Vertical markets

Vertical markets

Vertical Relations

Production and distribution chains are often made up of different firms. Manufacturers (upstream firms) rarely supply final consumers directly. Retailers (downstream firms) often make important decisions regarding the product.

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

Vertical markets

Vertical Relations

Why don't firms always vertically integrate?

Costs to VI:

- As firm size and scope increases, becomes harder to manage
- Explicit transaction costs to vertical mergers (lawyer and investment banker fees, regulatory constraints)

Vertical markets

Vertical Relations

Why do firms sometimes vertically integrate?

Non-integrated vertical partner does not always have the incentive to do what is best for the vertical coalition. Integration is a way to get around this "misalignment of incentives" problem.

Caution: most of the time, however, integration is a costly alternative to well-written contracts.

Vertical markets

Example of incentive misalignment #1: Hold up

Canonical "Hold-Up" Problem

Whenever firms in a production chain have to make relationship-specific investments that can not be completely contracted on, a possibility for investment "hold-up" arises.

- Upstream firm's production cost depends on investment: $c(I)$, where $c'(I) < 0$ and $c''(I) > 0$
- Investment costs I dollars per unit
- Downstream sells good to consumers at $v > c(I)$.

Vertical markets

Example of incentive misalignment #1: Hold up

- Game:
  1. Stage 1:
     - Upstream firm makes investment choice
     - Upstream firm makes product;
  2. Stage 2:
     - Downstream firm sells at v.
     - Set unit input payment from Downstream to Upstream firm $p(I)$, so that profits are split evenly.

Vertical markets

Example of incentive misalignment #1: Hold up

- Second stage of game, profits split evenly:

$$v - p(I) = p(I) - c(I)$$

$$p(I) = \frac{v + c(I)}{2}$$

Vertical markets

Example of incentive misalignment #1: Hold up

- First stage of game, upstream firm's investment decision

$$\max_I p(I) - c(I) - I = \max_I \frac{v - c(I)}{2} - I$$

- FOC: $-c'(I) = 2$ (recall $c' < 0$, as investment decreases costs)
- But the optimization problem of an integrated firm would have been different

$$\max_i (v - c(I) - I)$$

- FOC: $-c'(I) = 1$.
- Since $c' < 0$, $c'' > 0$, this means that the upstream firm makes too little investment compared to integrated firm.

Vertical markets

Vertical Relations

- Since $c' < 0$, $c'' > 0$, this means that the upstream firm makes too little investment compared to integrated firm.
- Intuition: upstream firm gets only \$0.50 benefit for every \$1 it spends on relationship specific investment.
- One solution: integration.

Vertical markets

Vertical Relations

In general, the activities of the downstream firms may affect the profits of the upstream firm. Two possible solutions to this (some subject to legal constraints):

- Vertical integration
- Contracts and other vertical restraints

At a deeper level, though, what is the difference between writing contracts with the manager/employees of the "downstream," as opposed to writing contracts across firm boundaries?

...no settled answer exists

Vertical markets

Vertical Relations

Let's focus on "contracting solutions" from now on. Main message is:

"One can cut through many possible inefficiencies and conflicts-of-interest through the use of well thought-out contracts."

Of course, this is conditional on the enforceability of those contracts.

Vertical markets

Vertical Relations

Types of contracts/vertical restraints used by firms in vertically-separated markets:

- "Transactional" restraints/contracts:
  - Franchise fees
  - Profit/revenue sharing arrangements
  - Resale Price Maintenance
  - Quantity forcing/quantity rationing
  - Full-line forcing
- "Organizational" restraints
  - Exclusive Territories
  - Exclusive Dealing

Vertical markets

Example of incentive misalignment #2: Double Marginalization

Basic Problem of Vertical Markets:

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 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.

Vertical markets

Example of incentive misalignment #2: Double Marginalization

Timing:

