

**Problem Set 5 (Due October 14, 2022)**

1. Governments use various instruments to influence the market outcomes. This question asks you to consider some of these.
  - (a) A minimum price may be set for goods. Can a minimum price above the competitive equilibrium price increase total producers' surplus in the market? Does it always increase producers' surplus?
  - (b) A price cap or a price ceiling (or a maximum price) is often meant to help the consumers in a competitive market. Does a price cap below market price always help the buyers? How are you evaluating the buyers' welfare?
  - (c) Suppose that in the absence of international trade, the domestic competitive equilibrium price for a good is EUR 60 per unit. The good is also available in the world market at price EUR 40 with a perfectly elastic (horizontal) supply curve. Draw the diagram for changes in domestic consumer and producer surplus after allowing free trade with the world market (assume no transportation costs). How do the surpluses change if a 10 EUR per unit import tariff is set for foreign production?
2. Consider a competitive market where firms can produce quantity  $q$  using a technology whose cost function is given by  $C(q) = F + cq^2$ , for  $q > 0$ ,  $C(0) = 0$ .
  - (a) What is the fixed cost of the technology, what is the marginal cost?
  - (b) What is the efficient scale of production (i.e. the quantity minimizing the average cost) for each firm?
  - (c) The demand curve for the market is given by  $P = 90 - 2Q$ , where  $Q$  denotes the total quantity demanded. Set  $F = 25$  and  $c = 9$ . What is the long-run equilibrium price for the market? How many firms enter?

- (d) How does the number of entering firms depend on the fixed cost (increasing or decreasing in the fixed cost?) How does it depend on the coefficient on marginal cost?
3. A competitive market for electricity production operates using fossil fuels. The market consists of small plants that differ from each other in terms of their marginal cost (perhaps due to technologies of different vintage). The supply curve of the industry is given by  $S(Q) = \frac{1}{10}Q$ . The demand for electricity is given by  $P(Q) = 100 - \frac{1}{10}Q$ .
- (a) Compute the equilibrium price and quantity for the market.
- (b) Advances in clean technology make electricity production by wind mills possible. Wind mills are all alike and can produce electricity up to maximum capacity of  $q = 1$  at zero marginal cost. Suppose that the fixed cost for constructing a wind mill is 20. Is it profitable for an individual investor to set up the only windmill in the market?
- (c) What is the long-run equilibrium number of wind mills in the industry if mills can be set up at cost 20 and there is no exit or entry into the fossil-based electricity production.
- (d) Discuss the effects of tradable emission permits for this market. More specifically, assume that with emission permits, the marginal cost of the fossil producers increases and the new supply curve for the fossil producers is  $S(Q) = 10 + \frac{2}{10}Q$ . Compute the new short run equilibrium for the industry.
- (e) In the long run, the number of wind mills adjusts to the new supply curve in the fossil sector. Compute the long run price in the market and the long run number of wind mills when the fixed cost for the wind mills remains unchanged.
4. Consider a model of trade between two countries, Domestic (D) and Foreign (F). In D, there are 100 competitive firms operating with marginal cost  $MC^D(q) = 2q$  at individual production of  $q$ . In F, there are 100 competitive firms with a lower marginal cost  $MC^F(q) = q$ .
- (a) Draw the supply curves for the two countries in a diagram with the coordinate system where total production  $Q$  is on the horizontal axis and price  $P$  is on the vertical axis.
- (b) Suppose that the demand function in both countries is given by  $P = 2 - \frac{Q}{100}$ . Find the equilibrium prices and quantities  $(P^D, Q^D)$  and  $(P^F, Q^F)$ .

- (c) Suppose that the two countries start trading so that there will be a single equilibrium price for the two countries such that total demand equals total supply. Solve for the equilibrium price and quantity. How does the free trade equilibrium quantity compare with the combined quantity  $Q^D + Q^F$  in the absence of trade?
5. A consumer lives for two periods. In the first period, she receives an income of 400 in the first period and 600 in the second. She wants to optimize her consumption over the two periods and income can be directly used in consumption.
- (a) Suppose that the consumer can borrow or save at zero interest rate. Explain some reasons why it might be a good idea to borrow in the first period.
- (b) Suppose next that the interest rate for both saving and borrowing is 30%. How does this affect the incentives to save or borrow?
- (c) Suppose next that there are also consumers that receive 800 in the first period and 200 in the second. How does the interest rate affect their optimal consumptions over the two periods?
- (d) At equilibrium interest rates, total savings in the economy equal total borrowing. What do you think happens to the equilibrium interest rate if the number of consumers of the second type increases?