Principles of Economics

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Fall term 2008-2009: Microeconomics

Course Outline

Week 1: Introduction

Part 1: Theories of the agent

Week 2: Consumer preferences and Utility
Week 3: The budget constraint and choice
Week 4: Consumer demand
Week 5: Extensions: uncertainty and intertemporal choice
Week 6: Modelling the producer: Costs and supply decisions

Part 2: Market structures and equilibrium

Week 7: The “ideal” benchmark of perfect competition
Week 8: The Monopoly
Week 9: In between the two benchmarks: Oligopolies and monopolistic competition
Week 10: The basics of Game theory

Part 3: Microeconomic issues and public intervention

Week 11: Welfare and state intervention, taxation
Week 12: Information theory
Week 13: Externalities and public goods
Week 14: Modelling the labour market

References

Week 1 - Introduction

Learning outcomes:

- Understanding the microeconomic approach
- Mathematical modelling and microeconomics
- The different faces of a mathematical function
- Tables and graphs

Reading:

Preface and mathematical appendix of Varian (2006)

Seminar material:

No seminar material for this week, but make sure to do the reading!
Week 2 - Consumer preferences and Utility

Learning outcomes:

- Understanding utility functions
- Representing preferences by indifference curves
- The marginal rate of substitution

Reading:

Chapters 3 and 4 of Varian (2006)

Seminar material:

Exercise 1: Normative vs positive statements

Identify which of the following statements are positive and which are normative:

1. More investment in education and R&D is required if OECD countries want to increase their growth rates.
2. The recent rise in oil prices has dramatically increased the costs the fuel-intensive sectors of the economy, and will cause a lot of businesses to close.
3. The French government should subsidise fuel-intensive sectors in order to shield them from further increases in the oil price.
4. The fact that they can paralyse the country means that French trade unions are too powerful.
5. Since the euro was introduced in December 1999, transaction costs between members of the EU have dropped.
6. A reduction in trade union power typically leads to a higher level of inequality.

Exercise 2: The scientific method

1. Explain what an economist means when he uses the expression *ceteris paribus* (other things being equal). What does this expression say about the approach we use when we try to understand the economy?
2. Do you think that it is possible to carry out experiments in economics? Does this question of experiments affect whether or not economics is a scientific process?
Week 3 - The budget constraint and choice

Learning outcomes:

- Understanding the budget constraint
- Understanding the link between tangent curves and the optimisation principle
- Income and substitution effects

Reading:

Chapters 2 (p 20-26), 5 (p 73-86) and 8 (p 136-142) of Varian (2006)

Seminar material:

**Exercise 1: Indifference curves**

Draw indifference curves for two goods X and Y when:

1. Both goods yield positive utility and the marginal rate of substitution between them is decreasing.
2. The goods are perfect substitutes.
3. The goods are perfect complements.
4. The goods satisfy point 1 but additionally the agent derives a higher level of satisfaction from consuming X than Y.
5. Both goods initially yield positive utility with a decreasing marginal rate of substitution, but after a certain level, the consumer is satiated and further consumption of X or Y decrease his utility.

**Exercise 2: The budget constraint**

The budget constraint of an individual can be written algebraically as:

\[ Q_y \times P_y + Q_x \times P_x = M \]

where \( Q_y \) and \( Q_x \) are quantities of two goods Y and X respectively, \( P_y \) and \( P_x \) are respective prices and \( M \) is income.

1. Re-write this expression with \( Q_y \) on the left-hand-side and everything else on the right-hand-side.
2. If \( M = 50 \, £, \, P_y = 5 \, £ \) and \( P_x = 10 \, £ \), what is the maximum amount of X which can be purchased?
3. By how much must the purchase of Y fall when \( Q_x \) increases by one unit?
4. Draw the budget constraint and label the intercepts and slope.
Week 4 - Consumer demand

Learning outcomes:

- Deriving consumer demand curves from consumer choices
- The link from individual to market demand
- The concept of elasticity on a demand curve

Reading:

Chapters 6 and 15 of Varian (2006)

Seminar material:

Exercise 1: Working on the budget constraint

An individual faces the budget constraint 1 and chooses to consume at the point $a$. In the following month, the price of popcorn and the individual’s monthly income both increase, while the nominal price of DVD’s remains constant. The budget constraint becomes 2.

