Econ 890, Vertical Relation

Allan Collard-Wexler

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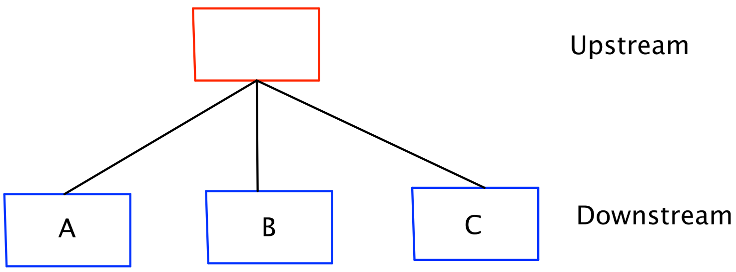
1 Vertical Control

Manufacturers rarely supply final consumers directly (as we've typically modeled them in the first part of the course). Instead, most industries are vertically separated. Recall the definition of "vertically-separated markets." We often refer to firms in these markets as upstream and downstream firms.

In these settings, downstream firms are the customers of the upstream firms, and many of the issues that we covered in the first part of the course still apply. For example, the upstream firm may want to price discriminate across the downstream firms.



Examples of Upstream-Downstream Issues

- Brewery-Owned Bars. What happens to prices, what about exclusion of other brands?
- Tesla trying to enter the market without dealers. GM can't get rid of dealerships.
- Intel had contracts that made it difficult to purchase microprocessors from AMD.
- Fox tried to buy Time Warner this summer.

Tension between benefits from vertical integration – being able to control everything, versus having firms distribute multiple products. Wholesale is a large part of the economy as well.

However, things can also get more complicated in vertical relationships between firms. In particular, downstream firms often do not simply consume the good, but typically make further decisions regarding the product.

Examples of activities of downstream firms:
1) determination of final price
2) promotional effort
3) placement of product on store shelves

4) promotion and placement of competing products
5) technological inputs

By the way, why don't manufacturers simply engage in direct marketing to consumers? (Tesla versus GM dealers)

- increasing returns to distribution due to shopping needs or travel costs for consumers
- choice of variety
- demand for service
- integration of complementary products
- different geographical markets

Unlike the consumption activities of final consumers, the activities of the downstream firms may affect the profits of the upstream firm. This is why upstream firms care about the activities of the downstream firms, and why we study vertical control/restraints between firms in these settings. We focus on the incentives for vertical control when the market for the intermediate good is imperfectly competitive.

A common benchmark for what firms can achieve through vertical control is the "vertically integrated profit." This is the maximum industry or aggregate (manufacturer plus retailer) profit. If firms use vertical restraints efficiently, they should achieve the vertically integrated profit.

1.1 Types of Vertical Restraints

4 types of vertical restraints used by firms in vertically-separated markets:
1) Exclusive Territories: a dealer/ distributor/ retailer is assigned a (usually geographic) territory by the manufacturer/ upstream firm and given monopoly rights to sell in that area.
2) Exclusive Dealing: a dealer/ distributor/ retailer is not allowed to carry the brands of a competing upstream firm.
3) "Full-line forcing": a dealer is committed to sell all varieties of a manufacturer's products rather than a limited selection. (the upstream firm ties all products when selling to the downstream firm).
4) Resale Price Maintenance: a dealer commits to a retail price or a range of retail prices for the product. This can take the form of either minimum resale price maintenance or maximum resale price maintenance.
Actually there are 5:
5) Contractual arrangements: upstream and downstream firms write contracts to provide greater flexibility in the transfer of the product. Profit sharing and revenue sharing are the most common, which we'll see soon. Also, quantity forcing and quantity rationing and franchise fees.

The typical outline of vertical control is as follows:
1) Basic Framework
2) The need for control because of externalities between downstream and upstream firms, or among downstream firms themselves.
3) Interbrand competition
4) Intrabrand competition

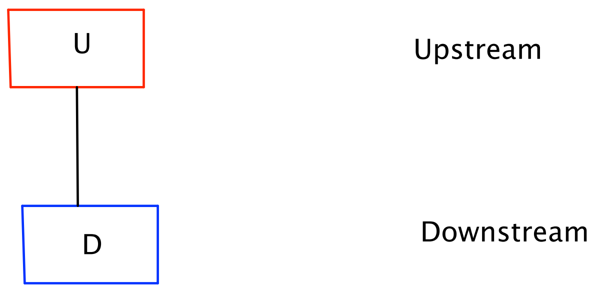
Think of exclusive dealing as a way of restraining interbrand competition, and exclusive territories as a form of vertical control to restrain intrabrand competition. (We cover these in the next lecture.)

1.2 Basic Framework:

Simple model: homogeneous good with (inverse) demand given by

$$p = a - Q$$

Suppose we have a monopolistic manufacturer and we have given exclusive rights to a dealer to sell the product of the manufacturer, so both the upstream and downstream firms are monopolistic. The downstream firm has marginal cost of selling the product of d which is equal to the wholesale cost of purchasing the product from the manufacturer, and the manufacturer has marginal cost of producing the good equal to c.



Dealer maximizes his profit given by

$$\pi_d = p(Q)Q - dQ = (a - Q)Q - dQ$$

F.O.C.:

$$\frac{\partial \pi_d}{\partial Q} = 0 = a - 2Q - d$$

$$Q^* = \frac{a-d}{2} \qquad p^* = \frac{a+d}{2} \qquad \pi_d = \frac{(a-d)^2}{4}$$

Now, how should the upstream firm set d?
Check: what are the strategies of the two players in this game? What does each firm choose?