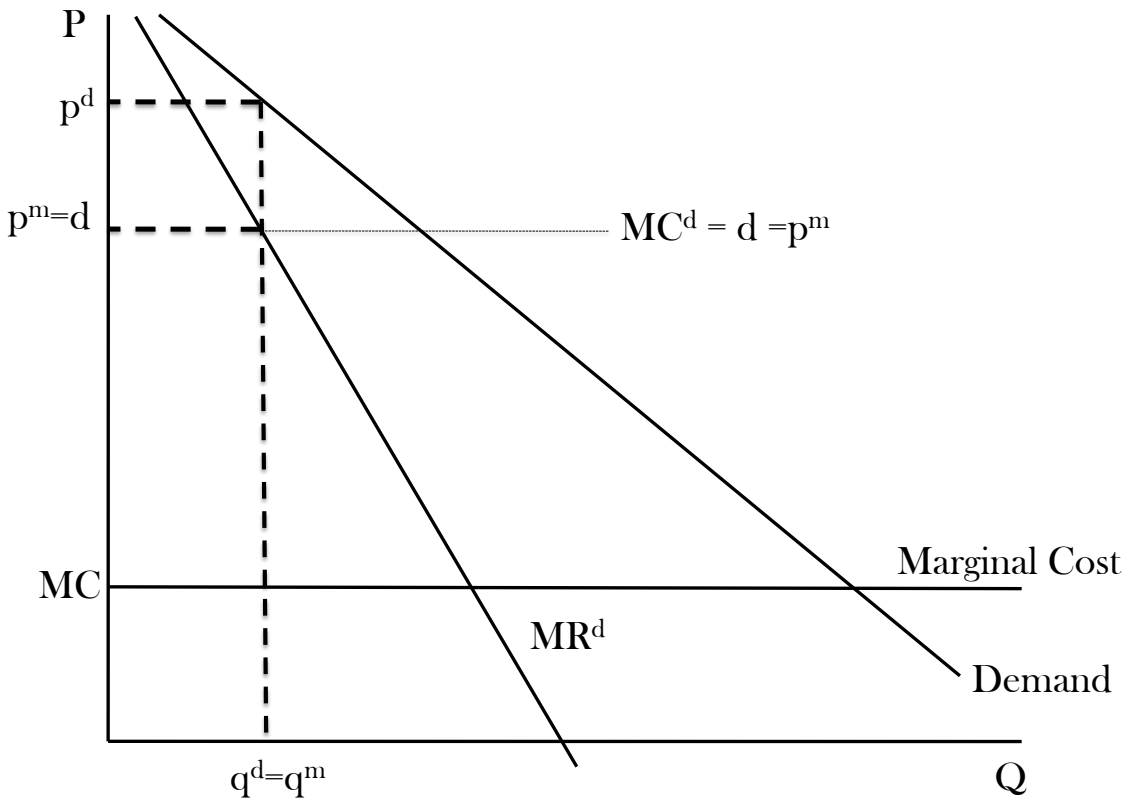
1. Stage 1:
   - Upstream firm sets the wholesale price d
2. Stage 2:
   - Downstream firm sets the retail price p, given wholesale price d
   - Sales are made and profits realized

Equilibrium concept is Subgame Perfect Nash Equilibrium

Vertical markets

Example of incentive misalignment #2: Double Marginalization

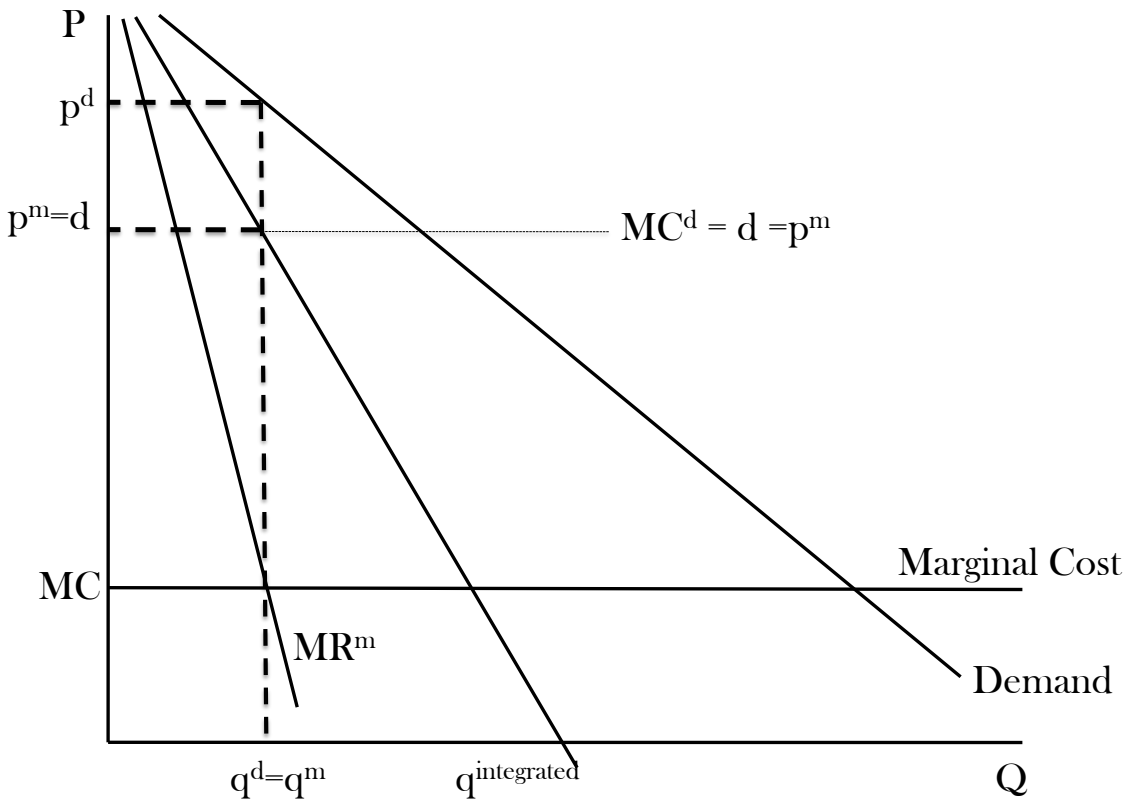
Figure: Double Marginalization: The Diagram