1. What has happened to the price of DVD’s relative to the price of popcorn?
2. What has happened to the individual’s real income?
3. Can you say whether the individual would consider locating at either of the points $b$ or $c$? Why?

Exercise 2: Income and substitution effects

This part assumes that we are still on budget constraint 1, and the agent still chooses point $a$.

1. On a new diagram, add an indifference curve and draw the consumer choice diagram for this decision.
2. What is the impact on the consumption decision if the price of popcorn, the price of DVD’s and the agent’s income all increase by 10%? Does pure inflation affect demand?
3. As for part 1, the price of popcorn increases and the price of DVD’s remains constant. However, this time, the individual’s income does not increase. Show the income and substitution effects that follow this increase in the price of popcorn.
Week 5 - Extensions: uncertainty and intertemporal choice

Learning outcomes:

- How consumer choice is modeled in the presence of uncertainty
- Why there is a demand for insurance
- How consumers choose over several periods in time

Reading:

Chapters 10 (p 182-191) and 12 (p 220-230) of Varian (2006)

Seminar material:

Exercise 1: Demand curves and elasticities

The following points define a simplified demand curve:

<table>
<thead>
<tr>
<th>Price</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

1. Draw the demand curve defined by these points.
2. What are the price elasticities of demand for prices of 10, 5 and 0 €? Label these values on your diagram.
3. What are the price elasticities of demand at 7.5 and 2.5 €? Label these values on your diagram.
4. What general conclusions can you draw about the relationship between price elasticity and price?

Exercise 2: Elasticities and marginal revenue

This exercise uses the table of values and diagram obtained in exercise 1.

1. Give the definition of total revenue.
2. What surface does total revenue correspond to graphically, for any given point on the diagram obtained in ex.1?
3. In a separate table, calculate the total revenue for all the price values of ex. 1 (0, 2.5, 5, 7.5 and 10 €).
4. For which price is total revenue maximised? What is the price elasticity of demand at this point of the demand curve?
Week 6 - Modelling the producer: Costs and supply decisions

Learning outcomes:

- Understanding the similarities between consumer and producer choice
- The concepts of a production function and a production technology
- Understanding the concepts of Isocasts and Isoquants
- From production costs to the supply curve

Reading:

Chapters 18, 20 and 21 of Varian (2006)

Seminar material:

An exercise on production functions

A small tailoring company has to decide how many tailors to hire in its workshop. The following table gives the monthly output of the workshop given the number of employees.

<table>
<thead>
<tr>
<th>Number of tailors</th>
<th>Total output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>84</td>
</tr>
<tr>
<td>8</td>
<td>88</td>
</tr>
<tr>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>11</td>
<td>88</td>
</tr>
<tr>
<td>12</td>
<td>84</td>
</tr>
</tbody>
</table>

1. Give a define of the average and marginal output, and calculate them for each level of employment (write them out in a new table).
2. Draw the total, average and marginal outputs as a function of the number of tailors. For the purpose of clarity, draw total output in one graph and average and marginal outputs in another.
3. For what number of employees is the average output equal to the marginal output? What can be said of average output at that point? Why do you think this is the case?
Week 7 - The “ideal” benchmark of perfect competition

Learning outcomes:

- The five ideal conditions for perfect competition
- The interaction of demand and supply on a market
- Short run and long run situations under perfect competition
- The zero-profit condition for maximum efficiency under perfect competition
- Surplus as a measure of welfare

Reading:

Chapters 22 and 23 of Varian (2006)

Seminar material:

An exercise on costs and the optimal level of production

A small firm produces mountain bikes. As a part of the business plan, the firm’s accountant works out the total cost of production for different levels of weekly output:

<table>
<thead>
<tr>
<th>Units produced</th>
<th>Total cost (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>1</td>
<td>1000</td>
</tr>
<tr>
<td>2</td>
<td>1400</td>
</tr>
<tr>
<td>3</td>
<td>1800</td>
</tr>
<tr>
<td>4</td>
<td>2200</td>
</tr>
<tr>
<td>5</td>
<td>2600</td>
</tr>
<tr>
<td>6</td>
<td>3000</td>
</tr>
<tr>
<td>7</td>
<td>3500</td>
</tr>
<tr>
<td>8</td>
<td>4080</td>
</tr>
<tr>
<td>9</td>
<td>4680</td>
</tr>
<tr>
<td>10</td>
<td>5300</td>
</tr>
</tbody>
</table>

