Econ 200 AE Spring '25 Week 6

Anirudh Ravishankar, onirudh3@uw.edu

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Section Information / Reminders

Friday 11:30am, MOR 221.

Office Hours: Tue Thur 11am-12pm, SAV 403.

Weekly material posted on https://onirudh3.github.io/teaching.

Grading:

- Homework: 20% (lowest grade dropped), due every Thursday 11:59pm.
- Writing assignments: 20% (due May 1 and June 5).
- Midterm: 30% Tuesday, April 29.
- Final: 30% (non-cumulative) June 5.

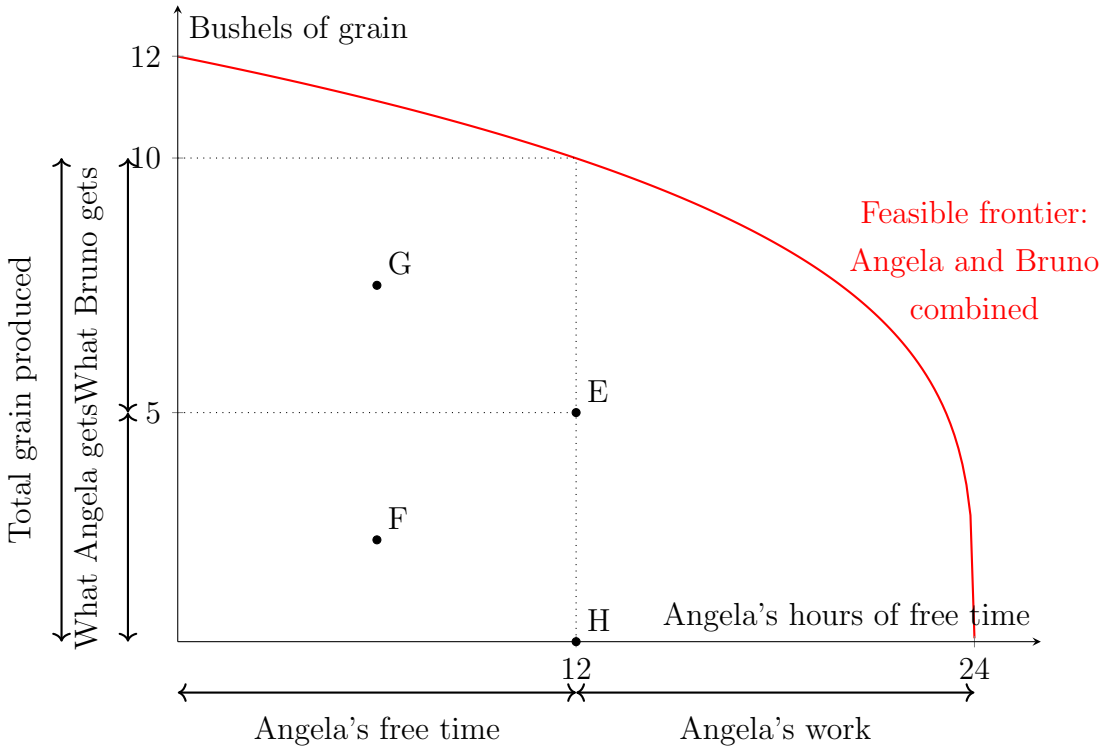
Unit 7 Review

Some important things to recall (not exhaustive):

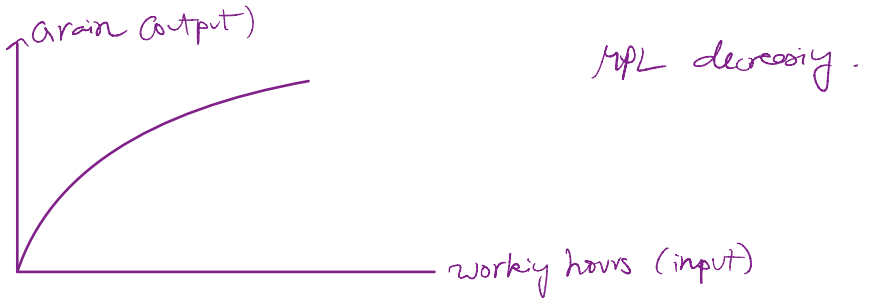
- Profit $= \underbrace{(\text{Price} \times \text{quantity})}_{\text{Total Revenue}} - \underbrace{(\text{Unit cost} \times \text{quantity})}_{\text{Total Cost}}$.
- Isoprofit curves: locus of (price, quantity) points that give the same profit.
- Cost function
- Returns to Scale
- Price elasticity $\varepsilon = -\frac{\%\text{Change in quantity}}{\%\text{Change in Price}}$
- Surplus, Deadweight Loss

