Intermediate Microeconomics

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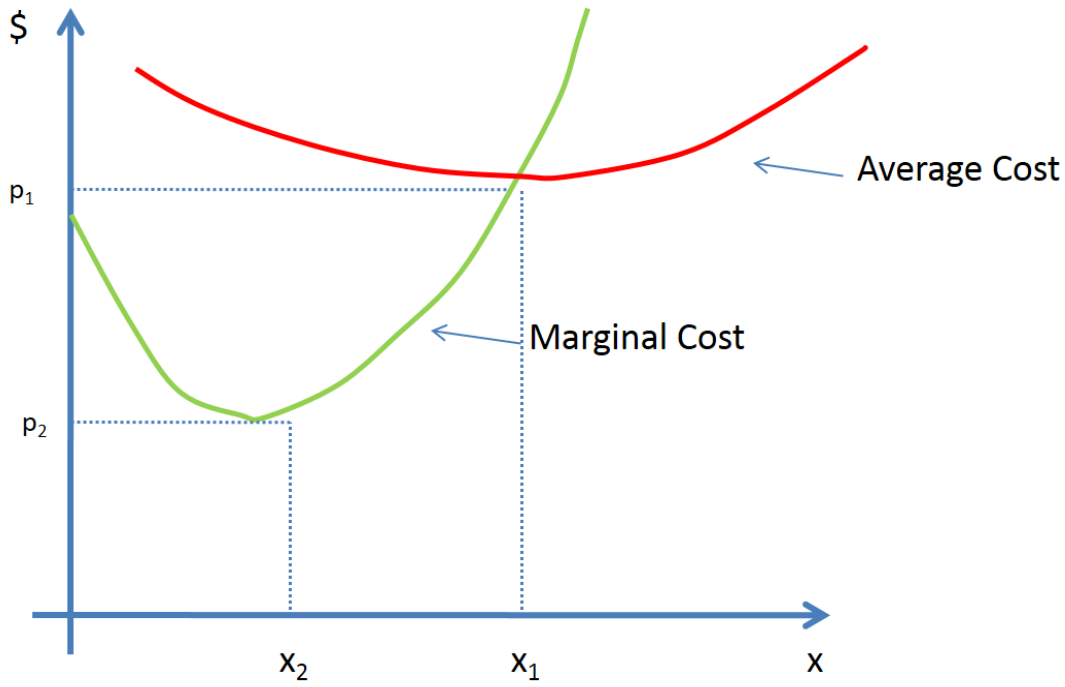
Homework 8

Due Wednesday, 13th April

Question 1 (Producer Surplus) In class we showed that, for a firm with no fixed costs and decreasing returns to scale, then the area above the demand curve and below the price was equal to the consumer surplus. Now we will show that this is more generally true

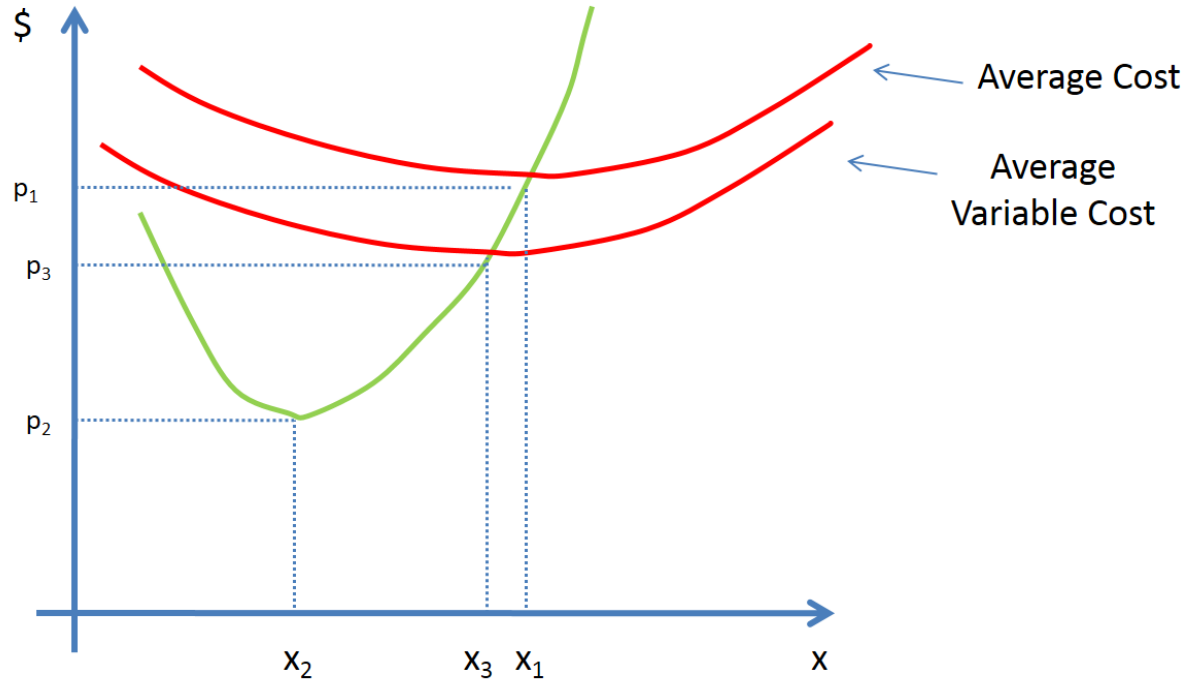
1. Imagine that the firm has cost curves as shown in the figure below, and has no fixed costs (i.e. $c(0) = 0$). Sketch the supply curve of this firm. Show that the area under the supply curve is equal to the cost of production for any $x > x_1$. Conclude that, for such output, the area above the supply curve but below the price line is equal to the

producer surplus



2. Now imagine the firm has fixed costs F, and its cost curves are as shown as in the figure below. Sketch the supply curve of the firm. Does the area under the supply curve still equal the cost of production? If not, why not? Show that the area above the supply

curve but below the price line still equals producer surplus



Question 2 (Consumer Surplus) We will now use the idea of quasi-linear preferences to help us to understand consumer surplus. Think of a consumer who has preferences over two goods given by

