Economics 111 Exam 1 Fall 2006 Prof Montgomery

Answer all questions. 100 points possible.

1) [23 points] Consider a market with demand function $Q_D = 100 - 2P$ and supply function $Q_S = -40 + 5P$ where P represents price.

a) Compute the equilibrium price and quantity. If the current price was 15, would there be a shortage or a surplus? How large would this shortage/surplus be?

b) Suppose that supply changes so that $Q_S = -26 + 5P$ (while the demand function remains the same as above). Compute the new equilibrium price and quantity.

c) Given the change in price and quantity from the old equilibrium (part a) to the new equilibrium (part b), compute the elasticity of demand. Is the demand curve (in the region under consideration) elastic or inelastic? Compute sellers' revenue for parts (a) and (b). In the present example, did the change in price cause revenue to increase or decrease? More generally, how does the elasticity of demand affect the relationship between change in price and change in suppliers' revenue?

2) [32 points] A firm's long-run production function is given by $Q = K^{1/3} L^{1/2}$ where Q = quantity of output, K = capital, and L = labor. However, in the short run, suppose that capital is fixed at K = 64 while labor remains a variable input. Thus, the firm's short-run production function becomes $Q = (64)^{1/3} L^{1/2} = 4 L^{1/2} = 4\sqrt{L}$. Further assume the wage per unit of labor is w = 2 and the price per unit of capital is r = 3.

a) Focusing on the short-run case, derive the firm's variable cost, total cost, marginal cost, and average cost functions. [HINT: You may answer by constructing a table with a column for each function, or else compute these functions analytically. If you construct a table, you might try increasing quantity by increments of 8.]

b) If the product price is P = 12, what is the optimal quantity (Q*) chosen by the firm? Compute the firm's profit (or loss) given production at this optimal quantity. Plot the firm's MC and AC curves. Using this graph, how is the optimal quantity determined? What area corresponds to the firm's profit or loss?

c) Still focusing on the short-run (with K fixed at 64), suppose the price of capital rises to r = 5. (As above, assume w = 2 and P = 12.) How does this affect the firm's MC and AC functions? Compute the firm's optimal quantity (Q*) and profit/loss.

d) Conceptually (without doing any numerical computation), how would the firm adapt to the increase in the price of capital in the longer run? Illustrate your answer using an isoquant diagram.

3) [30 points] Consider a worker who has 1000 total hours per year that may be allocated between work and leisure. Thus, letting H = work hours and L = leisure hours, the worker has a time budget H + L = 1000. The worker earns w = $30 per hour and has no non-labor income.

a) Suppose the government taxes income at a 20% rate. (In other words, the worker keeps 80% of each dollar she earns.) Plot the constraint which reflects the worker's tradeoff between after-tax income and leisure. [HINT: Your graph doesn't need to be perfectly scaled, but should be properly labeled, and you should include numerical values for the horizontal and vertical intercepts.]

b) Now suppose that the government switches to a progressive income tax. (An income tax is "progressive" when income is initially taxed at a low rate, and then addition units of income are taxed at higher rates.) More precisely, suppose that the government imposes no tax on the first $6000 of income, and then a 40% tax rate on additional income (above $6000). Plot the worker's new constraint reflecting her tradeoff between after-tax income and leisure. [HINT: Again, your graph doesn't need to be perfect, but should be properly labeled, and you should indicate numerical coordinates for all intercepts and "kink" points on the curve.]

c) For each of the cases below, would the change in the tax scheme (from part a to part b) cause the worker's optimal number of hours to *rise* or *fall* or is the answer *theoretically ambiguous*? In each case, briefly explain your answer by describing any relevant income and substitution effects. (You should assume that the worker's utility function depends positively on after-tax income and leisure, that both inputs generate diminishing marginal utility, and that both inputs are normal goods.)

i) worker initially chose to work H* = 100 hours
ii) worker initially chose to work H* = 300 hours
iii) worker initially chose to work H* = 500 hours

4) [15 points] Consider the market for UW football tickets. Camp Randall (the football stadium) has a fixed number of seats, and we may assume (for simplicity) that the university's cost of providing these seats (i.e., the university's "willingness to accept") is zero. Assume that quantity of tickets demanded falls as the ticket price rises.

a) Suppose that the university allowed the ticket price to adjust to equate supply and demand. Using a supply and demand diagram, indicate the equilibrium price (P*), consumer surplus (CS), and producer surplus (PS).

b) In fact, the university sets the ticket price below the equilibrium price. How does policy this affect producer surplus, consumer surplus, and total surplus? Would the outcome be more efficient if ticket buyers were allowed to resell tickets at a higher price? Briefly discuss.

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1a) [8 pts] The equilibrium price P* is determined by setting demand equal to supply:

$$100 - 2P^* = -40 + 5P^* \qquad \text{which implies } P^* = 20 \text{ and } Q^* = 60.$$

Given P = 15, $Q_D = 100 - 2(15) = 70$ and $Q_S = -40 + 5(15) = 35$. Because quantity demanded exceeds quantity supplied at this price, there would be a shortage of $Q_D - Q_S = 35$.

b) [4 pts] The equilbrium price is now determined by setting

$$100 - 2P^* = -26 + 5P^* \qquad \text{which implies } P^* = 18 \text{ and } Q^* = 64.$$

c) [11 pts] The elasticity of demand is given by the formula

$$\varepsilon = \left|\frac{\%\Delta Q}{\%\Delta P}\right| = \left|\frac{\frac{64-60}{60}}{\frac{18-20}{20}}\right| = 2/3.$$

Because ε < 1, demand is inelastic in this region of the demand curve.

Revenue fell from (20)(60) = 1200 in part (a) to (18)(64) = 1152 in part (b).

More generally, elastic demand (ε > 1) implies that revenue rises when price falls;
inelastic demand (ε < 1) implies that revenue falls when price falls.

