Advanced Microeconomics

Lecture 9: IO Frictions, Vertical Control, and Coase Conjecture

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Outline

1. Why IO needs frictions beyond textbook Bertrand
2. Search frictions: Diamond paradox and price dispersion
3. Hotelling spatial competition and product differentiation
4. Vertical control: double marginalization, RPM, and foreclosure
5. Durable-goods monopoly and the Coase conjecture

From Lecture 8 to Lecture 9

Lecture 8

- Beliefs can be designed.
- Bargaining power depends on patience and continuation values.
- Strategic outcomes depend on the information and timing environment.

Lecture 9

- Consumers may not observe all prices.
- Products and sellers may not be perfect substitutes.
- Production and distribution may be vertically separated.
- Buyers can wait for future price cuts.

Unifying question

When does market power survive, disappear, or change form once we add realistic frictions to the basic competition model?

Search frictions: why Bertrand can fail

Bertrand benchmark

- Homogeneous products.
- Consumers observe all prices.
- A small undercut captures the whole market.
- Equilibrium price is close to marginal cost.

Search environment

- Consumers must pay time, money, or attention to find another price.
- A consumer who has arrived at a store is partly captive.
- A small undercut may not be observed by many buyers.
- The demand curve faced by each firm becomes less elastic.

Main idea

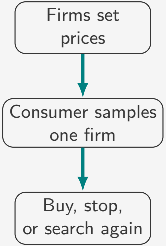
Competition requires that buyers can compare offers. A search cost weakens precisely that comparison margin.

Diamond model: setup

Environment

- $n \geq 2$ identical firms.
- Marginal cost is c.
- Each consumer wants at most one unit and values it at $v > c$.
- To learn one firm's price, a consumer pays search cost $s > 0$.
- Consumers do not know which firm is cheaper before visiting it.

Timeline



Question

Does the existence of many identical firms force price down to c?

The consumer's reservation logic

After observing a price p

The consumer compares buying now with paying another search cost and drawing another price.

In a symmetric pure-price candidate

If every other firm is expected to charge the same price p, searching again does not improve the expected price.

$$\text{buy if } p \leq v.$$

Reservation price

Let r denote the highest price the consumer is willing to accept after arriving at a firm. In the simple unit-demand version,

$$r = v.$$

Key asymmetry

Firms compete for consumers *before* consumers know prices. Once a consumer has arrived, the visited firm has local monopoly power up to r.

Diamond paradox: the core proof

Candidate with a price below the reservation price

Suppose all firms charge $p < r$. A firm can raise its price slightly to $p + \varepsilon < r$.

- Consumers who happen to visit this firm still buy.
- The firm does not lose a large group of comparison shoppers because prices are not observed before search.
- Demand is essentially unchanged, while margin rises.

So $p < r$ cannot be an equilibrium.

Candidate with undercutting

If other firms charge r, undercutting to $r - \varepsilon$ lowers margin but does not automatically attract consumers who do not observe the price before searching.

Diamond paradox

Even an arbitrarily small positive search cost can sustain the monopoly reservation price:

$$p_i = r = v \qquad \text{for all } i.$$

How to read the paradox

What it says

- A small friction can have a discontinuously large effect.
- The first store visited can treat the consumer as captive.
- The Bertrand undercutting logic relies on price observability, not just many firms.

What it does not say

- It does not say every real market has monopoly prices.
- It abstracts from advertising, reputations, repeat buyers, and price-comparison platforms.
- It is fragile once some consumers are informed.

Real-world interpretation

The model is most useful for explaining why posted prices can remain high when buyers rarely compare many sellers: repair services, local retail, financial products, or add-on fees.

Adding informed shoppers: pure prices fail

A simple two-firm extension

Two firms face shoppers of mass α who observe both prices and searchers of mass $1 - \alpha$ who visit one firm at random and buy if $p \leq r$.

Symmetric pure price

If both firms charge $p > c$, a firm can undercut by ε and win all shoppers for small $\varepsilon > 0$. If $p = c$, a deviation to r earns positive captive demand.

