Lecture 1: Introduction, and Review of Basic IO Theory Market Structure Models *

The purpose of this lecture is to give a map of the IO theory literature. It will be very fast and non-technical.

What I m assuming is that you have seen bits of it before. My objective is to give you some sense of what is out there and the issues covered in the basic IO cannon, so you can go into Tirole or the literature and find the bits you need when you need them.

Also, I want to make sure we have some shared vocabulary.

So this should feel like fast revision.

*Co-Written with John Asker using Julie Mortimer's Note

I. Introduction

A definition of industrial organization:

"Industrial organization is concerned with the workings of markets and industries, in particular the way firms compete with each other."

There are two branches of I.O.

- Theories of Markets and Market Structure. This branch treats the firm as a black box and focuses on how firms compete with each other.

- Theories of the Firm. (what the rest of the theory lectures are about) This branch investigates why some transactions are conducted through markets while others are conducted within a firm. Attempts to look inside the black box and explain things like firm size, the boundaries of the firm, and incentive schemes within the firm.

II. A Brief History of Industrial Organization

1. Harvard Tradition (1940 - 1960; Joe Bain)

- Structure-Conduct-Performance
- Structure (i.e., how sellers interact with each other, buyers, and potential entrants) is a function of number of firms, technology, existing constraints, products...
- Conduct (i.e., how firms behave in a given market structure) includes price setting, competition, advertising...
- Performance (i.e., technological efficiency, social efficiency, dynamic efficiency) includes consumer surplus, optimal variety, profits, social welfare...
- Empirically, use OLS regressions to identify correlations (i.e., industry profit = f(concentration))
- Argued that high concentration was bad for consumers, and paved the way for much antitrust legislation
- Main weakness: assumption that market structure is exogenous

2. Chicago School (1960 - 1980; Robert Bork esp. "The Antitrust Paradox")

- Firms become big for particular reasons
- Emphasis on price theory (markets work)
- More careful application of econometric techniques
- Use different market structures to understand different industry settings or markets
- Monopoly is much more often alleged than confirmed; entry (or just the threat of entry) is important
- When monopoly does exist, it is often transitory

3. Game Theory (1980 - 1990)

- Emphasis on strategic decision making
- Modeled mathematrically using Nash equilibrium concept
- Produces a huge proliferation of models which are often very intuitive theoretically
- However, it is difficult to know which model is the right one for a real world industry

4. New Empirical I.O. (1990 -)

- Combines theory and econometrics in a serious way
- Sophisticated, computationally intense, complex empirical models
- Not all I.O. economists think this way or use the same methods
- This view of the world is constantly evolving

IMPORTANTLY: Current issue of, say, RAND, will have papers some of which are NEIO style, some of which are very Game Theoretic and others which just try to understand how markets work...

Industrial Organisation Journal Rankings

- Top 5 Economics Journals [AER, Econometrica, JPE, QJE, ReSTud]
- RAND Journal of Economics
- Journal of Industrial Econ., Int.J.I.O., J. Econ. and Mgmt Srategy.
- Review of I.O., J. Law and Econ., J. Reg. Econ, Antitrust Bulletin, Management Science

Contemporary Issues in I.O.

- Entry and exit
- Merger analysis
- Product choice: characteristics and location
- Retail Markets
- Price discrimination
- The role of information and monitoring technologies
- Advertising
- Learning-by-doing
- Technological innovation
- R & D spillovers
- Regulation

noncooperative behavior can be modeled either where all firms choose their strategic variables price) once and at the same time, or dynamically, in sequence. Whether firms move simultaneously, in sequence, firms choose either prices (Bertrand) Cournot).

structure that economists tend to focus on as- aged in a repeated interaction of a simultaneous- That is, in each period, each firm chooses its tion set after observing what actions have been . The upward arrow in Figure II.1 hints that a ome of an infinitely repeated oligopoly game is ay their collusive (cooperative) actions (output

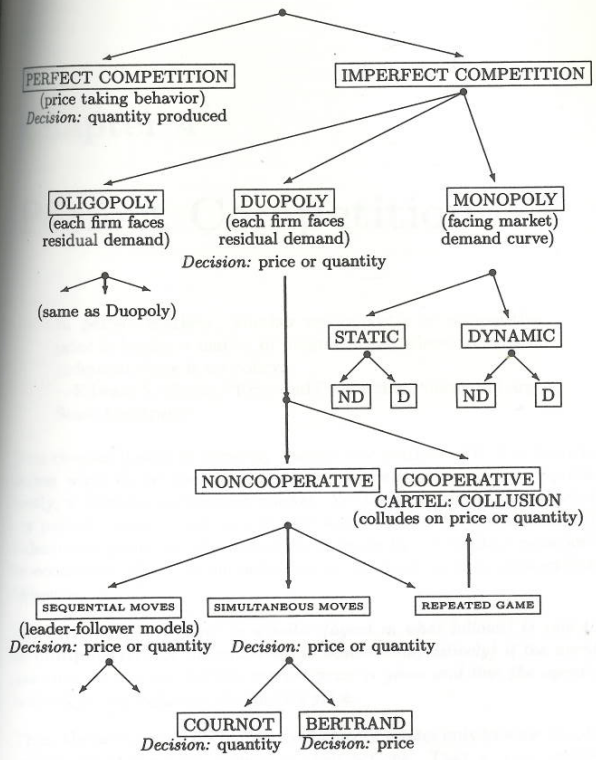
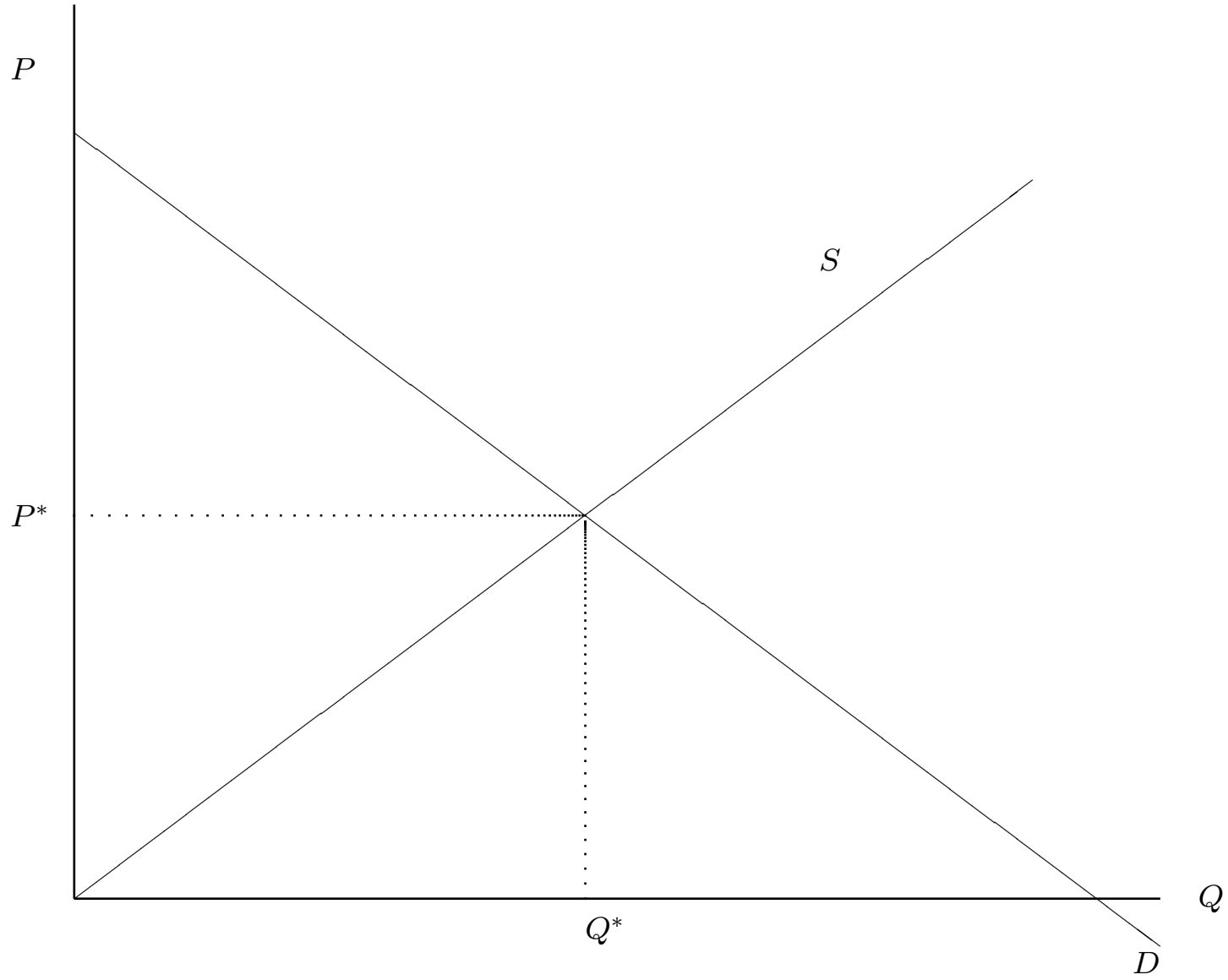