2a) [12 pts] We can rewrite the short-run production function to obtain the labor required for each level of production: $L = (Q/4)^2$. We can proceed analytically to obtain the functions

$$VC = wL = (2)(Q/4)^2 = Q^2/8$$

$$TC = VC + FC = wL + rK = (2)(Q/4)^2 + (3)(64) = Q^2/8 + 192$$

$$MC = dTC/dQ = Q/4$$

$$AC = TC/Q = Q/8 + 192/Q$$

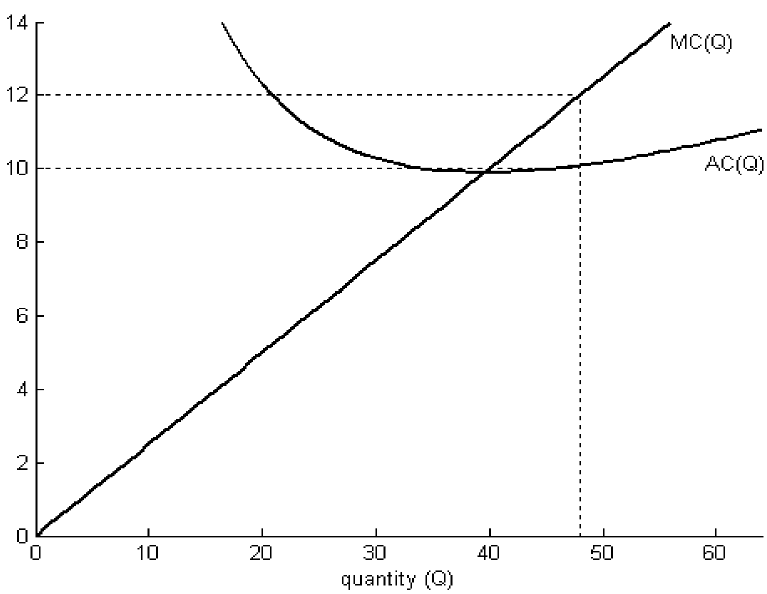
(Note that calculus is required to find MC, but not the other functions.)

Alternatively, constructing a table,

Q	L	VC	TC	MC	AC	R	Π
0	0	0	192	--	∞	0	-192
8	4	8	200	1	25	96	-104
16	16	32	224	3	14	192	-32
24	36	72	264	5	11	288	24
32	64	128	320	7	10	384	64
40	100	200	392	9	9.8	480	88
48	144	288	480	11	10	576	96
56	196	392	584	13	10.43	672	88
64	256	512	704	15	11	768	64

For this table, MC is computed as $\Delta TC/\Delta Q$. Because this is merely an approximation to the slope of the TC curve, the MC column differs slightly from the precise slope ($dTC/dQ = Q/4$) derived above. If you increased Q by smaller increments (say by 1 rather than 8), the numbers in MC column would become closer to the precise slope.

b) [10 pts] The firm sets Q* so that $MC(Q^*) = P$. Using the formula for MC derived above, $Q^*/4 = 12$ implies $Q^* = 48$. Alternatively, you can see from the table that the firm would want to produce 48 units because $MC < 12$ for $Q \leq 48$, but $MC > 12$ for $Q > 48$. [You can also determine the optimal quantity by computing the firm's revenue function $R = PQ$ and profit function $\Pi = R - TC$. As shown on the table, profit is maximized at $Q^* = 48$.] Graphically, the optimal quantity is determined by the intersection of the price line ($P = 12$) and the MC curve ($MC = Q/4$). Profit is given by the area $[P–AC(Q^*)]Q^*= [12–10](48) = 96$. (If you plotted the MC function from the table, you won't get the precise solution, but will obtain something close.)



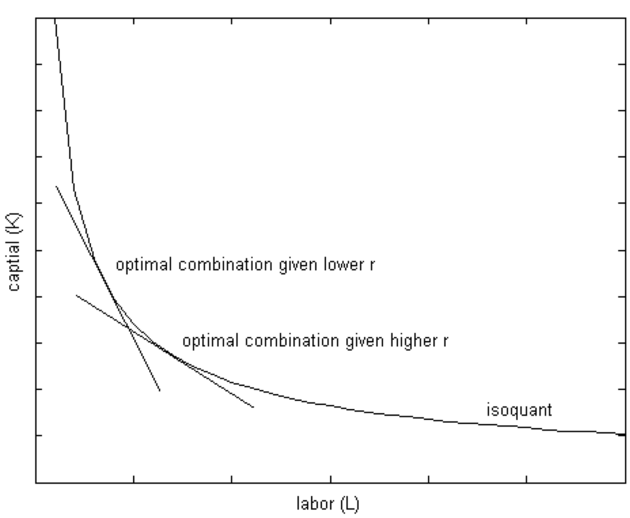
c) [6 pts] Fixed costs increase from (3)(64) = 192 to (5)(64) = 320. The total cost function becomes $Q^2/8 + 320$. Graphically, the TC curve shifts upwards by the increase in fixed costs. But because the slope of the TC curve does not change, there is no change in the MC curve. (Equivalently, the derivative dTC/dQ remains equal to Q/4.) However, average costs rise so that AC = Q/8 + 320/Q. Because the MC function hasn't changed, the optimal quantity remains Q* = 48. However, the firm is now incurs a loss of [AC(Q*)–P] Q* = [12.666 – 12] 48 = 32.