Manufacturer maximizes profit given by

$$\pi_m = (d - c)Q = (d - c)\frac{a-d}{2}$$

F.O.C.:

$$\frac{\partial \pi_m}{\partial d} = 0 = a - 2d + c$$

$$d^* = \frac{a+c}{2} \qquad \pi_m = \frac{(a-c)^2}{8}$$

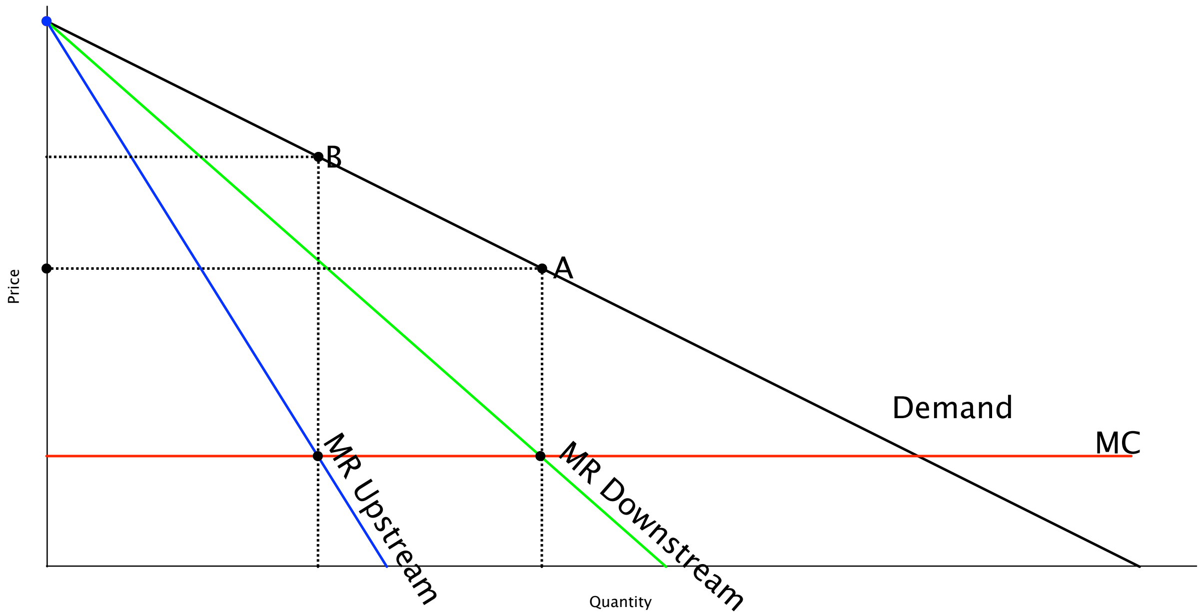
Note that we can now substitute into the dealer's solutions (for d) and get:

$$Q^* = \frac{a-c}{4} \qquad p^* = \frac{3a+c}{4} \qquad \pi_d = \frac{(a-c)^2}{16}$$

Results:
1. The manufacturer earns a higher profit than the dealer
2. The manufacturer could earn a higher profit if he does the selling himself. Total industry profit in this case is lower than the vertically integrated profit. Shown here:

$$\pi_{VI} = \frac{(a-c)^2}{4} > (\pi_d + \pi_m) = \frac{3(a-c)^2}{16}$$

The presence of two markups screws things up for the firms. This basic fact is called:
double-monopoly markup problem, successive monopolies problem, or double marginalization.



As mentioned earlier, there are many ways around these problems, including RPM, contracts, etc. There are also other problems that arise, and sometimes we might even create a successive monopoly problem in order to solve other incentive problems in the vertical channel.

1.3 Quantity Requirements

Quantity Forcing/Quantity Rationing: Instead of setting prices, require that downstream firms purchase a minimum or a maximum quantity of the product.
1) This may be used in place of price controls in the case when the upstream firm is a monopolist.
2) It is potentially used in vertical settings where the upstream firm is competing with other manufacturers. (interbrand versus intrabrand competition).

1.4 Contractual Arrangements

Instead of using RPM or ET, write other types of contracts. Perhaps lease the good to the downstream firm, perhaps use profit-sharing contracts.

Profit-sharing or revenue-sharing contracts: Similar to a two-part tariff. Instead of charging linear prices, the manufacturer requires a lump-sum transfer as well as a per-unit charge.

1.4.1 Tactic 1: Two-Part Tariffs

Two-part tariffs can be used both in vertical settings, and in direct-to-consumer or retail settings. Here is how it might work in the vertical setting.

The upstream firm charges the downstream firm a lump-sum amount equal to the expected profits that the downstream firm will make by purchasing the product at its true marginal cost of production and selling it to consumers at the monopoly price.

Once the downstream firm has paid the lump-sum payment, they purchase any amount of the product they want (note that this will be the monopoly quantity) at marginal cost. This mimics vertical integration, because it's how a jointly-owned firm would supply the good on the market.

1.4.2 Resale Price Maintenance

Requires retailers to maintain a minimum price, a maximum price, or a fixed price. Two goals:
1) Partially solve the double marginalization problem
2) Induce dealers or retailers to allocate resources for promoting the product, or exerting other forms of effort in distributing the product. (Examples: perfume, Coors beer)

Addressing the double-marginalization problem: Maximum Resale Price Maintenance (Maximum RPM), or Quantity Forcing.

Set a maximum resale price below the optimal retail price, in order to mitigate the double marginalization problem. Equivalently, use a Quantity Forcing arrangement. Examples include: gasoline, newspapers, "suggested retail prices"

Important Court Cases are: Albrecht v. The Herald Co. (1968) (per se), State Oil Co. v. Khan (1997) (rule of reason)

Consider the example of promotions or advertising: *Minimum* Resale Price Maintenance

Assume (inverse) demand is given by

$$p = \sqrt{A} - Q$$

The manufacturer sells to two dealers who compete in price. Denote the wholesale price as d and advertising expenditures as A_1 and A_2, where $A = A_1 + A_2$.

<u>First result</u>: For any given d, no dealer will engage in advertising and demand would shrink to zero, with no sales.

Firms compete in price, and they sell a homogeneous product. What does p equal in this case?What can Resale Price Maintenance do?

Minimum Resale Price Maintenance: $p = p^f \geq d$

Now demand is

$$Q = \sqrt{(A_1 + A_2)} - p^f$$

Assume that quantity demanded is split evenly between the two retailers. The only strategic variable for the retailers is A. Thus, writing profits as a function of A and finding the F.O.C. yields:

$$\pi_i = \frac{\sqrt{(A_i + A_j)} - p^f}{2}(p^f - d) - A_i$$

F.O.C.:

$$0 = \frac{\partial \pi_i}{\partial A_i} = \frac{p^f - d}{4\sqrt{(A_i + A_j)}} - 1$$

Note that we can only identify the sum of $A_1 + A_2$ and not A_1 and A_2 individually. But the idea is that retailers will compete on promotion now. As long as $p^f > d$ then at least one retailer has an incentive to advertise, and the total dollars spent on ads increases with the markup.

Examples of Minimum RPM: perfume, cameras, Coors beer, Windows 98, Windows XP, Vista, books, many, many retail products (toys, electronics, etc.)