Figure II.1: Commonly assumed and used market structures.
(*Note:* D=discriminating, ND=nondiscriminating)

III. Perfect Competition Often used as a benchmark. As a benchmark, it is very convenient, but one does not often believe the assumptions of perfect competition in reality.

Definition: An agent is said to be competitive if she assumes or believes that the market price is given and that her actions do not influence the market price.



(P^*, Q^*) is market clearing price and quantity.

Welfare and Perfect Competition: Under perfect competition, the first-best outcome is achieved. When you are thinking about evaluating a paper, the question of what is the first-best outcome should be paramount in your minds. Is there *Allocative Inefficiency*, i.e. do the people with the highest valuations get the good? Moreover, is the right quantity produced in the market?

Examples: Small Business Preference Programs create both allocative inefficiency and quantity distortions. Lack of a Carbon Tax may create quantity distortion.

An Important Feature of Perfect Competition: Under perfect competition, a firm can not affect the price it faces. Thus, there are no strategic interactions between firms. Another way of putting this is that each firm's residual demand curve is flat. This is what we mean when we say a firm is a price taker, and it implies that the firm's marginal revenue equals the price.

$$MR = P$$

This is an important characteristic of perfect competition. It is not true for any form of imperfect competition (monopoly, duopoly or oligopoly).

Importantly, the assumption of perfect competition does not imply anything about large numbers of firms. Some market structures imply that price converges to the competitive price as the number of firms gets large. Nevertheless, this is independent of the definition of perfectly competitive behavior.

Note: Re Perfect Competition

With locally increasing returns to scale there may be no market clearing price in perfect competition (depends on demand conditions). Hence ‘Natural Monoply’

More on this later.

Some other micro basics: Price elasticity of demand

The percentage change in demand that results from a one percent change in price:

$$|\epsilon_d| = \frac{\%\Delta Q}{\%\Delta P} = \frac{\Delta Q/Q}{\Delta P/P} = \frac{P/Q}{\Delta P/\Delta Q} = \frac{dQ}{dP} \cdot \frac{P}{Q}$$

$\epsilon_d > 1 \rightarrow$ elastic, $\epsilon_d = 1 \rightarrow$ unit elastic
$\epsilon_d < 1 \rightarrow$ inelastic

Of course, this is the market demand, not the residual demand facing an individual firm if the number of firms (N) is greater than one.

When writing up quantitative results, try to figure out if you can express these as elasticities, rather than a number like 23.23.

Lecture 2: Monopoly

Definition: A firm is a monopoly if it is the **only** supplier of a product in a market.
A monopolist's demand curve slopes down because firm demand equals industry demand.

Four cases:
1. Base Case (One price, perishable good, non-IRS Costs).
2. Natural Monopoly
3. Price Discrimination
4. Durable Goods

BASE CASE

Monopolist's Profit Maximization Problem:

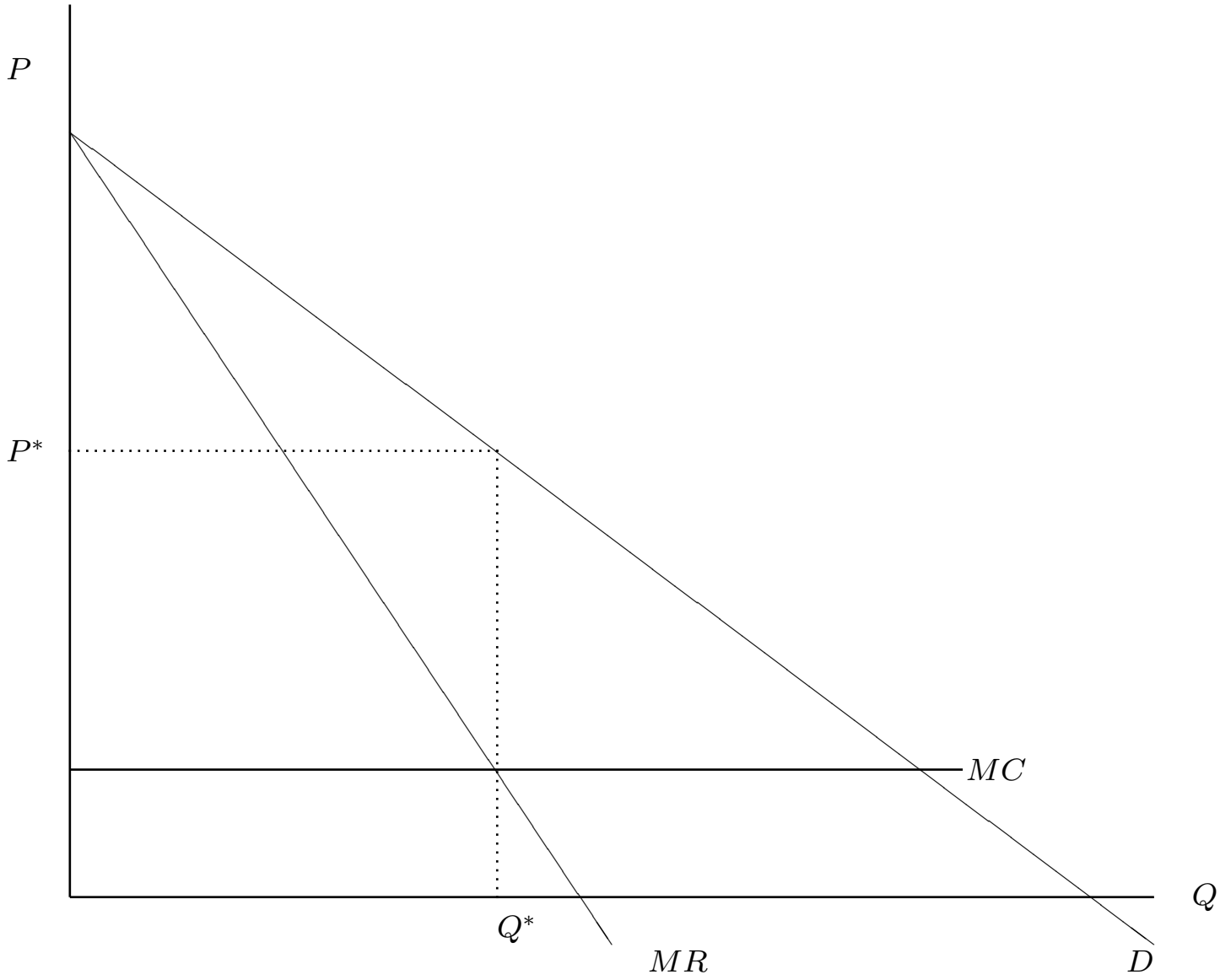
$$\max_{Q} \Pi = p(Q)Q - C(Q)$$

(Choosing P or Q makes no difference because we are selecting a single point on the demand curve. This will not be true when we consider oligopoly problems.) F.O.C. are:

$$\frac{d\Pi}{dQ} = P(Q) + Q\frac{dP}{dQ} - \frac{dC}{dQ} = 0$$

$$\rightarrow P(Q) + Q\frac{dP}{dQ} = \frac{dC}{dQ}$$

$$\rightarrow MR = MC$$



(P^*, Q^*) is profit-maximizing choice.