Problems

1. Bruno is a landowner and Angela is a farmer who pays an unspecified share of her grain output to Bruno as rent for the use of the land. Consider the following figure, which shows Angela's and Bruno's combined feasible set. Based on the figure, answer the following questions.



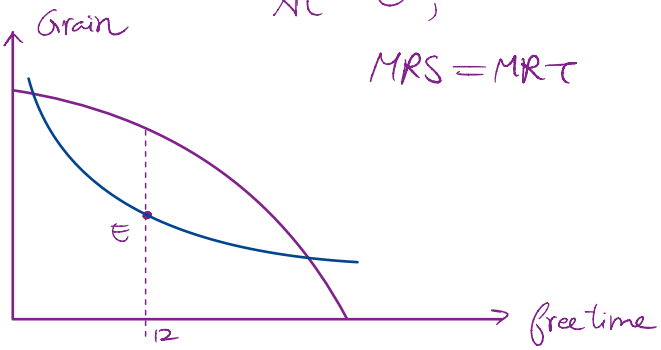
(a) Why is the feasible frontier curved? Can you sketch a sample production function for Angela based on this fact? What can you say about the marginal product of her labor?



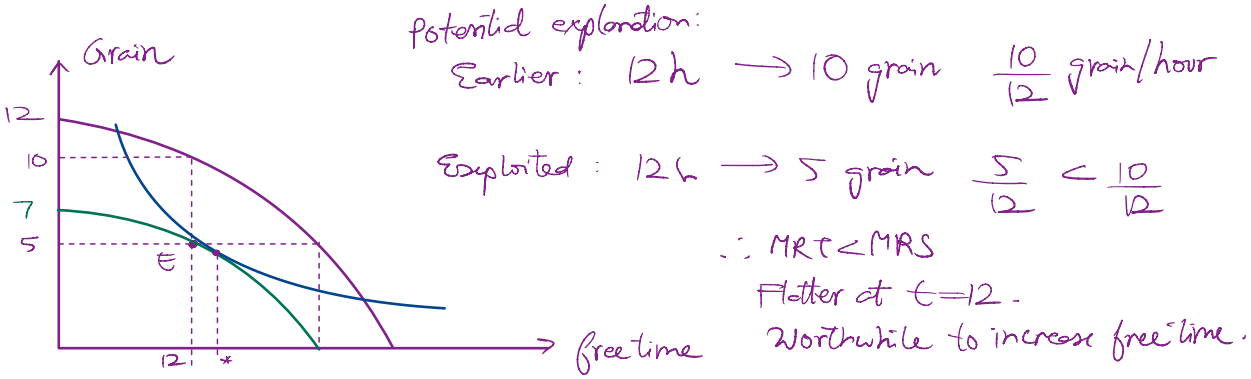
(b) What does it mean for the MRT to increase as Angela's free time increases?

Means that as Angela works less, she produces less grain per hour worked. Alternatively, as Angela gets more free time, every additional hour of free time costs her more grain.

