

Seminar 4 — Pricing and Game Theory

International Business and Finance, Warwick Summer School 2026

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Companion to the Day 4 lecture — Student sheet

Scope. Lecture material only: how firms actually set prices; price discrimination (first, second, third degree; behavioural; intertemporal; dynamic/algorithmic); pricing over the product lifecycle; transfer pricing; and game theory — dominant strategies, the prisoner's dilemma, sequential games and subgame-perfect equilibrium (backward induction), repeated games and tit-for-tat, and commitment vs flexibility.

Part 1. Multiple choice (10 questions)

Choose the single best answer.

1. Charging **each customer their maximum willingness to pay** is:
 - (a) first-degree (perfect) price discrimination
 - (b) second-degree
 - (c) third-degree
 - (d) not price discrimination
2. Offering **quantity discounts or versions** so customers self-select is:
 - (a) first-degree
 - (b) second-degree
 - (c) third-degree
 - (d) transfer pricing
3. Charging **different groups** (students, regions, seniors) different prices is:
 - (a) first-degree
 - (b) second-degree
 - (c) third-degree
 - (d) bundling
4. **Intertemporal** price discrimination occurs when firms:
 - (a) give bulk discounts
 - (b) set prices that vary over *time* to sort customers by willingness to pay (e.g. high launch price, later markdowns)
 - (c) charge every group the same
 - (d) personalise by individual data
5. In a one-shot game, a strategy that is best **regardless of what the rival does** is a:

- (a) mixed strategy
 - (b) dominant strategy
 - (c) tit-for-tat
 - (d) focal point
6. The **prisoner's dilemma** captures situations where:
- (a) cooperation is individually rational
 - (b) individually rational choices lead to a jointly worse outcome
 - (c) there is no equilibrium
 - (d) players always cooperate
7. In a **sequential** game solved by **backward induction**, the equilibrium concept is:
- (a) Nash equilibrium in dominant strategies
 - (b) subgame-perfect equilibrium (SPE)
 - (c) mixed-strategy equilibrium
 - (d) constant-sum outcome
8. In **repeated** games, cooperation can be sustained by strategies such as **tit-for-tat** because:
- (a) the game ends immediately
 - (b) the threat of future punishment makes defection unprofitable when the future matters enough
 - (c) there is only one player
 - (d) prices are fixed by law
9. Setting a **high launch price** for early adopters and lowering it later is **price skimming**, typically used in the product lifecycle's:
- (a) decline stage
 - (b) introduction/growth stage
 - (c) maturity only
 - (d) never
10. **Transfer pricing** — the internal price on goods/services moved between units of the same MNE — matters for international business mainly because it:
- (a) sets consumer prices
 - (b) shifts reported profit across tax jurisdictions and is a capital-structure/tax decision
 - (c) is set by the WTO
 - (d) only affects marketing

Part 2. Discussion questions (10)

Short, open questions for the table; talking points follow each.

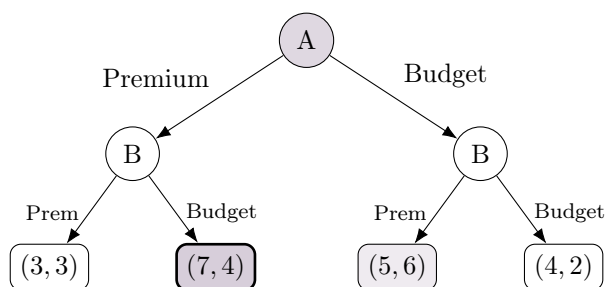
1. **Why prices are sticky.** Survey evidence (e.g. Bank of England) shows firms change prices infrequently and mostly cost-plus. Why, and what does this imply for how competition really works?

2. **Degrees of price discrimination.** Distinguish first-, second- and third-degree price discrimination with an example each, and state what a firm needs to make discrimination work.
3. **Intertemporal price discrimination.** Explain pricing the same product differently over time (new releases, then discounts). What can undermine it?
4. **Transfer pricing.** What is the transfer price, why does it matter for tax as well as internal incentives, and what disciplines it?
5. **The pricing prisoner's dilemma.** Why do two rational rivals often end up in a price war that hurts both, and how do real firms escape it?
6. **Repeated games and tacit collusion.** How does repetition sustain cooperation without an illegal agreement, and what conditions make it break down?
7. **Commitment and credible threats.** Why can *limiting your own options* make you better off? Give a business example of a credible commitment.
8. **Behavioural and dynamic pricing.** Algorithmic/surge pricing and personalised offers exploit behavioural patterns. What are the efficiency and fairness tensions, and why does backlash arise?
9. **First-mover advantage.** When is moving first a genuine advantage, and when is it a disadvantage? Relate to commitment and entry deterrence.
10. **Coca-Cola vs Pepsi.** A stable duopoly that avoids ruinous price war. What sustains the cooperation, using the game-theory tools of the week?