The monopolist chooses output such that the markup equals the inverse of the elasticity of demand:

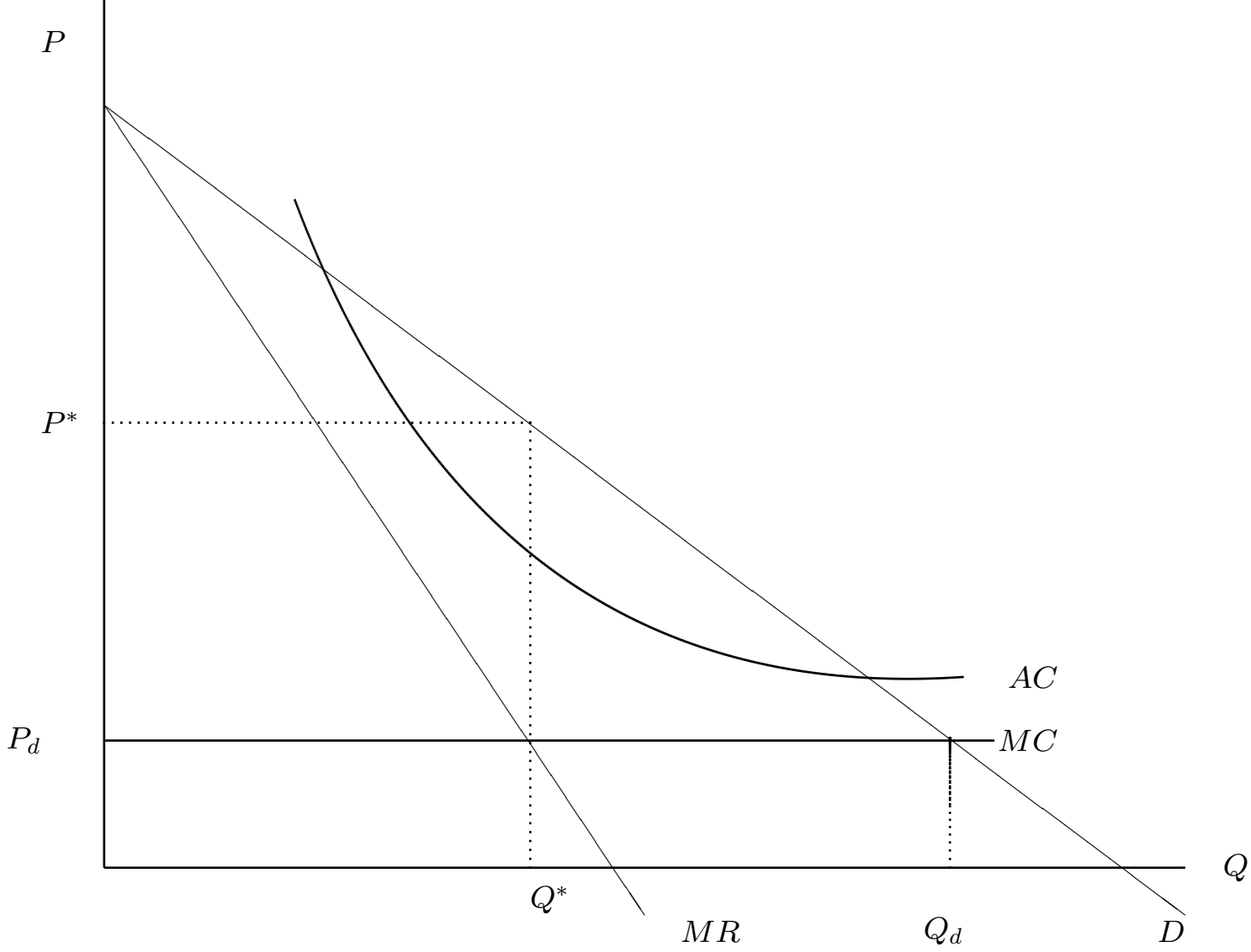
$$\begin{aligned}\frac{P(Q) - \frac{dC(Q)}{dQ}}{P(Q)} &= \frac{-Q\frac{dP(Q)}{dQ}}{P(Q)} \\ &= \frac{-Q}{P}\frac{dP(Q)}{dQ} \\ &= \frac{1}{|\epsilon_d|} > 0\end{aligned}$$

Dead Weight Loss exists because $P > MC$.

2. Natural Monopoly

Definition: Declining average cost over all meaningful quantities. The most efficient outcome is for a single firm to produce all output.

Note: IRS is sufficient but not necessary for a natural monopoly.



Natural Monopoly

Definition of natural monopoly: declining average cost over all meaningful quantities. The most efficient outcome is for a single firm to produce all output. (For example, public utilities)

Monopoly will maximize profits at (P^*, Q^*). (P_d, Q_d) are welfare maximizing, but a firm would make a loss in this case.

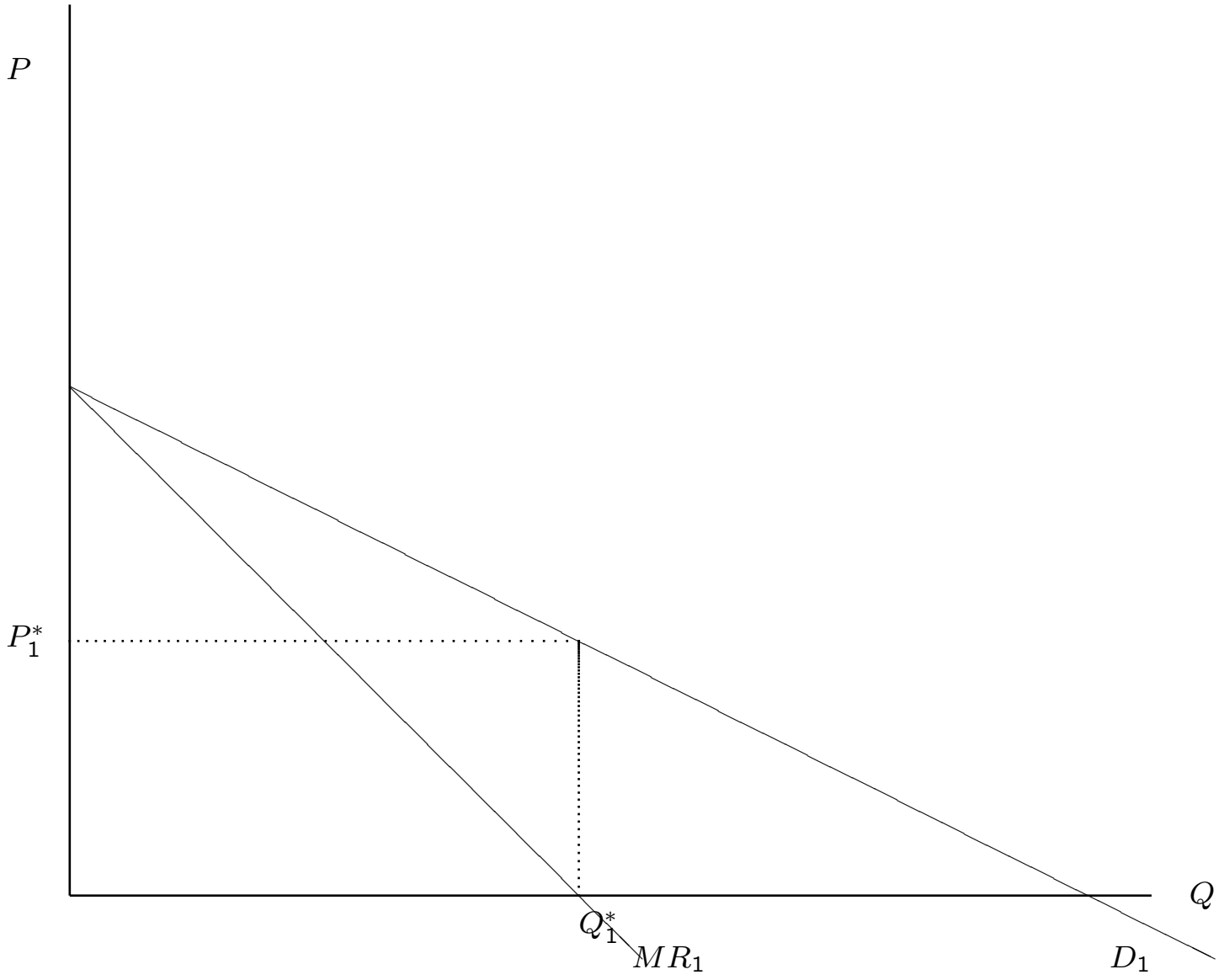
Raises the question of the first best regulation for a natural monopoly. Extensive literature on this that may touch on in assymetric information / adverse selection section.

