Concentrated Buyers and Negotiated Markets

Charlie Murry

Boston College

December 8, 2022

Motivation

Many markets are not posted unit-price markets.

Most notable example is input markets. Suppliers downstream firms can have bespoke/negotiated contracts with suppliers. Negotiation costs are small relative to surplus available.

How are prices determined when the seller *and buyer* market structures are oligopolistic and contract terms are negotiated?

Motivating Examples

Walmart/Target/Kroger are huge buyers of consumer packaged goods. How are wholesale prices determined?

Hospital systems and insurance companies are huge organizations, reimbursement rates vary for each bilateral relationship.

How are prices for Disney's content that is distributed by Comcast determined?

Public Policy Motivation

Many recent high-profile antitrust cases involve oligopolistic buyers and sellers with negotiated prices.

- US. v Apple 2013 (e-books)
- US v. Ticketmaster - Live Nation
- US v AT&T - Time Warner

Important questions about how concentration of buyers and sellers and integration of operations determine welfare.

Measure effects from a vertical merger:
(1) elimination of double-marginalization,
(2) foreclosure.

Villas-Boas (2007)

Formulation of vertical relationships in the typical empirical IO supply/demand approach.
How are prices and welfare in consumer packaged goods market determined?

Villas-Boas takes the case of yogurt.

Estimates alternative models of wholesale price determination – tests between these models.

Baseline conduct: Manufacturers make TIOLI offers to retailers (w/ full info).

Retailer Payoffs

$$\pi_j^D(\mathbf{w},\mathbf{p}) = \sum_i (p_{ij} - w_{ij} - c_{ij}^D) D_{ij}(\mathbf{p})$$

Taking wholesale prices and costs as given, assuming Nash-Bertrand pricing game, retail prices satisfy

$$\mathbf{p} = \mathbf{w} + \mathbf{c}^D - (\mathbf{T} * \Lambda^D)^{-1} \times D(\mathbf{p})$$

- $\mathbf{T}(m,n)$ equal to 1 if m and n share the same retailer.
- $\Lambda^D(m,n) = \frac{\partial D_n}{\partial p_m}$
- i indexes manufacturers and j indexes retailers.

Manufacturer Payoffs

$$\pi_i^U(\mathbf{w}) = \sum_j (w_{ij} - c_{ij}^U) D_{ij}(\mathbf{p}(\mathbf{w}))$$

Assuming manufacturer makes a TIOLI offer, the wholesale FOC for a single good is...

$$\mathbf{w} = \mathbf{c}^{\mathbf{U}} - (\Lambda^P \times \Lambda^D)^{-1} \times D(\mathbf{p}(\mathbf{w}))$$

where Λ^P is a pass-through term with elements $\frac{\partial p}{\partial w}$, so the manufacturer incorporates the total effect of a change in wholesale price on demand, *through retail prices.*

$$\frac{\partial D}{\partial w} = \frac{dp}{dw}\frac{\partial D}{\partial p}$$

Computing Pass-through

Total differentiate the **retailer** FOC for a specific product i.

$$\sum_k \underbrace{\left[\frac{\partial D_j}{\partial p_k} + \sum_i \left(T^D(i,j) \frac{\partial^2 D_i}{\partial p_j \partial p_k}(p_i - w_i - c_i^D) \right) + T^D(k,j) \frac{\partial D_k}{\partial p_j}\right]}_{g(j,k)} dp_k - \underbrace{T^D(f,j) \frac{\partial D_f}{\partial p_j}}_{h(j,f)} dw_f = 0$$

- $T^D(i,j) = 1$ if products are sold by the same retailer.

Then we can invert this system as

$$\frac{dp}{dw_f} = G^{-1} H_f$$

- Villas-Boas shows how to aggregate this across products and invert the manufacturer FOCs for manufacturer costs/markups.

VB2007 Tests Different Offer Games

1. **Manufacturers make TIOLI offer**

2. **Manufacturers make TIOLI offer, internalize private labels**

3. **Non-linear pricing**
   3.1 Retailers as residual claimants. [manufacturers set $w = c^U$]
   3.2 Wholesalers as residual claimants. [retailers set $p = w + c^D$]

4. **Manufacturer collusion**

5. **Retailer collusion**

6. **Complete vertical/horizontal collusion**

The cool thing is that all of these conduct assumptions are nested in the manufacturer TIOLI algebra.