1. In a new table, calculate the average and marginal costs of production (note: your table also needs 2 spare columns for the next part of the question).
2. The firm sells a mountain bike at a unit price of 500 €. The price is set by the market, and the firm cannot influence it. Calculate the total revenue and the profits made by the firm for each level of output.
3. What level of output will the want to firm produce (explain your answer)?
4. What can we say about the price and the marginal cost at the level of output found in the previous question? Why is this the case?
Week 8 - The Monopoly

Learning outcomes:

- Understanding that firm demand is the same as market demand
- Understanding the link between marginal revenue and demand
- The monopoly diagram
- Welfare aspects and deadweight loss of surplus in a monopoly

Reading:

Chapter 24 of Varian (2006)

Seminar material:

Exercise 1: Perfect competition and efficiency

1. Explain the difference between normal and supernormal profits.
2. Explain why the zero-profit condition is a sign of an efficient market allocation. In particular, why would firms want to keep producing if they are making zero profits?
3. Is it possible for a competitive firm to make supernormal profits in the short run? Try to use an example to illustrate your answer.
4. Is it possible for a competitive firm to make supernormal profits in the long run? Why is that the case?

Exercise 2: Perfect competition and the adjustment to the long run

For this second exercise, we will look at the production decision of a single firm on a perfectly competitive market. Initially, we assume a short-run situation where the firm is making supernormal profits.

1. Draw two diagrams side by side: On the left draw the market equilibrium, and on the right the corresponding single firm equilibrium. Label the consumer surplus on the market diagram and the supernormal profits of the firm diagram.
2. How will agents react to the supernormal profits made by our firm? Show how the market supply and/or the demand curve move in the transition to the long term. What is the effect of this on the demand facing our firm?
3. Identify the consumer surplus for the long run equilibrium. Are consumers better or worse off than in the initial situation? What about the producers?
Week 9 - In between the two benchmarks: Oligopolies and monopolistic competition

Learning outcomes:

- The competition continuum
- The definition of an oligopoly, and the interdependence problem
- Finding the solution for a simple case: Cournot competition
- The concept of monopolistic competition and its relevance to “real life”
- Welfare aspects of monopolistic competition

Reading:

Chapters 25 (p 459-466) and 27 of Varian (2006)

Seminar material:

Profit maximisation and the Lerner index in a monopoly

Consider the following equation, which describes the profits made by a monopoly

\[ \pi (q) = p(q) \times q - C(q) \]

\( p(q) \) describes price and \( C(q) \) describes the total cost of production as a function of the total quantity produced.

1. Differentiate the profit equation to find the profit maximising condition. Why is marginal revenue smaller than price in a monopoly? (Hint: Remember the following rule for the differentiation of a product of functions)

\[ f(x) = u(x) \times v(x) \Rightarrow f'(x) = u'(x) \times v(x) + u(x) \times v'(x) \]

2. Using the formal definition of the price elasticity of demand, modify the first order condition you obtained and isolate the Lerner index. What does this index tell you about the relation between the price elasticity of demand and the size of the markup?

3. Draw two monopoly equilibrium diagrams, one with a relatively elastic demand curve and the other with a relatively inelastic demand curve (Hint: Remember that the marginal revenue curve is twice that of the demand curve). In both diagrams, label the supernormal profits and the markup. Does your diagram correspond to what you found in the previous question?

4. Why is it impossible for a monopolist to produce on the inelastic section of the demand curve?
Week 10 - The basics of Game theory

Learning outcomes:
- The origins of game theory: The prisoner’s dilemma
- The concept of a dominant strategy
- The difference between pure and mixed strategies
- The concept of a Nash equilibrium
- Game theory as a driver of economic research

Reading:

Chapters 28 and 29 of Varian (2006)

Seminar material:

Exercise 1: Monopolistic competition

For information, this exercise will require 3 side-by-side diagrams, so plan your space!