3. Price Discrimination:

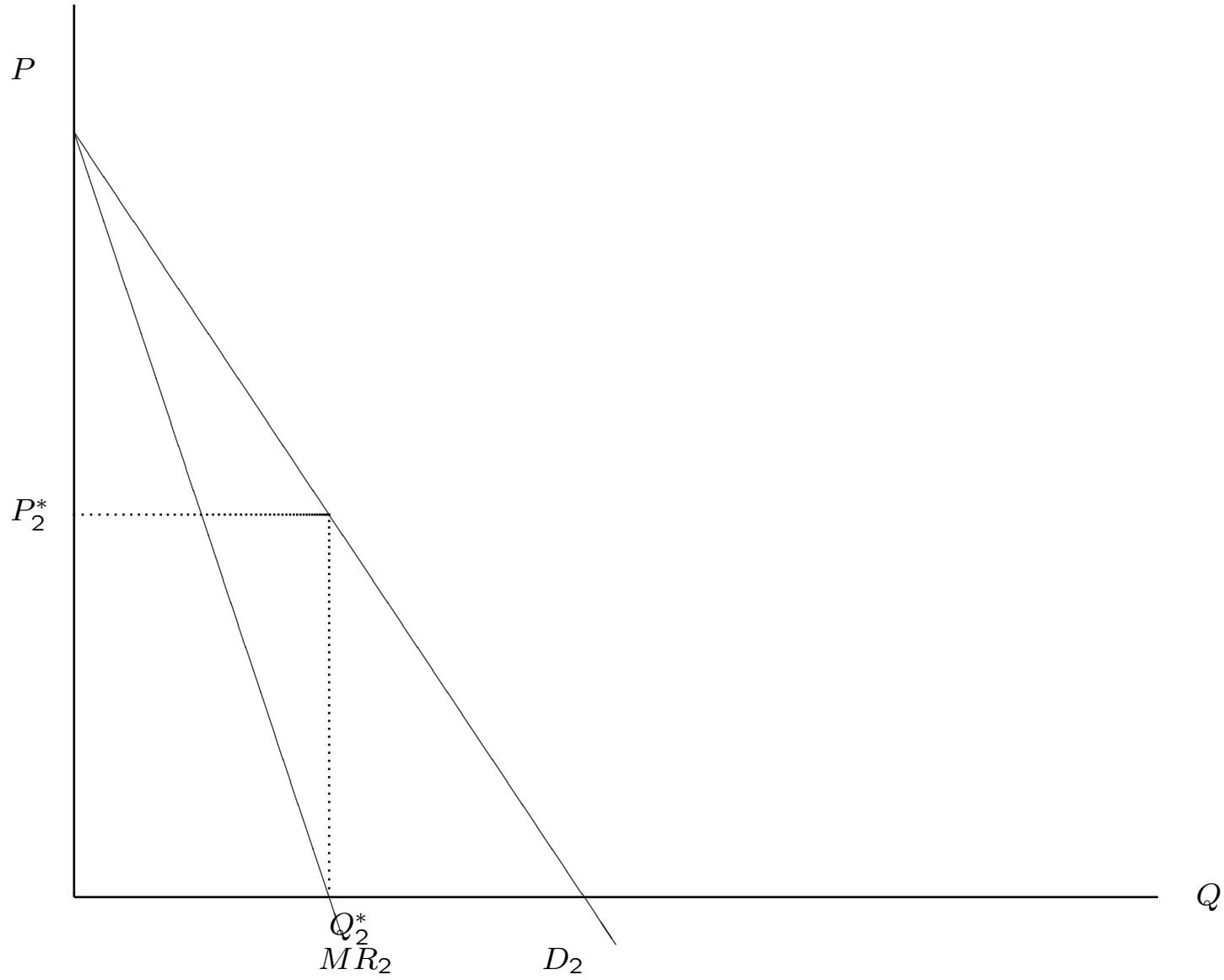
1. We distinguish between three types of price discrimination:

- First degree (i.e., perfect price discrimination)
- Second degree (i.e., non-linear pricing such as quantity discounts)
- Third degree (i.e., market segmentation)

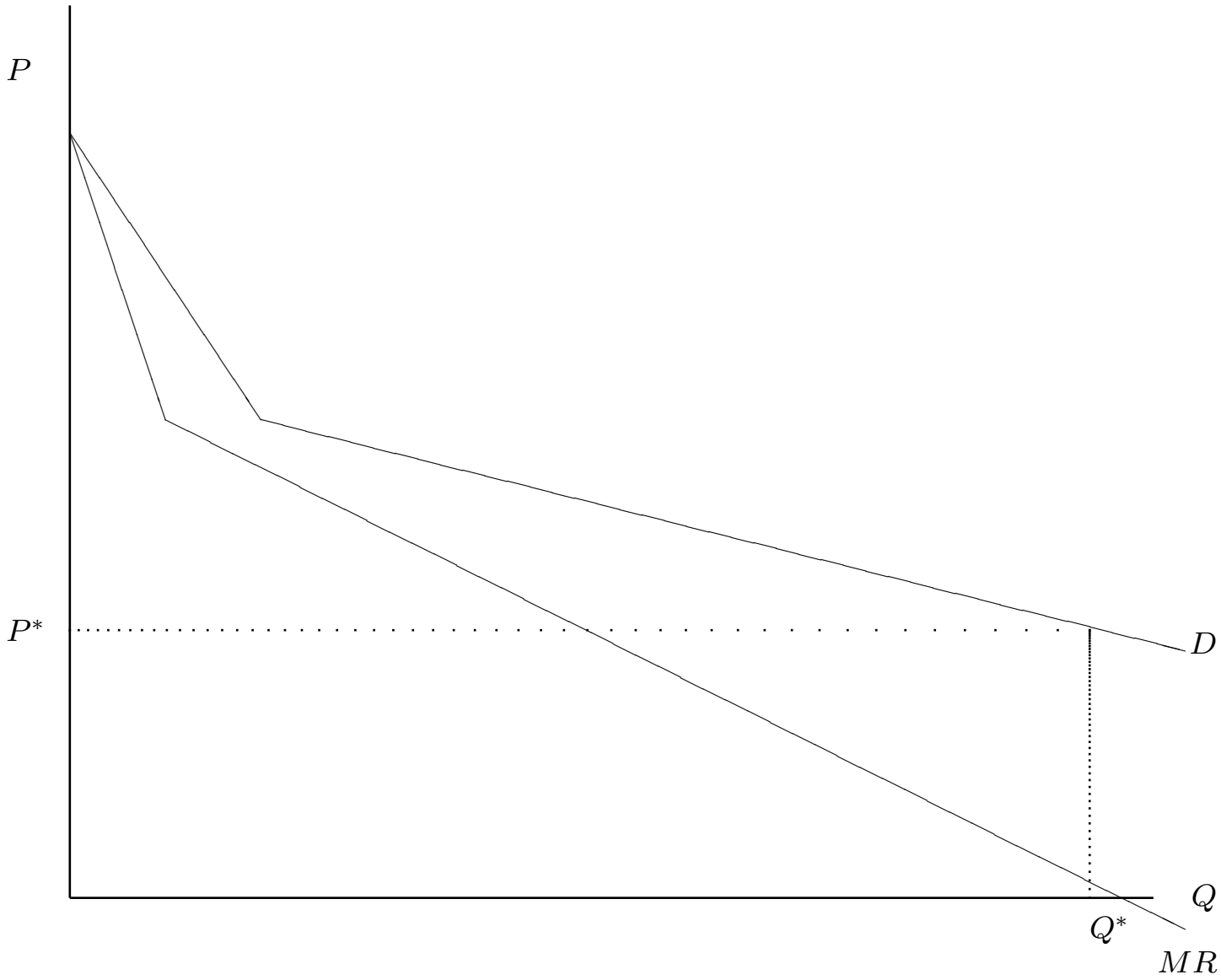
2. Price discrimination always increases profits (producer surplus), but its effects on consumer surplus are ambiguous.



