of flexible demand models with many differentiated goods and unrestricted substitution patterns (BLP 95)
  - Better data, better models and methods, on aggregate or decision-maker level data
- Supply models
  - Given demand, supply specification allows to "reverse engineer" margins - if the model is identified
  - Simple Bertrand-Nash price competition model is generally identified and allows to recover price cost margins and marginal costs
  - Recent developments to account for vertical relationships, double marginalization, non linear contracts, bargaining, ..

Outline of the Talk

- Brief remarks on standard demand estimation
- Methods to identify margins
  - Horizontal price competition
  - Taking into account vertical relationships
    - Linear pricing
    - Two Part Tariffs contracts
    - Bargaining
- Conclusion and research questions

Demand

- Research on how to obtain a flexible demand function between quantities $\mathbf{q}$, prices $\mathbf{p}$, observed and unobserved shifters $(\mathbf{z}, \varepsilon)$:

$$\mathbf{q} = D(\mathbf{p}, \mathbf{z}, \varepsilon)$$

- Dimensionality reduction with demand in *characteristics space* instead of *product space*
- Classical demand models: Linear Expenditure model (Stone, 1954), Rotterdam model (Theil 1965, Barten 1966), Translog model (Christensen Jorgenson Lau 1975), Almost Ideal Demand System (Deaton and Muellbauer 1980), ...
- Workhorse random utility model underlying consumer decisions:
  - Usually implemented as discrete choice, but does not have to be
  - Random coefficient logit (Berry 1994, BLP 1995)

Random Coefficients Logit Model

- Identification and estimation on market or consumer level data
- Any random utility model can be approximated by a mixed logit model, provided the mixing distribution is adequate (McFadden and Train 2000)
- Random coefficients allow relax the strong restrictions on substitution patterns imposed by the Logit model
- Model is identified on market level data with instrumental variables for prices that must be independent of demand shocks
  - "BLP" instruments: characteristics of competing goods
  - Hausman instruments: prices in other markets (indirect cost measures)
  - Cost shifters
- No need to know or specify the supply side (Nevo 2001)

Extension of Discrete Choice Demand Models

- Multiple Discreteness: Hendel (1999) models the demand for computers by firms. Each firm buys several brands and several units
- Discrete/continuous models (Dubin-McFadden 1984, Hanemann 1984, Smith 2004, Dubois Jodar, 2011, Dubois Griffith Nevo 2014)
- Dynamics, stockpiling (Hendel Nevo 2006, Dubois Magnac 2015)
- Uninformed consumer: search models (De los Santos Hortaçsu Wildenbeest 2012)

Demand Models

- Assume now demand shape is identified/known independently of the supply
- In some cases, demand cannot be fully identified without a supply side equilibrium model.
- Use supply side equilibrium conditions within the demand estimation method to infer unobservable. For example:
    - Dubois Magnac (2015) with unobserved stockpiling (consumer unobserved stockpiling depends on sales promotion probability which depends on supply side strategy)
    - Dubois Saethre (2017) with unobserved choice set (patients choice of parallel imported drugs depends on pharmacy optimal choice set determination)

Identifying margins in horizontal price competition

- Method is driven by typical data availability: data on sale quantities and retail prices usually good but wholesale prices and marginal costs not available
- Example of oligopoly with J differentiated products, from F firms
- The static profit of firm f selling goods G_f is

$$\Pi_f = \sum_{j \in G_f} \underbrace{(p_j - c_j)}_{\text{margin}} \quad \underbrace{s_j(\mathbf{p}, \mathbf{z})}_{\text{market share of } j} \quad - \underbrace{C_f(\mathbf{z})}_{\text{fixed cost}}$$

for any vector of state variables $\mathbf{z}$ (advertising, regulation, ..).