Also sometimes called "Telser special services".

Important court cases include: Miles Medical v. John Park and Sons (1911) (per se), Leegin Creative Leather Products v. PSKS (2007) (rule of reason).

Note that one problem in the last example was that competition between the retailers initially resulted in too much competition downstream, so that firms could not afford to advertise as a vertically-integrated firm would choose to do. One way around that: Exclusive Territories or "Territorial Dealerships."

Legal Issues

- There are many ambiguities in the legal treatment of vertical contracts.
- Until 1970s, RPM and E. Territories were per se illegal under Sherman Act.
- But many states passed fair trade laws that were interpreted to cover some of these cases.
- Furthermore, the Khan case in 1997 switched Maximum RPM to a "rule of reason" status, as did the Leegin Leather Products case in 2007 for Minimum RPM.

Thus, although price fixing remains per se illegal, it's not always applied in vertical settings because it conflicts with free-trade notions between mfgs and their distributors.

Non-price issues have been generally accepted to be ok by the courts. Decisions turn on arguments about efficiency vs. anti-competitive effects.

- Exclusive territories
- Refusal to deal
- Foreclosure, etc.

2 Exclusive Dealing

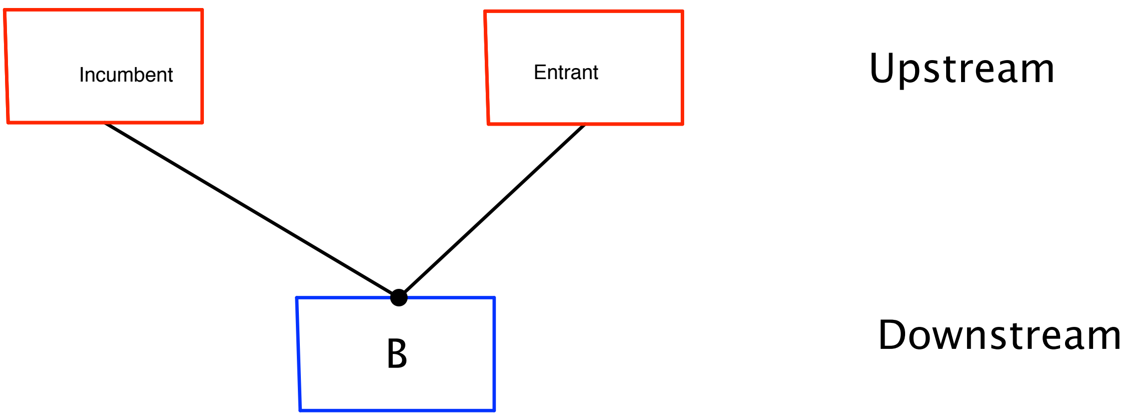
Dealers

- Distinction between exclusive dealers (cars), versus non-exclusive dealers (grocery stores).

- Do we think that exclusion:
  - Can happen?
  - Is it anticompetitive?
- Examples
  - Intel having exclusives with Dell, excluding AMD.
  - Beer distributors are restricted on which beer they can distribute.
  - Apple had an exclusive agreement with ATT for several years, when the iPhone was launched.
  - The newspaper Lorain Journal refused to print advertisements by those who patronized its rival.
- Policy history of exclusion is quite varied: sometimes banned outright, now something that is more lightly regulated.

2.1 Exclusion: Chicago School

- Two suppliers: Incumbent (I), Entrant (E).
- One buyer (B), with demand $D(p)$ for the input.
- Cost of Entry by Entrant is f.
- Marginal cost advantage for entrant: $c_E < c_I$.
- It will be socially efficient for this entrant to come in. (this means that $\int_{c_I}^{c_E} D(p)dp > f$).



2.2 Exclusive Contract

- Suppose that the incumbent offers a contract to the buyer:

  Buy exclusively from me, and I will pay you t \$.

- Three period model:
  1. Seller I offers or not an exclusive contract to buyer (B) at price t.

2. Firm E can enter at cost f.
3. Firms I and E compete simultaneously in prices p that they sell to B, or Firm I is the only firms in the market.

- Solve this by backward induction.

Exclusive Contract: Solution

3) Firms Compete in prices:
   - Bertrand like solution $p = c_I$, and the entrant sells everything, if both firms enter.
   - Otherwise, monopoly price p_I^M given cost for incumbent c_I, if only firm I enters, where:

$$p_I^M \to \max_p (p - c_I)D(p)$$

2) Entry:

   The entrant will come in if a) no exclusive contract, and b) if it is profitable:

$$(c_I - c_E)D(c_I) > f$$

1) Accept or reject exclusive contract.

   Notice that buyer B will accept if:

$$\int_{c_I}^{p^m} D(p)dp < t$$

Can I offer more than t? No! Remember that the profits of I are:

$$(p_I^M - c_I)D(p_I^M) < \int_{c_I}^{p_I^M} D(p)dp$$

2.3 "Naked" Exclusion: Externalities between Firms

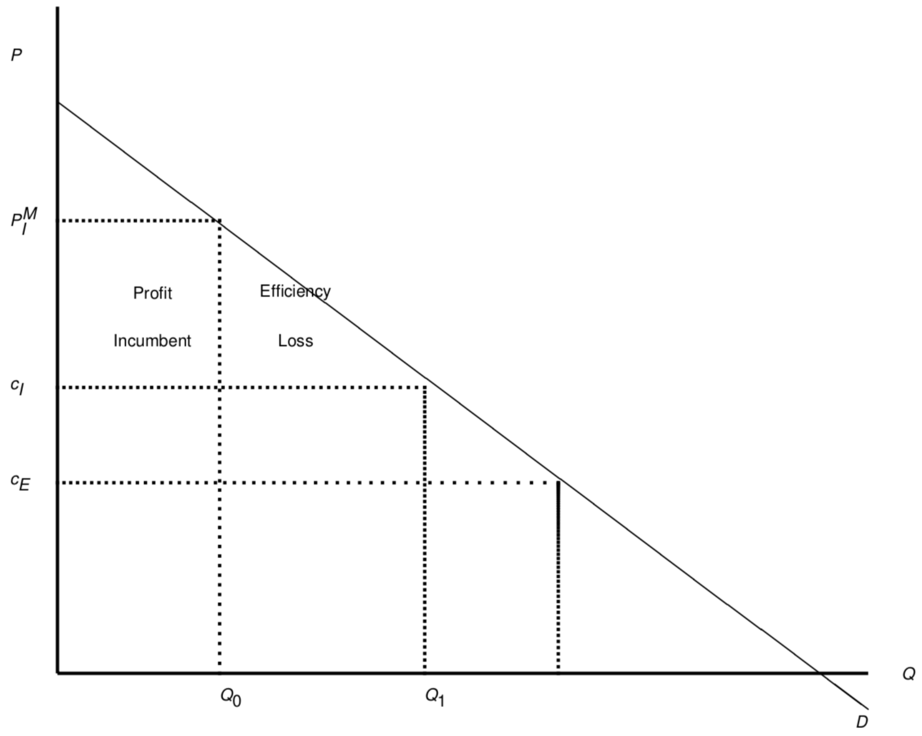
- So far we don't get any reason for exclusion, and no reason to think that it is anticompetitive.