Part 3. Analytical questions (5)

Structured, exam-style problems with diagrams and calculations. Full model answers follow.

1. **A sequential entry game (game tree).** Firm A chooses its positioning first — *Premium* or *Budget* — then Firm B, observing A, chooses its own. Payoffs are (π_A, π_B) . Solve by backward induction, state the subgame-perfect equilibrium, and explain the first-mover advantage.

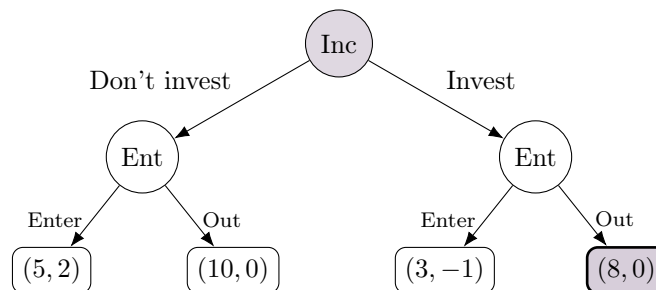


2. **Pricing prisoner's dilemma (payoff matrix).** Two firms simultaneously set a *High* or *Low* price. Profits (π_1, π_2) :

		Firm 2	
		High	Low
Firm 1	High	(10, 10)	(4, 12)
	Low	(12, 4)	(6, 6)

- (i) Find each firm's dominant strategy. (ii) State the Nash equilibrium and why it is inefficient. (iii) How could repetition change the outcome?

- Third-degree price discrimination (a calculation).** A firm with marginal cost £10 sells in two separable markets with constant demand elasticities $\varepsilon_A = -2$ and $\varepsilon_B = -4$. Using the inverse-elasticity (Lerner) rule, compute the profit-maximising price in each market, and state the conditions the strategy requires.
- Transfer pricing and tax (a calculation).** An MNE makes a component in country L (corporate tax 10%) at a cost of £40 and its subsidiary sells the finished good in country H (tax 30%) for £100. The internal *transfer price* TP splits the £60 profit between the two units. (i) Write total tax as a function of TP . (ii) Which direction minimises tax, and how much is saved by moving TP from £50 to the arm's-length ceiling of £70? (iii) What limits the shifting?
- Entry deterrence through commitment (game tree).** An incumbent decides whether to sink cost in extra capacity (*Invest* or *Not*); then a potential entrant decides *Enter* or *Stay out*. Payoffs $(\pi_{\text{Inc}}, \pi_{\text{Ent}})$. Solve, and explain why irreversibility matters.



Part 4. Case studies

Case A — OPEC+: the cartel as a repeated prisoner's dilemma

OPEC and its partners (“OPEC+”, including Russia) coordinate crude-oil output to influence prices. The arrangement has the structure of a **prisoner's dilemma**: the group is collectively better off restraining output to keep prices high, but each member is individually tempted to pump a little more and sell into the high price others are supporting. If everyone yields, output floods the market and prices collapse. Because members interact **repeatedly**, cooperation can be sustained: quotas are agreed, output is monitored, and cheating is deterred by the threat that others retaliate by opening their taps (a price war). In early **2020** cooperation broke down — a Saudi–Russia disagreement triggered a price war, each raising output, and (with pandemic demand collapsing) prices fell to historic lows, briefly negative in one US futures contract — before members reversed course with record coordinated cuts.

Questions.

- Set out the **prisoner's dilemma** facing two representative producers (“restrain” vs “overproduce”). Why is mutual overproduction the one-shot equilibrium, and why is it collectively bad?
- Explain how **repetition** lets OPEC+ sustain cooperation the one-shot game cannot. What role do monitoring and the price-war threat play?
- Interpret the **2020** breakdown as a failure of the repeated-game conditions. Which condition(s) failed, and how did the outcome resemble the dilemma's bad equilibrium?

Case B — One pill, many prices: pharmaceuticals across borders

The same patented medicine often sells at very different prices across countries — high in the United States, lower in much of Europe, and lower still in many emerging markets. This is textbook **third-degree price discrimination** by national market, reflecting different willingness to pay, incomes and regulation (many countries negotiate or cap prices; the US historically does less). Firms defend it as funding the large fixed cost of R&D while enabling access in poorer markets; critics call the high prices unfair. The structure survives only if the markets stay separate: **parallel trade** (buying where the drug is cheap and reselling where it is dear) is the arbitrage threat, which firms and regulators limit through supply controls, differentiated packaging, contracts and legal restrictions on reimportation.

Questions.

1. Identify the type of price discrimination and the single condition that makes it sustainable across countries.
2. Give the firm's welfare/access argument for cross-country price discrimination, and the main criticism.
3. Explain how **parallel trade** works and one mechanism used to limit it — and connect this to why arbitrage is the enemy of third-degree discrimination.

Note. Case adapted from the instructor's seminar handouts and public reporting on OPEC+; items follow the Warwick Summer School written-exam format. Set `\answertrue` for the answer key.