Identifying margins in horizontal price competition

- Assuming Bertrand-Nash equilibrium across F firms, for all j

$$s_j(\mathbf{p}, \mathbf{z}) + \sum_{k \in G_f} (p_k - c_k) \frac{\partial s_k(\mathbf{p}, \mathbf{z})}{\partial p_j} = 0$$

- Valid even in a dynamic setting for any MPE where price is one strategic variable, provided current price $\mathbf{p}_t$ does not affect future states $\mathbf{z}_{t+\tau}$
- If all relevant state variables $\mathbf{z}$ are observed, we obtain J linear equations with J unknowns $(p_j - c_j)$, so that margins are identified using

$$\mathbf{p} - \mathbf{c} = \Omega^{-1} \mathbf{s}(\mathbf{p}, \mathbf{z})$$

where $\Omega_{jk} = \begin{cases} -\partial s_k / \partial p_j & \text{if } \{k, j\} \subset G_f \\ 0 & \text{otherwise} \end{cases}$

Identifying margins in horizontal price competition

- Very powerful:
  - identifies margins with market structure, demand shape and equilibrium prices and quantities
- Very useful:
  - Given current horizontal price competition model, marginal costs are identified and allow to perform horizontal merger simulation (Nevo, 2000) or simulate other counterfactual price equilibrium
  - Estimating margins under different horizontal price competition (collusion, Bertrand competition) and adding an external assumption on marginal costs or margins allows test between models of conduct (Nevo, 2001)

Counterfactual merger Simulation

- Once recovered marginal costs, simulate post-merger price equilibrium
- Marginal costs are

$$\mathbf{c} = \mathbf{p}^{pre} + {\Omega^{pre}}^{-1}\mathbf{s}(\mathbf{p}^{pre}, \omega)$$

with $\Omega^{pre}_{jk} = \frac{\partial s_k}{\partial p_j}$ if $\{k, j\} \subset G^{pre}_f$, 0 otherwise

- Assuming same state variables ω ($\omega^{pre} = \omega^{post}$) and same marginal cost ($\mathbf{c}^{pre} = \mathbf{c}^{post} = \mathbf{c}$), post merger prices satisfy

$$\mathbf{p}^{post} = \mathbf{c} - {\Omega^{post}}^{-1}\mathbf{s}(\mathbf{p}^{post}, \omega)$$

where Ω^{post} is the post merger matrix. Then

$$\mathbf{p}^{post} = \mathbf{p}^{pre} \underbrace{+ {\Omega^{pre}}^{-1}\mathbf{s}(\mathbf{p}^{pre}, \omega)}_{-\text{ margin pre merger}} \underbrace{- {\Omega^{post}}^{-1}\mathbf{s}(\mathbf{p}^{post}, \omega)}_{+\text{ margin post merger}}$$

Testing across models of horizontal price competition

- Under Bertrand-Nash competition

$$\mathbf{c} = \mathbf{p} - \Omega^{-1}\mathbf{s}(\mathbf{p}, \mathbf{z}) \rightarrow c_{jt}^{0}$$

- Under collusion

$$\mathbf{c} = \mathbf{p} - \Omega_{\text{collusion}}^{-1}\mathbf{s}(\mathbf{p}, \mathbf{z}) \rightarrow c_{jt}^{1}$$

- Can compare c_{jt}^{0} and c_{jt}^{1} to potentially observed accounting margins to reject one model or another
- Introduce a model for marginal costs

$$\begin{cases} c_{jt}^{0} = x_{jt}\beta^{0} + \varepsilon_{jt}^{0} \\ c_{jt}^{1} = x_{jt}\beta^{1} + \varepsilon_{jt}^{1} \end{cases}$$

and test which model has the better fit.