> *Antitrust law bans exclusionary agreements: contracts that say, "You agree not to purchase from anyone besides me." No one, however, has explained convincingly how such contracts could be both profitable and pernicious.*

- Now let's change the model a little bit to get a motive for exclusion.
- There are three buyers now. They have the same demand curve $D(p)$, and are in separate markets, i.e. they don't compete with each other.
- As well, the entrant needs at least two buyers to break even:

$$2(c_I - c_E)D(c_I) > f > (c_I - c_E)D(c_I)$$

- Notice that there are externalities here: if a firm signs an exclusive, it lowers the probability that the entrant will serve the other firms.

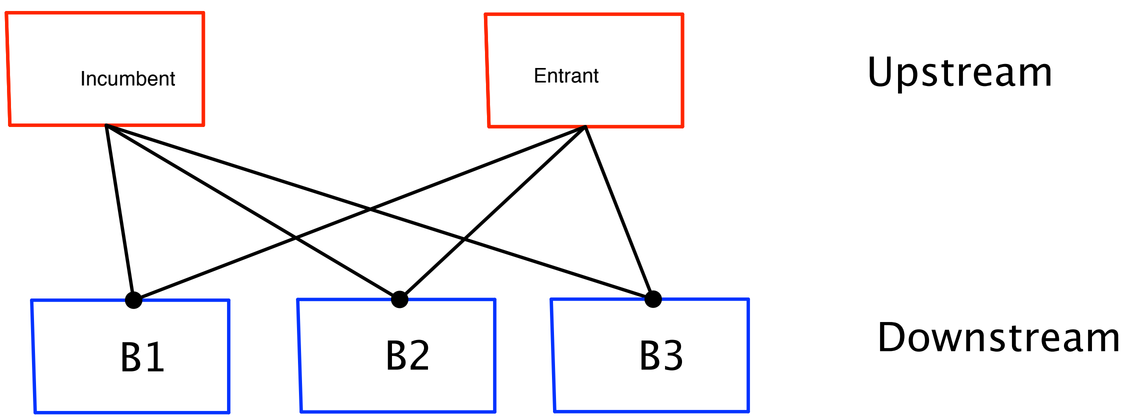


More specifics

- Suppose that the monopolist's surplus is $\pi^M = 9$ (I get to buy only from incumbent), and if $x^* = 12$ (I get to buy from entrant). So deadweight loss of monopoly (versus bertrand) is 3.
- This is called "naked exclusion" (like the work naked short in finance).

> *We focus on exclusionary conduct that is "naked": conduct unabashedly meant to exclude rivals, for which no one offers any efficiency justification.*

2.3.1 Naked Exclusion Model



Timing

1. Incumbent I offers firm 1 an exclusive for t_1.
2. Incumbent I offers firm 2 an exclusive for t_2.
3. Incumbent I offers firm 3 an exclusive for t_3.
4. Entrant E makes entry decision.
5. Either entrant E and incumbent I, or just incumbent I, compete a la Bertrand in prices with each firm 1, 2, 3 (i.e. they can price discriminate between each firm).

2.3.2 Solve this game by backward induction

5) Last stage: usual prices p_I^M or c_I depending on whether the entrant has entered.
4) Entrant will enter as long as two of the three firms have not signed exclusive contracts.
3) What will firm 3 accept in terms of t_3, exclusion payment. It depends on whether firms 1 and 2 have already signed exclusives, since this determines E's entry decision.
   - Neither firm 1 or firm 2 has signed an exclusive.
   - Both firm 1 and firm 2 have signed an exclusive.
   - Only one of firms 1 and 2 have signed an exclusive agreement.
2) What payment will firm 2 accept t_2.
1) What payment will firm 1 accept t_1.
0) What payments t_1, t_2, t_3 will be offered by firm B.

3) What will firm 3 accept in terms of t_3, exclusion payment.

- Both firm 1 and firm 2 have signed an exclusive.

  In this case, E won't enter. So firm 3 will accept anything above 0, $t_3 = 0.01$ say.

- Neither firm 1 or firm 2 has signed an exclusive.

  In this case, E will enter for sure. So firm 3 will accept anything above $t_3 > 12$, whereas E's profits in one market from monopoly are 9. Notice that this is the case we studied before, where I will not find it profitable to offer an exclusive agreement at this price.

- Only one of firms 1 and 2 have signed an exclusive agreement.

  This case gets more complicated. Firm 3 will be pivotal about firm E's entry decision. As such, it will accept if $t_3 > 12$. This is a little different from the previously studied case, since firm I will have a larger incentive to get firm 3 to accept: it ensures that it has monopoly in all three markets (comparing $t_3 = 12$ to profits $9 \times 3 = 27$.

2) What payment will firm 2 accept t_2

Now this depends on firm 1's agreements:

- Firm 1 has signed an exclusive.

  If firm 1 has signed an agreement, then firm 2 knows that if it disagrees, then firm 3 will sign an exclusive at $t_3 = 12$. So firm 2 knows that either way, E won't enter. Thus firm 2 will accept anything above a penny. Thus, $t_2 = 0.01$ and firm 2 agrees to an exclusive.

- Firm 1 has not signed an exclusive.

  In this case, firm 2 knows that it is pivotal: if it signs, firm 3 will sign, and the entrant won't come in. It will accept as long as $t_2 \geq 12$.

  Now firm I has to decide what to do. They will compare $t_2 + t_3 = 12 + 12 = 24$ to the profits from monopoly, $3 \times 9 = 27$. So this is a case where they will want to monopolize the market by exclusive agreements.