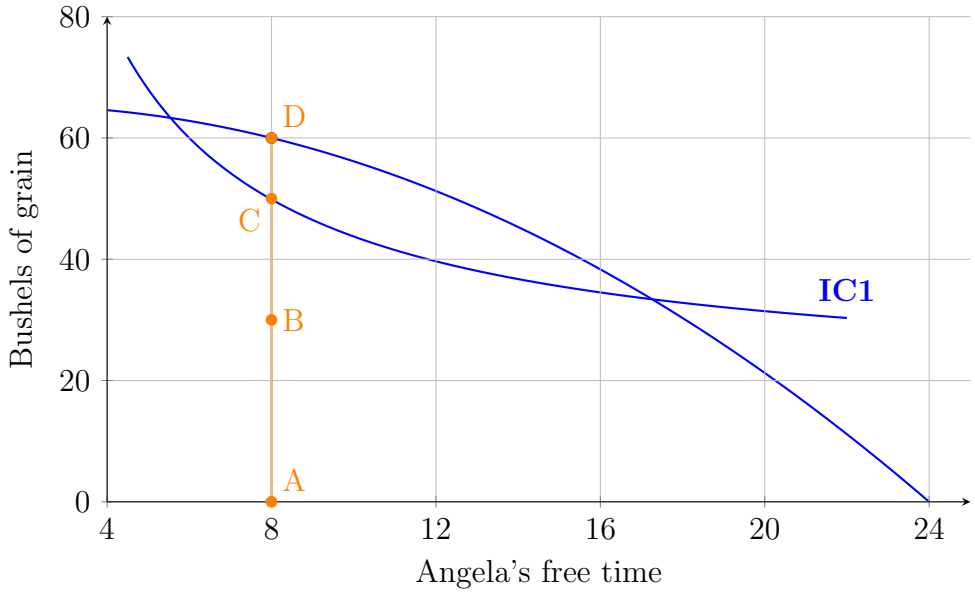
(c) If Bruno can make Angela a take-it-or-leave-it employment contract, draw Angela's reservation indifference curve if you know that point E is on her indifference curve and Bruno prefers her to work 12 hours.



(d) If Angela and Bruno have a contract where Angela pays Bruno 5 bushels of grain in rent no matter her output, draw Angela's feasible frontier for grain consumption. How would Angela's hours of free time be chosen in this case?



2. The figure shows the feasible frontier depicting how much grain Angela can produce depending on the free time Bruno allows her (Case 2, forced labor) and Angela's reservation indifference curve. Suppose Bruno allows Angela 8 hours of free time.



(a) How much grain do Angela and Bruno get?

Angela gets 50.
Bruno gets 10.

(b) What are their economic rents?

B: 10 doesn't work.
A: 50−50=0 Since on reservation IC, = opportunity cost.

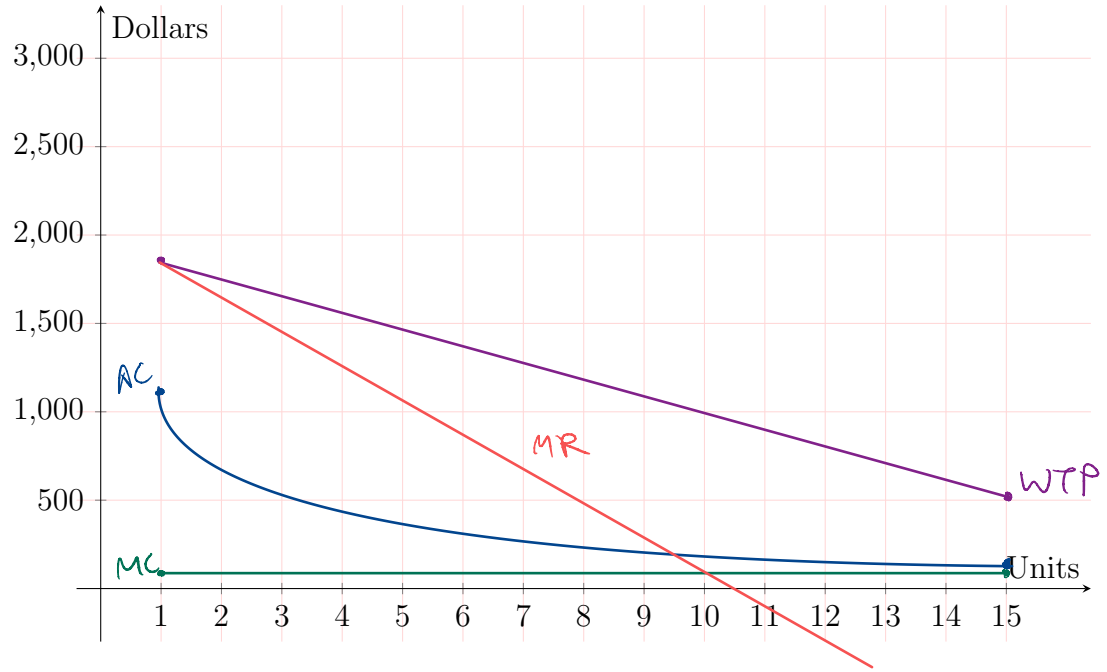
(c) Is this outcome Pareto efficient? Explain.

