

ECONOMICS 1 (Lecture1)

NEW and IMPROVED Key to PROBLEM SET #2

1. Jasmine is willing to pay \$12 for the first lamp that she purchases each year, \$11 for the second, \$10 for the third, and so on down to \$1 for the twelfth and nothing for the thirteenth. The market price is \$5.25.
 - a) **How many** lamps will she buy? (she can't buy fractions of a lamp) **How much** does she spend on those lamps? **What is** the maximum amount she would have been willing to pay for them?

She is willing to spend \$6.00 on the seventh one, so she buys that one: she would be willing to spend a maximum of \$5.00 for the eighth lamp, so she finds \$5.25 too steep, so stops after seven lamps. She has spent 7 times \$5.25, which is \$36.75. She would have been willing to spend 12.00 on the first one, 11.00 on second one, and so on until 6.00 for the seventh one: for a total of 63.00.

Other way to look at it: she was willing to spend 12.00 on the first lamp and only had to pay 5.25: she had a 'bonus' of 6.75 on that particular lamp. She gets similar, progressively smaller 'bonuses' on subsequent lamps of 5.75, 4.75 and so on until the seventh lamp, on which the difference between her willingness to pay and the price she must pay is 6.00 minus 5.25 \rightarrow 0.75. The total 'bonus' would be 25.25: we call that the *consumer surplus*. It actually would have been faster to subtract the expense (36.75) from her total willingness to pay (63.00).

- b) The next year, the price of lamps drops to \$1.75. **How many** lamps does she buy now? **What happened** to her consumer surplus?

She now buys eleven lamps. Her consumer surplus (calculated in the same way as in part a) is now 57.75.

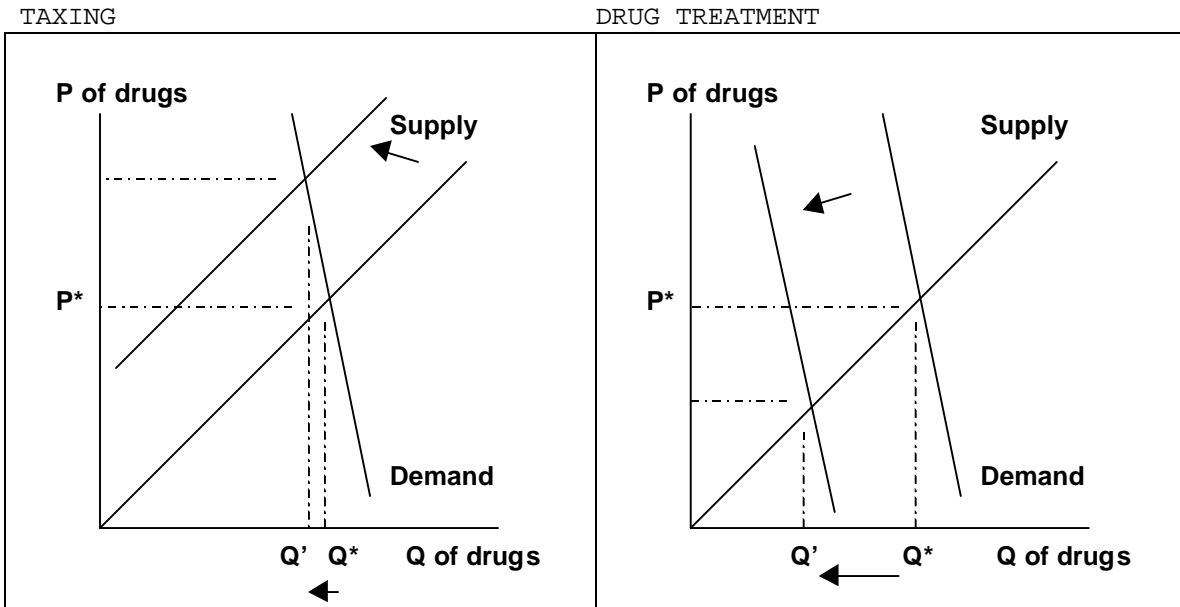
- c) **Provide** an intuitive explanation for the concept of consumer surplus, and why it is often used as measure of welfare.

If you were willing to pay 6.00 for a novel, and by some coincidence that was the market price, you would be *indifferent* between having the money or the book in your hands: buying it would not increase your *welfare*. If however, it sold for \$3.90, this simple trade could increase your welfare by \$2.10, the consumer surplus on that item.