Issues with Horizontal Price Competition Model

- Ignores the possible intermediary between the producer and consumer: retailer, platform, ..
- Consumer prices may not be chosen by manufacturer/producer
- Can cause many problems: for example, likely bias towards finding collusion when there is none because retailer takes into account effects across products, estimated margins corresponding to retail margins only if linear pricing without vertical restraints
- Extension to vertical contracts necessary: double marginalization, non linear pricing, vertical restraints, multiple equilibria

Vertical Linear Pricing: Double Marginalization

- Simple extension with linear pricing vertical contracts
- Retailer profit given $\mathbf{w}$

$$\Pi^r = \sum_{j \in S_r} (p_j - w_j - c_j) s_j(\mathbf{p})$$

- Bertrand-Nash equilibrium in retail prices among retailers

$$s_j + \sum_{k \in S_r} (p_k - w_k - c_k) \frac{\partial s_k}{\partial p_j} = 0$$

identifies retail margins as solution of

$$\mathbf{p} - \mathbf{w} - \mathbf{c} = \Omega^{-1} \mathbf{s}(\mathbf{p}) \qquad \longrightarrow \qquad (\mathbf{p} - \mathbf{w} - \mathbf{c})^*$$

Vertical Linear Pricing: Double Marginalization

- Profit of manufacturer f is

$$\Pi^f = \sum_{j \in G_f} (w_j - \mu_j) s_j(\mathbf{p})$$

- Bertrand-Nash equilibrium in wholesale prices among manufacturers

$$s_j + \sum_{k \in G_f} \sum_{l=1,..,J} (w_k - \mu_k) \frac{\partial s_k}{\partial p_l} \frac{\partial p_l}{\partial w_j} = 0 \rightarrow \qquad (\mathbf{w} - \boldsymbol{\mu})^*$$

  Derivatives $\frac{\partial p_l}{\partial w_j}$ by total differentiation of retailer's first order conditions

- Retail margins $(p_j - w_j - c_j)$ and wholesale margins $(w_j - \mu_j)$ are identified, thus total marginal cost $(\mu_j + c_j)$ is identified

Vertical Contracts with Non Linear Pricing

- But parties may have an incentive to use non linear pricing contracts, vertical restraints
- Theoretical arguments (Bernheim Whinston 1985, Rey Tirole 1986, O'Brien Shaffer 1997, Rey Vergé 2004)
- Empirical evidence (Villas-Boas, 2007, Bonnet Dubois, 2010)
- Price equilibrium conditions change relationship between margins, demand shape and market structure

Vertical Contracts with Non Linear Pricing

- Two-part Tariffs (Rey Vergé, 2004, 2010, Bonnet Dubois, 2010)
- Simultaneous take-it or leave-it offers from manufacturers to retailers
- Manufacturers set w_k and franchise fee F_k to maximize

$$\Pi^f = \sum_{k \in G_f} [(w_k - \mu_k) s_k(\mathbf{p}) + F_k]$$

subject to participation constraints $\Pi^r \geq \overline{\Pi}^r$, where

$$\Pi^r = \sum_{j \in S_r} [(p_j - w_j - c_j) s_j(\mathbf{p}) - F_j]$$

- As participation constraints must be binding:

$$\Pi^f = \sum_{k \in G_f} \underbrace{(p_k - \mu_k - c_k)}_{\text{total margin}} s_k(\mathbf{p}) + \sum_{k \notin G_f} \underbrace{(p_k - w_k - c_k)}_{\text{retail margin}} s_k(\mathbf{p}) - \sum_{j \notin G_f} F_j$$

Vertical Contracts with Non Linear Pricing

- Binding participation constraints ($\overline{\Pi}^r = 0$):

$$\sum_{j \in S_r} F_j = \sum_{j \in S_r} [(p_j - w_j - c_j) s_j(\mathbf{p})]$$

$$\begin{aligned}
\Pi^f &= \sum_{k \in G_f} [(w_k - \mu_k) s_k(\mathbf{p})] + \sum_{k \in G_f} F_k \\
&= \sum_{k \in G_f} [(w_k - \mu_k) s_k(\mathbf{p})] + \sum_r \left(\sum_{k \in S_r} F_k \right) - \sum_{k \notin G_f} F_k \\
&= \sum_{k \in G_f} (w_k - \mu_k) s_k(\mathbf{p}) + \sum_r [\sum_{j \in S_r} (p_j - w_j - c_j) s_j(\mathbf{p})] - \sum_{k \notin G_f} F_k \\
&= \sum_{k \in G_f} [(w_k - \mu_k) s_k(\mathbf{p})] + \sum_k (p_k - w_k - c_k) s_k(\mathbf{p}) - \sum_{k \notin G_f} F_k \\
&= \sum_{k \in G_f} (p_k - \mu_k - c_k) s_k(\mathbf{p}) + \sum_{k \notin G_f} (p_k - w_k - c_k) s_k(\mathbf{p}) - \sum_{j \notin G_f} F_j
\end{aligned}$$

