

January Examination Period 2022-23

ECN113: Principles of Economics

Duration: 2 hours

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Answer ALL questions

Calculators are permitted in this examination. Please state on your answer book the name and type of machine used. Complete all rough workings in the answer book and cross through any work that is not to be assessed.

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Examiner: Dr. Eileen Tipoe

PART A: LONG-ANSWER QUESTIONS**Question 1 (40 marks)**

In an economy, all workers are paid the same hourly wage of £15 and can freely choose how many hours to work per day (ranging from 0 to 24, inclusive), for 365 days a year.

All workers get utility from consumption (denoted c) and free time (denoted t , defined as any time not spent working). Initially, there is no income tax, so their daily budget constraint is $c = 15(24 - t)$.

There are two types of workers in the economy:

- Type 1 workers have the utility function $u(c, t) = ct^5$
- Type 2 workers have the utility function $u(c, t) = c^2t$

a) Find the optimal daily consumption (£) and free time (hours) for Type 1 workers.

[4 marks]

b) Find the optimal daily consumption (£) and free time (hours) for Type 2 workers. By referring to the utility functions of both types, explain how and why the optimal choice for Type 1 and Type 2 workers differ.

[4 marks]

Now the government imposes an income tax of 20% on any earnings above £12,500. (So, if a worker earned £20,000, then £7,500 of their income would be subject to a 20% tax.) After the tax, Type 1 workers choose 7,000 hours of free time per year and £23,620 of (after-tax) consumption; Type 2 workers choose 3,050 hours of free time per year and £68,520 of (after-tax) consumption.

c) Illustrate the before-tax and after-tax optimal choices of Type 1 and Type 2 workers, using an indifference curve and budget constraint diagram with annual consumption (£) on the vertical axis and annual hours of free time on the horizontal axis (you can either draw a single diagram or one diagram for each type of worker). Remember to label the axes, the x- and y-intercepts of the budget constraints, and any other relevant points.

[6 marks]

d) Use the concepts of income effect and substitution effect to explain how the income tax affects the optimal choices of Type 1 and Type 2 workers.

[4 marks]

Suppose there are 100 people in this economy: 70 Type 1 workers and 20 Type 2 workers are employed; 10 workers are unemployed. If there is an income tax, then the unemployed each receive £10,000 in unemployment benefits each year; otherwise they receive £0. For parts e) to g), assume that the number of people in each group (Type 1 employed, Type 2 employed, unemployed) are the same before and after the tax.

e) By calculating the income shares of each group, draw the before-tax and after-tax Lorenz curves for this economy (cumulative share of income on the vertical axis, cumulative share of the population (from poorest to richest) on the horizontal axis).

[6 marks]

f) Using the Lorenz curve diagram from part (e), calculate and interpret the before-tax and after-tax Gini coefficient for disposable income. Round your answers to 3 decimal places where necessary. (You can round the income shares from part (e) to 1 decimal place before doing the Gini coefficient calculation.) [6 marks]

Suppose instead that Type 1 workers responded to the 20% tax by choosing 7,700 hours of free time, and Type 2 workers choose 2,200 hours of free time.

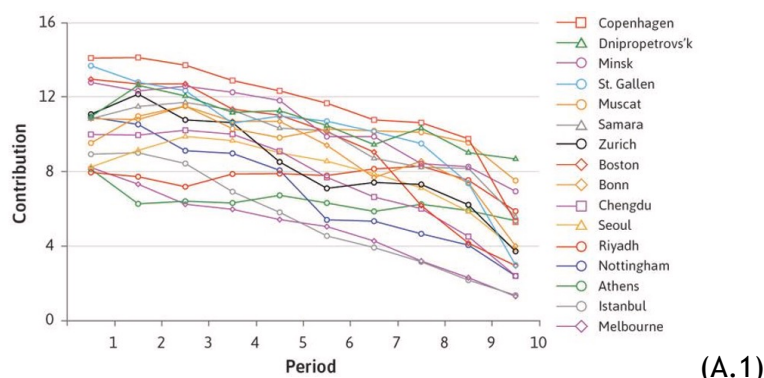
g) By calculating the after-tax income under this scenario and comparing the income shares before and after the tax, explain how the tax affects disposable income inequality. Round your answers to 3 decimal places where necessary. (You do not need to draw a new Lorenz curve or recalculate the Gini coefficient.) [4 marks]

h) Identify 3 factors (mentioned in this question and/or other factors) that could influence how the income tax affects disposable income inequality, and explain why. [6 marks]

Question 2 (15 marks)

Figure A shows the results of an experiment where people in various cities around the world played 10 rounds of a public goods game (note that the vertical axis range in panels A.1 and A.2 are slightly different). Players were randomly assigned into groups of 4. In each round, every player was given \$20 and chose how much to contribute to a money pot. At the end of each round, every player received 0.4 times the total amount in the pot plus the money he/she chose not to contribute. Players were also told how much everyone else chose to contribute. The game with punishment (panel A.2) was identical to the game without punishment, except that players could choose to punish other players who did not contribute.