This question could also have been answered by revising the table:

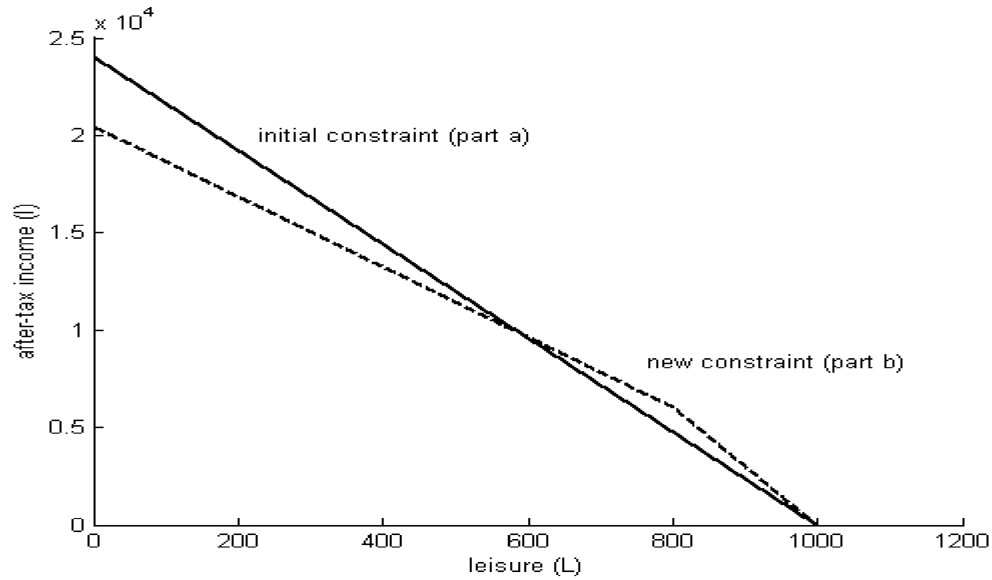
Q	L	VC	TC	MC	AC	R	Π
0	0	0	320	--	∞	0	-320
8	4	8	328	1	41	96	-232
16	16	32	352	3	22	192	-160
24	36	72	392	5	16.33	288	-104
32	64	128	448	7	14	384	-64
40	100	200	520	9	13	480	-40
48	144	288	608	11	12.66	576	-32
56	196	392	712	13	12.71	672	-40
64	256	512	832	15	13	768	-64

Note that the change in the TC function does not affect the MC function, and hence the optimal quantity remains unchanged. However, because profit fell by 128, the profit at the optimal quantity is now negative.

d) [4 pts] In the longer run, the firm would substitute away from capital towards labor, adopting a more "labor-intensive" technology. Graphically, isocost curves become flatter (in L-W space) as the cost of capital rises. Given the quantity produced, the firm would choose the point where the slope of the isoquant is equal to the slope of isocost curve (given by the ratio of relative factor prices, -w/r).



3a) [5 pts]   b) [10 pts]



To give equations for these constraints, let I denote after-tax income. For part (a),

$I = (0.8)(30)H = (0.8)(30)(1000\text{-}L) = 24{,}000 - 24L$

For part (b), note that the individual's income exceeds 6000 when $H > 200$. Thus,

$I = (30)H \quad \text{for } H \leq 200$
$= (.6)(30)(H\text{-}200) + 6000 \quad \text{for } H > 200.$

Substituting $H = 1000 - L$ and then simplifying, we obtain

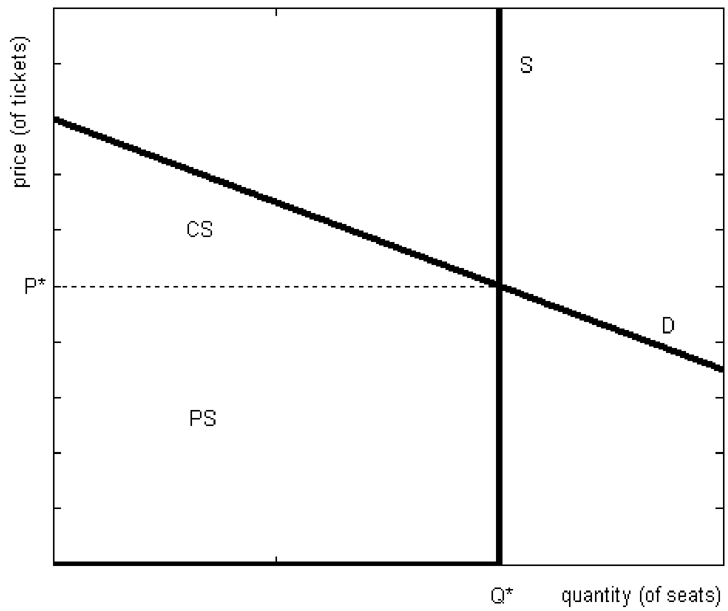
$I = 30{,}000 - 30L \quad \text{for } L \geq 800$
$= 20{,}400 - 18L \quad \text{for } L < 800$

ci) [5 pts] Given worker initially chose $H^* = 100$ (so that $L^* = 900$),
substitution effect causes L to fall (constraint becomes steeper) → H rises
income effect causes L to rise (constraint shifts outward) → H falls
overall effect on L is ambiguous → overall effect on H is ambiguous

ii) [5 pts] Given worker initially chose $H^* = 300$ (so that $L^* = 700$),
substitution effect causes L to rise (constraint becomes flatter) → H falls
income effect causes L to rise (constraint shifts outward) → H falls
overall, L rises → H falls

iii) [5 pts] Given worker initially chose $H^* = 500$ (so that $L^* = 500$),
substitution effect causes L to rise (constraint becomes flatter) → H falls
income effect causes L to fall (constraint shifts inward) → H rises
overall effect on L is ambiguous → overall effect on H is ambiguous

4a) [6 pts]



Note that the supply curve is "L-shaped" because the university supplies a fixed number (= stadium capacity = Q*) of seats regardless of price (given the assumption that willingness to accept is zero).

b) [9 pts] Producer surplus is lower. (Given actual price P < P* and the fixed quantity Q*, the producer surplus would fall from P*Q* to PQ*.)

Consumer surplus is probably higher, but this depends on how tickets are rationed. If the tickets are sold to the consumers with the highest willingness to pay (i.e., the same consumers who receive tickets in part a), then CS rises. However, if many tickets are sold to consumers with lower willingness to pay (who would not be willing to buy tickets at the price P*) then it is possible that CS would fall.

If tickets are rationed to consumers with the highest willingness to pay, then the increase in CS is exactly equal to the decrease in PS and thus TS is unchanged. But if ANY tickets are sold to consumers with willingness to pay below P*, then TS will fall.

Presumably, at least some tickets are sold to consumers with willingness to pay below P*. Thus, the university's policy generates an outcome that violates "exchange efficiency": consumers who purchased tickets and have willingness to pay below P* could resell tickets to consumers who were unable to purchase tickets and have willingness to pay above P*, and both types of consumers would be better off.