Vertical Contracts with Non Linear Pricing

- Resale Price Maintenance (RPM) equilibrium :

$$\max_{\{p_k, w_k, F_k\} \in G_f} \Pi^f = \max_{\{p_k\} \in G_f} \Pi^f$$

- Pricing decisions implemented by manufacturers
- First order conditions of RPM equilibrium

$$\sum_{k \in G_f} (p_k - \mu_k - c_k) \frac{\partial s_k(\mathbf{p})}{\partial p_j} + s_j(\mathbf{p}) + \sum_{k \notin G_f} (p_k - w_k - c_k) \frac{\partial s_k(\mathbf{p})}{\partial p_j} = 0$$

- Multiple equilibria depending on wholesale prices
- Contrary to linear pricing: **no identification of margins**

Vertical Contracts with Non Linear Pricing

- Identifying assumption (choosing a possible equilibrium):
  - $w_k^* = \mu_k$: retailers as residual claimants and manufacturers capture full monopoly rents through fixed fees. FOC are

$$\sum_{k=1}^{J}(p_k - \mu_k - c_k)\frac{\partial s_k(\mathbf{p})}{\partial p_j} + s_j(\mathbf{p}) = 0$$

  - $p_k^*(\mathbf{w}^*) - w_k^* - c_k = 0$:

$$\sum_{k \in G_f}(p_k - \mu_k - c_k)\frac{\partial s_k(\mathbf{p})}{\partial p_j} + s_j(\mathbf{p}) = 0$$

- Total margins are then identified but not wholesale and retail margins separately nor the sharing of profit in the vertical chain

Vertical Contracts with Non Linear Pricing

- Without RPM, manufacturer maximizes

$$\max_{\{w_k\}\in G_f} \sum_{k\in G_f} (p_k - \mu_k - c_k) s_k(\mathbf{p}) + \sum_{k\notin G_f} (p_k - w_k - c_k) s_k(\mathbf{p})$$

- Then, using retailers reaction function when setting optimal retail margins, retail and wholesale margins are identified (but again not the profits because fixed fees are unidentified)
- Each two part tariff price equilibrium allows identify total marginal costs but at the condition of imposing some supply side model (contracts usually not observed by econometrician)
- Each model of vertical contract can give a full set of varying margins

Inference on Supply Side Models

- We need to **add restrictions**: either on costs, margins, or cross market variations of equilibrium
- Total marginal cost for model n is $C^n_{jt} = \mu^n_{jt} + c^n_{jt}$,

$$C^n_{jt} = p_{jt} - \underbrace{\left(w_{jt} - \mu_{jt}\right)^n}_{\text{model } n \text{ wholesale margin}} - \underbrace{\left(p_{jt} - w_{jt} - c_{jt}\right)^n}_{\text{model } n \text{ retail margin}}$$

- Example of testing between models using cost restrictions:
  - across products (identification improves with more products and more retailing channels)

$$\mu^n_{jt} = \mu^n_{j't} \quad \text{if } j, j' \in S_r \quad \text{and} \quad c^n_{jt} = c^n_{j't} \quad \text{if } j, j' \in G_f$$

  - across markets t (identification improves with more markets)

$$C^n_{jt} = W'_{jt}\alpha + \eta_{jt}$$

- Non-nested tests (Vuong 1989, Rivers Vuong 2002) for inference

Identification in vertical contracts

- We can identify margins and marginal costs even in non linear vertical contracts (provided we maintain some cost restrictions), but *not* the sharing of profits because of unidentified and unobserved fixed transfers
- Solution: model the determination of reservation profits or bargaining ability of parties
- For example, allow downstream retailers to have some endogenous buyer power coming from the horizontal competition of upstream manufacturers (Bonnet Dubois 2015).
- Allows to recover price-cost margins at the upstream and downstream levels, as well as fixed fees of two part tariffs contracts and the sharing of profits

