Principles of Economics I
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Problem Set 5 (Due October 16, 2020)

1. Governments use various instruments to influence the market outcomes. This question asks you to consider some of these.

   (a) In order to help the producers, a minimum price may be set for the market. 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?

   (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?

   (d) Instead of imposing a tariff, an import quota can be set for products produced in foreign countries. A quota just sets an upper bound for imports of the good in question. The goods within the quota are sold in the market together with domestic products. Assume that consumers view foreign and domestic products as perfect substitutes. Which of the two methods for restricting imports would you use? (Hint: for a tariff of x EUR per unit of import, consider a quota of y units in such a way that the total quantity sold in the market is equalized. Compare the outcomes).

2. Consider a model of trade between two countries, Domestic (D) and Foreign (F). Manufacturing labor is cheaper in F than in domestic and as a result, the equilibrium price of large appliances is EUR 90 lower

in F than in D if there is no foreign trade. All appliances regardless of the country where they are produced are considered to be equally good by all buyers (no home bias).

(a) Draw the demand and supply diagrams for the two countries in two graphs that allows you to compare the price levels (as in the lecture notes). Assume that the two countries start trading, but the cost of transporting goods is EUR 60 per appliance. Consider the resulting equilibrium prices in the two countries after allowing free trade. Explain how the prices are different if the buyers in D pay the transportation cost versus if the producers pay the cost to get to the market in D.

(b) Suppose another country (S) exactly similar to D joins in the free trade area. The cost of transportation between any two countries is EUR 60. What happens to equilibrium prices? What can you say about the producer and consumer surplus in D as a result of S joining the free trade area.

3. In this problem, we return to the problem of consumption and saving that we saw in Problem Set 1. There are two types of individuals: students and trust fund kids. Students work hard and earn 100 in period 2 when they are old. Unfortunately since they study in period 1, they have no income in that period. Trust fund kids get an inheritance of 200 and they conclude that they do not have to study. As a result, they have no labor income in period 2. Denote consumptions in the two periods by c_1 and c_2.

(a) Since both types of individuals like to consume on both periods, they realize that a market for borrowing and loans might be a good idea. Suppose that there is a market rate for lending and borrowing at r so students can borrow c_1 for consumption when young in exchange of paying $(1+r)c_1$ back when old. We require that $(1+r)c_1 \leq c_2$ so that any amount borrowed can be paid back. Similarly the trust fund kids may save s when young to get back $(1+r)s$ when old. Draw the budget sets for the two types of individuals.

(b) Draw indifference curves to the two types of buyers that reflect the fact that the MRS between consumption in period 1, c_1 and

consumption in period 2, c_2 is given by the ratio of the two consumptions: $MRS = \frac{c_2}{c_1}$. (Actually you can graph such indifference curves explicitly as $c_2(c_1) = \frac{u}{c_1}$ and the indifference curves corresponding to higher u give consumption pairs that are better than consumption pairs on indifference curves with lower u). Find the optimal savings s for the trust fund kids and optimal borrowing c_1 for the students in the graphs.

(c) Use the budget constraint and the requirement that MRS = MRT to solve algebraically the optimal savings and borrowings.

(d) Determine the effect of an increase in r on the optimal savings and borrowings graphically. Show the income and substitution effects in the graphs.

(e) (Extra credit) In any credit market, borrowing must equal lending since each transaction has these two sides. For our model, this means that the borrowing by students must equal lending by trust fund kids. Using the algebraic solutions that you found in c., determine the equilibrium rate r that makes borrowing equal to lending whet 10% of the population are trust fund kids. How does the equilibrium rate vary as we change the fraction x of trust fund kids in the model and what are the implications of this to the welfare of the two types of individuals?

4. In this Exercise you are invited to think about some concrete examples of production technologies and what they imply for the supply function in a particular industry. I want you to. consider an important market for a homogenous good: the market for electricity. There are five main sources of supply for electricity in the Nordic market. Wind plants, nuclear plants and combined heat and electricity production account together for 40% of actual generation. Hydro power accounts for about 55% of generation and the remainder (between 5 and 10% in most years) comes from fossil fuel thermal plants. I want you to think about equilibrium prices in markets composed of such supply sources.

   (a) Ignore for the moment hydro power generation. This case is closer to Spain or California where hydro is not such an important energy source. Construct the supply curve for the electricity market where nuclear generation accounts for 80 TWh per year, wind

accounts for 30 TWh and combined production accounts for 40 TWh. (You may assume that the marginal cost of production for these is zero even though for nuclear, the marginal cost for short periods is negative). The rest of the supply comes from thermal plants of fixed size. Assume that these plants vary in efficiency of production, but not in size. There are 100 plants each with capacity 1 TWh per year and cost of production that varies between 1 and 100 by plant (so that at each integer P between 1 and 100, there is one plant with average cost at P). Draw the resulting supply curve for price taking electricity producers.

(b) Suppose that the demand is completely inelastic at 170 TWh per year. What is the equilibrium price in the market? What are the profits for various types of producers?

(c) Assume now that we go to the actual case of hourly pricing of supplies and demands. We keep on using the same numbers (just not measured in TWh but 1/8760 parts of TWh). Wind production varies between 0 and 60 based on the wind conditions. Let W denote the potential wind production in a given hour. What is the equilibrium price as a function of W?

(d) Add some further realism to the model by assuming that demand in winter is 190 per hour and in summer 160 per hour. What are the prices for the different seasons (depending on wind conditions)?

(e) (Extra credit) Finally add some hydro power into the consideration. How does hydro power production differ from the other sources? (Hint: the marginal cost of operating the plant is minuscule, but what is the opportunity cost of producing electricity for a given hour?) Is there any natural variability in hydro power production over the year? How would you supply electricity in the market if you were the manager of a profit maximizing small hydro plant?