Asymmetric pure price

If one firm is strictly cheaper, it wins shoppers. But it can raise its price slightly without losing shoppers as long as it remains below the rival's price.

Cycle

Low prices attract shoppers; high prices exploit captive searchers. No pure price profile balances both incentives.

Mixed pricing with shoppers

Demand at price p

Let $F(p)$ be the rival's equilibrium price distribution. With no atoms, a firm charging p wins shoppers when the rival charges more:

$$D(p) = \frac{1-\alpha}{2} + \alpha[1 - F(p)].$$

Searchers are captive first visits; shoppers are won only by being cheaper.

Profit

$$\pi(p) = (p - c)\left[\frac{1-\alpha}{2} + \alpha[1 - F(p)]\right].$$

Equilibrium price dispersion

Constant-profit condition

Every support price must give the same profit:

$$(p-c)\left[\frac{1-\alpha}{2}+\alpha[1-F(p)]\right]=\bar{\pi}.$$

Upper end of the support

The support cannot end below r: the top-price firm would move up. At $p_H = r$, it wins no shoppers:

$$\bar{\pi}=(r-c)\frac{1-\alpha}{2}.$$

Lower end

At p_L, the firm wins all shoppers:

$$p_L = c+(r-c)\frac{1-\alpha}{1+\alpha}.$$

Comparative static

More informed shoppers lower expected prices; searchers keep prices dispersed above cost.

Solving the mixed distribution

From constant profit to the CDF

Using

$$\bar{\pi} = (r - c)\frac{1-\alpha}{2},$$

the constant-profit condition implies

$$1 - F(p) = \frac{1-\alpha}{2\alpha}\left(\frac{r-c}{p-c} - 1\right) = \frac{1-\alpha}{2\alpha}\frac{r-p}{p-c}.$$

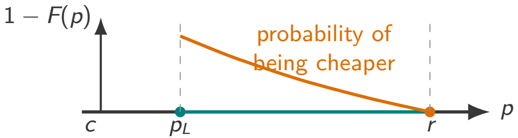
Therefore

$$F(p) = 1 - \frac{1-\alpha}{2\alpha}\frac{r-p}{p-c}, \qquad p \in [p_L, r].$$

Reading the formula

As p rises, margin rises but the probability of winning shoppers falls. Randomization equalizes these two forces.

A picture of price dispersion



Intuition

- A high price earns a large margin on searchers.
- A low price wins shoppers more often.
- Firms randomize because each price trades off margin and probability of winning comparison shoppers.

Empirical implication

Price dispersion can be an equilibrium outcome even when products and costs are identical.

Where search models show up

Market design and platforms

- Price-comparison sites lower search costs.
- Sponsored rankings can increase effective search costs.
- Platforms may profit from making comparison easy in some dimensions and hard in others.

Industrial organization

- Add-on pricing: base price is visible, fees are discovered late.
- Loyalty programs make consumers less likely to search.
- Advertising can be informative, persuasive, or both.

Differentiation as another source of market power

Search model

Products are identical, but consumers do not observe all prices.

friction = comparison is costly.

Hotelling model

Consumers observe prices, but sellers are not perfect substitutes.

friction = distance or mismatch is costly.

Common logic

A firm has market power when some consumers find switching costly, either because they must search or because the rival product is a worse match.

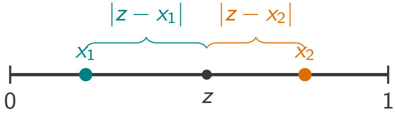
Quadratic city: setup

Consumers and firms

- Consumers are uniformly located on $[0, 1]$.
- Firm 1 is located at x_1, firm 2 at x_2, with $x_1 < x_2$.
- A consumer at z buying from firm i gets

$$u_i(z) = v - p_i - t(z - x_i)^2.$$

- The parameter $t > 0$ measures how costly mismatch is.



Interpretation

The line can be geography, taste, ideology, brand style, delivery time, or product attributes. Quadratic costs make distant mismatches especially painful.

Price competition with fixed endpoint locations

To isolate the price logic, put firm 1 at 0 and firm 2 at 1.