Two-Part Tariffs and Endogenous Retail Buyer Power

- Assume manufacturers make take-it-or-leave-it offers to retailers and characterize symmetric subgame perfect Nash equilibria.
- Rey and Vergé (2010) proved existence of equilibria:
  - Contracts: franchise fees, wholesale prices but also retail prices in case of RPM.
  - Offers are public and retailers simultaneously accept or reject.
  - Retailer can reject a contract while accepting others.
  - After decisions on contracts, retailers simultaneously set retail prices, demands and contracts are satisfied.
- Contracts negotiated at firm level and not by brand i.e. "bundling" offers to retailers. Likely to increase the market power of multiproduct manufacturers and reduce the buyer power of retailers.

Two-Part Tariffs and Endogenous Retail Buyer Power

- Manufacturers set two-part tariffs contracts to maximize their profit subject to incentive constraints

$$\Pi^r \geq \sum_{s \in S_r \backslash G_{fr}} [(\widetilde{p}_s^{fr} - w_s - c_s) s_s(\widetilde{p}^{fr}) - F_s]$$

  - $\widetilde{p}^{fr} = (\widetilde{p}_1^{fr}, .., \widetilde{p}_J^{fr})$ vector of retail prices absent products G_{fr}
  - $S_r \backslash G_{fr}$: set of products retailed by r but not manufactured by f
  - $s_s(\widetilde{p}^{fr})$: market share of s when products G_{fr} are absent

- Endogenous buyer power: retailers may refuse some contracts proposed by manufacturers while accepting other two-part tariffs contracts

Two-Part Tariffs and Endogenous Retail Buyer Power

- With binding incentive constraint:

$$\sum_{s\in G_{fr}} F_s = \sum_{s\in S_r} \left[(p_s - w_s - c_s) s_s(\mathbf{p}) - (\tilde{p}_s^{fr} - w_s - c_s) s_s(\tilde{\mathbf{p}}^{fr}) \right]$$

- Profit of manufacturer f becomes

$$\Pi^f = \sum_{s\in G_f} (w_s - \mu_s) s_s(\mathbf{p})$$

$$+ \sum_{s=1}^{J} \left[\underbrace{(p_s - w_s - c_s)}_{\text{retail margin if agree}} \underbrace{s_s(\mathbf{p})}_{\text{demand}} - \underbrace{(\tilde{p}_s^{fr(s)} - w_s - c_s)}_{\substack{\text{retail margin} \\ \text{if } r(s) \text{ refuses } f \text{ offer}}} \underbrace{s_s(\tilde{\mathbf{p}}^{fr(s)})}_{\substack{\text{counterfactual} \\ \text{demand}}} \right]$$

where $r(s)$ denotes the retailer of product s

Two-Part Tariffs and Endogenous Retail Buyer Power

- With RPM:
    - retail equilibrium price conditions identical as when exogenous reservation profit of retailer
    - but **fixed fees** in the contracts are endogenously determined and **identified** by retail equilibrium margins and counterfactual margins
- Without RPM:
    - all margins are also identified but different from exogenous case
    - **fixed fees** are also **identified**

Estimation Results

- Estimation in Bonnet Dubois (2015) on French markets for bottles of water
- Variants of linear pricing models not shown:
  - Different interaction between manufacturers and retailers.
  - Assuming collusion between manufacturers and/or retailers or assuming that retailers act as neutral pass-through agents of marginal cost of production (Sudhir, 2001).
  - All these models are strongly rejected.
- Model where no wholesale price discrimination imposed (restrictions incorporated in estimation of margins): wholesale price of j depends only on brand $b(j)$ and not on retailer $r(j)$.