1) What payment will firm 1 accept t_1

Firm 1's decision is clear: no matter what it does, firm 2 and 3 will sign exclusive agreements, and the entrant won't come in. Thus, firm 1 will accept $t_1 = 0.01$.

2.3.3 Naked Exclusion: Intuition

- What is going on here?
- What is happening is that firms 1, 2 and 3 have an incentive to band together to get the entrant to come in.
- This means that when firm 1, say, signs an exclusive agreement with B, it imposes an externality on firms 2 and 3.
- Seller I is exploiting the lack of coordination: there is a free rider problem that allows it to inefficiently lock up the market.

2.4 Exclusion: Other models

- Maybe one seller is really efficient: I tie then up to raise my rivals marginal cost.
- Net Neutrality debate has some flavor of the debate on exclusion: discriminating between different firms.
- We don't know much empirically about the effects of these policies.

3 Bargaining

3.1 Markets with Bargaining

- Many of the market power issues we are looking into involve *bilateral oligopoly.*
- These are market where input suppliers and final goods producers are both concentrated: there is monopsony and monopoly power.
- In these markets, we think that prices are negotiated.
- The idea of "countervailing market power" is an old idea. Galbraith (1954) coined it to discuss the effects of consequences of say GM bargaining with UAW on wages. The idea being that concentration in the demand side for labor (GM), is countered by concentration in the supply of labor (the UAW union).

Motivation: Surplus Division in Bilateral Oligopoly

- Many current antitrust cases hinge on understanding concentrated upstream and downstream markets.

  - Hachette and Amazon E-Book pricing case.
  - Accountable Care Organization (ACO), and Hospital Mergers.
  - Cable TV Mergers.
  - Net Neutrality debate: Verizon and Netflix.
  - Rise of large chain stores (Walmart or Tesco).

- Comcast and Time Warner announced that they are merging: over 30% of U.S. Cable TV consumers.
- How should we think of these mergers?
  - These firms do not compete over the same customers: non-overlapping local cable monopolies?
  - However, providers of content; e.g. ESPN, Big Ten Network, are more worried about the merger.
  - Should we approve a merger in a context of bilateral oligopoly?

3.2 Nash Bargaining and Rubinstein Bargaining Model

3.2.1 Nash Bargaining

Nash (1950), not Nash (1951) which introduces Nash-Equilibrium as a solution concept, presents an axiomatic solution for bargaining problems.

Consider the bargaining problem over x, where you can think of there being one dollar on the table, and x denotes the share that goes to player 1, and thus, $1-x$ goes to player 2. More generally, think of players as receiving utilities $u_i(x)$. So we have:

$$\mathcal{U} = \{(v_1, v_2) | v_1 = u_1(x), v_2 = u_2(x)\}$$

Other examples include:

- Split the dollar: $u_1 = x$, $u_2 = 1 - x$.
- Manufacturer-Retailer (from a couple of lectures ago), where t is the wholesale price and demand is $P = a - Q$:

$$u_1 = \pi^M(t) = (t-c)\frac{a-t}{2}$$
$$u_2 = \pi^R(t) = \frac{(a-t)^2}{4}$$

The Nash Bargaining Solution is the x that maximizes the Nash Product:

$$\mathcal{N} = \max_x (u_1(x) - d_1)(u_2(x) - d_2)$$

where d_1 and d_2 denote the reservation value, the utility that 1 and 2 get if they don't agree. This is to make sure that payoffs are split relative to what the parties would get absent agreement, and, in particular, insures that bargaining is better than walking away from the the table.

Generalized Nash Bargaining

The Generalized Nash Bargaining Solution is the x that maximizes the Nash Product:

$$\mathcal{GN} = \max_x (u_1(x) - d_1)^{\alpha}(u_2(x) - d_2)^{1-\alpha}$$

where α denotes the weights on the utilities of agent 1 and agent 2.

3.2.2 Solving Nash Bargaining

Suppose we have a split the dollar game: The Nash Bargaining Solution is the x that maximizes the Nash Product:

$$\mathcal{N} = \max_x x(1-x)$$

taking first-order conditions with respect to x:

$$\begin{aligned}\frac{\partial \mathcal{N}}{\partial x} &= 0\\ (1-x) - x &= 0\\ x &= \frac{1}{2}\end{aligned}$$

Solving Generalized Nash Bargaining

Suppose we have a split the dollar game: The Generalized Nash Bargaining Solution is the x that maximizes the Nash Product:

$$\mathcal{GN} = \max_x x^{\alpha}(1-x)^{1-\alpha}$$

taking first-order conditions with respect to x:

$$\begin{aligned}\frac{\partial \mathcal{GN}}{\partial x} &= 0\\ \alpha x^{\alpha-1}(1-x)^{1-\alpha} - (1-\alpha)x^{\alpha-}(1-x)^{-\alpha} &= 0\\ x &= \alpha\end{aligned}$$

So the generalized solution allows for differences in surplus split

3.2.3 Manufacturer Retailer Example

Recall the profit functions are:

$$\begin{aligned}u_1 = \pi^M(t) &= (t-c)\frac{a-t}{2}\\ u_2 = \pi^R(t) &= \frac{(a-t)^2}{4}\end{aligned}$$

Which gives:

$$\mathcal{N} = \max_t \left((t-c)\frac{a-t}{2}\right)\left(\frac{(a-t)^2}{4}\right)$$

taking first-order conditions with respect to t, $\frac{\partial \mathcal{N}}{\partial t} = 0$:

$$\begin{aligned}\frac{a-t}{2}\frac{(a-t)^2}{4} + \frac{a-t}{2}\frac{(a-t)^2}{4} - 2\frac{a-t}{4}(t-c)\frac{a-t}{2} &= 0\\ a-t+c-t-2t+2c &= 0\\ t &= \frac{a+3c}{4}\end{aligned}$$

- Recall that the solution for the game where the manufacturer sets the wholesale price is $t = \frac{a+c}{2}$.

- What would the wholesale price be if, instead, it was the retailer who set it (and then the manufacturer produces)?

  $t = c$ right?

- So how should we look at the bargaining solution of $t = \frac{a+3c}{4}$?