Price Discrimination by the Monopolist:
Market 1



Price Discrimination by the Monopolist:
Market 2



No Price Discrimination by the Monopolist:
A Single Price in Markets 1 and 2

Price Discrimination by the Monopolist:
Implications for Consumer Surplus in both Markets:

This is an empirical issue essentially. Theory tells us how to think about the problem, but does not answer the welfare question (other than to say that P.C. would do better).

Implications for firm profits? They should go up with price discrimination. Remember we could always choose optimal p_1 and p_2, such that $p_1 = p_2$ so the option of price discrimination must do at least as well.

4. Monopolists Selling Durable Goods

Definition of a Durable Good: goods that are bought only once in a long time and can be used for a long time. Examples: cars, houses, land.

(The typical analysis uses *perishable* or *flow* goods.)

Since the typical analysis uses perishable goods, we can use static models to understand pricing decisions.

With durable goods, we need to take the future into account, and we need dynamic models to understand pricing decisions.

(Note that durability is a relative concept: there are many different degrees of durability. Definition by U.S. Census: 3 years.)

Coase Conjecture.

Consider the example of a monopolist who owns all the land in the world and wants to sell it at the largest discounted profit.

In year 1, the monopolist sets a monopoly price and sells half the land. (Think of a linear demand curve with marginal cost at zero.)

In year 2, the monopolist will want to do the same with the remaining land, but unless the population is growing very quickly, demand for land will be lower. Thus, the monopoly land price in year 2 will be lower.

Coase conjecture: if consumers do not discount time too heavily and if consumers expect price to fall in future periods, current demand facing the monopolist will fall, implying that the monopoly will charge a lower price (compared to a perishable good). (Price is driven to marginal cost "in the blink of an eye.")

Crucial assumptions:

1. durable good
2. demand does not grow quickly over time
3. consumers anticipate price cuts

Showing the extent to which this conjecture is true has lead to a long literature, and much of the game theoretic literature on bargaining starts here (see the chapter in Fudenberg and Tirole)

Choosing a lower relative level of durability is one way of solving the problem of consumers' expectations of future price discounts.

Other ways include:

- Renting (as opposed to selling)
- Planned obsolescence (new car models, new fashions... as long as costs are not too high)
- Capacity constraints (numbered prints)
- Buy-back provisions (not useful if consumers can damage good, or easily resell)
- Announcements/advertising future prices

BASIC OLIGOPOLY MARKET STRUCTURE MODELS

Outline:

- Cournot (Nash-in-quantities)
- Cournot with Sequential Moves
- Bertrand (Nash-in-prices)
- Bertrand with capacity constraints
- Cournot versus Bertrand
- Self-enforcing Collusion

Cournot and Bertrand are sometimes referred to as "conjectural variation" models of firm behavior. However, they reduce to Nash equilibria.

1. Cournot (Nash in Quantities)

Cournot wrote in 1838–well before John Nash!

He proposed an oligopoly-analysis method that is (under many conditions) in fact the Nash equilibrium w.r.t. quantities.

Firms choose. . . production levels.

A. Simple Two-seller game

Cost: $TC_i(q_i) = c_i q_i$

Demand: $p(Q) = a - bQ$ where $Q = q_1 + q_2$

Define a game:

Players: firms.
Action/Strategy set: production levels/quantities.
Payoff function: profits, defined:

$$\pi_i(q1, q2) = p(q_1 + q_2)q_i - TC_i(q_i)$$

Now we need an equilibrium concept.

$\{p^c, q_1^c, q_2^c\}$ is a Cournot equilibrium ("Nash-in-quantities" equilibrium) if:

1. a) given $q_2 = q_2^c, q_1^c$ solves $max_{q_1}\pi_1(q_1, q_2^c)$
 b) given $q_1 = q_1^c, q_2^c$ solves $max_{q_2}\pi_2(q_1^c, q_2)$

2. $p^c = a - b(q_1^c + q_2^c)$, for $p^c, q_1^c, q_2^c \geq 0$.

"No firm could increase its profit by changing its output level, given that other firms produced the Cournot output levels."

This is just the Nash Equilibrium concept applied to our game. If you aren't familiar with this concept, go take a game theory course and then take this course next year.

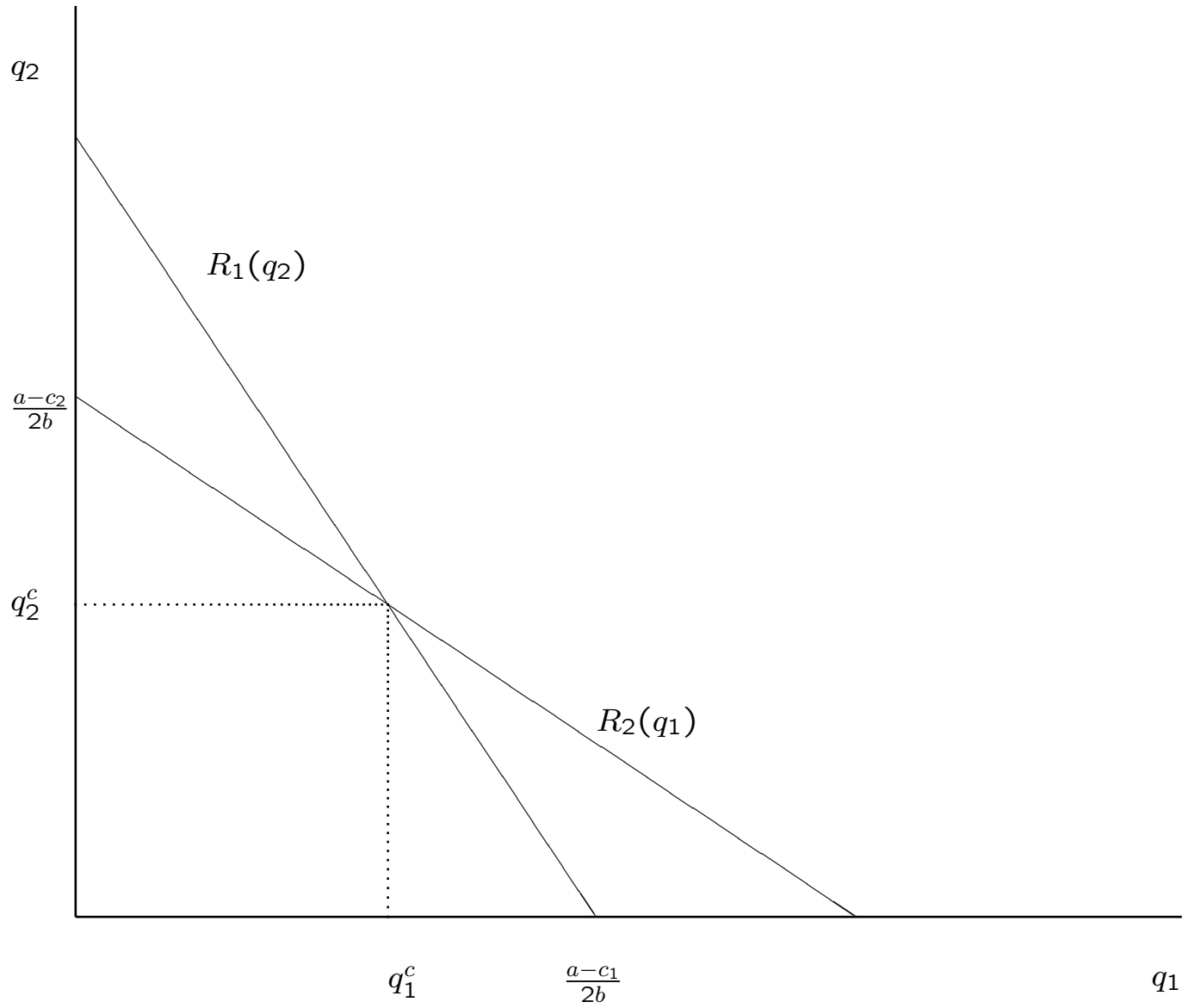
$$\pi_1(q1, q2) = (a - bq_1 - bq_2)q_1 - c_1 q_1$$