Vertical markets

Example of incentive misalignment #2: Double Marginalization

Figure: Double Marginalization: The Diagram



Vertical markets

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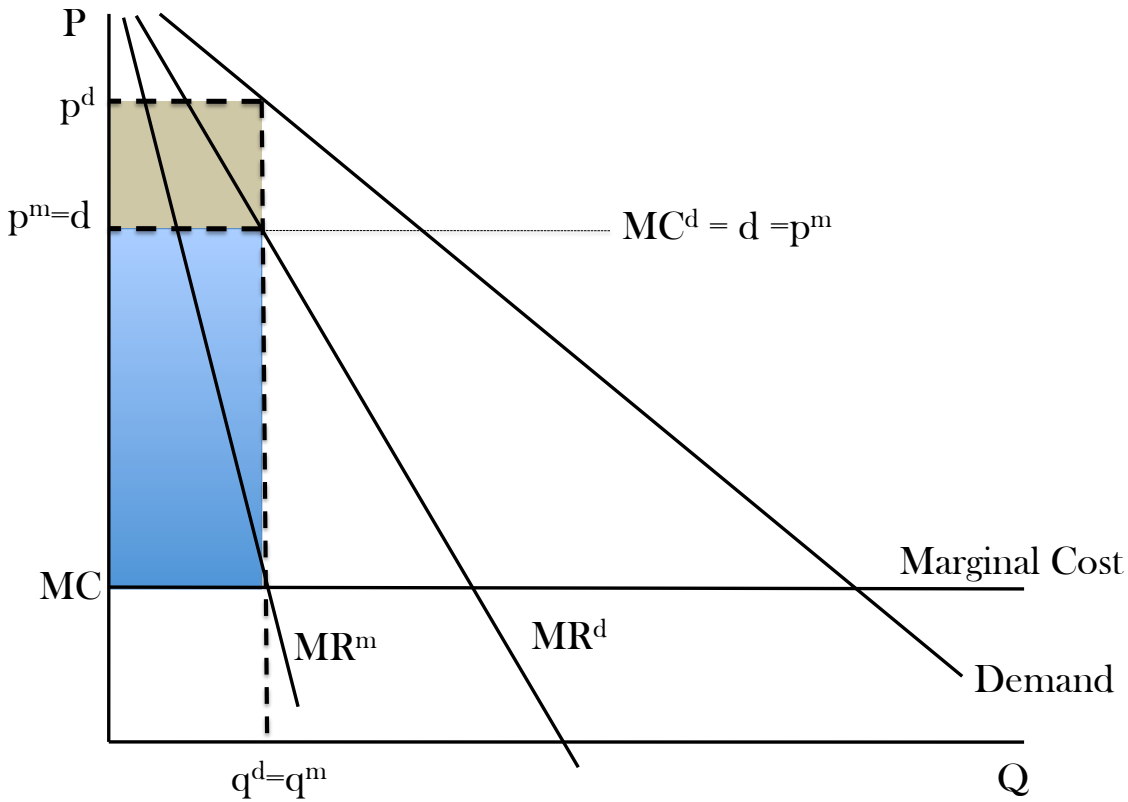

Vertical markets

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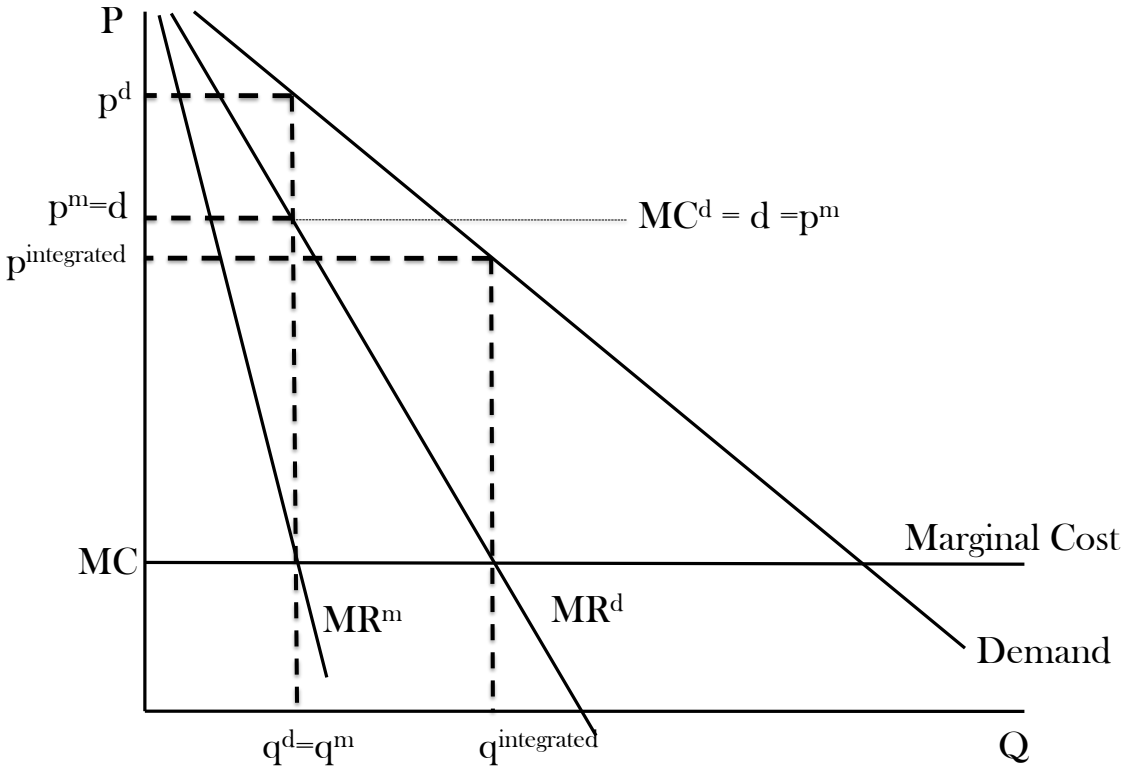

