Final Exam Review Notes for Intermediate Microeconomics

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December 28, 2024

Abstract

This is the review outline for the final exam of *Intermediate Microeconomics (30510743-0)* instructed by Tianshi MU. All figures included in this outline are sourced from our textbook Kandori (2023).

1 Firm Behaviors

- Long-run production function
  - Return to Scale: constant, increasing and decreasing, $y(tL, tK)$ and $ty(L, K)$
  - Substitution between Inputs: isoquant's slope = marginal rate of subsitution (diminishing)
- Profit maximization
  - perfectly competitive assumption (p,w, r holding fixed)
  - FOC: $p\frac{\partial F(L,K)}{\partial L} = w$ and $p\frac{\partial F(L,K)}{\partial K} = r$
  - MPL, MPK, $MRTS_{LK} = \frac{w}{r} \Rightarrow$ cost minimization
- Long-run supply curve
  - Construct LTC, LAC and LMC from STC, SAC and SMC
  - The LTC (LAC) curve is the lower envelope of the STC (SAC) curves
  - when STC = LTC, STC is also tangent to LTC
  - General Case: many inputs and outputs $\Rightarrow$ Law of Supply (upward-sloping)

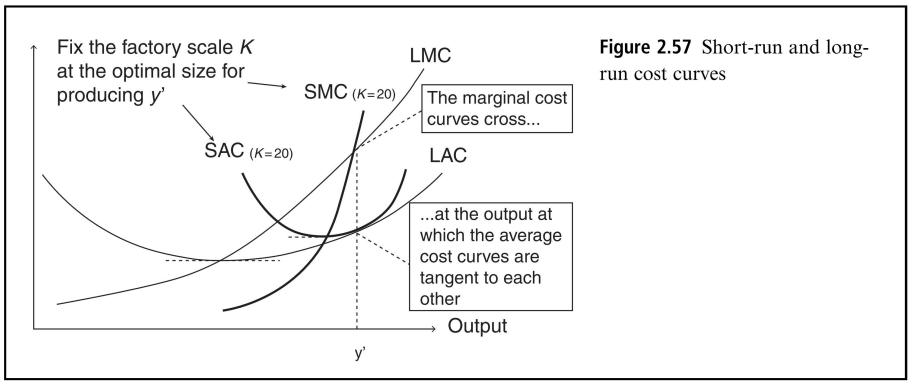

Figure 2.57 Short-run and long-run cost curves

- Profit and Income Distribution (perfectly competitive markets)
  - Accounting (Short-run profit is $MPK \times K$) vs. Economic profit
  - marginal product of input (own the input for producing high price goods)

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2 Partial Equilibrium

- Equilibrium
  - (market) demand meets (market) supply
  - partial: a single market holding other markets fixed
  - general: simultaneously analyze all markets
  - aggregation across individuals: horizontal summation
  - movement along the supply/demand curve $\Leftrightarrow$ shift (comparative statics)
- Short-run partial equilibrium
- Long-run equilibrium
  - sufficient time to adjust
  - firm: no fixed cost
  - industry: free entry/exit, able to use the same (most efficient) technology
  - Normal profits: maximum profits possible in other industries
  - long-run industry supply curve is a horizontal line ($p^* = LAC$)
- Consumer surplus under quasi-linear utility
  - CS: Benefits (measured by dollars) consumers gain from market transactions
  - Quasi-linear utility: CS accurately measures consumers' benefits from market transactions
  - $V(Q, m) = U(Q) + m$: additive, income effect is zero
- Example: Inefficiency of indirect tax
  - Indirect tax: a tax can be passed on or shifted to others (via increasing price)
  - Lump-sum tax: a fixed tax amount that does not distort the price
  - Deadweight loss (DWL): the amount of surplus reduction

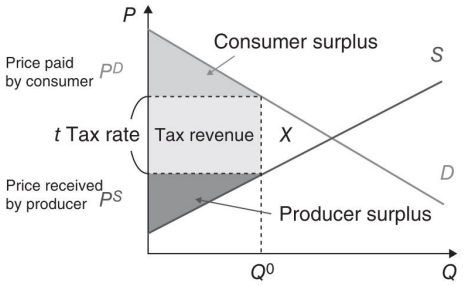
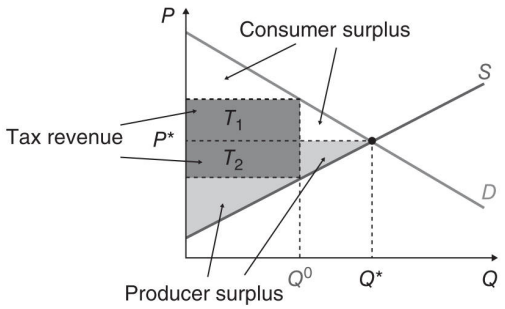