1. Let's explore how you can use Econ 1 for important policy issues: in this case, drug use. You are the President's "drug czar", and he gives you two suggestions for accomplishing your goal (a large reduction in drug use among young people) The first is to legalize drugs and put a tax on them. The second is to mount an effective treatment program for addicted individuals. **Your job** is to decide which policy is more likely to succeed, and **explain** your analysis. (Hint: **make** assumptions about the price

elasticity of drug users' demand, then **use** graphs. You can model the supply of drugs as a generic 45 degree curve. One way to think of a tax is as an increase in costs for the producer.

Let's assume that drug users are addicts and buy drugs at almost any price. That means that their demand is relatively price inelastic (almost vertical on the graph) Look first at legalizing and taxing drugs. One way to think of a tax is as an increase in cost to the producer: the supply curve shifts left. That produces only a small reduction in the quantity of drugs sold. On the other hand, implementing an effective drug-treatment program would amount to reducing demand (shifting demand curve left) This should reduce substantially the quantity of drugs sold.



On the graph P^* and Q^* are the equilibrium price and quantity before any intervention. Notice how the treatment program has been more successful in reducing the amount of drug use. This conclusion rests on our original assumption: users are addicts. Try this again, on the assumption that people who buy drugs are recreational users and are sensitive to price changes. The conclusion would be reversed: taxing would be more successful. Make sure you get the intuition. Can you formulate an opinion on drug policy in this country? (you can think of seizing shipments at the border and destroying crops in other countries as supply-side policies)

- Using the definitions of the different types of costs, **fill** the missing entries in the following table, and **use a graph** to illustrate the results.

To answer this, you need to know that:

- fixed costs are the same for all levels of production (even zero)
- $TC = FC + VC$
- $AC = TC / Q$ (which means of course that $AC * Q = TC$)
- $MC = \text{change in } VC / \text{change in } Q$

(it is also equal to change in TC / change in Q ; do you understand why?)

(note: 'AC' and 'ATC' are equivalent)

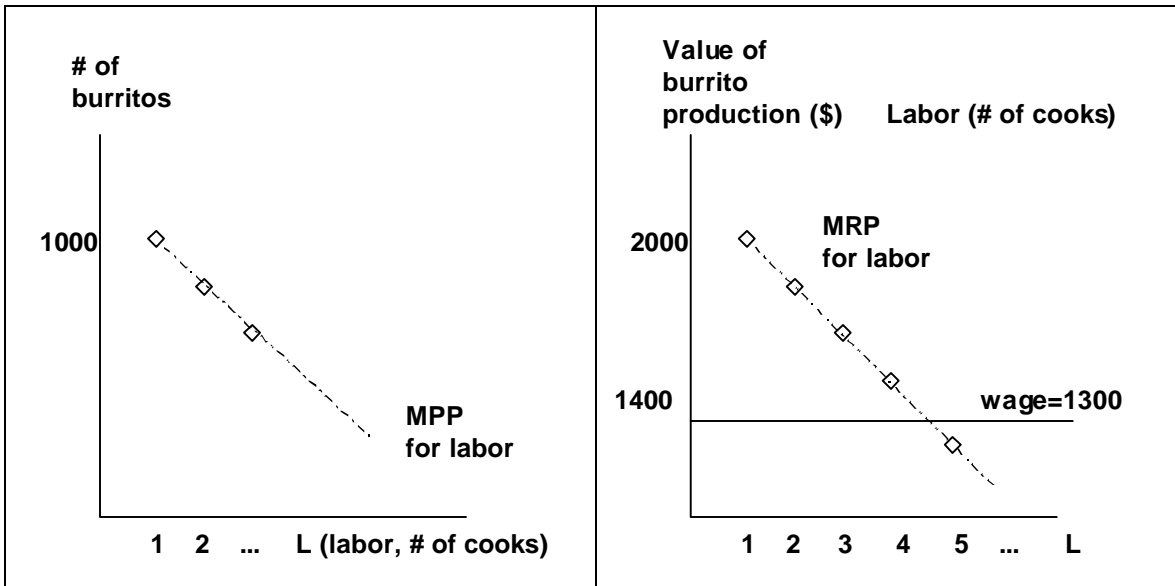
<u>Quantity (Q)</u>	<u>Fixed Cost (FC)</u>	<u>Variable Cost (VC)</u>	<u>Total Cost (TC)</u>	<u>Marginal Cost (MC)</u>	<u>Average Cost (AC)</u>
0	500	0	500	----- (*)	----- (**)
1	500	125	625	125	625
2	500	200	700	75	350
3	500	325	825	125	275
4	500	500	1000	175	250
5	500	750	1250	250	250
6	500	1450	1950	700	325

* we are not really interested in what happens when we increase production from minus one unit to zero

** cannot divide by zero

1. You decide to open a burrito shop. You then lease a restaurant space on Bancroft, and buy all the necessary kitchen stuff (all completely worthless after a year's use): you have spent \$1200 before cooking a single burrito. Hiring a single burrito-engineer (cook) would mean a total production of 1000 burritos for the year. Hiring the second one means an additional 900 burritos, the third one 800 more, and so on, until the eleventh one, whose presence (even though he *does* work) adds *no* burritos at all to the total production. The competitive price for burritos is \$2, and the competitive wage paid to burrito-engineers is \$1300 a year.
 - a) **Graph** the relationship between the number of additional burritos and cooks. (be sure to correctly label everything) **What** do you call this curve? **Is it possible** for all cooks to have exactly the same skills? **Explain** why or why not.