VB2007 Estimation

1. Estimate demand.
   - Usually we use $\frac{\partial D_j}{\partial p_k}$ to then back out marginal costs.
   - Now we need $\frac{\partial^2 D_j}{\partial p_j \partial p_k}$
   - We get this for free already!
2. Use new vertical conditions to back out markups and margins in the vertical chain.
   - Recover price-cost margins $SIPCM^D(\theta)$ and $SIPCM^U(\theta)$

3. For all models, compare how the recovered price-cost margins explain unobserved determinants of price. Use a non-nested test statistic due to Smith (1992 ECMA).

$$p = f(C\gamma) + SIPCM^D \lambda^D + SIPCM^U \lambda^U + u$$

VB2007 Results

Crucial is that VB has cost shifters, so there is hope distinguishing between the models.

p-Values for pairwise non-nested comparisons

	Alternative models						
H_0 model	1	2	3·1	3·2	4	5	6
1: Simple linear pricing	–	0·50	0·00	0·50	0·24	0·00	0·50
2: Hybrid	0·00	–	0·50	0·50	0·12	0·00	0·50
3.1: Zero wholesale margin	0·41	0·29	–	0·05	0·50	0·39	0·07
3.2: Zero retail margin	0·39	0·40	0·05	–	0·50	0·39	0·17
4: Wholesale collusion	0·49	0·48	0·50	0·50	–	0·48	0·50
5: Retail collusion	0·00	0·00	0·50	0·50	0·22	–	0·50
6: Monopolist	0·34	0·35	0·17	0·31	0·48	0·34	–
Chain size weighted							
1: Simple linear pricing	–	0·08	0·01	0·06	0·08	0·00	0·00
2: Hybrid	0·17	–	0·15	0·22	0·00	0·06	0·14
3.1: Zero wholesale margin	0·08	0·15	–	0·11	0·15	0·12	0·00
3.2: Zero retail margin	0·01	0·07	0·00	–	0·09	0·01	0·00
4: Wholesale collusion	0·00	0·05	0·04	0·09	–	0·00	0·02
5: Retail collusion	0·00	0·02	0·03	0·11	0·02	–	0·00
6: Monopolist	0·10	0·20	0·00	0·15	0·20	0·14	–

Notes: *p*-Values reported from non-nested, Cox-type (Smith, 1992) test statistics of the null model in a row being true against the specified alternative model in a column. Bottom part is a robustness check. It has the same format as above, but the non-nested comparisons are based on estimates for the case when the portion of the manufacturer's profit due to each retailer is weighted by the retailer's chain size.

Related Papers

Ho (2009, AER)
Hospitals make TIOLI offers to insurers comprising of a linear and fixed fee, then insurers decide which contracts to accept and set premiums. Relates vertical profitability to hospital quality.

Yang (2020 RAND)
Do vertically integrated firms make greater product investments because there is a coordination failure in investments.

Murry (2017, wp)
Car manufacturers make TIOLI wholesale price **and** brand advertising offers. Car dealers decide prices and local advertising. Manufacturer may charge low wholesale prices to encourage downstream effort (advertising).

Many many many more examples from the quantitative marketing literatures involving consumer packaged goods and hospital-insurance IO literature

Limits of TIOLI Model and the Nash-in-Nash Model

TIOLI Model

- Assume all firms of one type have the same "power."
- Demand elasticities really pin down market power – no flexibility.
  - Perhaps only negative marginal costs rationalize prices.[Grennan 2013]

Nash-in-Nash

- No need to specify who makes what offer.
- Recover relationship specific "power" that can rationalize prices.

Economic implications of TIOLI offers

The retailer's price choice imposes an externality on the manufacturer.

- $\rightarrow$ higher prices and lower quantity.

There is an optimal 2-part tariff that achieves the (monopolist) efficient outcome.

- $w = c^U \rightarrow$ retail price is the monopoly price, and manufacturer can tax profit to split the surplus.

Alternatively, we can think about the contract (in this case the transfer) emerging from a bargaining process.