Figure 3.17 Equilibrium and surplus under indirect taxation

Figure 3.19 Equilibrium and surplus under lump-sum taxation



3 General Equilibrium

- Motivation
  - spillover across markets
  - substitute/complement goods vs. input markets
  - both inputs and outputs
- setup
  - price profile: $p = (p_1, ..., p_N)$, Firms: $j = 1, ..., J$, Consumers: $i = 1, ..., I$
  - $\left\{u^i, w^i, Y^j, \theta^{ij}\right\}_{i=1,j=1}^{I,J}$
  - utility maximiztion $\Leftrightarrow$ profit maximization

$$\underbrace{px^i}_{\text{spending}} = \underbrace{pw^i}_{\text{income from endowment}} + \underbrace{\sum_{j=1}^{J} \theta_{ij} p y^j(p)}_{\text{profit distribution from firms}}$$

$$\underbrace{\sum_{i}^{l} x_n^i(p)}_{\text{demand}} = \underbrace{\sum_{j}^{J} y_n^j(p)}_{\text{output-input}} + \underbrace{\sum_{i=1}^{l} w_n^i}_{\text{original endowment}} \quad \text{for } n = 1, 2, \cdots, N$$

- Existence of the equilibrium price profile
  - Walras' Law: For all price profile p and excess demand functions $z(p)$, $pz(p) = 0$
  - Implication: $N - 1$ out of N markets are in equilibrium, then the remaining market must also be in equilibrium
  - Construct $f(p)$ so that the equilibrium price corresponds to a fixed point
- Exchange Economy: the simple tool
  - Edgeworth Box: 2×2
  - Pareto improvement: a change that harms no one and benefits at least one person
  - Pareto efficiency: No Pareto improvement (not unique, Contract curve, social desirability?)
  - introduce a market: $p_1 x_1^A + p_2 x_2^A = p_1 w_1^A + p_2 w_2^A$ (consumption vs. endowment)
  - $MRS_{12}^A = MRS_{12}^B = \frac{p_1}{p_2}$ (Market equilibrium achieves Pareto efficiency!)

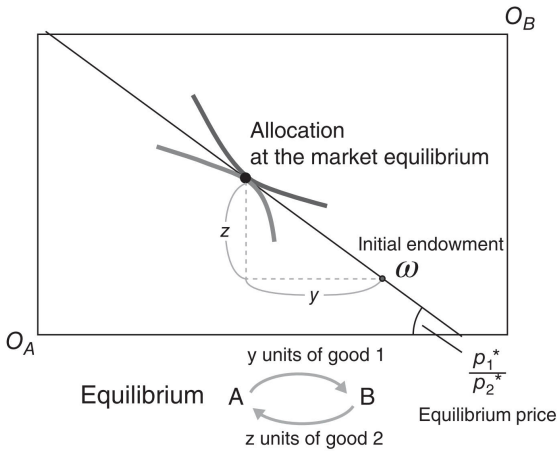
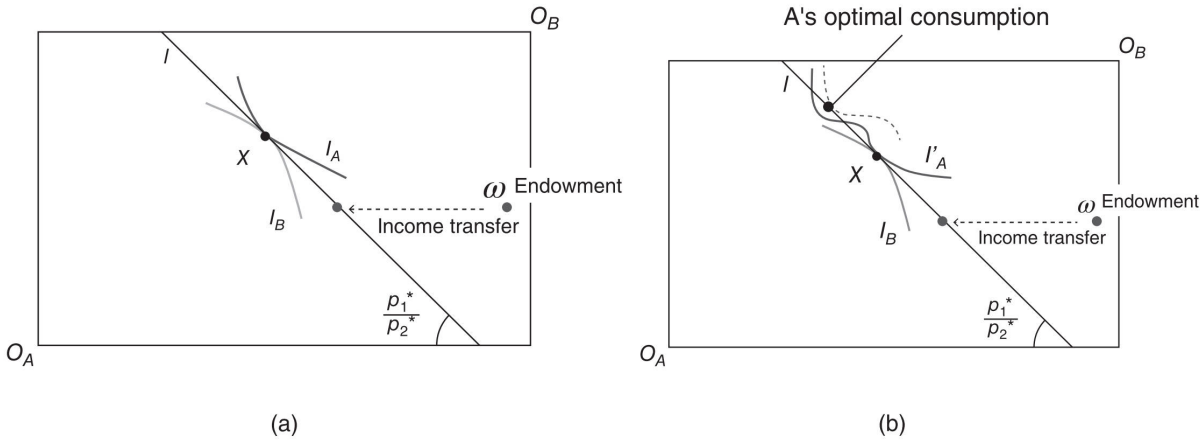