It is the Marginal Physical Product curve for of an input (labor in this case, so MPP_L) It is perfectly possible for cooks to have all the same ability. The reason additional cooks produce less is the fixed input: the kitchen is not getting bigger, nor are pots and pans multiplying as new cooks come in.



- a) **Draw** another curve (again, be careful with labels) which illustrates the value of this production to you (the burrito shop owner) **What** do you call this curve? **How many** cooks will you choose to hire? (you can't hire half a cook)

It is the Marginal Revenue Productivity of an input (labor in this case, so MRP_L) It represents the value of the additional production:

$MRP_L = MP_L * \text{Price of output}$. Recall that the first cook hired ($L=1$) produces 1000 burritos, so at a price of \$2.00, the value of that production is \$2,000. Since that is higher than what it is costing you to hire that cook (\$1,300), you decide to hire her. The value of the second cook hired is \$1,800, and you hire him too, as well as the third and fourth ones. Hiring a fifth one would increase production by 600 units, worth \$1,200 (less than wage = 1,300), so you stop at four.

- b) **How much** profits will you make that year? Bonus (don't ask) question: if you are at least as skilled as the cooks you have hired, **was it a good idea** to start this business?

If you hire 4 cooks, you have a total output of 3,400 units (1,000+900+800+700), which brings you revenues of $3,400 * 2 = \$6,800$. To get profits you have to subtract costs. Fixed cost is \$1,200 and variable (only labor in this case) costs are $4 * 1,300 = 5,200$. So profits are:

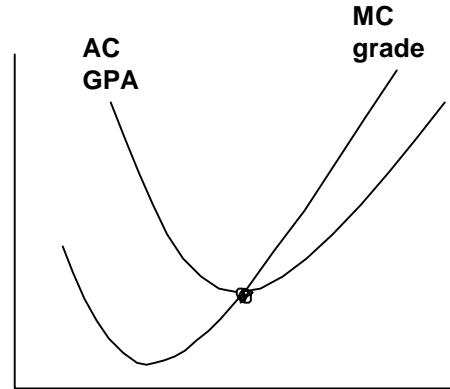
$$\text{Profits} = TR - TC = TR - (FC + VC) = 6,800 - (1,200 + 5,200) = \$400$$

If you are at least as skilled as your employees, that means that you could get a similar salary (your *opportunity cost* of starting a business) on the competitive market for cooks. Since you can make a higher salary than the profits you made, maybe the business was not such a great idea.

5. Let's say you have a GPA of A after your first (very keen) semester at CAL. Second (over-confident) semester, you get all Cs. **What happens** to your GPA? Third and

fourth (some soul-searching) semesters, you get all Bs. **What has happened** to your GPA during the second year? **Why?** Third (you have achieved zen wisdom) year, you get all As again, and your GPA now ... **Of which economic concepts** should this little story remind you? (**illustrate** your answer with a graph)

Think of each semester grade as your *marginal* grade, and of your GPA as your *average* grade. The point of this problem was to convince you that Marginal Cost (MC) can only cut through the Average Cost curve through its minimum (min of AC). It does not matter whether the MC is increasing or decreasing: as long as it is below the AC, AC must be decreasing. (in the same way, it does not matter whether you are getting Bs and Cs or Cs and Bs this year: if your GPA was 4, you will bring your GPA down) Similarly, if MC is above AC, then Average Cost must be increasing. It is crucial that you understand the difference between *marginal* and *average*.



5. You start a new business (Mexican food is out of fashion) selling japanese onigiris (little stuffed rice triangles), and your only fixed cost is renting the trailer (\$110 a week) You calculate the following (weekly) total cost figures:

Qu.	100	200	300	400	500	600	700	800	900	1000	1100	1200
TC	210	300	370	400	420	430	490	560	640	740	850	1000

- a) **compute** average (AC) and marginal (MC) costs to 2 decimal points (pennies!)