1. Draw the long run equilibrium diagram of a monopoly and the long run equilibrium diagram of a firm in monopolistic competition. Using the concepts seen in the lecture, explain which market structure is more efficient.
2. Next to the previous diagrams, draw the long run equilibrium diagram of a firm in perfect competition. Compare it with the monopolistic competition case: which of the two structures is the most efficient? Why is that the case?
3. Again comparing perfect and monopolistic competition, why is it appropriate to talk about a “competition continuum”?

Exercise 2: Solving a Cournot model

Two firms, 1 and 2, form a Cournot duopoly on a given market. Their profits are given by the following equations:

\[
\begin{align*}
\pi_1(q_1) &= p \times q_1 - c_1 \times q_1 \\
\pi_2(q_2) &= p \times q_2 - c_2 \times q_2
\end{align*}
\]

Furthermore, the price on this market is given as a negative function of total output:

\[p = \alpha - \beta \times (q_1 + q_2)\]

1. In a Cournot duopoly, what assumption does a firm make about the level of production of its rival?
2. Substitute the pricing equation into the profit functions, and derive the reaction functions of the two firms. (Hint: remember the following differentiation rule)

\[f(x) = x^2 \implies f'(x) = 2x\]

3. Given the following parameter values for \(\alpha, \beta, c_1\) and \(c_2\), draw and label the reaction functions in \(\{q_1, q_2\}\) space. Explain from this diagram how the equilibrium solution is reached.

\[\alpha = 100 \quad \beta = 5 \quad c_1 = 20 \quad c_2 = 30\]

4. What are the equilibrium outputs \(q_1, q_2\) and the equilibrium price \(p\)?
Learning outcomes:

- Inequalities: definition and measure
- The Lorenz curve and the Gini coefficient
- The concept of Pareto efficiency
- The fundamental theorems of welfare and the justification for public intervention
- The distortion effect of taxation

Reading:

Chapter 31 of Varian (2006)

Seminar material:

An exercise on oligopolies and game theory

Airbus and Boeing both want to develop a new type of plane. Because these two companies constitute a duopoly, their joint decision can be analysed using a non-repeated game, where either company can choose to develop the new planes or not. If either company decides not to build the new planes, it makes zero profits. If one of them decides to build and the other decides not to build, it gets monopoly profits of $8000 \text{ M}\ €$. Finally, if both companies decide to build the new types of planes, they share the market and get $2500 \text{ M}\ €$ in profits.

- Draw up the payoff matrix for this game. Identify the equilibrium situation and show that it corresponds to a Nash equilibrium.

After consulting with their potential customers, Airbus and Boeing realise that the airlines will only buy the new planes if they are more fuel-efficient than the previous generation of planes. This imposes higher development costs than initially planned. These extra costs will reduce all profits they make by $4000 \text{ M}\ €$ if they decide to develop the planes. If a firm decides not to develop the planes, it does not incur this extra development cost.

- Draw up the new payoff matrix, taking into account the extra development cost. Show that the previous equilibrium is no longer stable, and identify the new equilibrium location(s).

Because a higher fuel-efficiency means that the new planes will be more environmentally friendly, the EU regulator decides to give Airbus a $3000 \text{ M}\ €$ subsidy to help cover the extra development cost. Airbus will only receive this payment if it decides to develop the new planes.

- Draw up the new payoff matrix, taking into account the extra development cost and the potential EU subsidy on Airbus. How is the previous equilibrium situation affected by this subsidy? How realistic is it that the EU would subsidise Airbus in such a situation?
Week 12 - Information theory

Learning outcomes:

- Understanding asymmetric information
- A practical example: The market for “lemons”
- The concepts of moral hazard and adverse selection
- The principal - agent problem and its usefulness in modern theory

Reading:

Chapter 37 of Varian (2006)

Seminar material:

Exercise 1: Pareto efficiency

Is a Pareto efficient allocation systematically preferable to a Pareto inefficient allocation? Make use of the concepts seen in week 11, such as the Edgeworth box or the fundamental theorem of welfare, to explain your answer.

Exercise 2: Income tax exercise

Consider the following income tax system: individuals pay a flat tax rate of 20% on income above 5000 €. Individuals earning less than 5000 € do not pay any tax.