Public goods game without punishment



Public goods game with punishment

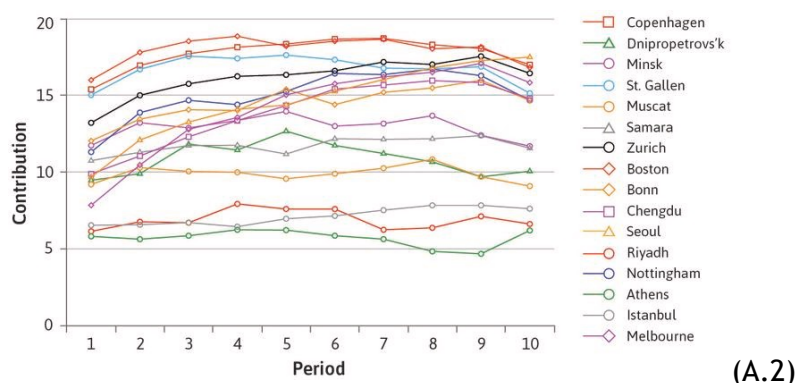


Figure A. Average contributions in the public goods game (with and without punishment)

a) With references to the charts, identify and explain the motives (e.g. self-interest, types of social preferences) that are consistent with participants' behaviour in this experiment.

[6 marks]

Now assume the public goods game is played only once, rather than 10 times.

b) Show that for a completely selfish player (your payoffs only depend on the money you have at the end of the round) contributing \$0 is a dominant strategy in the public goods game without punishment. (*Hint: Let P be the amount of money that the other players contributed. Write a player's payoff in terms of the amount he/she contributes, and P .*)

[3 marks]

In the game with punishment, any player who contributes £0 is punished by having an amount £X deducted from the money he/she has at the end of the round.

c) If the amount deducted is £6, how much would a completely selfish player choose to contribute? (*Hint: Find the amount that makes the player indifferent between contributing that amount and not being punished vs. contributing \$0 and being punished.*)

[2 marks]

d) Explain how the amount that a completely selfish player chooses to contribute varies with

- i) the size of the punishment, £X;
- ii) the proportion of the money pot that is given back to the players (which was 0.4 in the example above).

[4 marks]

Question 3 (15 marks)

In an economy, all workers in formal employment are paid an hourly wage of £15 and work 40 hours a week. All workers in the gig economy are paid an hourly wage of £7 and work 40 hours a week.

There are two types of workers in that economy:

- Type A workers have an hourly disutility of effort of £5 when formally employed, an hourly disutility of effort of £4 if in the gig economy, and a £2 per hour psychological cost of unemployment (when unemployed).
- Type B workers have an hourly disutility of effort of £2 when formally employed, an hourly disutility of effort of £4 if in the gig economy, and a £4 per hour psychological cost of unemployment (when unemployed).

All unemployed workers receive unemployment benefits of £6 per hour for the entire duration of their unemployment, and expect to find a formal job with an hourly wage of £15 after being unemployed for 35 weeks.

a) For each type of worker, calculate the employment rent per hour (from formal employment) and the total employment rent.

[4 marks]

b) Using your answer to part a), describe how the best response curve for Type A workers (with hourly effort on the vertical axis and hourly wage on the horizontal axis) differs from that of Type B workers. (You do not have to draw a diagram; a detailed description of the relevant curves is enough.)

[3 marks]

c) Suppose the gig economy now has a labour union, so the hourly wage rises to £8 and the hourly disutility of effort decreases to £3.

i) Recalculate the total employment rent for both types of workers and interpret your answer.

ii) Use the wage-setting/price-setting model to explain how this change would affect the equilibrium real wage and equilibrium employment.

[8 marks]

PART B: SHORT-ANSWER QUESTIONS

For each of the statements below, determine whether it is true or false and provide a short explanation (around 1-3 sentences) of your answer. One example is given below.

Each statement is worth 3 marks: 1 mark for the correct answer, 2 marks for a valid explanation.

[Example]

Statement: A monopoly is a price-taking firm.

Answer: False

Explanation: A monopoly is a price-setting firm because it chooses price to maximise profits rather than taking the market price as given.

Question 4

In Malthus' model of real wages and population size, when there is a positive one-off technological shock (such as better fertilizer), the population initially rises but then falls to the pre-technological shock level.

Question 5

For the production function $f(K, L) = 4K + 7L$, if capital (K) costs £3 and labour (L) costs £5, then the firm would minimize costs by only using labour.

Question 6

A price-setting firm facing the demand curve $P=100-3Q$ may find it optimal to produce at the point $Q=20$, $P=40$.

Question 7

Figure B shows the effect of a per-unit tax of £5 on producers.