Nash Bargaining

Define contracts $\mathbb{C}(y, t)$ for payoff relevant variables y and transfers t.

Define payoffs Π_D and Π^U and the payoff from the "null contract" as $\overline{\Pi} \equiv \Pi(\mathbb{C}_0)$

If there is a contract that results in gains from trade for both parties, then the parties agree to a contract that solves

$$\max_{\mathbb{C} \in \mathcal{C}^+} [\Pi_D(\mathbb{C}) - \overline{\Pi}_D]^b [\Pi_U(\mathbb{C}) - \overline{\Pi}_U]^{1-b}$$

for a given bargaining power parameter $b \in [0, 1]$.

- With transfers, this outcome is pareto efficent: given a profit level for one party, the other profit is maximized.
- Witout transfers, we can nest the TIOLI outcome. If $b = 1$, we have double marginalization and if $b = 1$ we have integrated solution.

Nash-in-Nash Bargaining: Multilateral Baraining

Horn and Wolintzky (1988)

A collection of contracts $(\mathbb{C}_{ij})$ is a Nash-in-Nash equilibrium if each pair's contract solves the bilateral Nash bargaining problem **taking the contracts agreed to by all other pairs as given**.

This omits potentially interesting but very difficult to model bargaining externalities among multilateral parties.

Imagine a Rubinstein (1982) sequential bargaining game, but the firms send distinct agents to engage in the pairwise negotiations. The agents hold passive beliefs and cannot communicate with each other.

Empirical Implementation I

Important to define the

- The payoffs (including demand and, maybe, costs) (Π_{Dj}, Π_{Ui}).
- What is being bargained over (e.g. wholesale costs (w_{ij})).
- Other payoff relevant variables (a_i or a_j) (e.g. retail prices, investment, product line decisions.) e.g. customers enter in the contract in heathcare industry.

Step 1: Construct equilibrium payoffs and counterfactual (disagreement) payoffs from demand (and marginal cost) estimates.

Empirical Implementation II

Step 2: Supply-side estimation of bargaining model – FOC of NiN objective function.

Example: Ho and Lee (2017)
Health insurers negotiate consumer facing premiums with a large employer simultaneously with contracts $\mathbb{C}$ specifying per-admission hospital payments w. FOCs for NiN bargaining over w given "downstream" choices of p are

$$\hat{w}_{ij} \times \underline{D}_{ij} = (1 - b_{ij}) \times \Delta_{ij}\Pi_{Dj}(\{(w_{ij} = 0), \hat{\mathbb{C}}_{-ij}\}, \hat{\mathbf{p}}) \quad (1)$$

$$-b_{ij} \times \Delta_{ij}\Pi_{Ui}(\{(w_{ij} = 0), \hat{\mathbb{C}}_{-ij}\}, \hat{\mathbf{p}}) \quad (2)$$

$$\text{where} \Pi_{Ui} = \sum_{j} \in \mathbb{C}_{ij}(w_{ij} - c_i)\overline{D}_{ij}(p, N)$$

$$\Pi_{Dj} = (p_j - \eta_j)\underline{D}_j(p, N) - \sum_{i \in \mathbb{C}_{ij}} w_{ij}\overline{D}_{ij}(p, N)$$

Estimation I

Ideal Scenario:

- Researcher recovers demand and observes wholesale costs and other marginal costs.
- bargaining parameters can be recovered directly from the FOC of the NiN objective.
- Can solve for pair-specific bargaining parameters. [are these primatives?]

Unobserved Manufacturer Marginal Costs

- Are w's high because of high b or high c^U?
- Need a variable that shifts surplus across multiple bargaining instances.
- If we shift surplus, how responsive is w?
- Data on lump-sum transfers can add additional information.
- Basically, we are hunting for a pass-though rate.

Estimation II

Unobserved Contract Payments

- We can always invert downstream competition to recover retailers' total marginal costs.
- Then, regress these costs on "network" dummies – we have now inferred w and are back in the ideal scenario.
- Alternatively, place structure on backed out retailer costs are related to wholesale costs: Crawford et al. (2018) back out contracts relying on optimal assortment decisions of retailers.