Qu.	100	200	300	400	500	600	700	800	900	1000	1100	1200
TC	210	300	370	400	420	430	490	560	640	740	850	1000
AC (ATC)	2.10	1.50	1.23	1.00	0.84	0.72	0.70	0.70	0.71	0.74	0.77	0.83
MC	1.00	0.90	0.70	0.30	0.20	0.10	0.60	0.70	0.80	1.00	1.10	1.50

- b) **show** MC and AC on a graph.

(same shape as number 5)

- c) The number of trailers selling onigiris is fixed (Berkeley permits), but the market is otherwise perfectly competitive, with a price of \$1.00. **What is** your profit-maximizing output? **Explain.**

As a profit maximizer, you want to set the quantity you produce and sell at a point where $MR=MC$. Perfect competition implies that each producer is too small to affect market price so the marginal revenue you get is the market price. Note that it would be different if you were a monopolist for example: then, any attempt by you to sell a larger quantity would depress the price and your MR would be lower than the price. In this case, $MR=MC=1.00$ occurs when quantity is equal to one thousand units. (one problem when we use discrete amounts is that we don't know what happens between 900 and 1000 units: if the MC is equal to 1.00, then any quantity in that range would be optimal)

d) **Why** would producing one more or one less onigiri lower your profits?

In general, "one less" implies that ($MR>MC$): in other words that you could still make some profit on the last one, so why not do it? Producing one more would imply $MR<MC$: more money going out than coming in, so why do that? It is best to produce where $MR=MC$.

e) **Calculate** that profit.

You can calculate the profits as follows (TR is Total Revenue, which is Price times Quantity; you can also think of P as average revenue):

$$\text{Profits} = TR - TC = (1.00 \cdot 1000) - (740) = 260$$

Note that since $AC = (TC/Q)$, you would have the same results by:

$$\text{Profits} = TR - TC = (P \cdot Q) - (AC \cdot Q) = (P - AC) \cdot Q = (1.00 - 0.74) \cdot 1000 = 260$$

f) If the permit restriction is lifted, **what will happen** to the number of firms (anyone can rent a trailer and prepare onigiris at the same price)? To the **market price**? To your **profits**? **Explain**.

If others see you making profits selling onigiris they will want to enter the industry (if there were losses, firms would exit) As firms enter the supply curve shifts to the right. This will happen until profits are zero (at which point nobody wants to enter the industry and firms in the market will continue to produce) This occurs when $P=0.70$ and each firm produces 800 units. Why? Because at that point $P=AC$, which implies that profits are zero (on average you get just enough money to cover costs), so:

$$\text{Profits} = (0.70 - 0.70) \cdot 800 = 0$$

g) **Re-tell** the above story, pointing some real-world conditions that might change it.

Recall that perfect competition requires that all firms sell an homogenous product, and thus would not be able to sell anything if they increase their price in the slightest. In this case, fast food around campus is likely to see a variety of slightly differentiated products. Also, since space is limited, it is unlikely that anybody would want to could find a space for their onigiri trailers. None of this should detract from the main insight of the model: if firms are first

restricted from entering an industry that is at least somewhat competitive, then allowed to enter it, the market price will drop.

5. True or false? **Explain.**

- a) A firm produces the quantity which maximizes total revenue minus total costs, not the quantity at which marginal revenue equals marginal costs.

FALSE: Maximizing the difference between total revenues and total costs (that difference represents profits) requires that you keep producing while what you add to revenues (MR) is larger than what you add to your costs (MC). So profits are maximized when MR just equals MC. So the quantity which maximizes TR-TC and the quantity where MR=MC are always one and the same.

- b) Individual firms in perfect competition face flat demand curves (perfectly inelastic)

FALSE: It is true that individual firms face flat demand curves (why? because by definition they are small and cannot influence the market price by producing more or less). A flat demand curve however implies perfect *elasticity*. From the point of view of the individual firm, consumers are very sensitive: if it tries to increase its price just a little, *all* consumers will buy from some other firm.

- c) A change in fixed cost might affect a firm's decision to produce or not but would not affect its profit-maximizing output.

TRUE: A firm decides to produce a quantity where MR=MC. Since the fixed cost does not influence the MC (recall that MC tracks the change in variable cost: fixed costs do not change, of course, they stay *fixed*) If the fixed costs are too high however, the firm may experience losses and stop producing.

- d) There are no fixed costs in the long run.

TRUE: Fixed costs pay for inputs that are fixed in the short run. In the long run, by definition, all inputs are variable, so there are no fixed costs.

- e) Bonus (still can't ask) question: It is possible to have diminishing marginal returns to all inputs, but constant returns to scale overall.

TRUE: Diminishing marginal returns refer to the MPP of a particular input when all others are fixed. Returns to scale refer to what happens when *all* inputs are increased.