F.O.C. (for firm 1):

$$\frac{\partial \pi_1(q_1, q_2)}{\partial q_1} = a - 2bq_1 - bq_2 - c_1 = 0$$

Best response is:

$$q_1 = R_1(q_2) = \frac{a - c_1}{2b} - \frac{1}{2}q_2$$


q_2
$R_1(q_2)$
$\frac{a-c_2}{2b}$
q_2^c
$R_2(q_1)$
q_1^c
$\frac{a-c_1}{2b}$
q_1

Note both best-response functions are downward sloping. For each firm: if the rival's output increases, I lower my output level. (i.e., an increase in a rival's output shifts the residual demand facing my firm inward, leading me to produce less.)

Now we can compute Cournot equilibrium output levels.

$$q_1^c = \frac{a - 2c_1 + c_2}{3b}$$

$$q_2^c = \frac{a - 2c_2 + c_1}{3b}$$

Equilibrium quantity supplied on the market is

$$Q^c = q_1^c + q_2^c = \frac{2a - c_1 - c_2}{3b}$$

We can also find equilibrium price.

$$p^c = a - bQ^c = \frac{a + c_1 + c_2}{3}$$

What are the pay-off functions in equilibrium?

$$\pi_i^c = [(a - bQ^c) - c_i](q_i^c)$$

$$= (p^c - c_i)(q_i^c) = b(q_i^c)^2$$

Extending this to N firms.

It's harder to see the reaction functions, but the story is exactly the same.

Now each firm maximizes profits according to:

$$\pi_i(q_1, q_2, ...q_N) = p(Q)q_i - TC_i(q_i)$$

We would derive the best response function for all N firms. For firm 1,

$$q_1 = R_1(q_2, ..., q_N) = \frac{a - c_1}{2b} - \frac{1}{2}(\sum_{j=2}^{N} q_j)$$

We need N of these equations. However, if we assume that firms' costs are the same ($TC_i(q_i) = c \forall i$), it's a lot easier. Each firm has the same reaction function, which is

$$q_i = R_i(q_{-i}) = \frac{a-c}{2b} - \frac{1}{2}(\sum_{j \neq i}^{N} q_j)$$

Back to the reaction function.

$$q_i = R_i(q_{-i}) = \frac{a-c}{2b} - \frac{1}{2}(\sum_{j \neq i}^{N} q_j)$$

$$q = \frac{a-c}{2b} - \frac{1}{2}(N-1)q$$

Thus,

$$q^c = \frac{(a-c)}{(N+1)b}$$

$$Q^c = \frac{N(a-c)}{(N+1)b}$$

Now it is straightforward to solve for p^c (the market price) and π_i^c (profits for each firm).

Sanity checks. . .

Do we get the monopoly result for N = 1?
Do we get the duopoly result for N = 2?
What is the Cournot solution for $N = \infty$?

Take the limit as $N \to \infty$ for q^c and Q^c and p^c. They are:

$$\lim_{N\to\infty} q^c = 0$$

$$\lim_{N\to\infty} Q^c = \frac{a-c}{b}$$

$$\lim_{N\to\infty} p^c = c$$

Under the assumption of Cournot competition, market supply approaches the competitive supply as $N \to \infty$.

Note that market supply depends on the slope and intercept of demand, and the (common) marginal cost. Individual firms' output levels approach zero as $N \to \infty$.

Take a look at the results when firms have different levels of marginal cost.

Let marginal cost of firm i be c_i. The F.O.C. is only a slight modification from before.

$$\pi_i = [(a - bq_i - bq_{-i}) - c_i](q_i)$$

$$\frac{\partial \pi_i}{\partial q_i} = a - 2bq_i^* - b\sum_{i \neq j} q_j^* - c_i = 0$$

Rewrite the F.O.C. as

$$a - bQ^* - bq_i^* = c_i$$

Substitute in for price:

$$p - c_i = bq_i^* \frac{Q^*}{Q^*}$$

Rearrange...

$$\frac{p - c_i}{p} = \frac{bq_i^*}{Q^*} \frac{Q^*}{p}$$

$$\frac{p - c_i}{p} = \frac{-\partial p}{\partial Q} \frac{q_i^*}{Q^*} \frac{Q^*}{p}$$

The term $\frac{q_i^*}{Q^*}$ is the market share of firm i. Denote this simply as s_i.

We now have the inverse elasticity rule of Cournot oligopoly:

$$\frac{p - c_i}{p} = \frac{s_i}{-\epsilon_d}$$

And note that for perfectly competitive markets:

$$\frac{p - c_i}{p} = \frac{0}{-\epsilon_d}$$

And for monpolistic markets:

$$\frac{p - c_i}{p} = \frac{1}{-\epsilon_d}$$

Cournot with Sequential Moves:

We could also think about this in a game where firm 1 moves first, firm 2 moves second, etc. We call this a leader-follower market structure, or a **Stackelberg** game. The sequential moves game is a very reduced-form way to think about situations with incumbent firms and potential entrants.

- Work backwards: Suppose firm 1 sets output level to q_1. What would firm 2 do?
- $R_2(q_1) = \frac{a-c}{2b} - \frac{1}{2}q_1$
- Firm 1 can figure this out. What will Firm 1 do in response?
- $\max_{q_1} p(q_1 + R_2(q_1))q_1 - cq_1$

What's different between this profit function and a Cournot profit function?

- Turns out leader output level is: $q_1^S = \frac{a-c}{2b} = \frac{3}{2}q^C$.
- Follower output level is: $q_2^S = \frac{a-c}{4b} = \frac{3}{4}q^C$
- Equilibrium price is lower than Cournot, output is larger than Cournot – hence more consumer surplus.
- First-mover advantage: "leader" makes more profit than "follower". "Leader" is better off than in Cournot.

Bertrand ("Nash in Prices")

When do you think price setting makes more sense than setting quantity?
In general, economists may believe that different assumptions hold for different settings. Then we have to argue about which one is more consistent with the data.

Bertrand reviewed Cournot's work 45 years later.

Go through a two-firm example again. Now firms set prices. We need two assumptions.

1. Consumers always purchase from the cheapest seller (recall defn of homogeneous goods).
2. If two sellers charge the same price, consumers are split 50/50.