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Answer all questions. 100 points possible.

1. [27 points] A monopolist sells a unique type of computer to consumers in America and Japan. The quantity demanded by Americans is $Q_A = 200 - 2P_A$ where P_A is the price charged to Americans. The quantity demanded by Japanese is $Q_J = 180 - 3P_J$ where P_J is the price charged to the Japanese. Assume the monopolist's total costs are $10(Q_A + Q_J)$. Thus, the monopolist has constant marginal cost equal to 10.

a) Assuming it is possible for the monopolist to set a different price for each market, what prices P_A* and P_J* would the monopolist set in order to maximize profit? How many computers does the monopolist sell in each market? Compute the monopolist's total profit (summed across both markets). [HINT: You may need to rewrite the demand functions in order to compute marginal revenue.]

b) What might prevent the monopolist from setting different prices across markets?

c) If the monopolist is forced to set a single price in both markets, what common price P* (= P_J* = P_A*) would the monopolist set? How many computers does the monopolist sell? Compute the monopolist's profit. [HINT: Recall that aggregate demand is the horizontal summation of individual demand curves. You can focus on the portion of the aggregate demand curve where $P < 60$ and $Q > 80$.]

2. [28 points] A small bakery is run by 3 bakers (Al, Beth, and Carl) who produce cookies and cakes. Al works 50 hours per week, can produce 100 cookies per hour, and can produce 2 cakes per hour. Beth works 40 hours per week, can produce 75 cookies per hour, and can produce 3 cakes per hour. Carl works 20 hours per week, can produce 75 cookies per hour, and can produce 1 cake per hour.

a) Derive an equation for each baker's production possibilities curve (with cookies as a function of cake). What is the marginal rate of transformation for each baker? Which baker has the strongest comparative advantage producing cookies?

b) Plot the (combined) production possibilities curve for the bakery. [HINT: Your graph doesn't need to be perfect, but it needs to be properly labeled and you must give numerical coordinates for horizontal and vertical intercepts and any kink points.]

c) Suppose the bakery has customer orders for x cakes. The bakers want to produce this number of cakes in the most efficient manner, using any remaining time to produce cookies. For each possible value of x, describe the optimal division of labor and give an equation for the number of cookies produced. [HINT: You're identifying *ranges* of x.]

3. [25 points] Consider the Cournot duopoly model in which two firms produce an undifferentiated product and compete by simultaneously choosing quantities. Price adjusts to equate supply and demand. Total industry output is $Q = Q_1 + Q_2$ where Q_1 is firm 1's quantity and Q_2 is firm 2's quantity. Suppose that industry demand may be written as $P = 100 – Q$.

a) Suppose that each firm has a constant marginal cost equal to 20. Derive the reaction function for each firm. What is the equilibrium quantity produced by each firm? What is the market price? What is the profit earned by each firm?

b) Now suppose that firm 1's marginal cost rises to 40 (while firm 2's marginal cost remains equal to 20). How does this affect the equilibrium quantities, market price, and profit earned by each firm? Use a reaction-function graph to illustrate how the situation has changed.

4. [20 points] To dispose of its garbage, suppose that the City of New York could either dump the garbage in New York harbor (at a cost of 2 million dollars) or in landfill (at a cost of 4 million dollars). If the garbage is dumped in the harbor, some of it will wash up on New Jersey beaches. To residents of New Jersey, the value of clean beaches is 5 million dollars; the cost of beach clean-up would be 3 million dollars. Thus, the payoffs to the parties are given by the following matrix. (NY's payoff is given first and NJ's payoff is given second. Thus, in the top left cell NY receives –2 while NJ receives 2.)

		New Jersey: clean up	New Jersey: don't clean up
New York	dump in harbor	-2, 2	-2, 0
	landfill	-4, 2	-4, 5

a) What is the Nash equilibrium of this game? What payoff is received by each party? Does this outcome maximize the joint payoff? If not, which outcome does?

b) In part (a), we implicitly assumed that there was no clear assignment of property rights. In particular, the parties could not buy or sell the right to dump in the harbor. Assume now that property rights can be assigned and that bargaining between NY and NJ is costless. If NY is granted the right to dump garbage in the harbor, what is the outcome? What payoff is received by each party? Alternatively, if NJ is granted the right to determine whether dumping occurs, what is the outcome? What payoff is received by each party?

c) Briefly explain how your answers to part (b) illustrate the Coase Theorem.

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1a) [12 pts] Given two separate markets, the monopolist determines the optimal quantity in each market by setting marginal revenue equal to marginal cost for that market.

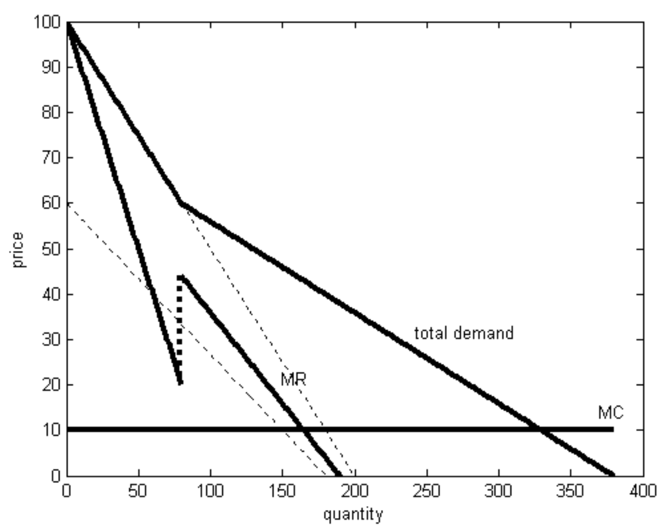
For the American market, the demand curve is $Q_A = 200 - 2P_A$. To determine marginal revenue, we first rewrite demand as $P_A = 100 - (1/2)Q_A$. Marginal revenue is then $MR = 100 - (2)(1/2)Q_A = 100 - Q_A$. Setting MR = MC, we obtain $100 - Q_A = 10$ and hence $Q_A^* = 90$. Thus, $P_A^* = 100 - (1/2)(90) = 55$.