Indifferent consumer

$$v - p_1 - tz^2 = v - p_2 - t(1-z)^2.$$

Therefore

$$z^* = \frac{p_2 - p_1 + t}{2t}.$$

Demand is

$$D_1 = z^*, \qquad D_2 = 1 - z^*.$$

Firm 1's problem

$$\max_{p_1} \, (p_1 - c)\left(\frac{p_2 - p_1 + t}{2t}\right).$$

The first-order condition is

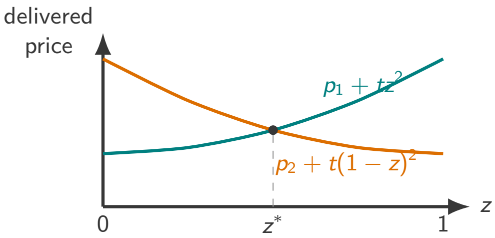
$$p_1 - c = t + p_2 - p_1.$$

Symmetric price equilibrium

$$p_1^* = p_2^* = c + t, \qquad D_1 = D_2 = \frac{1}{2}.$$

The markup is exactly the transportation-cost parameter t.

How differentiation softens price competition



When t is high

- Delivered-price curves rise faster away from each firm.
- A small price cut moves fewer consumers.
- Each firm faces a less elastic local demand.
- Equilibrium markup rises.

Economic reading

Horizontal differentiation gives a firm “local monopoly power” over consumers whose tastes or locations are close to it.

Location choice: two forces

Market-share force

If prices are fixed, moving toward the center captures more consumers.

$$\text{fixed prices} \quad \Rightarrow \quad \text{minimum differentiation.}$$

This is the classic median-voter style logic.

Price-softening force

If prices are chosen after locations, moving away can make later price competition less intense.

$$\text{endogenous prices} \quad \Rightarrow \quad \text{differentiation motive.}$$

Important caution

The linear-transport location game has technical nonexistence problems. With quadratic transport costs, the price subgame is well behaved, and the standard two-stage result is maximal differentiation:

$$x_1^* = 0, \qquad x_2^* = 1.$$

How to use Hotelling models in applications

Good uses

- Tea shops choosing locations near campus gates.
- Political parties choosing ideological positions.
- Platforms choosing product features.
- Restaurants choosing cuisine style and delivery radius.

What must be specified

- What is the line?
- What does distance mean?
- Are prices fixed or strategic?
- Does quality or brand strength also differ?

Modeling discipline

Do not stop at the label "Hotelling." The model must say what distance means and whether the key force is market share, price softening, or both.

Why study vertical control?

Horizontal competition

Firms at the same layer compete with each other:

- two retailers,
- two platforms,
- two manufacturers.

Vertical structure

Firms at different layers contract with each other:

- manufacturer and retailer,
- platform and merchant,
- brand owner and franchisee.

Core issue

Vertical contracts change three margins:

retail price, retailer effort, rival access to consumers.

A basic upstream–downstream model

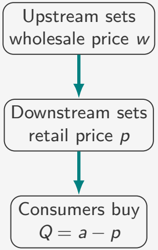
Demand and costs

$$P(Q) = a - Q, \qquad a > c.$$

The upstream producer has marginal cost c. The downstream retailer has no additional marginal cost.

$$\pi_U = (w - c)Q, \qquad \pi_D = (p - w)Q.$$

Timeline



What is inefficient?

Each layer adds a margin without internalizing how its margin reduces total channel output.

Double marginalization

Downstream pricing given w

$$\max_p \,(p-w)(a-p) \quad\Rightarrow\quad p(w)=\frac{a+w}{2}, \qquad Q(w)=\frac{a-w}{2}.$$

Upstream problem

$$\max_w \,(w-c)\frac{a-w}{2} \quad\Rightarrow\quad w^*=\frac{a+c}{2}.$$

Therefore

$$p^{DM}=\frac{3a+c}{4}, \qquad Q^{DM}=\frac{a-c}{4}.$$

Vertical integration benchmark

A single integrated monopolist solves

$$\max_p \,(p-c)(a-p).$$

So

$$p^{VI}=\frac{a+c}{2}, \qquad Q^{VI}=\frac{a-c}{2}.$$

Comparison

Vertical separation creates a higher retail price and a lower quantity than the integrated monopoly outcome.