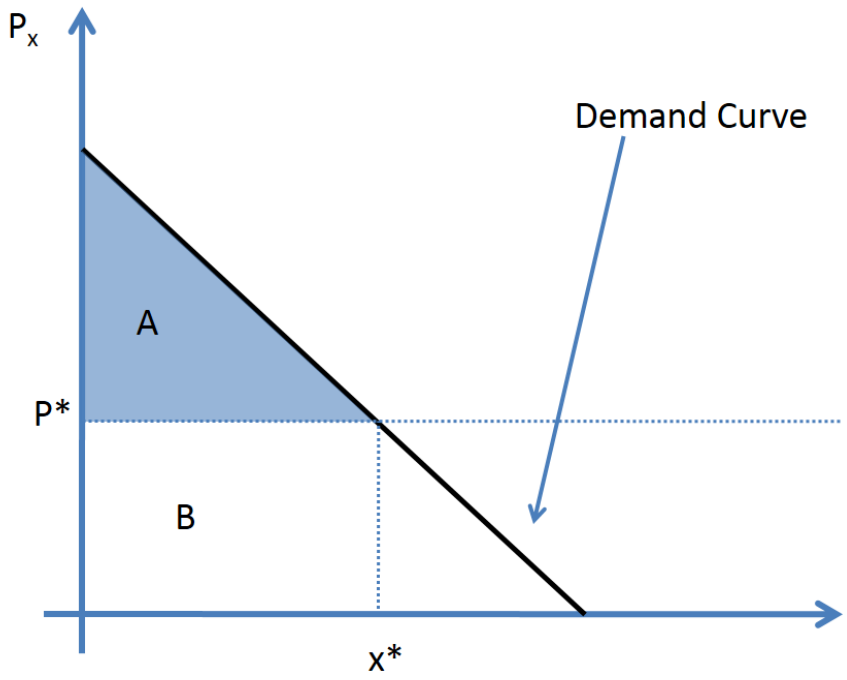
$$u(x, y) = v(x) + y$$

We will think of good x as 'figs' and good y as 'money' - i.e. the utility the person gets from spending the money they have left over after buying figs. Assume that $v(0) = 0$. The budget constraint is

$$p_x x + y \leq M$$

1. If the consumer buys amount x of figs at price p_x, how much higher is their utility than if they were allowed to buy no figs - in other words what is the consumer surplus?
2. The figure below depicts the demand function for figs - Notice that we can think if this as showing price as a function of demand - i.e. for every demand level x, $P(x)$ is the price at which x is demanded. Use the first order conditions of the consumer's optimization

problem to show that $P(x) = \frac{\partial v(x)}{\partial x}$



3. Use this to conclude that the area A+B in the above picture is the total utility of consuming the amount of figs x^*
4. Use this to conclude that the area A is the consumer surplus from purchasing x^* figs at price p^*

Question 3 (Industry Supply) Imagine that a firm has cost curves of the shape indicated in the figure for question 1 part 1 above, with no fixed costs. To make things slightly easier, we will also assume that marginal costs are linear above x_1, so that, $x_1 = 7$, $p_1 = 5$ and above x_1, marginal cost is given by $MC = 5 + 2(x - 7)$.

1. Sketch the supply curve for the firm.
2. Now imagine there are two firms in the industry, each with exactly the same cost curves. Sketch the industry supply curve. How does the area between the price line and the industry supply curve relate to the profits of the two firms
3. Imagine that demand is given by $35 - 2p$. How many firms can this demand support? What is the price at which demand equals industry supply?

Question 4 (Partial Equilibrium) US demand for grits is given by $D(p) = 15 - 2p$.US firms supply grits according to $S_{us}(p) = 2p$. UK firms (being more efficient) supply grits at $S_{uk}(p) = 3p$. Assume that each firm is setting price equal to marginal cost, and have no fixed costs. Sensibly, people in the UK do not eat grits, so demand in the UK for grits is zero.

1. Say there is no international trade in Grits, so US consumers can only buy from US producers (we call this autarky). Calculate the equilibrium price, consumer and producer surplus in the US market.
2. Imagine that there is now international trade. Calculate the industry supply curve for Grits from US and UK firms.
3. Graph total supply and total demand for grits. Find the equilibrium price of grits. Calculate the consumer surplus and producer surplus (i.e. profits) for each firm in equilibrium
4. Jealous of the magnificence of UK firms, congress passes a law charging a tariff of $\tau < 1$ on imported grits. Thus, if the price in the US market is p, then UK firms receive $p\tau < p$. What is equilibrium price and output now?
5. What is the consumer surplus and the profit of US firms in this case? Compare these to the case of autarky and full international trade. Compared to a case of full international trade, how much would US firms be prepared to bribe congress in order to ensure a tariff of level τ?