The second assumption is that q_i takes the values:
0 if $p_i > a$
0 if $p_i > p_j$
$\frac{a-p}{2b}$ if $p_i = p_j = p < a$
$\frac{a-p_i}{b}$ if $p_i < \min(a, p_j)$

Do you see a difference between Cournot and Bertrand?

Bertrand has an important discontinuity in the game (more specifically, there is a discontinuity in the pay-off functions.)

Solving for the equilibrium required us to say something about costs.

1. If costs are the same, a Bertrand equilibrium is price = marginal cost, with quantity supplied on the market equal to the perfectly competitive outcome (equally split between the two firms).

2. If costs differ, (say firm 1 has cost = c_1 where $c_1 < c_2$), then the firm with the lower cost charges $p_1 = c_2 - \epsilon$, firm 2 sells zero quantity, and firm 1 sells quantity given by $q_1^b = \frac{(a-c_2+\epsilon)}{b}$.

Intuition:

If costs are the same, undercutting reduces price to marginal cost. If costs differ, undercutting reduces price to "just below" the cost of the high-cost firm.

An important aspect of bertrand is that equilibrium may not exist if marginal costs are not constant. This has lead to various models, the most sucessful of which is the ‘Supply function equilibrium’ of Klemperer and Meyer (1989) Econometrica.

Bertrand under capacity constraints (keep the assumption that costs are the same):

Note that if firms choose capacity then prices, you can get outcomes more like Cournot. This depends crucially on the rationing protocol via which consumer match to transactions. Tirole is quite good on this. This model is called Kreps-Scheinkman (1983).

Comparison of Equilibrium in Models Covered So Far:
Monopoly (M), Cournot (C), Stackelberg (S), Perfect competition and Bertrand (PC)

$$CS^M < CS^C < CS^S < CS^{PC}$$

$$PS^M > PS^C > PS^S > PS^{PC} = 0$$

$$DWL^M > DWL^C > DWL^S > DWL^{PC} = 0$$

Differentiated Products

We now finally drop the assumption that firms offer homogeneous products.

Differentiated product models are among the most realistic and useful of all models in IO.

If you understand the basic elements of product differentiation theories, then you should have an awareness of the economics underlying:

1. product placement
2. niche markets
3. product design to target certain types of consumers
4. brand proliferation, etc.

There are two aspects of product differentiation:
1. Horizontal differentiation: if all products were the same price, consumers disagree on which product is most preferred
Eg. films, cars, clothes, books, cereals, ice-cream flavors, Starbucks (by geographic location), ...

2. Vertical differentiation: if all products were the same price, all consumers agree on the preference ranking of products, but differ in their willingness to pay for the top ranked versus lesser ranked products Eg. computers, airline tickets, different quantities, car packages, ...

Differentiated Products Betrand Equilibrium

Now we examine a pricing equilibrium with differentiated products. It should be no surprise that we solve for a Nash-in-prices equilibrium.

There a several cute models of pricing in differentiated products Bertrand where people set up the cross-elasticities so that there is enough structure and symmetry to give analytical results. Basically, these models are not that useful for applied work however. Which is a shame because differentiated Bertand is hyper-helpful way to conceptualize many industries.

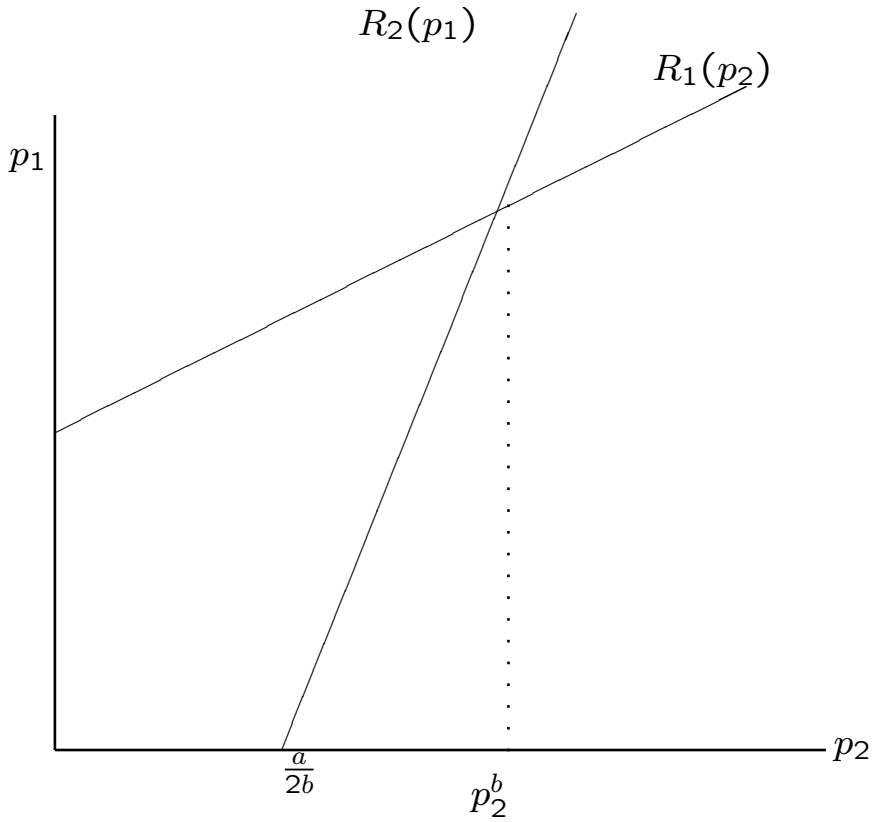
Key things to realize: The discontinuity in homogenous products Bertrand goes away.

Things look more like Cournot (in the sense of positive margins etc)

$$(p_i - c)d_i(p_i, p_j)$$

First order condition as expected. The extent to which best response slopes away from 45 degree line depends on cross-easticities (see next slide for diagram of what I mean). This in turn affects the extent to which things start to look somewhat similar to cournot.

Best Response Function, 2 firms, Bertrand



"Industry structure" refers to the number of firms in an industry and the size distribution of those firms, among other things.

Many policy issues revolve around the concentration and number of firms in a particular industry and how competitive we think the industry is.

i.e., Why do some markets have a small number of firms while other markets have a large number of firms?

We've already seen that the number of firms in an industry can have a big impact on the supply equilibrium in the market, but we have not discussed how the number of firms might arise endogenously in the industry.

Notation:
N is number of firms
Q is total industry output
q_i is output of firm i, so $Q = \sum_{i=1}^{N} q_i$
s_i is % share of firm i (ie., $s_i = 100 * \frac{q_i}{Q}$)

Two Measures of Concentration:

1) Four-firm Concentration Ratio:
$I_4 = \sum_{i=1}^{4} s_i$

Examples (1992, 2-digit SIC classifications):
Tobacco: 91.8
Furniture: 29.3
Department stores: 53.8
Legal services: 1.4

Problems with this or any other "linear" measure: No difference between (80,2,2,2) and (20,20,20,26) (ie, can't distinguish concentration between the top 4.)

2) Herfindahl-Hirshman Index (HHI)

$I_{HH} = \sum_{i=1}^{N} (s_i)^2$

Solves the linearity problem. Notice:

Monopoly: $I_{HH} = 10,000$
10 identical firms: $I_{HH} = 1,000$

DOJ Merger Guidelines use I_{HH}. If $I_{HH} > 1,800$, then mergers come under scrutiny.

Problems with Using Concentration Measures Generally:

Market Definition: How should we define markets and industries when products are differentiated?

Does not get to central issue about how firms behave. For example, consider the case with 2 equal-sized firms, but in one industry, they compete Cournot, and in another, they compete Bertrand. The $I_{HH} = 2,500$, but we only worry about the Cournot industry.

This is why sticking HHIs into a cross-industry regression to take care of 'competition' is not going to get a warm welcome from an IO guy.

Entry

We will focus on entry in two different contexts.