No. Can make Bruno better off (by moving to the right). Angela's rent wouldn't change.

3. Apple sells iWidgets. It sells more iWidgets the lower the price it charges consumers. The demand for iWidgets is given by the equation $WTP = \$2,000 - 100Q$, as shown in the table below. Meanwhile, it costs Apple \$1,000 to develop the iWidget and \$100 to produce each iWidget. Using this information, find the equilibrium price, quantity, and profit.

Q	WTP	Cost	ATC	MC	Profit	Elasticity	TR	MR	Isoprofit Price
0	-	1000	-	-	-	-	0	-	
1	$1900	1100	1100.00	100	$800	-19.0	$1900	1900	9100
2	$1800	1200	600.00	100	$2400	-9.0	$3600	1700	4600
3	$1700	1300	433.33	100	$3800	-5.7	$5100	1500	3100
4	$1600	1400	350.00	100	$5000	-4.0	$6400	1300	2350
5	$1500	1500	300.00	100	$6000	-3.0	$7500	1100	1900
6	$1400	1600	266.67	100	$6800	-2.3	$8400	900	1600
7	$1300	1700	242.86	100	$7400	-1.9	$9100	700	1385.7
8	$1200	1800	225.00	100	$7800	-1.5	$9600	500	1225
9	$1100	1900	211.11	100	$8000	-1.2	$9900	300	1100
10	$1000	2000	200.00	100	$8000	-1.0	$10000	100	1000
11	$900	2100	190.91	100	$7800	-0.8	$9900	-100	918.2
12	$800	2200	183.33	100	$7400	-0.7	$9600	-300	850
13	$700	2300	176.92	100	$6800	-0.5	$9100	-500	792.3
14	$600	2400	171.43	100	$6000	-0.4	$8400	-700	742.9
15	$500	2500	166.67	100	$5000	-0.3	$7500	-900	700

(a) Graph the consumers' WTP curve. Verify that the numbers in the table match the numbers produced by the function.



(b) Using the information above, express Apple's Cost as a function of the Quantity of iWidgets it produces. In the table, calculate the TC of producing $1, 2, \ldots, 15$ units.

Cost = Fixed cost + Variable cost
= 1000 + 100Q

(c) Express Apple's Average Cost as a function of the quantity of iWidgets it produces. In the table, calculate the AC of producing 1, 2, ..., 15 units.

$$ATC = \frac{Cost}{Q}$$

(d) Express Apple's Marginal Cost as an equation. In table, calculate the MC of producing $1, 2, \ldots, 15$ units.

$$MC = 100$$

(e) Draw AC and MC on your graph.

(f) In the table, calculate the Apple's Total Revenue R when it produces $1, 2, \ldots, 15$ units. (Extra credit: Express Apple's Total Revenue as a function of the quantity of iWidgets it produces. Since WTP is also a function of the quantity of iWidgets, you can write the Total Revenue simply as a function of Q using the demand curve given in the problem.)

$$TR = Price \times Quantity = (2000 - 100Q)Q$$

(g) Calculate Apple's Marginal Revenue when it produces $1, 2, \ldots, 15$ units. (Extra credit: Express Apple's Marginal Revenue as a function of the quantity of iWidgets it produces. Since Marginal Revenue is simply the change in Total Revenue with a 1-unit increase in the quantity of iWidgets, you can calculate the MR as the first derivative of TR.)

$$MR = (2000 - 100(Q+1))(Q+1) - 2000Q - 100Q^2 = 1900 - 200Q$$

(h) Using what you know about Apple's MC and MR, what quantity of iWidgets maximizes Apple's profits? Why?