3.2.4 Outside Options

Suppose we have a split the dollar game, but firm 1's outside option is 0.8, but firm 2's outside option is 0.1. The Nash Bargaining Solution is the x that maximizes the Nash Product:

$$\mathcal{N} = \max_x (x - 0.8)(1 - x - 0.1)$$

taking first-order conditions with respect to x:

$$\begin{aligned} \frac{\partial \mathcal{N}}{\partial x} &= 0 \\ (0.8 - x) - (x - 0.9) &= 0 \\ x &= 0.85 \end{aligned}$$

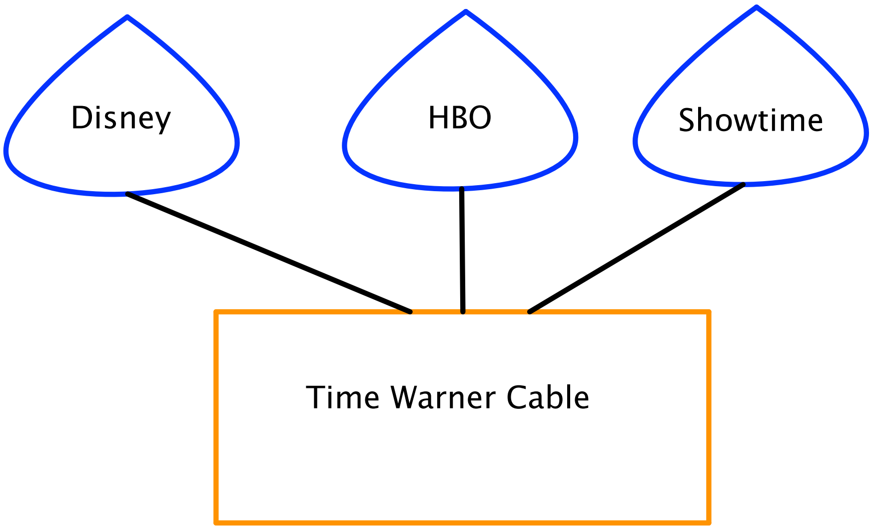
Basically, what is left is 0.1 units of surplus $1 - (0.8 + 0.1) = 0.1$, which is split 50-50.

3.2.5 Axioms for Nash Bargaining

Nash (1950) shows that the Nash Bargaining solution is the only one that satisfies the following axioms:

- Pareto optimality
- Invariant to affine transformations or Invariant to equivalent utility representations.
- Symmetry: if the payoffs are the same, then the split of surplus should not depend on the identity of the firm.
- Independence of irrelevant alternatives: adding an option that won't get chosen should not change the split of surplus.

3.2.6 Example of a Bilateral Market



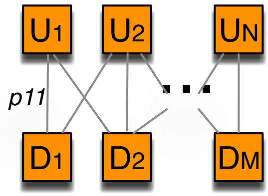
$$\pi^{TW}(D, HBO, S) = 1 \qquad \pi^{TW}(D) = 0.5$$
$$\pi^{TW}(D, S) = 0.9 \qquad \pi^{TW}(HBO) = 0.5$$
$$\pi^{TW}(D, HBO) = 0.8 \qquad \pi^{TW}(S) = 0.5$$
$$\pi^{TW}(HBO, S) = 0.8$$

Existing Literature: Who should make take-it or leave-it offers?

Suppose we want to evaluate the effects of a merger between all three upstream firms.

- Suppose that Downstream Firms (Time Warner Cable) Make take-it or leave-it offers.
  - Prices Before Merger
    $p^{HBO} = 0$, $p^S = 0$, $p^D = 0$.
  - Prices After Merger
    $p^{HBO} = 0$, $p^S = 0$, $p^D = 0$.
- Suppose that Upstream Firms (HBO, Showtime, Disney) Make take-it or leave-it offers.
  - Prices Before Merger
    $p^{HBO} = 0.1$, $p^S = 0.2$, $p^D = 0.2$ (Nash Equilibrium)
  - Prices After Merger
    $\sum p^{HBO} + p^S + p^D = 1$ (Price for the bundle of all channels), instead of $\sum p^{HBO} + p^S + p^D = 0.5$ bundle price before the merger.

"Work Horse" Model

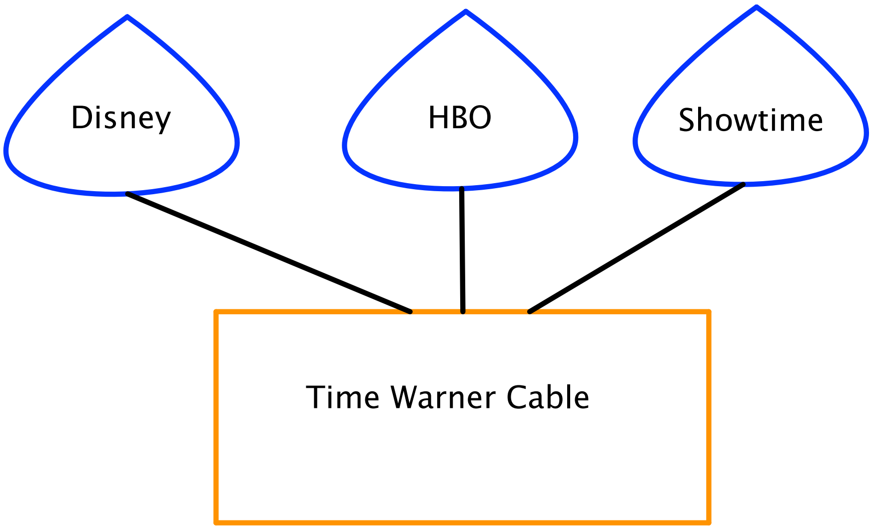


- N Upstream firms $U_1, \ldots, U_N$
- M Downstream firms $D_1, \ldots, D_M$.
- $\mathcal{G}$ is set of all agreements.
- Primitives: $\pi_i^U(\mathcal{A})$ and $\pi_j^D(\mathcal{A})$
  - for all $\mathcal{A} \subseteq \mathcal{G}$
  - Allows for externalities
- U_i and D_j bargain over p_{ij}

Horn Wolinsky (1988) (Generalized)

$$\begin{aligned} p_{ij}^N &= \arg\max_p [\pi_j^D(\mathcal{G}) - \pi_j^D(\mathcal{G} \setminus ij) - p]^{b_{j,D}} \times [\pi_i^U(\mathcal{G}) - \pi_i^U(\mathcal{G} \setminus ij) + p]^{b_{i,U}} \\ &= \frac{b_{i,U}\Delta\pi_j^D(\mathcal{G}, ij) - b_{j,D}\Delta\pi_i^U(\mathcal{G}, ij)}{b_{i,U} + b_{j,D}}, \forall i = 1, \ldots, N, j = 1, \ldots, M. \end{aligned}$$