Vertical markets

Example of incentive misalignment #2: Double Marginalization

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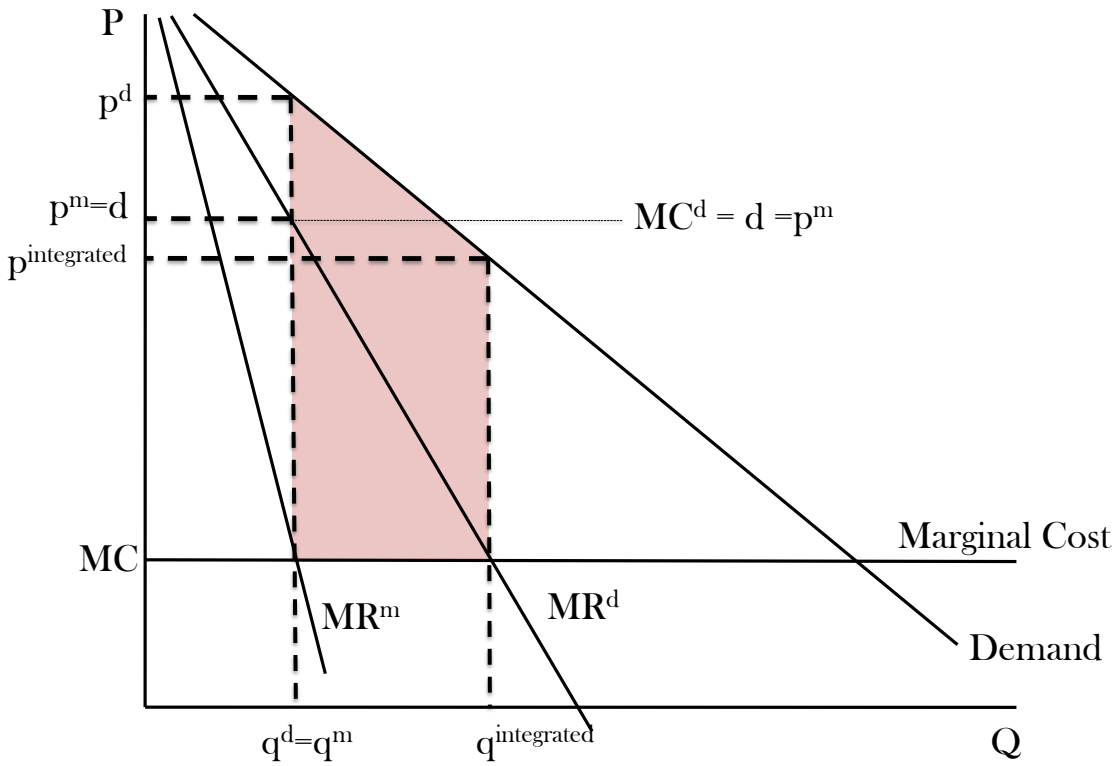


Vertical markets

Double Marginalization: Stage 2 solution

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?

Vertical markets

Double Marginalization: Stage 1 solution

Manufacturer maximizes profit given by

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

F.O.C.:

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

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

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

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

Vertical markets

Example of incentive misalignment #2: Double Marginalization

Results:

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

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

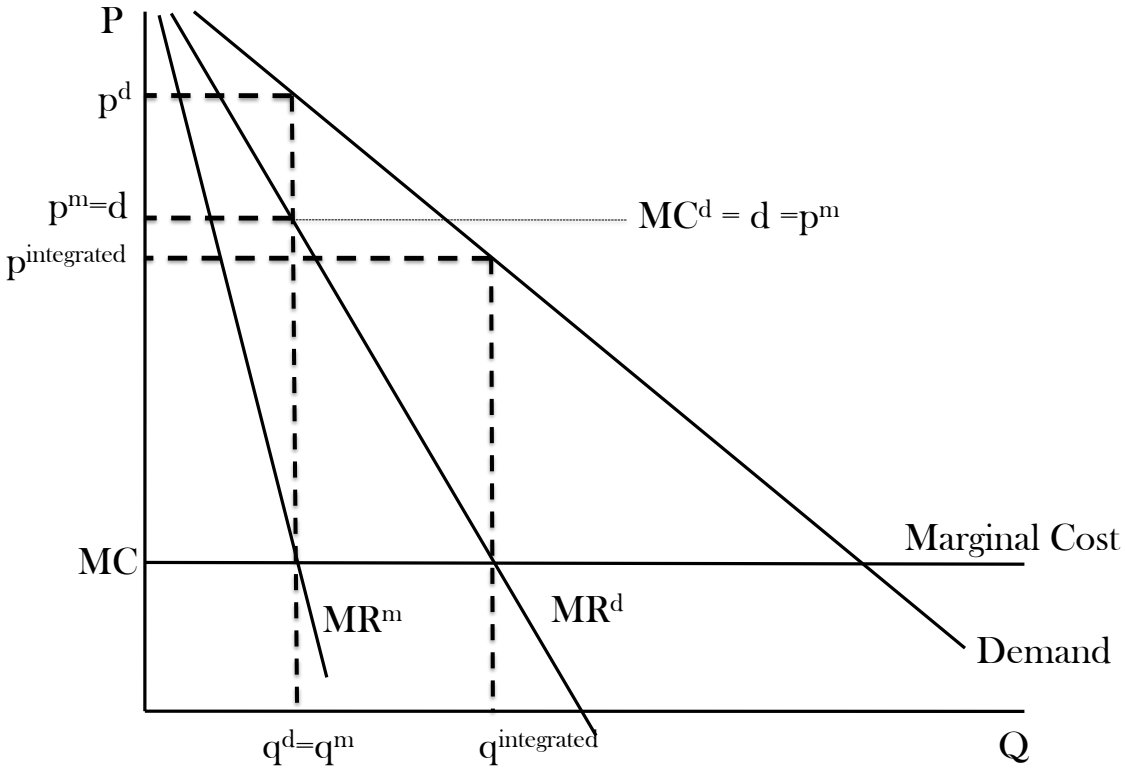
The presence of two markups causes this distortion. This basic fact is called:

double-monopoly markup problem, successive monopolies problem, or **double marginalization**.

Vertical markets

Example of incentive misalignment #2: Double Marginalization

Figure: Double Marginalization: The Diagram



Vertical markets

Double Marginalization: Solutions: Franchise fees

How to solve this:

Franchise fee:

Set franchise fee $\phi = \frac{(a-c)^2}{4}$, and a unit price of $d = c$ to dealer.

Manufacturer completely internalizes monopoly profit! (like 1st degree PD)

Some problems with this:

Vertical markets

Double Marginalization: Problems w. franchise fees

Some problems with this:

- In the case where demand is uncertain, retailer absorbs all risk. Giving the retailer a discount on franchise fee, but charging a price above c may provide some insurance, but introduces some "agency" problem.
  - One can think of uncertainty case with franchise fee and & marginal cost pricing as the pure profit-sharing case.
  - The insurance motive, in effect, leads to partial "profit sharing" between manufacturer and retailer.

Vertical markets

Double Marginalization: Problems w. franchise fees

Some more problems with this:

- Retailer may have private info about true demand for product (a), and it might be tough for manufacturer to set correct franchise fee. One solution: offer a "menu" of franchise contracts to induce correct self-selection. This will still leave some information rents to retailer, but will improve upon having a single contract. (like 2nd degree PD)
- If there are multiple retailers, setting $d = c$ may not result in correct incentives. Think about Cournot competition between N downstream firms: will charging $d = c$ and $\phi = \frac{(a-c)^2}{4N}$ give monopoly profits to manufacturer? What about setting $\phi = \frac{\pi^C}{N}$?
- What if there are multiple manufacturers and a single dealer?

Vertical markets

RPM

Another solution to double margin problem: Resale Price Maintenance (RPM):

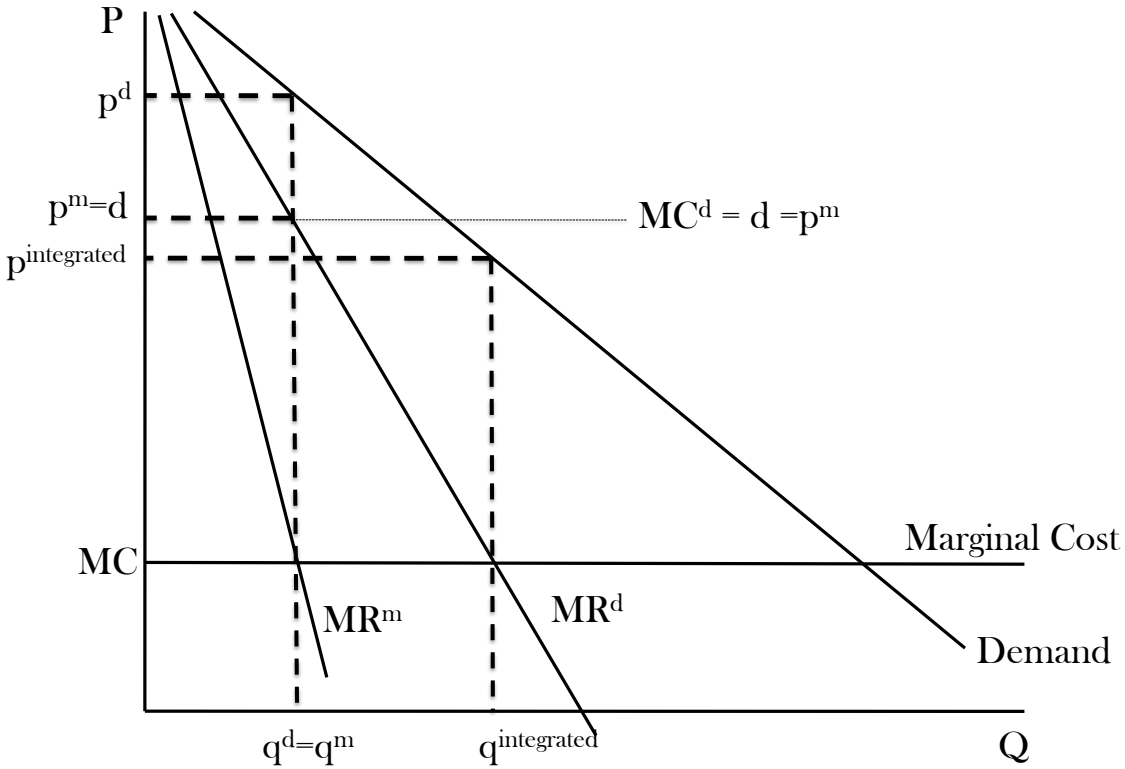
RPM requires retailers to maintain a minimum price (min RPM), a maximum price (max RPM), or a fixed price (point RPM). Two goals:

1. Partially solve the double marginalization problem (max or point RPM)
2. Can induce dealers or retailers to allocate resources for promoting the product, or exerting other forms of effort in distributing the product. (min or point RPM)

Vertical markets

Example of incentive misalignment #2: Double Marginalization

Figure: Double Marginalization: The Diagram



MinRPM and service/sales effort/advertising

Consider the example of promotions or advertising. Assume (inverse) demand is given by

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

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

Result 1: For any given d, no dealer will engage in advertising and demand will shrink to zero, with no sales.

Vertical markets

Sales effort & RPM

Result 1: For any given d, no dealer will engage in advertising and demand will shrink to zero, with no sales.

Why?

Firms compete in price, and they sell a homogeneous product. What does p equal in this case? What is profit?

Vertical markets

Sales effort & RPM

How can Resale Price Maintenance solve this?

Minimum Resale Price Maintenance: $p = p^{RPM} \geq d$
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:

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

Vertical markets

Sales effort & RPM

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

F.O.C. wrt A:

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

Note that we can only identify the sum of $A_1 + A_2$ and not A_1 and A_2 individually (although if we restrict ourselves to a symmetric Nash equilibrium we can). 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.

Vertical markets

Sales effort & RPM

Symmetric Nash:

F.O.C. wrt A:

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

$$0 = \frac{p^f - d}{4\sqrt{2A}} - 1$$

$$4\sqrt{2A} = p^f - d$$

$$A = \frac{1}{2}\left(\frac{p^f - d}{4}\right)^2$$

Vertical markets

Exclusive territories

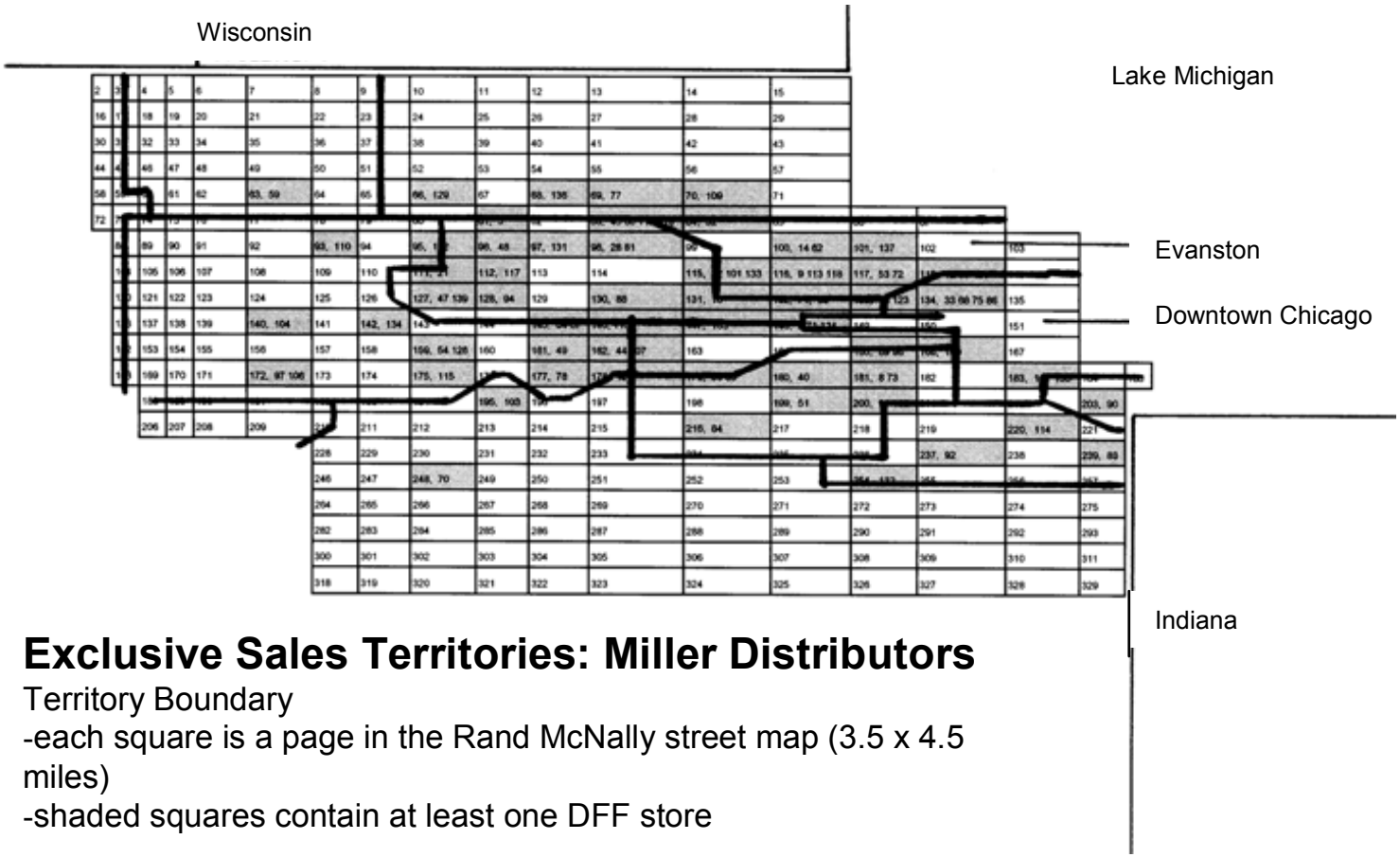
Note that one problem in the last example was that competition between the retailers initially resulted in too much competition downstream, so that firms could not afford to advertise as a vertically-integrated firm would choose to do.