For the Japanese market, the demand curve is $Q_J = 180 - 3P_J$ which can be rewritten as $P_J = 60 - (1/3)Q_J$ and thus marginal revenue is $MR = 60 - (2)(1/3)Q_J = 60 - (2/3)Q_J$. MR = MC implies $60 - (2/3)Q_J = 10$ and hence $Q_J^* = 75$. $P_J^* = 60 - (1/3)(75) = 35$.

Total profit is $P_A^*Q_A^* + P_J^*Q_J^* - 10(Q_A^*+Q_J^*) = (55)(90) + (35)(75) - 10(165) = 5925$.

b) [3 pts] The monopolist will not be able to charge different prices if consumers (or middlemen) are able to buy the good in one market (with the lower price) and resell the good in the other market (with the higher price). In that case, all consumers would be able to buy at the lower price. (See discussion in text [4th ed], pp 266-67.)

c) [12 pts] Total demand (for the combined markets) is given by the horizontal summation of the two demand functions. Assuming $P < 60$, total quantity demanded is $Q = Q_A + Q_J = 380 - 5P$. [Given $P > 60$, demand would be zero in Japan, so that Q is simply equal to Q_A. See the graph below.] The aggregate demand function can be rewritten as $P = 76 - (1/5)Q$ and thus $MR = 76 - (2/5)Q$. Setting MR = MC, we obtain $Q^* = 165$ and $P^* = 43$. Total profit is $P^*Q^* - 10Q^* = (43)(165) - (10)(165) = 5445$.



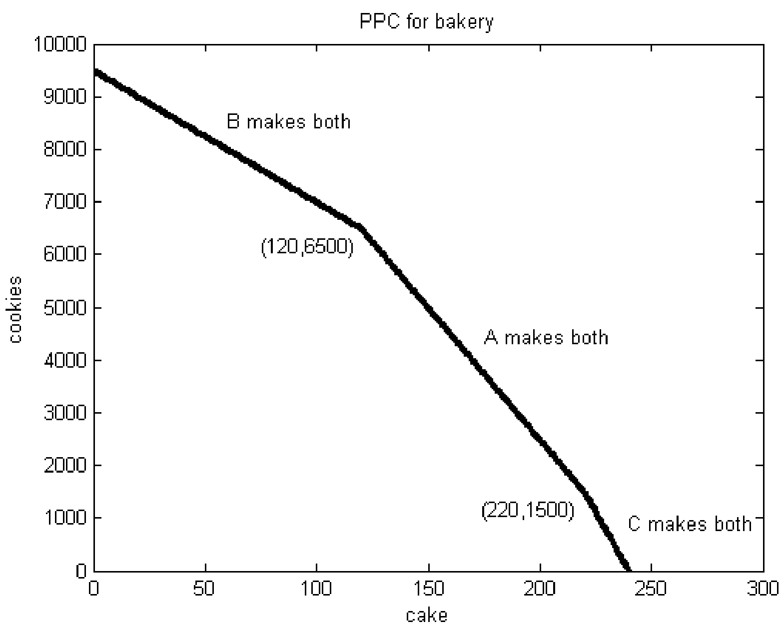
The thin dotted curves show the demand curves for America and Japan. The heavy solid curves show D, MR, and MC for combined market. The kink point in D implies MR is discontinuous ($MR = 100 - Q$ for $Q < 80$, while $MR = 76 - (2/5)Q$ for $Q > 80$).

2a) [8 pts] Let y denote the quantity of cookies and x denote the quantity of cake.

Al:	$y/100 + x/2 = 50$	implies	$y = 5000 - 50x$
Beth:	$y/75 + x/3 = 40$	implies	$y = 3000 - 25x$
Carl:	$y/75 + x/1 = 20$	implies	$y = 1500 - 75x$

The marginal rate of transformation (MRT) is given by the slope of the PPC. Thus, Al's MRT is 50, Beth's is 25, and Carl's is 75. Carl has the highest MRT and thus has the strongest comparative advantage at cookie production.

b) [8 pts]



c) [12 pts] For x between 0 and 120:

Beth produces both cookies and cakes (x cakes, $3000 - 25x$ cookies)
Al and Carl produce only cookies (6500 cookies)
number of cookies = $9500 - 25x$

For x between 120 and 220:

Beth produces only cakes (120 cakes)
Al produces both cookies and cakes ($x-120$ cakes, $5000 - 50(x-120)$ cookies)
Carl produces only cookies (1500 cookies)
number of cookies = $5000 - 50(x-120) + 1500 = 12{,}500 - 50x$

For x between 220 and 240:

Beth and Al produce only cakes (220 cakes)
Carl produces both cookies and cakes ($x-220$ cakes, $1500 - 75(x-220)$ cookies)
number of cookies = $1500 - 75(x-220) = 18{,}000 - 75x$