Figure 3.45 Market equilibrium

- The First Welfare Theorem (Efficiency)
  - The perfectly competitive market equilibrium is Pareto-efficient
- The Second Welfare Theorem (Equity)
  - Any Pareto-efficient allocation can be achieved as a perfectly competitive market equilibrium under some income redistribution policy using lump-sum taxes and lump-sum subsidies
  - Conditions: Among other technical conditions, the main conditions are the indifference curve of each consumer is bowed towards the origin and each firm's production possibility set is convex
  - (whether an allocation is efficient or not DOES NOT depend on prices themselves)



4 Monopoly

- Optimal decisions for a monopolistic firm
  - An individual firm faces a horizontal demand curve in a perfectly competitive market
  - A monopolist firm faces a downward sloping demand curve
  - Inverse demand function: $P(Q) = D^{-1}(Q)$ (determine the market price by choosing an output)
  - $MR(Q) = MC(Q)$
  - A monopolist sets price based on demand elasticity: $\underbrace{\frac{P - MC}{P}}_{\text{Learner Index}} = \frac{1}{\varepsilon}$
- What is wrong with monopolies?
  - Inequality: The producer generates more profits, while consumer surplus is lower
  - Inefficiency: Total surplus is lower ("shrinking the pie" for the whole society)
- Natural monopolies and price regulation
  - defining characteristic: massive fixed costs + low-elasticity demand
  - regulation balances the trade-off between technology efficiency and market power
  - one solution is to allow a monopoly but impose price regulation
  - Different price regulation rules

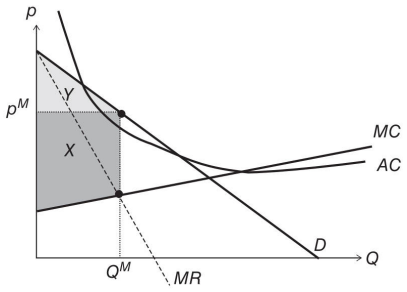


Figure 5.9 Leaving a natural monopoly unregulated

Figure 5.10 Marginal cost pricing rule

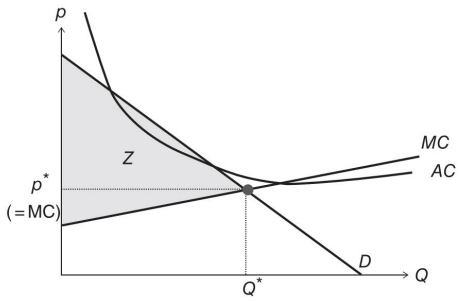
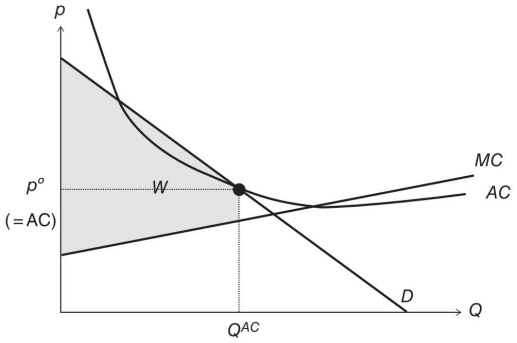


Figure 5.11 Average cost pricing rule



5 Static Game

- Motivation: Strategic Behaviors
  - Difficulty: pin down beliefs
  - Game theory: a theory considers how to predict others' beliefs and hence their decisions
  - Simultaneous moves: everyone makes his or her decision at the same time
- Nash Equilibrium
  - Definition
    - A strategy profile a^* is a Nash equilibrium if for every player i and every strategy profile a_i, $g_i(a^*) \geqslant g_i(a_i, a^*_{-i})$
    - Rationality: each player is playing his best response given his belief about what the other players will play
    - Consistency: beliefs are consistent with actual actions
  - Search for Nash Equilibrium (finite strategy space)
    1. Enumerate all possible strategy profiles
    2. Test whether there is unilateral deviations or not