1. Non-strategic Effects on Entry (Entry Barriers)

These are features of firms' costs or production technologies that affect how many firms can efficiently serve a market. For example, natural monopolies, generally the m.e.s. compared to the market size. Other features could include absolute cost advantages, regulatory restrictions (licensing, etc.), capital requirements...

2. Strategic Effects on Entry (Entry Deterrence)

These are costs of entry borne by entrants (or potential entrants) that are a result of strategic behavior by incumbent firms. Some examples are capacity commitment, spatial preemption, limit pricing, long-term contracts, and other actions that an incumbent firm might take in the presence of an entry threat that he would not take otherwise. (Possibly also tying or other arrangements that have been discussed in the Microsoft case.)

Usually barriers to entry can be expressed in terms of sunk costs.

1. Exogenous Sunk Costs

Costs that are embedded in the underlying conditions of the market and not determined by firms' actions.

2. Endogenous Sunk Costs

Conditions and strategic actions that firms within the industry can change. These are entry costs for which the firm has choice over how large they will be.

Examples:

1. Exogenous Sunk Costs or Barriers to Entry:
Capital requirements
Scale economies
Absolute cost advantages
Asset specificity
Regulatory restrictions (licensing)

2. Endogenous Sunk Costs or Barriers to Entry:
R&D
Patents
Excess capacity
Control over strategic resources
Contracts
Advertising?

Why advertising?

There is debate about this. The argument for thinking of advertising as a barrier to entry is:

It does not depend on the level of output
The effect of advertising is to increases consumers' willingness to pay for that product
There are no spillovers that benefit other firms (usually)
All consumers in the market are affected

The opposing side of the debate says:

If capital markets are efficient, a new entrant will just borrow the money necessary to do his own (possibly higher) level of advertising.

Both sides have a point: perhaps it depends on the market. (i.e., pepsi and coke vs. kitchen appliances)

Usual form of these types of models

Timing of events:

1) Each firm decides whether to enter an industry/market
2) There are some exogenous sunk costs (ie., the acquisition of a plant of minimum efficient size)
3) Each firm then chooses some endogenous sunk costs (ie., advertising or R&D)
4) Finally, firms in the market engage in some form of competition

Stages 3 and 4 can be pretty complicated, depending on the model. Eg Reputation models (gang of 4 etc), some of Whinston's exclusion papers etc

Lecture 11: Vertical Control (Part 1)

Manufacturers rarely supply final consumers directly. Instead, most industries are vertically separated. We often refer to firms "vertically-separated 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 have reviewed already still apply. For example, the upstream firm may want to price discriminate across the downstream firms.

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 activites 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

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. IO research has tended to focus on the incentives for vertical control when the market for the intermediate good is imperfectly competitive because this is where antitrust concerns are most apparent. This leaves fairly open the question of why they do it in other contexts (although read Williamson, 'The Economic Institutions of Capitalism')

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.

Often vertical restraints used by firms in vertically-separated markets are grouped into 5 classes:

- 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.

- Exclusive Dealing: a dealer/ distributor/ retailer is not allowed to carry the brands of a competing upstream firm.

- "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).

- 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.

- 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) Intrabrand competition

4) Interbrand competition

Think of exclusive territories as a form of vertical control to restrain intrabrand competition, and exclusive dealing as a way of restraining interbrand competition.

Basic Framework: Double Marginalization

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

$$p = a - Q$$

(ie. I'm keeping things super simple to show you flavor fast)

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:

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

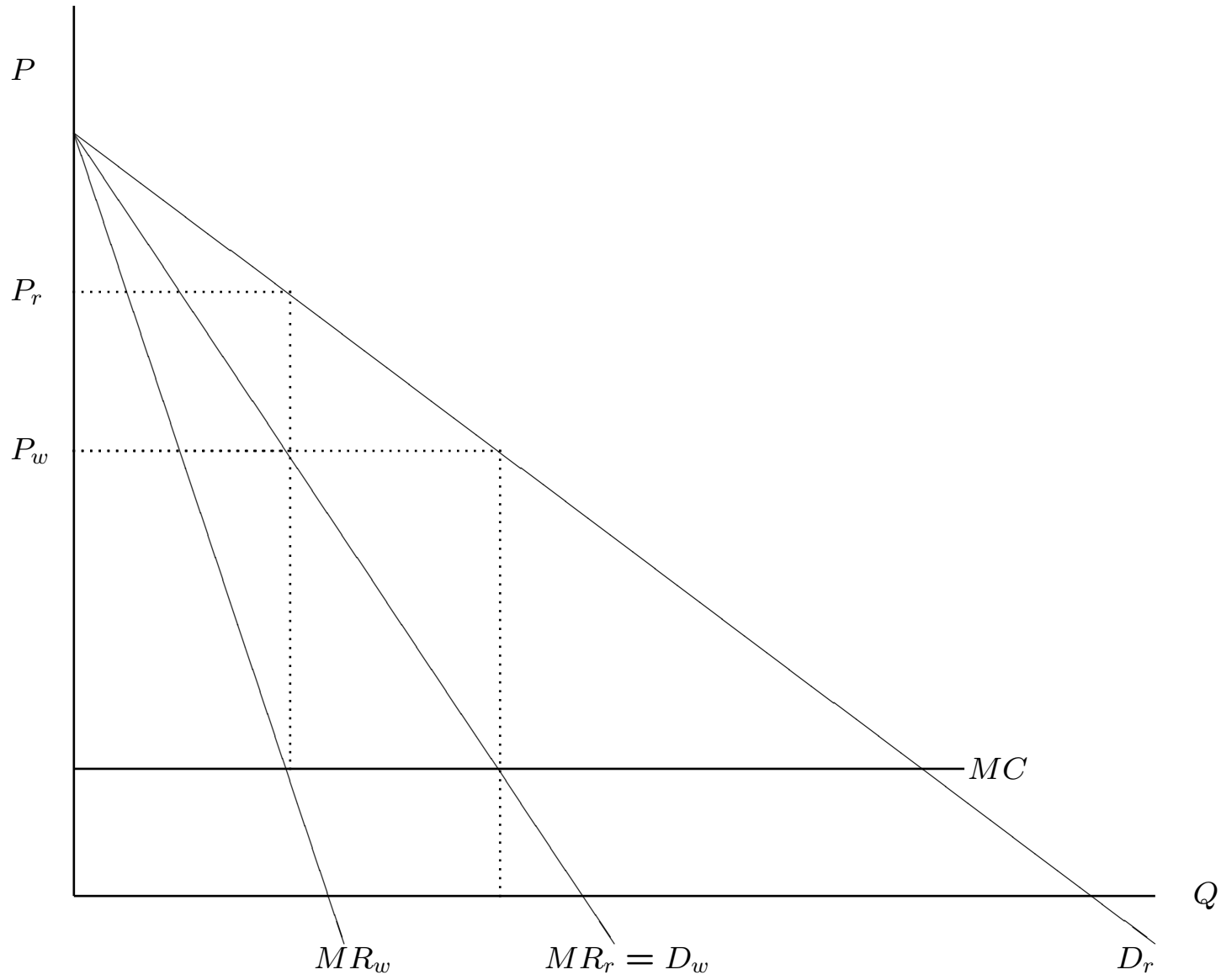
Results:

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.


P
P_r
P_w
MC
Q
MR_w
$MR_r = D_w$
D_r

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.

Resale Price Maintenance:

Requires retailers to maintain a minimum price, a maximum price, or a fixed price. Examples: Windows 98, Windows XP, books, many many retail products.

Two goals:

1) Partially solve the double marginalization problem

2) Can 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)

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 in price. Denote the wholesale price as d and advertising expenditures as A_1 and A_2, where $A = A_1 + A_2$.

First result:

For any given d, no dealer will engage in adveritsing and demand would 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 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.

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 a lot of ambiguities in 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.

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

–Non-price issues have been generally accepted to be ok by the courts

- Exclusive territories
- Refusal to deal
- . . . Foreclosure?