$MR = MC = 100$, so $Q = 10$

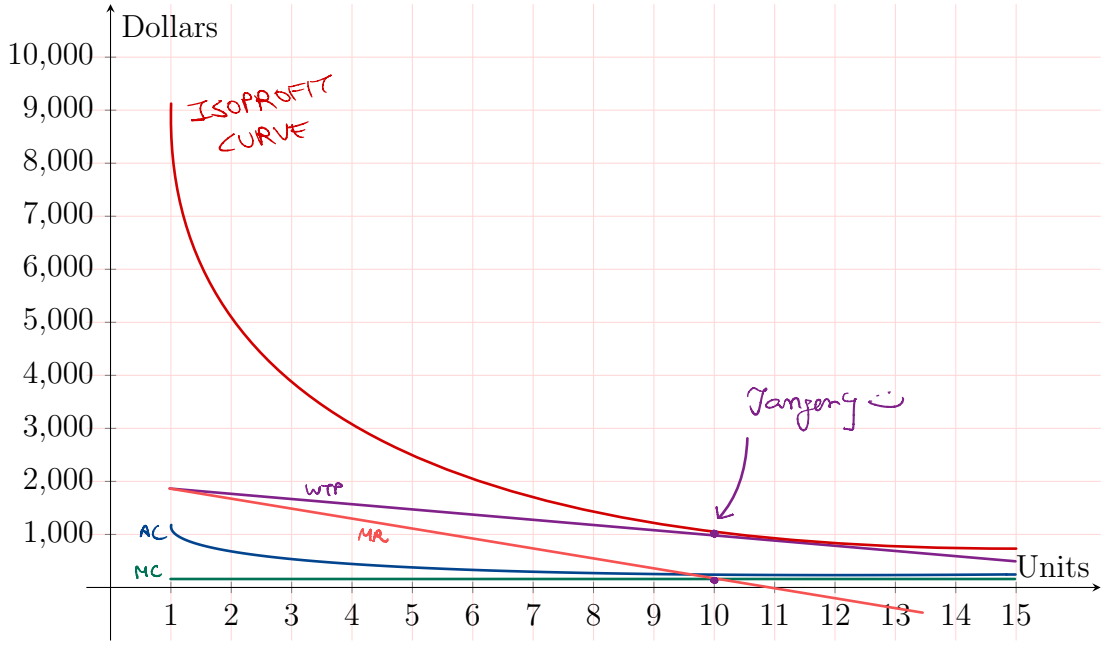
(i) Verify your answer in (h) by calculating Apple's Profit when it produces $1, 2, \ldots, 15$ units in your table. How much profit does Apple earn producing the profit-maximizing quantity of iWidgets?

Profit = \$8000

(j) Using your answer in (i), calculate the price Apple would have to sell its iWidgets for to make the same profit when it produces $1, 2, \ldots, 15$ units in the Isoprofit column of your spreadsheet.

$$8000 = TR - Cost = PQ - (1000 + 100Q) \Rightarrow P = \frac{8000 + (1000 + 100Q)}{Q}$$

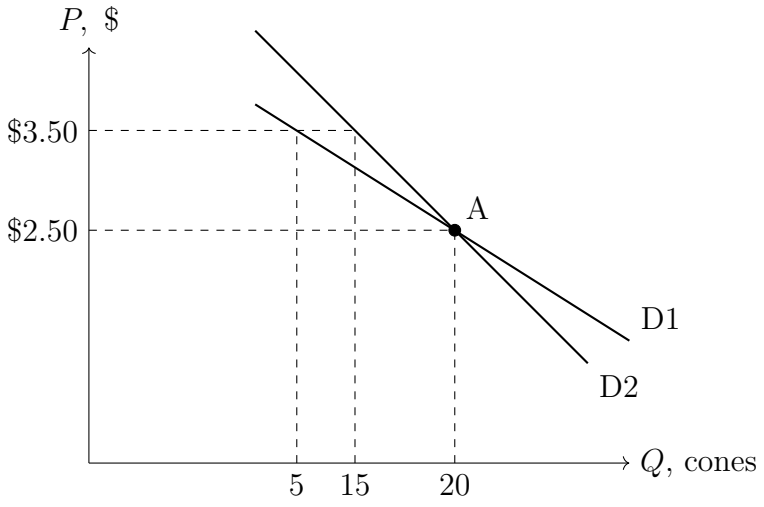
(k) Create a figure showing Apple's WTP, AC, MC, MR, and Isoprofit curves. Explain why your answer in (h) maximizes Apple's profits using the MC and MR curves. Then explain it using the WTP and Isoprofit curves.