    1. Calculate the best response function for each player
    2. Search for the intersection of those best response functions
  - Efficiency
    - Prisoner's Dilemma (inefficiency: lack of coordination, neglect negative externality)
    - network externality
    - Hotelling's location game
- Oligopoly: Cournot and Bertrand
  - Firms simultaneously choose their strategies
  - Cournot: Firms compete by choosing the quantities they supply (output)

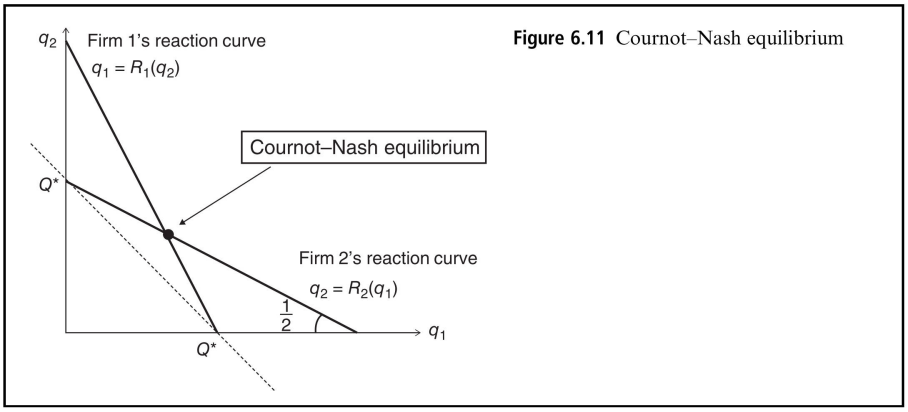


Figure 6.11 Cournot–Nash equilibrium

Output under monopoly $<$ total output under oligopoly (quantity competition) $<$ total output under perfect competition

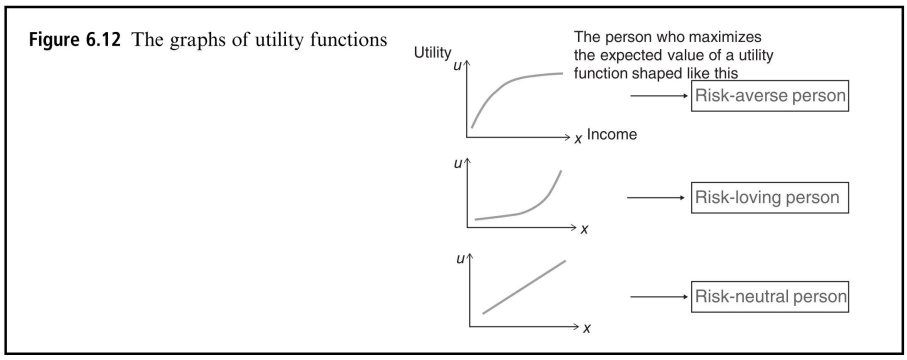
  - Bertrand: Firms compete by deciding the price they sell the good at
    - Assumption: No product differentiation $\Rightarrow p_1^* = p_2^* = c$, zero profits
    - Consumers always buy the cheapest product
    - The firm with the lower price gets all the demand
    - Tie-breaking rule: If two firms set the same price, each firm gets half the demand
    - Better suited for homogeneous products, e.g., gasoline, vitamin, crude oil, ...

6 Uncertainty and Mixed Strategy NE

- Expected Utility
  - lottery, St. Petersburg paradox ⇒ Decision making based only on expected values is not satisfactory
  - The curvature of a person's utility function distinguish different risk attitudes

$$\mathbb{E}[u(\widetilde{x})] = p_1 u(x_1) + p_2 u(x_2) + \cdots + p_K u(x_K)$$

- Risk Aversion
  - The curvature of a person's utility function distinguish different risk attitudes



In the expected utility model:

- the utility function is a **strictly concave** function ⇔ **risk-averse** person;
- the utility function is a **strictly convex** function ⇔ **risk-loving** person;
- the utility function is a **linear** function ⇔ **risk-neutral** person.

- Mixed Strategy Equilibrium
  - Mixed strategy: A player's strategy is a distribution of actions
  - Pure Strategy: A player's strategy is one action with prob. 1
  - Existence: For any game with a finite number of players, each of whom has a finite number of pure strategies, there exists a Nash equilibrium (possibly a mixed-strategy equilibrium)

Good Luck!

References

Kandori, M. (2023). *Mighty Microeconomics: A Guide to Thinking Like an Economist.* Cambridge University Press.