1. For each level of the following levels of income, calculate the amount of income tax paid, the average tax rate and the marginal tax rate: 10000 €, 12500 €, 16000 €, 18000 €, 20000 € and 25000 €.
2. Which is higher, the marginal tax rate or the average tax rate? What can you conclude on the regressive or progressive nature of this tax?

Exercise 3: Effects of taxation

The government wishes to introduce a tax on the market for wine, with a fixed amount to be paid per bottle sold.

1. Draw a standard market equilibrium diagram, with an upward-sloping supply curve and a downward-sloping demand curve.
2. Show the effect that such a tax has on the market equilibrium. Make sure to label the consumer surplus, the producer surplus, the tax revenue and the deadweight tax loss.
3. Draw a second market equilibrium diagram, but this time make the demand curve less price-elastic. Redo question 2 on this second diagram.
4. By comparing the two diagrams, what relation can you see between the elasticity of demand and the share of the tax burden paid by consumers? Give an example of a good that is both highly taxed and has a price-inelastic demand. In this example, who do you think carries the biggest share of the tax burden?
Learning outcomes:

- The definition of a public good: Non exclusion and non-rivalry
- The free-rider problem
- Externalities, and the difference between social and private costs and benefits
- The Coase theorem

Reading:

Chapters 34 and 36 (p 670-677) of Varian (2006)

Seminar material:

Adverse selection in the mortgage market

Mortgage brokers A and B provide mortgages to two types of borrowers. Type 1 borrowers are considered low risk, as only a few of them default on the repayment of their mortgage. Type 2 borrowers, however, are considered as high risk, as a high proportion of them will eventually default on their repayments. In order to cover the risk of default, the brokers take out an insurance, which they charge to their customers through a risk premium.

1. Mortgage broker A can observe the risk level of its borrowers. In order to completely cover the risk of default, how much will it charge type 1 borrowers compared to the market rate of interest? What about Type 2 borrowers?
2. Assume that mortgage broker B cannot assess the risk level of borrowers. How will it charge borrowers to cover the default risk? Compare this to the pricing policy of broker A and explain how this affects which brokers type 1 and type 2 borrowers will want to choose.
3. What will happen to mortgage broker B if it effectively applies this pricing policy to any borrowers that ask for a loan?
4. How realistic is this situation? In reality, what mechanisms do lenders put in place to avoid this adverse selection problem?
5. We now assume that all mortgage brokers assess the risk of the lenders and adjust the interest rates accordingly. Furthermore, we also assume that the probability of default increases with the cost of the mortgage. If brokers themselves have to borrow funds from investors in the financial market, do they have an interest in being transparent to investors about the risk level of their customers?
6. How does your previous answer illustrate the link between the sub-prime mortgage crisis and the current liquidity crisis on financial markets? Try and use current examples to explain your answer.
Learning outcomes:

- Understanding the leisure vs labour supply decision of agents
- The classical labour market and the effect of a minimum wage
- The asymmetric information approach: efficiency wages
- The imperfect competition approach: monopsony power in the labour market

Reading:

Chapter 26 of Varian (2006)

Seminar material:

*Modelling the labour supply decision*

An economic agent has to choose a combination of a basket of goods $c$ and leisure time $l$. Both of these consumption increase the agent’s utility, with a decreasing marginal utility. Furthermore, we assume that the maximum amount of useful time available in a day is 16 hours, so that if the agent chooses $l$ hours of leisure, this means he works $(16 - l)$ hours.

1. With leisure on the horizontal axis and consumption on the vertical axis, draw an indifference curve corresponding to the agent’s utility function. What can we say about the marginal rate of substitution between consumption and leisure?
2. The agent has an unearned income $I$ and additionally is paid a wage $w$ for every hour worked. The price of a unit of the consumption basket $c$ is $p_c$. Assuming that the agent spends all his income on the consumption of $c$, write out the budget constraint that the agent faces. What is the slope of this constraint?
3. Show the effect of an increase in unearned income on the optimal choice (for example a win at the lottery or a large inheritance). What is the effect on the number of hours worked?
4. Show the effect of an increase in the wage rate on the optimal choice. Is there necessarily an increase in the amount of hours worked?
5. How well do you think this model explains the decision of agents to supply labour? In particular, is it realistic to assume that agents can freely choose the number of hours they work?