Double marginalization: profit comparison

Vertical separation

$$\pi_U^{DM} = \left(\frac{a-c}{2}\right)\left(\frac{a-c}{4}\right) = \frac{(a-c)^2}{8},$$

$$\pi_D^{DM} = \left(\frac{a-c}{4}\right)\left(\frac{a-c}{4}\right) = \frac{(a-c)^2}{16}.$$

Therefore

$$\Pi^{DM} = \frac{3(a-c)^2}{16}.$$

Vertical integration

The integrated monopolist earns

$$\Pi^{VI} = \left(\frac{a-c}{2}\right)\left(\frac{a-c}{2}\right) = \frac{(a-c)^2}{4}.$$

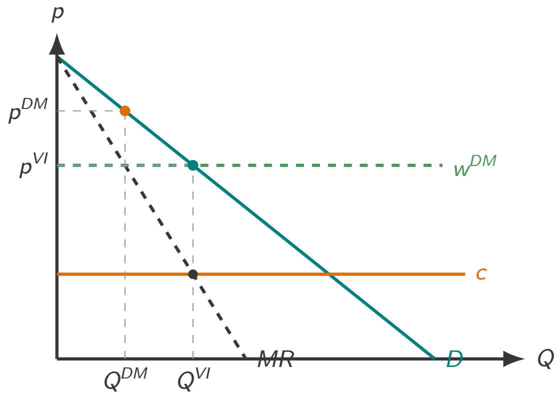
Hence

$$\Pi^{DM} < \Pi^{VI}.$$

Economic meaning

Double marginalization is not just a redistribution between upstream and downstream firms. It lowers total channel profit by reducing output too much.

Double marginalization in a graph



Reading the graph

- Vertical integration is already monopoly, not perfect competition.
- $MR = c$ pins down Q^{VI}; demand then gives p^{VI}.
- In this linear example, $w^{DM} = p^{VI}$, so the retailer adds another margin on top of the wholesale price.
- Double marginalization adds another distortion on top.

Two-part tariff

Contract and pricing

The upstream firm charges $w = c$ and a fixed fee F. Then the retailer solves

$$\max_{p} \, (p - c)(a - p),$$

which is exactly the integrated monopolist's pricing problem:

$$p = p^{VI}, \qquad Q = Q^{VI}.$$

How surplus is transferred

The fixed fee does not affect the marginal pricing decision. It only determines how channel profit is divided.

- Upstream take-it-or-leave-it power: F can extract downstream operating profit.
- Bilateral bargaining: F reflects bargaining power and outside options from Lecture 8.

Important distinction

Two-part tariffs remove double marginalization, but not the monopoly distortion relative to perfect competition.

Resale price maintenance

Starting point

The double-marginalization problem is that the retail price is too high. If the upstream firm can directly restrict the resale price, it may try to fix that price margin without using a fixed fee.

Maximum RPM

The upstream firm imposes a retail price ceiling.

- Setting $\bar{p} = p^{VI}$ can stop the retailer from adding the double margin.
- It is the RPM form most directly linked to double marginalization.

Minimum RPM

The upstream firm imposes a retail price floor.

- It can preserve retailer margins for service provision.
- It can also soften retail competition or facilitate collusion.

Policy lesson

RPM is not one thing. A price ceiling, a price floor, and a recommended resale price solve different incentive problems and create different antitrust risks.

Sales effort: the benchmark first-order conditions

Add downstream effort

Demand depends on price and retailer effort:

$$Q(p, e) = a + \phi e - p, \qquad \psi(e) = \frac{1}{2}ke^2.$$

Effort is not contractible, so the retailer must have enough marginal return to provide it.