Each price maximizes Nash product given other prices: hence "Nash-in-Nash bargains"



$$\begin{aligned} &\pi^{TW}(D, HBO, S) = 1 & \pi^{TW}(HBO, S) &= 0.8 \\ &\pi^{TW}(D, S) = 0.9 & \pi^{TW}(HBO) &= 0.5 \\ &\pi^{TW}(D, HBO) = 0.8 & \pi^{TW}(S) &= 0.5 \\ &\pi^{TW}(D) = 0.5 & & \end{aligned}$$

Effects of a Merger

- Say HBO and Disney merge. What is the effect on the prices that they receive?

$$\underbrace{MC}_{\text{marginal contribution}} = \pi^{TW}(D, HBO, S) - \pi^{TW}(S)$$
$$= 1 - 0.5 = 0.5$$

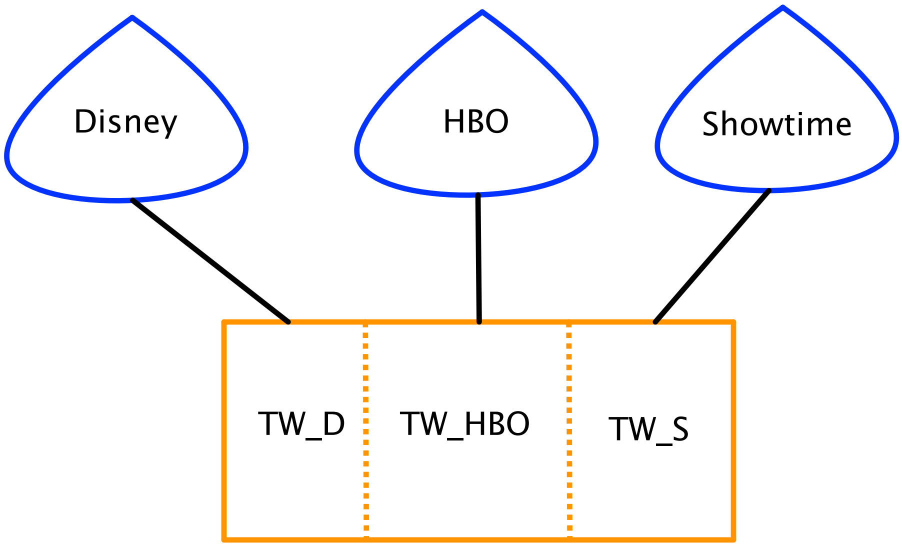
$$\underbrace{P^{\{D,HBO\}}}_{\text{price}} = \underbrace{\frac{1}{2}}_{\text{even surplus split}} \times 0.5 = 0.25$$

- Price without a merger:

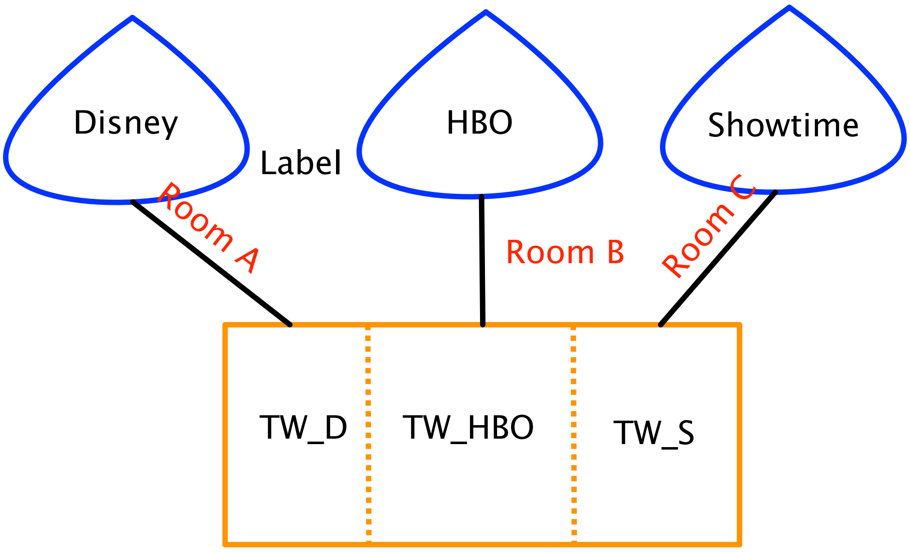
$$p^D + p^{HBO} = 0.05 + 0.10 = 0.15$$

3.3 Theory Background for Nash-in-Nash

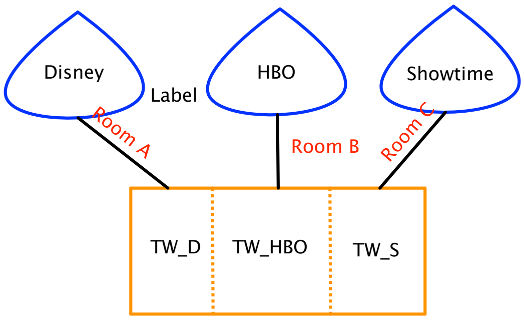
- Rubinstein (1982) — really aided by Binmore — proposes an alternating move game to give a non-cooperative foundation to Nash Bargaining (a cooperative game theory concept).
- Crawford and Yurukoglu (2012) propose the so called "schizophrenic" model to rationalize Nash-in-Nash outcomes.



Negotiation à la Rubinstein (1982), with each separate "self" (or agent) of Time Warner.



Negotiation à la Rubinstein (1982), with each separate "self" (or agent) of Time Warner.