This erodes the incentive to give service: i.e. likely too much intra-brand competition and too little inter-brand competition

One way around that: Exclusive Territories or "Territorial Dealerships"

Vertical markets

Exclusive territories: Miller and Chicago Beer Distribution



Exclusive Sales Territories: Miller Distributors

Territory Boundary

-each square is a page in the Rand McNally street map (3.5 x 4.5 miles)

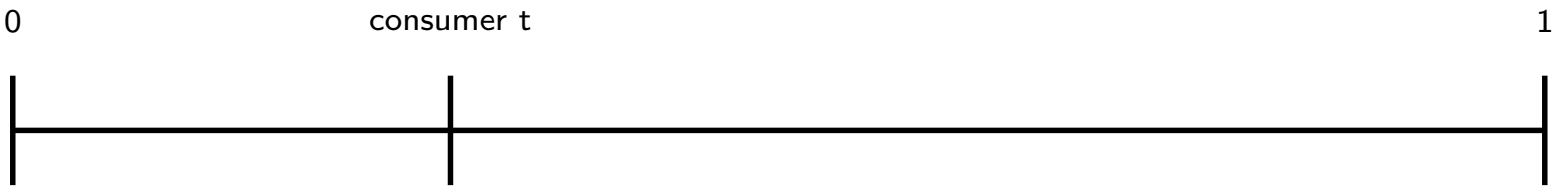
-shaded squares contain at least one DFF store

Vertical markets

Exclusive territories: Simple Model

Simple Model of Exclusive Territories:

- Consumers are uniformly distributed on the unit interval (so t lie to the left of consumer t, and $(1-t)$ lie to the right)



- Retailers are located at the ends of the interval (at 0 and 1). They are denoted R_L and R_R for left and right.
- To reach a retailers, consumers must pay a transport cost, t, equal to their distance from the retailer.

Vertical markets

Exclusive territories: Simple Model

- Consumers valuation for the good is:
  - V, if no service is provided
  - $V + \alpha F$ if service is provided by one retailer ($\alpha > 2$)
  - $V + 2\alpha F$ if service is provided by both retailers ($\alpha > 2$)
- assume $V > 2$

- Service is provided by a retailer at a fixed cost of F.

Vertical markets

Exclusive territories: Simple Model

Timing of the game (without exclusive territories)

1. Manufacturer sets a franchise fee equal to D, (there is no per-unit wholesale price).
2. Retailers choose their service levels. I.e. do they sink the fixed cost F
3. Retailers set retail prices P_L and P_R, observing the service level
4. Purchases are made and profits realised

Vertical markets

Exclusive territories: Simple Model

Steps in solving this style of model:

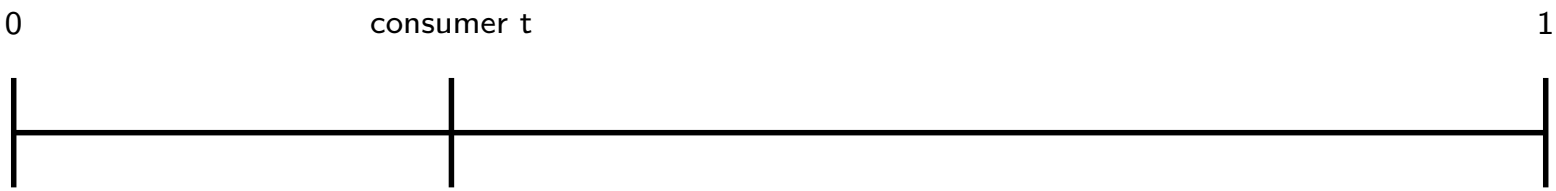
1. Work out what demand is for a given set of retail prices and service
2. Work out what profit is for a given set of retail prices, d and service
3. Solve for the nash equilibrium in retailer prices, given service
4. Examine what the incentives for providing service are
5. Look to see what d is in manufacturers best interest