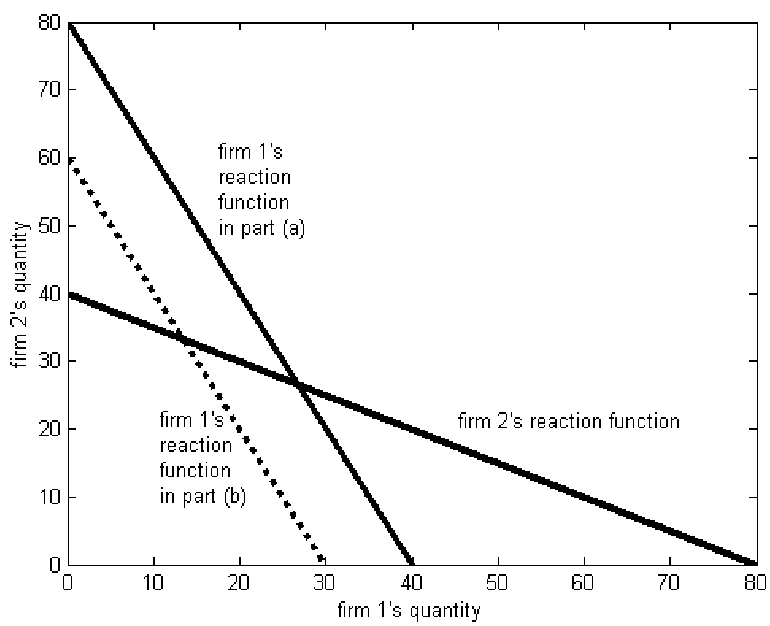
3a) [10 pts] For firm 1, $MR = 100 - Q_2 - 2Q_1$. Setting MR = MC, we obtain $100 - Q_2 - 2Q_1 = 20$. Solving this equation for Q_1, we obtain firm 1's reaction function: $Q_1 = 40 - (1/2)Q_2$. Similarly, for firm 2, $MR = 100 - Q_1 - 2Q_2$. Setting MR = MC, we obtain $100 - Q_1 - 2Q_2 = 20$ and thus firm 2's reaction function: $Q_2 = 40 - (1/2)Q_1$.

Nash equilibrium is determined by the intersection of the reaction functions. Substituting firm 2's reaction function into firm 1's reaction function, we obtain $Q_1 = 40 - (1/2)[40 - (1/2)Q_1]$ which implies $Q_1 = 80/3 = 26.67$ and thus $Q_2 = 40 - (1/2)(80/3) = 80/3 = 26.67$. The market price is given by $P = 100 - (80/3) - (80/3) = 140/3 = 46.67$. The profit for firm 1 is $\Pi_1 = PQ_1 - 20Q_1 = (140/3)(80/3) - (20)(80/3) = (80/3)^2 = 711.11$. Similarly, firm 2's profit is $\Pi_2 = (80/3)^2 = 711.11$.

b) [15 pts] Firm 2's reaction function has not changed: $Q_2 = 40 - (1/2)Q_1$. Setting MR = MC for firm 1, we now obtain $100 - Q_2 - 2Q_1 = 40$. Solving this equation for Q_1, we obtain firm 1's new reaction function: $Q_1 = 30 - (1/2)Q_2$.

Nash equilibrium is again determined by the intersection of the reaction functions. Substituting firm 2's reaction function into firm 1's reaction function, we obtain $Q_1 = 30 - (1/2)[40 - (1/2)Q_1]$ which implies $Q_1 = 40/3 = 13.33$ and thus $Q_2 = 40 - (1/2)(40/3) = 100/3 = 33.33$. The market price is given by $P = 100 - (40/3) - (100/3) = 160/3 = 53.33$. Firm profits are $\Pi_1 = (160/3)(40/3) - (40)(40/3) = (40/3)^2 = 177.78$ and $\Pi_2 = (160/3)(100/3) - (20)(100/3) = (100/3)^2 = 1111.11$.

Graphically, the increase in firm 1's marginal cost causes its reaction function to shift leftwards. As we've already computed, this causes firm 1's optimal quantity to fall (from 80/3 to 40/3) and causes firm 2's optimal quantity to rise (from 80/3 to 100/3).



4a) [5 pts] In this game, NY's best response is always dump in the harbor regardless of NJ's action. If NY chooses to dump in the harbor, NJ's best response is to clean up. Thus, the Nash equilibrium is (dump in harbor, clean up) which implies that NY receives -2 while NJ receives 2. This outcome generates a joint payoff $= -2 + 2 = 0$. The actions (don't dump, don't clean) would generate a higher joint payoff $= -4 + 5 = 1$.

b) [10 pts] Suppose that the right is assigned to NY. By dumping, NY increases its payoff by 2. Thus, NY would be willing to sell the rights for any price $P > 2$. If it needs to clean up, NJ's payoffs are reduced by 3. Thus, NJ would be willing to pay any price $P < 3$. Thus, there is a "zone of agreement" at a price between 2 and 3. NJ would buy the rights for some P in this range (say $P = 2.5$), and would then choose the outcome (don't dump, don't clean). NY's payoff would be $-4 + P = -4 + 2.5 = -1.5$. NJ's payoff would be $5 - P = 5 - 2.5 = 2.5$. Note that both firms are better off than they were in part (a).

Suppose that the right is assigned to NJ. Now NY would be willing to buy the rights for any price $P < 2$, while NJ would be willing to sell the right for any price $P > 3$. Now, there is no zone of agreement. Thus, NJ would retain the rights and choose the outcome (don't dump, don't clean). NY's payoff would be -4. NJ's payoff would be 5.

c) [5 pts] The Coase Theorem states that, if bargaining is costless, the outcome will be efficient (maximizing joint payoff) regardless of the initial assignment of property rights. Consistent with this theorem, the parties in part (b) negotiated the efficient outcome (don't dump, don't clean) whether the rights were initially assigned to NY or NJ. Of course, because property rights are valuable, their assignment does affect the payoffs of the parties. But again, assignment does not affect which actions are ultimately taken.

Economics 111 Exam 3 Fall 2006 Prof Montgomery

Answer all questions. 100 points possible.

1. [7 points] Given a population of 300 million people, suppose that 15 million are unemployed and that 120 million are out of the labor force. Calculate the unemployment rate. If the economy was in the midst of a prolonged recession, explain why the unemployment rate might understate the true extent of the unemployment problem.

2. [7 points] How do macroeconomists define the "output gap"? According to Okun's Law, how are changes in the output gap related to changes in the unemployment rate?