<u>Room A:</u> Disney and Time Warner Negotiation

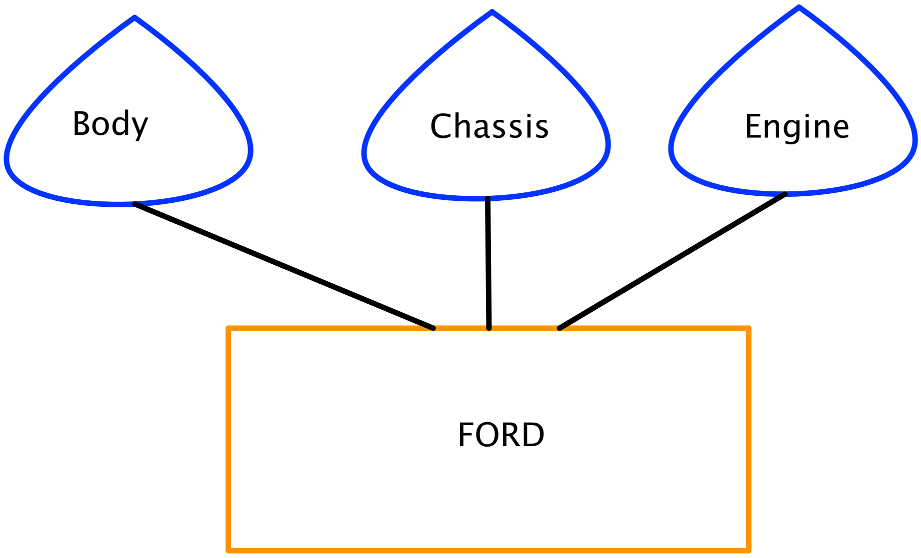
- Surplus if HBO and Showtime sign with Time Warner Cable

$$\begin{aligned} MC &= \pi(HBO, D, S) - \pi(HBO, S) \\ &= 1 - 0.8 = 0.2 \\ \rightarrow p_D^{NN} &= \frac{1}{2} \times 0.2 = 0.1 \end{aligned}$$

- Surplus if HBO and Showtime do not sign with Time Warner Cable

$$\begin{aligned} MC &= \pi(D) - \pi(\emptyset) \\ &= 0.5 - 0 = 0.5 \\ \rightarrow p_D^{NN} &= \frac{1}{2} \times 0.5 = 0.25 \end{aligned}$$

When does this break down?



$$\pi(B, C, E) = 1$$
$$\pi(B, C) = \pi(B, E) = \pi(C, E) = 0$$
$$\pi(B) = \pi(E) = \pi(C) = 0$$

- Collard-Wexler, Gowrisankaran, and Lee (2019) have a foundation for Nash-in-Nash Bargaining.
- The assumptions are essentially that links are substitutes rather than complements.

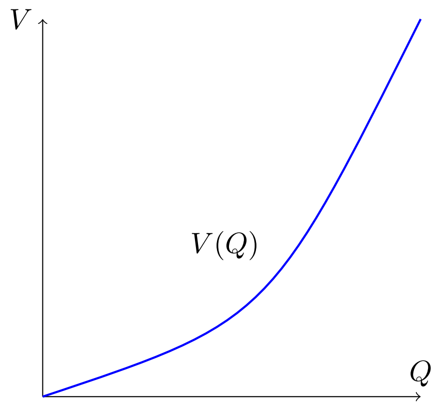
3.4 Buyer Size and Negotiated Contracts

3.4.1 Chipty and Snyder, Stole and Zwiebel

- Do mergers, or unions, raise or lower prices.
- Suppose the buyer has a valuation of $V(Q)$, where Q is quantity.
- Each Supplier can produce 1 unit, unless they merge, and have size X. They have marginal costs of c.
- Will larger suppliers get better prices?
- Prices are determined by:

$$p = \frac{b_S}{b_S + b_B}\left([V(Q) - V(Q-1)] - c\right)$$

Convex Value Function

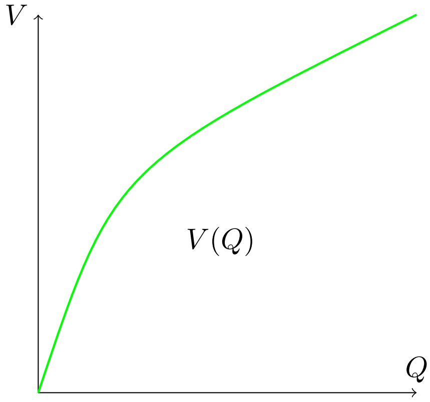


We will obtain:

$$\frac{V(\overline{Q}) - V(\overline{Q} - A)}{A} \leq \frac{V(\overline{Q}) - V(\overline{Q} - B)}{B}$$

for any $A \leq B$. This means that larger firms pay more,

Concave Value Function



We will obtain:

$$\frac{V(\overline{Q}) - V(\overline{Q} - A)}{A} \geq \frac{V(\overline{Q}) - V(\overline{Q} - B)}{B}$$

for any $A \geq B$. This means that larger firms pay more,

Evidence on the shape of $V(Q)$ from advertising

FIGURE 4.—SERIES ESTIMATION OF ADVERTISING REVENUE FUNCTION

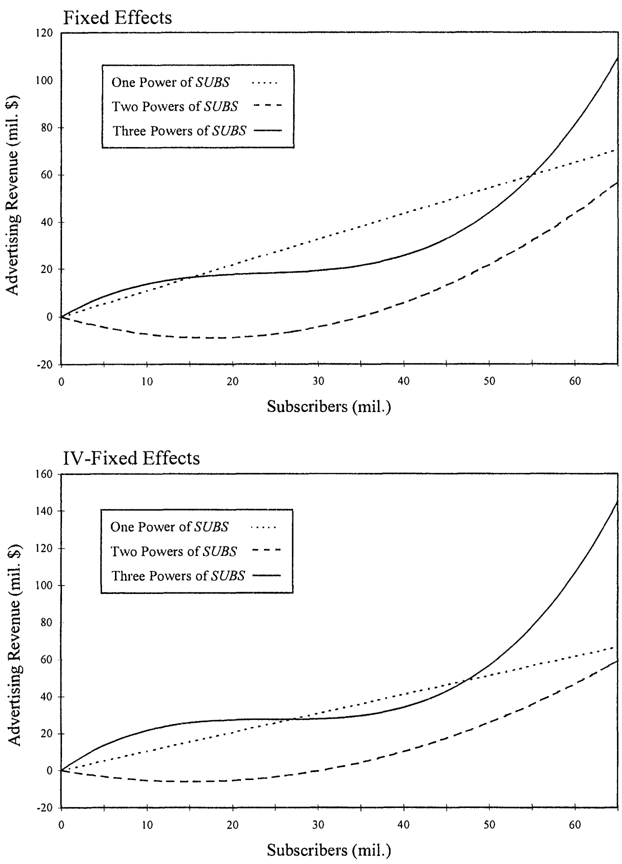


FIGURE 5.—CUBIC ADVERTISING REVENUE FUNCTION WITH CONFIDENCE SLEEVE