Integrated channel

$$\max_{p,e} \; (p - c)(a + \phi e - p) - \frac{1}{2}ke^2.$$

The first-order conditions are

$$a + \phi e - p = (p - c), \qquad \phi(p - c) = ke.$$

Interpretation

Effort expands demand by ϕ units per unit. The second first-order condition says

$$\underbrace{\phi}_{\text{demand gain}} \underbrace{(p - c)}_{\text{margin}} = \underbrace{ke}_{\text{effort cost}}.$$

Why TPT and RPM diverge with sales effort

Two-part tariff

If $w = c$, the retailer chooses p and e to solve

$$\max_{p,e} (p - c)(a + \phi e - p) - \frac{1}{2}ke^2 - F.$$

The fixed fee drops out of the first-order conditions:

$$\phi(p - c) = ke.$$

RPM with wholesale margin

With a resale price fixed at p, the retailer chooses effort from

$$\max_{e} (p - w)(a + \phi e - p) - \frac{1}{2}ke^2.$$

Thus

$$\phi(p - w) = ke$$

which is below the integrated incentive whenever $w > c$.

Lesson

Maximum RPM can correct the retail price, but it does not automatically give the retailer the right margin for noncontractible service effort.

Intrabrand and interbrand competition

Intrabrand competition

Competition among retailers selling the same upstream brand.

- Discounting can benefit consumers directly.
- But it may create free-riding on service, display, or promotion.

Interbrand competition

Competition among different upstream brands.

- Strong retail service may help one brand compete against another.
- Some restraints reduce intrabrand competition to strengthen interbrand competition.

Application

In franchise systems, platform channels, and branded alcohol distribution, the same vertical restraint may be defended as solving a service problem and criticized as sustaining market power.

Exclusive dealing and foreclosure

Basic idea

An incumbent upstream firm signs contracts that prevent downstream retailers from carrying an entrant's product.

Efficiency story

Exclusive dealing can support relationship-specific investment, training, inventory planning, or brand-specific services.

Foreclosure story

Exclusive dealing can deny the entrant enough access to consumers, making entry unprofitable and preserving incumbent market power.

What to check

The key is whether the restraint creates verifiable efficiency gains or mainly raises rivals' costs and blocks efficient entry.

Why foreclosure may require a coordination problem

A useful caution

With one retailer and a clearly more efficient entrant, the entrant can often compensate the retailer for rejecting exclusivity. Naked exclusion is then hard to sustain.

When foreclosure becomes plausible

- The entrant needs access to many retailers to cover fixed entry costs.
- Each retailer signs separately.
- Each retailer may not fully internalize how its own exclusivity decision affects the entrant's viability and other retailers' future options.

Economic mechanism

Exclusive contracts can create a collective-action problem among downstream firms:

$$\text{individually acceptable} \quad \not\Rightarrow \quad \text{collectively efficient.}$$

Durability as intertemporal competition

Static monopoly

A monopolist restricts quantity and charges above marginal cost because consumers cannot buy the same good from a rival.

Durable-goods monopoly

Consumers may not need a rival seller. They can wait for the same seller to cut price later.

$$\text{rival} = \text{the monopolist's future self.}$$

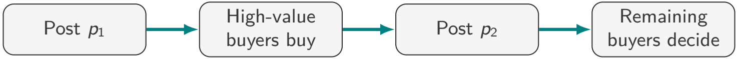
Core friction

The issue is not search or location. It is lack of commitment over future prices.

Durable-goods monopoly: the puzzle

Environment

- A monopolist sells a perfectly durable good.
- Marginal cost is c.
- Consumers have different values and rational expectations.
- The seller cannot commit today not to lower the price tomorrow.



Puzzle

If buyers expect future markdowns, can the monopolist still sell at the one-shot monopoly price today?

Two-period prototype

Normalize $c = 0$ and let consumer values be uniformly distributed on $[0, 1]$.