(l) Is the profit-maximizing price and quantity efficient? Explain.

No, because there are more gains from trade that consumers could have if the good was sold at lower price.

4. Answer the following questions using the market for ice cream cones shown below:



(a) Calculate the price elasticity of demand for D1 and D2 at point A.

$$\varepsilon_{D1} = -\frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = -\frac{\frac{5-20}{20}}{\frac{3.5-2.5}{2.5}} = \frac{\frac{15}{20}}{\frac{1}{2.5}} = \frac{15}{20} \times 2.5 \approx 1.9$$

$$\varepsilon_{D2} = -\frac{\frac{15-20}{20}}{\frac{3.5-2.5}{2.5}} = \frac{5}{20} \times 2.5 = 0.6$$

(b) Which curve is more elastic?

D1

(c) Suppose Yolanda is initially selling 20 cones per day at a price of \$2.50 per cone. If she changes her price to \$3.50 per cone what will be her change in revenue if her demand curve is D1?

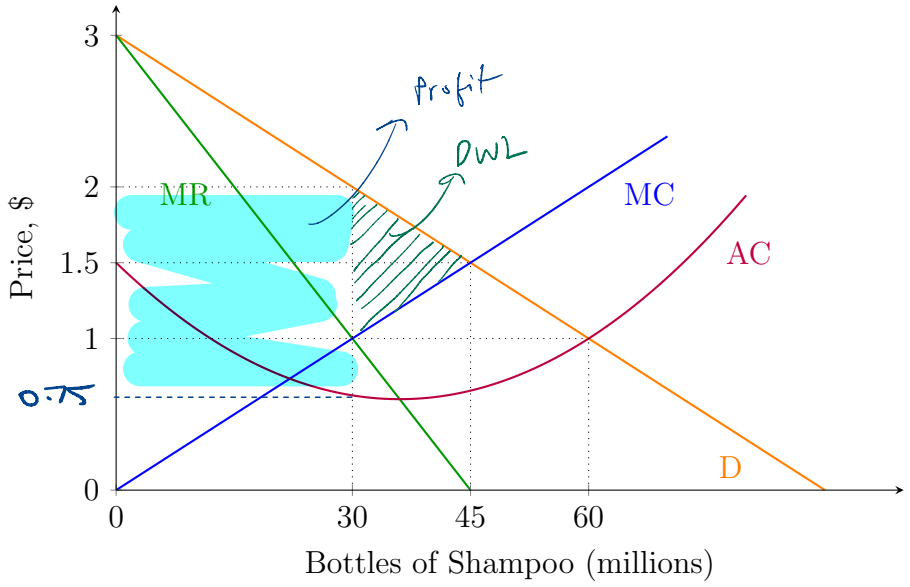
$$\text{Change in Revenue} = (3.5 \times 5) - (2.5 \times 20)$$
$$= 17.5 - 50$$
$$= -32.5 \text{ \$}$$

(d) What if she is on D2?

$$\text{Change in Revenue} = (3.5 \times 15) - (2.5 \times 20)$$
$$= 52.5 - 50$$
$$= 2.5$$

(e) Can you explain the difference in these results using what you know about elasticity and total revenue? D1 reacts to price changes more (higher elasticity) so the change from \$2.5 to \$3.5 causes a large drop in demand, significantly lowering revenue.

5. The figure shows the demand, MR, and costs for a fictional brand of shampoo called SqueakyKleen. SqueakyKleen is a differentiated product and the firm faces a downward-sloping demand curve.



(a) What is the price and quantity of SqueakyKleen?

Intersection of MR & MC

$\Rightarrow$ \$2 , 30 bottles

(b) What is the profit? Can you draw on graph?

Profit = Revenue − Cost , where Cost = avg. cost × quantity

$= (2 \times 30) - (0.75 \times 30)$ (look at graph & reason that avg. cost is around 0.75 at 30 bottles)

$= 37.5$

(c) Draw the dead-weight loss and calculate its magnitude.

$DWL = \frac{1}{2}(2-1)(45-30) = 7.5$