

14.01 Principles of Economics Fall 2018
Final Exam

Long Question 1: Trade (40 minutes)

For this question, it is okay to have non-integer answers

Steel manufacturing in the US requires only one input: labor. Steel is produced by a representative firm under perfect competition according to the production function

$$S(L) = \frac{1}{2}L$$

Throughout this problem assume that the wage in the United States is 1.

- (1) (4 minutes) Suppose that United States can freely import and export steel. Foreign supply of steel is supplied with perfect elasticity at a price of 1. How much steel is produced in the US?

Car manufacturers use steel and labor to make cars. Both steel and labor are variable inputs and cars are produced by a representative firm under perfect competition according to the production function

$$F(L, S) = (\sqrt{L} + \sqrt{S}).$$

- (2) (10 minutes) Now suppose the price of steel is p_s . Solve for the supply function of US car manufacturers (quantity supplied as a function of the price of cars, p , and the price of steel p_s).

(3) (3 minutes) Assume the US freely trades steel, where the world price of steel is 1 as before. What is the supply curve for cars?

(4) (8 minutes) Suppose that the supply of cars from foreign producers is perfectly elastic at $p = 100$ (the world price of cars is 100), and the US demand for cars is $Q = 1080 - 10P$.

(a) (4 minutes) Supposing that there is free trade in the car market as well as the steel market, calculate the equilibrium price and quantity of cars consumed (purchased) in the United States. Does the US import or export cars and how many does the US import or export?

(b) (4 minutes) Calculate consumer and producer surplus under trade.

(5) (15 minutes) The US government is unhappy with steel imports and decides to impose a 200 percent tariff on imported steel so that the price of *imported* steel is now 3 when importing from abroad. (Continue to assume that the US domestic steel market operates in perfect competition with production function $S(L) = \frac{1}{2}L$)

(a) (2 minutes) What is the price of domestic steel? Will car manufacturers choose to use domestic or foreign steel?

(b) (5 minutes) Calculate the new equilibrium in the US market for cars, continuing to assume that cars are traded freely at a world price of 100. Does the US still export cars?

(c) (4 minutes) What happens to the consumer and producer surplus in the market for cars? (You can describe the changes qualitatively, you do not need to calculate the numbers)

(d) (4 minutes) What does this exercise suggest about the costs of implementing tariffs on intermediate goods such as steel?

Long Question 2: Redistribution and Efficiency (40 minutes)

Consider an economy with two types of individuals: skilled and unskilled workers. The only difference between the two is that the skilled have a higher hourly wage $w_s = 40$ than the unskilled do, $w_u = 10$. Suppose that there are 400 unskilled and 100 skilled workers in this economy.

Suppose that each individual has a utility function over consumption (c) and leisure (l) of the following form:

$$U(c, l) = \ln(c) + 2\ln(l)$$

where $l \in [0, 24]$.

1. (a) (3 minutes) Write down the individual's budget constraint in terms of consumption and leisure. Draw the budget constraints for the skilled and unskilled workers in the same graph with leisure on the x -axis.

- (b) (7 minutes) Solve for each individual's optimal leisure, labor, and consumption choice.

2. (10 minutes) Now suppose that the government wants to redistribute from the skilled to the unskilled workers. It levies an income tax which collects 20% of each skilled worker's earnings and then uses the tax revenue to give an equal amount (lump-sum transfer) T to each unskilled worker. So only the skilled workers are taxed and only the unskilled workers receive the transfer.

(a) (4 minutes) On the same set of axes, draw the new budget constraints faced by the two types of individuals.

(b) (4 minutes) Solve for each skilled individual's new optimal leisure, labor, and consumption. Does labor supply change? What is the intuition behind this result?

- (c) (2 minutes) Compute the total tax revenue collected by the government from taxing the skilled individuals.
3. (a) (4 minutes) Suppose that for every tax dollar collected, 6.25 cents are lost due to administrative costs. Suppose that the government sets T so that it spends what it collects (the government balances its budget). How large is T ?

(b) (10 minutes) Solve for each unskilled individual's new optimal leisure and consumption. Compare the results to the ones before the policy was enacted.

(c) (6 minutes) Now suppose that the government wants to maximize a utilitarian social welfare function. Would it prefer setting no taxes, as in part 1 of this section, or would it prefer to set an income tax + lump-sum transfer scheme as described in part 2 of this exercise?

Hint: You can have non integer answers.

3. (5 minutes) The consumption of fossil fuels produces externalities by polluting the environment. Therefore, an organization like OPEC that tries to promote collusion among oil producers could improve total social surplus.

4. (5 minutes) Consider the market for roses on Valentine's day. Suppose that every couple in the US will buy exactly one rose regardless of the price, so the domestic demand is perfectly inelastic. The US is an importer of roses. If the government sets an import tariff, there will be no efficiency loss since the quantity consumed will not change.

3. (4 minutes) Does increasing β increase or decrease savings? What is the intuition behind this result?

4. (4 minutes) Does a higher interest rate increase or decrease savings? Provide the intuition for this result.

5. (20 minutes) Now suppose that $\beta = 1$ and that there are two types of households: rich and poor. They differ only in their first period wealth which is $W = k$ for the rich and $W = \frac{3k}{4}$ for the poor for some $k > 0$. Now, the households can only save by investing in a risky asset (the safe asset option of the previous questions is not available now). This asset requires an investment of exactly $\frac{k}{2}$ and will yield gross second period income equal to k with probability $1/3$ and gross second period income of 0 with probability $2/3$. Note that households can only buy exactly one unit of the risky asset. Households seek to maximize their expected utility of consumption.
- (a) (8 minutes) Will the poor households choose to invest in the risky asset in order to transfer resources to the next period? Why or why not?

(b) (12 minutes) Will the rich households choose to invest in the risky asset? Is your answer different from the previous subquestion? Provide an intuition for why or why not.

b) (2 minutes) What is the market supply function?

c) (6 minutes) What is the price in equilibrium? How many lobsters are sold? How many market stalls will there be?

5. (10 minutes) Suppose now that both market stalls form a cartel. That is, they agree on the quantity that they will produce and the price they will charge to maximize joint profits. What is the new equilibrium price and quantity? How many lobster does each market stall produce?
6. (4 minutes) Rank each of the models (perfect competition, monopoly, Cournot and cartelization) according to consumer surplus and explain the intuition behind it. Explain the intuition. You do not need to make any calculations for this part.

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