Period 2

Suppose period 1 leaves all consumers with values $v \leq v_1$ in the market. The residual demand is

$$Q_2(p_2) = v_1 - p_2.$$

The seller solves

$$\max_{p_2} \; p_2(v_1 - p_2),$$

so

$$p_2^* = \frac{v_1}{2}.$$

Period 1 cutoff

The marginal buyer v_1 is indifferent between buying now and waiting:

$$v_1 - p_1 = \delta(v_1 - p_2^*).$$

Using $p_2^* = v_1/2$,

$$p_1 = \left(1 - \frac{\delta}{2}\right) v_1.$$

The seller's time-inconsistency problem

Choosing the first-period cutoff

Substitute

$$p_2^* = \frac{v_1}{2}, \qquad p_1 = \left(1 - \frac{\delta}{2}\right) v_1$$

into the seller's discounted profit:

$$\Pi(v_1) = \left(1 - \frac{\delta}{2}\right) v_1(1 - v_1) + \delta \left(\frac{v_1}{2}\right) \left(v_1 - \frac{v_1}{2}\right).$$

Simplify

The objective simplifies to

$$\Pi(v_1) = \left(1 - \frac{\delta}{2}\right) v_1 - \left(1 - \frac{3\delta}{4}\right) v_1^2.$$

First-order condition

$$\frac{\partial \Pi}{\partial v_1} = \left(1 - \frac{\delta}{2}\right) - 2\left(1 - \frac{3\delta}{4}\right) v_1 = 0.$$

Thus

$$v_1^* = \frac{2 - \delta}{4 - 3\delta}.$$

Two-period prices and patience

Equilibrium prices

$$p_2^* = \frac{v_1^*}{2} = \frac{2-\delta}{2(4-3\delta)},$$

$$p_1^* = \left(1 - \frac{\delta}{2}\right) v_1^* = \frac{(2-\delta)^2}{2(4-3\delta)}.$$

Price path

For $\delta < 1$,

$$p_1^* - p_2^* = \frac{(2-\delta)(1-\delta)}{2(4-3\delta)} > 0.$$

High-value consumers buy early; lower-value consumers wait for the markdown.

Comparative static

As buyers become more patient, v_1^* rises and more consumers wait. The markdown shrinks to zero as $\delta \to 1$.

The Coase conjecture

Infinite horizon intuition

- If offers can be made very frequently, waiting becomes cheap.
- Buyers expect that any price above marginal cost will soon be cut.
- The seller's attempt to skim high-value buyers unravels.

Canonical conclusion

As the time between offers goes to zero and the good is perfectly durable,

$$p_t \to c$$

in the canonical no-commitment durable-goods monopoly model.

Escaping the Coase logic

Commitment devices

- Lease instead of sell.
- Announce and credibly follow a no-discount policy.
- Use price guarantees: if the seller cuts price later, early buyers receive a refund.
- Use most-favored-customer clauses: early buyers are promised terms no worse than later buyers, making future markdowns costly.
- Build reputation for not cutting prices.

Changing the product or market

- Finite durability or depreciation.
- Capacity constraints or limited editions.
- Versioning and planned product turnover.
- Secondary-market restrictions.

General lesson

Durable-goods pricing is an IO problem because market power depends on commitment, expectations, and intertemporal substitution.

One lecture, four ways market power changes

Search

Many firms do not guarantee low prices if consumers cannot easily compare offers.

Vertical control

Contracts can eliminate internal supply-chain distortions, but may also restrict competition.

Differentiation

Firms can price above cost because nearby or well-matched consumers dislike switching.

Durability

A monopolist may lose power because buyers can wait for its future self to cut prices.

Unifying message

Market power is not a single primitive. It is produced or limited by information, substitution, contracting, and commitment.

How this closes the course

The backbone across lectures

- Consumer theory gave us preferences, constraints, duality, and welfare measures.
- Market models showed how prices and quantities are determined under different competitive structures.
- Game theory added strategic response, credibility, and equilibrium refinement.
- Information economics and mechanism design showed how private information changes allocation and rent extraction.
- Today's IO topics show how real market frictions reshape the same basic forces.

Final takeaway

Advanced microeconomics is less a list of models than a way to identify the constraint that makes a decision problem strategic.

End of Lecture 9

- Search costs can support high prices and equilibrium price dispersion.
- Hotelling models turn differentiation into local market power.
- Vertical restraints can either repair incentive problems or foreclose competition.
- Coase conjecture shows how no-commitment durable-goods monopoly can collapse toward competitive pricing.
- The common task is to locate the friction that changes the firm's demand, the consumer's outside option, or the credibility of a strategic move.

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