Estimation Results

Price-Cost Margins (% of p_{jt})		Mineral Water		Spring Water	
		Mean	Std.	Mean	Std.
Linear Pricing (Double Marginalization)					
Model 1	Retailers	16.93	2.36	26.56	6.92
	Manufacturers	23.35	4.14	44.12	5.98
	Total	36.39	8.40	58.62	27.48

Estimation Results

Price-Cost Margins (% of p_{jt})		Mineral Water		Spring Water	
		Mean	Std.	Mean	Std.
Two part Tariffs with RPM					
Model 2	General wholesale prices (w_{jt}) with restriction on costs				
	Retailers	49.05	23.49	45.95	36.69
	Manufacturers	5.25	21.43	21.43	41.14
	Total	54.30	14.51	67.38	33.62
Model 3	No wholesale price discrim. ($w_{b(j)t}$) with restriction on costs				
	Retailers	61.46	17.18	29.72	8.77
	Manufacturers	0.00	0.00	44.32	45.47
	Total	61.46	17.18	74.04	39.53
Model 4	Zero wholesale margin ($w=\mu$)	66.32	19.08	78.18	41.04
Model 5	Zero retail margin ($p=w+c$)	25.53	5.07	43.39	14.40

Estimation Results

Price-Cost Margins		Mineral Water		Spring Water	
(% of retail price p_{jt})		Mean	Std.	Mean	Std.
Two-part Tariffs without RPM					
Exogenous Retail Buyer Power					
Model 6	Retailers	16.93	2.36	26.56	6.92
	Manufacturers	18.75	3.88	25.76	3.99
	Total	32.56	6.58	49.44	18.21
Endogenous Retail Buyer Power					
Model 7	Retailers	16.93	2.36	26.56	6.92
	Manufacturers	21.71	6.39	49.53	13.71
	Total	35.03	8.77	61.33	31.26

Non Nested Tests

- Cost equations test which model fits best the data (Vuong 1989, Rivers Vuong 2002)

$T_n \rightarrow N(0,1)$: Non Nested Tests						
╲	H_2					
H_1	2	3	4	5	6	7
1	1.10	0.71	0.28	7.48	4.25	**-3.16**
2		-3.79	-4.99	14.22	9.33	**-2.51**
3			-5.47	13.72	10.01	**-2.37**
4				13.14	9.85	**-2.21**
5					-11.38	**-5.60**
6						**-3.99**

- Tests statistics show best model is model 7.

Estimation Results in Bonnet Dubois (2015)

- Fixed fees identified in preferred model

$$\sum_{s\in G_{fr}} F_s = \sum_{s\in S_r} \left[(p_s - w_s - c_s) s_s(p) - (\widetilde{p}_s^{fr} - w_s - c_s) s_s(\widetilde{p}^{fr}) \right]$$

Retailer	Manufacturer 1	Manufacturer 2	Manufacturer 3
1	-1,672	294	-555
2	-18,910	-15,420	-17,650
3	1,087	1,378	1,215
4	2,509	2,621	2,534
5	3,271	607	1,216
6	1,063	1,114	1,091
7	972	1,016	1,000

Notes: Numbers are average fees per month thousands of Euros.

Contracts as the Result of Bargaining

- How are two-part tariffs with endogenous buyer power different from a bargaining outcome?
- Consider a Nash equilibrium in Nash Bargaining over two part tariffs contracts

$$\max_{(w_j,F_j),j\in G_{fr}} \left(\Pi^r - \Pi^{r\backslash f}\right)^{\beta} \left(\Pi^f - \Pi^{f\backslash r}\right)^{1-\beta}$$

where

$$\Pi^{r\backslash f} = \sum_{j\in S_r\backslash G_{fr}} [(p_j^{-fr} - w_j - c_j)s_j(\mathbf{p}^{-fr}) - F_j]$$
$$\Pi^{f\backslash r} = \sum_{j\in G_f\backslash G_{fr}} [(w_j - \mu_j)s_j(\mathbf{p}^{-fr}) + F_j]$$