3. [36 points] Use the ***full-employment*** model to answer this question.

a) Consider an open economy (with foreign exchange market). What accounting identity equates inflows and outflows in the capital market? What accounting identity equates inflows and outflows in the foreign exchange market? [HINT: You don't need to draw the circular-flow diagram, but it might help you keep track of these flows.]

b) Suppose that the US government cuts the tax rate while maintaining a constant level of government spending. Will the tax cut cause each of the following to increase, decrease, or remain unchanged?

i) the budget deficit
ii) private savings
iii) the interest rate
iv) investment
v) net capital flows
vi) the exchange rate
vii) imports
viii) exports
ix) the trade deficit
x) national income

c) Further illustrate your answers to part (b) by showing any changes in the supply-and-demand diagrams for the capital and foreign-exchange markets. [HINT: To receive full credit, you need to label the supply and demand curves to show which flows on the circular-flow diagram are associated with supply and demand in each market.]

d) What is "crowding out"? Would this phenomenon be more severe or less severe in a closed economy (with no foreign sector)? Briefly explain.

e) Must net capital flows and the trade deficit always change in the same direction? Must the trade deficit and budget deficit always change in the same direction? Briefly explain.

4. [9 points] List the three policy "tools" that the Federal Reserve could use to conduct monetary policy. In practice, which tool is most important for influencing the money supply? How would the Fed use this tool to expand the money supply?

5. [26 points] Use the ***unemployment*** model to answer this question.

a) Consider a closed economy in which consumption (C), investment (I), government spending (G), and tax revenues (T) are given by

$$C = 30 + .8(1-\tau)Y$$
$$I = 78$$
$$G = 60$$
$$T = \tau Y$$

where τ is the tax rate and Y is income. If $\tau = .1$, what is the equilibrium level of income? How large is the multiplier? How much will income fall if an "investment shock" causes investment to fall from 78 to 50?

b) Given $I = 78$ and $\tau = .1$, compute the government's budget deficit in part (a). To ensure that the budget deficit does not grow larger, suppose that congress considers a constitutional amendment. The amendment requires that, whenever income changes, government spending must always be adjusted so that $G = \tau Y$. Suppose that the amendment also permanently fixes the tax rate at $\tau = .1$. If this amendment is accepted, what is the new (balanced-budget) multiplier? Now how much would income fall if investment falls from 78 to 50? What effect would this investment shock have on government spending?

c) When it was debated in the 1980s, many economists opposed a balanced-budget amendment on the grounds that it would "destabilize" the macroeconomy, increasing the effect of any investment shocks on the equilibrium income level. Comparing your answers to parts (a) and (b), briefly discuss this effect.

6. [15 points] Suppose that the macroeconomy is initially at full employment. Use the ADI-AS model to explain the short-run and long-run effects of a sudden decrease in investment. Illustrate your answer using the ADI-AS graph. How would your analysis change if the Fed quickly responded by "loosening" its monetary policy? Why might the Fed prefer instead to maintain a constant policy rule?

Econ 111 **Exam 3** **Fall 2006** **Solutions**

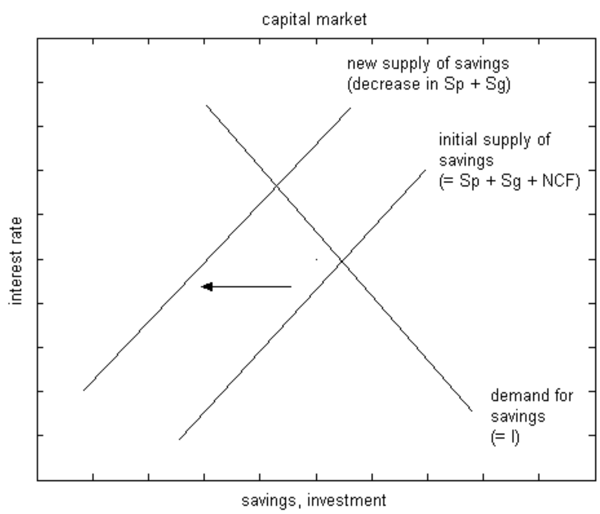
1) [7 pts] The population can be partitioned into employed, unemployed, and people who are out of the labor force (POP = E + U + OLF) and the unemployment rate is computed as U/(E + U). In this example, the unemployment rate is thus 15/180 = 8.3%. If the economy is in a prolonged recession, some workers may stop looking for work, and thus become classified as OLF instead of U. This "discouraged worker" effect decreases both the numerator and denominator of the unemployment rate, and causes the apparent unemployment rate to fall.

2) [7 pts] The "output gap" is the difference between potential GDP (that is, the "full-employment" Y_f) and the actual GPD (actual Y) as a proportion of actual GDP Thus, the output gap is $(Y-Y_f)/(Y_f)$. (You can then multiply by 100 to obtain the output gap as a percentage.) Okun's Law states that a 1 percentage-point change in unemployment is associated with a 2 percentage-point change in the output gap.

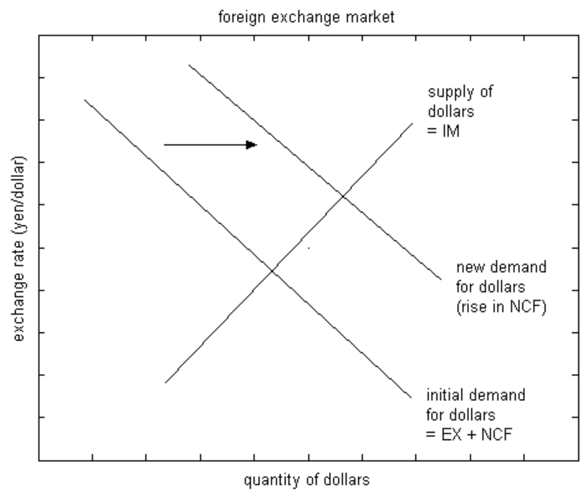
3a) [6 pts] Capital market: $S_p + S_g + NCF = I$ For-ex market: IM = EX + NCF

b) [10 pts]
i) budget deficit increases (because tax revenues fall)
ii) private savings increases (because disposable income rises)
iii) interest rate increases (because national savings decreases)
iv) investment decreases (because the interest rate rises)
v) net capital flows increase (because the interest rate rises)
vi) exchange rate increases (rise in NCF increases demand for dollars)
vii) imports increase (because the exchange rate increases)
viii) exports decrease (because the exchange rate increases)
ix) trade deficit increases (because IM increases and EX decreases)
x) national income unchanged (by assumption in full-employment model)

c) [8 pts] In capital market, decrease in supply of savings causes interest rate to rise:



In foreign-exchange market, increase in demand for dollars causes exchange rate to rise:



d) [6 pts] "Crowding out" occurs when the government finances a budget deficit by borrowing from the capital market. This causes the interest rate to rise which causes firms to borrow less. Thus, investment is "crowded out" by government borrowing.