Vertical markets

Exclusive territories: Simple Model

Step 1: Working out what demand looks like:

- Consumers are uniformly distributed on the unit interval (so t lie to the left of consumer t, and $(1-t)$ lie to the right)



- There will be some consumer, at some unknown point t, who is indifferent between R_L and R_R. For this consumer

$$V + \alpha F_L + \alpha F_R - P_L - t = V + \alpha F_L + \alpha F_R - P_R - (1-t)$$

Note, F_L and F_R will be equal to zero if no service. Solve for t to get:

$$t = \frac{P_R - P_L + 1}{2}$$

Step 1: Working out what demand looks like:
So the demand for R_L is all consumer to the left of t

$$D_L(p_L, p_R) = t = \frac{p_R - p_L + 1}{2}$$

Demand for R_R is all consumers to the right of t, that is:

$$D_R(p_R, p_L) = (1 - t) = \frac{p_L - p_R + 1}{2}$$

Technical point: if prices are too far apart, one retailer will get the entire market.

Vertical markets

Exclusive territories: Simple Model

Step 2: Working out profits:

- if a retailer does not engage in service profits are $(i, j \in \{L, R\},\ i \neq j)$

$$\pi_i = \frac{1}{2}\left(p_j - p_i + 1\right) p_i - D$$

- if a retailer does engage in service profits are

$$\pi_i = \frac{1}{2}\left(p_j - p_i + 1\right) p_i - D - F$$

- in either case, FOC wrt p_i is

$$p_j - 2p_i + 1 = 0$$

$$\text{Hence, } p_i = \frac{(p_j + 1)}{2}$$

Step 3: Work out the price equilibrium

- The best response function is

$$p_i = \frac{(p_j + 1)}{2}$$

- (note that the differentiation due to different locations removes the discontinuity in the classic bertrand model, hence we can use calculus...)
- If we look for the symmetric nash equilibrium in prices, set $p_i = p_j = p$ and get

$$p = 1$$

Vertical markets

Exclusive territories: Simple Model

Step 3: Work out the price equilibrium

- This means that profits are

$$\pi = \text{demand} \times (\text{price}) - D(-F \text{ if service provided})$$

- which, in symmetric price equilibrium is

$$\pi = \frac{1}{2} \times 1 - D(-F \text{ if service provided})$$

- so, if service is provided, profit is:

$$\pi^{service} = \frac{1}{2} - D - F$$

- and, if no service is provided, profit is:

$$\pi^{noservice} = \frac{1}{2} - D$$

Vertical markets

Exclusive territories: Simple Model

Step 4: Work out the incentives for service provision

- Clearly, no retailer has any incentive to provide service

Vertical markets

Exclusive territories: Simple Model

Step 5: What D will the manufacturer set?

- D will be set to extract all the surplus from the retailers, so $D = \frac{1}{2}$

Vertical markets

Exclusive territories: Simple Model

Can the manufacturer do better by adding vertical restraints?

- Often, yes. For instance, a problem is that no service is being done, despite the fact that it generates more benefit to consumers than it costs to do... If the manufacturer can capture this benefit then that is a chance to make more profit.
- The source of this lack of incentive to invest is that intra-brand competition means the retailers cannot internalise the benefit from it.
- One solution is to give each retailer a territory in which they are the exclusive seller. For instance, split the interval down the middle, so R_L get s all consumers $\in 0, \frac{1}{2}$ and R_R gets the rest.

Vertical markets

Exclusive territories: Simple Model

Can the manufacturer do better by adding vertical restraints?

- if these ET's are set, since $V > 2$ the best price for a dealer is $V + \alpha F_L + \alpha F_R - \frac{1}{2}$ - that is, to serve the entire exclusive market. (check by setting MR= MC).
- Hence, retailers can cover the cost of service, and the manufacturer can charge a higher franchise fee.

You should make sure you can derive these conclusions (it is required in a problem set). This illustrates how exclusive territories can help dampen intra-brand competition so as to enhance service.

Vertical markets

Vertical relations: Legal issues

Legal Issues:

There are a lot of ambiguities in legal treatment of vertical contracts. Key issue is that these restrictions can inhibit competition, but also enhance incentives for customer service.

- Until 1977 E. Territories were *per se* illegal under Sherman Act. US Supreme court changed standard to rule of reason in *Sylvania*
- Until 2007 RPM was *per se* under federal law, subject to many exceptions, US Supreme court changed standard to rule of reason in *Leegin*
- State law treatments vary, and worth having a lawyer examine contracts, especially if a firm has market power.

Vertical markets

Vertical relations: Legal issues

Anti-competitive issues

- vertical arrangements at times alleged to facilitate collusion (e.g. ET can look like market division, RPM can look like price fixing)
- can also be alleged to lead to exclusion of rivals (e.g. exclusivity contracts)