Statement: The producers would be willing to pay up to £15 to the government to abolish this tax.

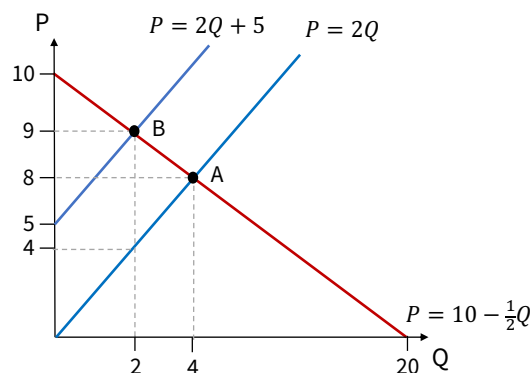


Figure B. Diagram for Question 7.

Question 8

In Figure C, the firm's marginal cost of production, (a), is £75.

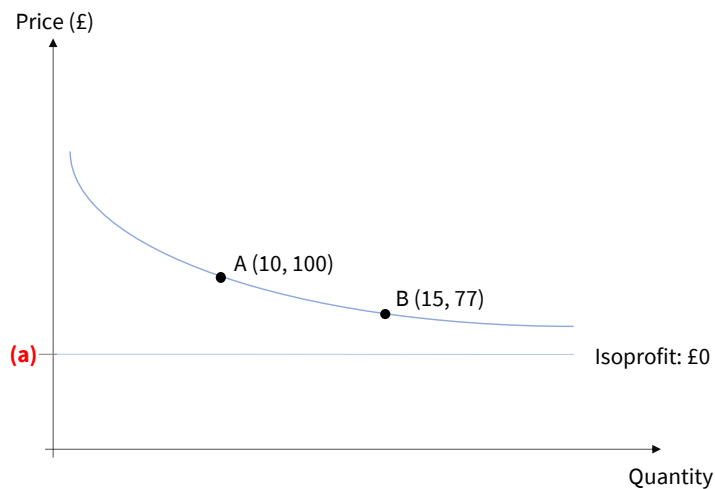


Figure C. Diagram for Question 8.

Question 9

In an Airbnb contract, the owner and the person renting the property are both principals and agents.

Question 10

In the market for a particular identical good there are initially a large number of each of two types of producers: Type A and Type B. Type A producers use a better production technology than Type B producers, so Type A's average cost curve is lower than Type B's. Both types have upward-sloping marginal cost curves and U-shaped average cost curves.

Statement: In the long-run equilibrium, both Type A and Type B firms produce at where the price equals their average cost (AC).

Question 11

Figure D represents the interaction between two software engineers, Astrid and Bettina, who are working together to write code as a part of a project. The numbers represent the pay (in thousands of dollars) for completing the project.

Statement: This game has two Nash equilibria: (C++, C++) and (C++, Java).

		Bettina	
		Java	C++
Astrid	Java	3 4	2 2
	C++	0 0	6 3

Figure D. Diagram for Question 11.

Question 12

Consider a beekeeper who produces honey and sells it at a constant price per kilogram. Assume that the marginal private cost of producing honey increases with output, and that there is a neighbouring farmer whose crops the bees can help pollinate.

Statement: In this scenario, the marginal social benefit (MSB) curve will be above the MPB curve.

Question 13

Figure E shows a situation where a factory producing humanoid robots is situated next to a dormitory for nurses who work night shifts. The production process is rather noisy, and the nurses often complain that their sleep is disturbed. The graph depicts the MPC and MSC of the robot factory production. The robot market is competitive and the market price is £340.

Statement: In this scenario, the producer surplus at the factory's profit-maximising level is £9,600.

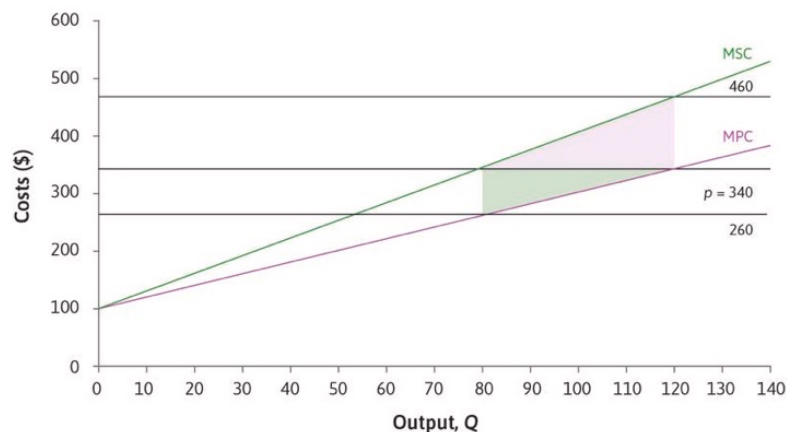


Figure E. Diagram for Question 13.

End of Paper