The crowding-out phenomenon would be more severe in a closed economy. In an open economy, an increase in the US interest rate causes net capital flows to rise (because foreigners will increase their savings in the US). Thus, the supply curve is positively sloped. In a closed economy, there is no increase in NCF when the interest rate rises. Thus, government borrowing causes a larger increase in the interest rate and a greater decrease in investment.

e) [6 pts] Inflows must always equal outflows in the foreign-exchange market, and thus IM = EX + NCF. Rewriting this equation, we obtain IM – EX = NCF. Thus, the trade deficit (the difference between imports and exports) must always equal net capital flows, and the two must always change in the same direction.

Equating inflows and outflows in the capital market, $S_p + S_g + NCF = I$. Because $S_g = T - G$ and $NCF = IM - EX$, we can rewrite the capital-market equation to obtain $G - T = (IM - EX) + (S_p - I)$. Thus, the budget deficit (G–T) may be greater or smaller than the trade deficit (IM – EX) depending on S_p and I. As an empirical matter, the budget deficit and the trade deficit sometimes move together (during the 1980s, both were rising) and sometimes move in opposite directions (during the 1990s, the budget deficit was falling while the trade deficit continued to rise).

4) [9 pts] To control the money supply, the Fed may use three tools: the reserve ratio, the discount rate, or open-market operations (buying and selling T-bills). The most important tool is open-market operations. To expand the money supply, the Fed would buy T-bills.

5a) [10 pts] Setting income (Y) equal to aggregate expenditures (AE), we obtain

$$Y = C + I + G$$
$$Y = 30 + .8(1\text{-}\tau)Y + I + 60$$
$$Y = (30 + I + 60) / (1 - .8(1\text{-}\tau))$$

Given I = 78 and $\tau = .1$, we thus obtain Y = 600.

The multiplier is $1 / (1 - (.8)(.9)) = 1 / (.28) = 3.57$

Given I = 50 and $\tau = .1$, you can substitute into the preceding formula to obtain Y = 500. Thus, Y falls by 100. (Alternatively, the change in Y is equal to the change in I times the multiplier. Thus, $\Delta Y = (3.57)(-28) = -100$.)

b) [12 pts] The government spends G = 60 and collects tax revenue T = (.1)(600) = 60. Thus, the budget deficit = G – T = 0.

If the amendment was accepted, the government would be forced to set $G = \tau Y$. Thus, equilibrium Y would be determined by the equation

$$Y = C + I + G$$
$$Y = 30 + .8(1\text{-}\tau)Y + I + \tau Y$$
$$Y\,[1 - .8(1\text{-}\tau) - \tau] = 30 + I$$
$$Y = (30 + I) / [(.2)(1\text{-}\tau)]$$

Further fixing $\tau = .1$, we obtain Y = (30 + I) / (.18).

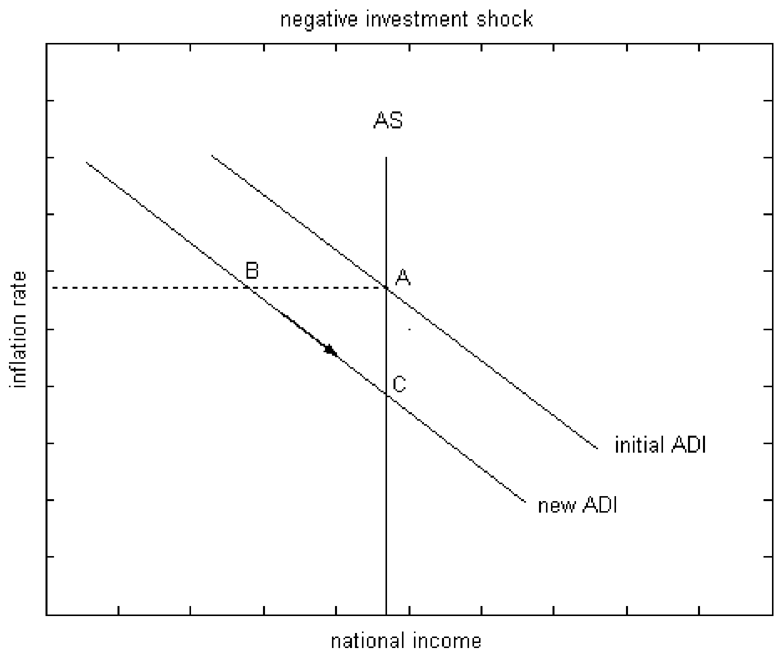
Thus, the multiplier is now $1 / (.18) = 5.56$

Now, if I falls from 78 to 50, equilibrium Y falls by 28/(.18) = 155.55. (Thus, Y falls from 600 to 444.44.)

Government spending (which is always equal to τY) would fall from 60 to 44.44

c) [4 pts] With or without the balanced-budget amendment, a fall in investment causes equilibrium income to decrease. Given the balanced-budget amendment, this decrease in income would further force the government to decrease spending, which would cause a further decrease in income. Thus, given the amendment, the multiplier becomes larger and an initial shock has a larger effect on the economy.

6) [15 pts] A decrease in investment would cause the ADI curve to shift leftwards. In the short run, the economy would move from point A to point B. Inflation would be constant but income would fall. In the long-run, because actual Y is below full-employment Y, inflation would begin to fall. The economy would move along the ADI curve from point B toward point C. Thus, in the long run, the economy would return to full-employment, but at a lower inflation rate.



Instead of allowing the economy to follow this course, the Fed might "loosen" its policy rule (setting a lower interest rate for each inflation rate). This would cause the ADI curve to shift rightwards, returning to its initial position (point A). But if the Fed is concerned primarily with inflation rather than unemployment, it might prefer to allow a recession because would eventually cause the inflation rate to fall (point C).