Contracts as the Result of Bargaining

- Taking first order conditions with respect to fixed fees:

$$\Pi^f - \Pi^{f\backslash r} = \frac{1-\beta}{\beta}\left(\Pi^r - \Pi^{r\backslash f}\right)$$

thus giving

$$\sum\nolimits_{j\in G_{fr}} F_j =$$

$$(1-\beta)\left(\sum_{j\in S_r}(p_j - w_j - c_j)s_j(\mathbf{p}) - \sum_{j\in S_r\backslash G_{fr}}(p_j^{-fr} - w_j - c_j)s_j(\mathbf{p}^{-fr})\right)$$

$$-\beta\left(\sum_{j\in G_f}(w_j - \mu_j)s_j(\mathbf{p}) - \sum_{j\in G_f\backslash G_{fr}}(w_j - \mu_j)s_j(\mathbf{p}^{-fr})\right)$$

- Fixed fees identified up to β. Bounds identified since $\beta \in [0,1]$

Contracts as the Result of Bargaining

- Replacing the fixed fees in profit functions, Nash bargaining amounts to maximize for $j \in G_{fr}$

$$\sum_{j \in S_r} [(p_j - w_j - c_j) s_j(\mathbf{p})] - \sum_{j \in S_r \setminus G_{fr}} [(p_j^{-fr} - w_j - c_j) s_j(\mathbf{p}^{-fr})]$$
$$+ \sum_{j \in G_f} [(w_j - \mu_j) s_j(\mathbf{p})] - \sum_{j \in G_f \setminus G_{fr}} [(w_j - \mu_j) s_j(\mathbf{p}^{-fr})]$$

which is equivalent to maximize

$$\underbrace{\sum_{j \in S_r} (p_j - w_j - c_j) s_j(\mathbf{p})}_{\text{variable retail margin of } r} + \underbrace{\sum_{j \in G_f} (w_j - \mu_j) s_j(\mathbf{p})}_{\text{variable wholesale margin of } f}$$

Contracts as the Result of Bargaining

- With take it or leave it TPT contracts, maximize

$$\sum_{j\in G_f}(w_j-\mu_j)s_j(\mathbf{p})+\sum_{j=1}^{J}(p_j-w_j-c_j)s_j(\mathbf{p})-(\widetilde{p}_j^{fr(j)}-w_j-c_j)s_j(\widetilde{\mathbf{p}}^{fr(j)}$$

$$=$$

$$\sum\nolimits_{j\in S_r}[(p_j-w_j-c_j)s_j(\mathbf{p})]+\sum\nolimits_{j\in G_f}(w_j-\mu_j)s_j(\mathbf{p})\quad \text{(bargaining)}$$

$$-\underbrace{\sum\nolimits_{j\in S_r\backslash G_{fr}}[(\widetilde{p}_j^{fr(j)}-w_j-c_j)s_j(\widetilde{\mathbf{p}}^{fr(j)})]}_{\text{retailer } r \text{ margin on non } f \text{ products}}$$

$$+\underbrace{\sum\nolimits_{j\notin S_r}\left[(p_j-w_j-c_j)s_j(\mathbf{p})-(\widetilde{p}_j^{fr(j)}-w_j-c_j)s_j(\widetilde{\mathbf{p}}^{fr(j)})\right]}_{\text{change in retail margin obtained by other retailers when } r \text{ refuses } f \text{ offer}}$$

Contracts as the Result of Bargaining

- With take-it-or-leave-it offers of two part tariffs, manufacturers adjust contractual terms in order to extract the variable margin gain they obtain by accepting their contract offer compared to refusing
- Margins and marginal costs are identified using first order conditions
- Bargaining parameter does not affect equilibrium prices but affects fixed fees and sharing of profit that are not identified without assumption on β

Conclusion and Research Directions

- Identification of margins and marginal costs with vertical contracting in many cases, including non linear contracts and bargaining
- Inference to test models of conduct is possible using additional restrictions across products or across markets, and may be better than imposing some unobserved contract structure
- Further empirical research on vertical contracts
  - Secret contracts (Rey Vergé 2017)
  - Endogenizing exclusive dealing, foreclosure
  - Dynamics
- Theory based estimation and theory tests