14.41 Midterm Answer Key - 2004

True/False/Uncertain—EXPLAIN

1) There are other externalities to smoking, including increased risk of fires, lost productivity that is not reflected in wages, and the dangers of second-hand smoke. The optimal tax should reflect these externalities as well as the increased health costs. Also, there are probably significant "internalities" to smoking, such that a cigarette tax can help people who want to quit but have trouble doing so by acting as a commitment device.

2) If the property rights to the lake are clearly assigned either to Eve or to Adam, then there is no need for intervention—we know that they have costless bargaining, since they already engage in trade. If the property rights are not assigned (or if you think the higher power would be needed to assign the rights), then there is need for intervention. Note that the fact that dumping raises the price Adam faces for fish does *not* mean he internalizes the externality—he internalizes only the dumping's effect on his consumption of fish, not the effect on Eve's consumption of fish.

3) If deficits are short-term and offset by surpluses at other points in the business cycle (cyclical deficits) then they are probably inconsequential. In addition, if individuals offset the government's borrowing by increasing their private saving (Ricardian equivalence) then they will be inconsequential. However, if deficits persist throughout the business cycle (that is, structural deficits) and are not offset by individuals—which appears to be the case in the U.S.—then they do matter. They increase the debt, driving up interest rates and crowding out investment, leading in the long term to slower growth. The best evidence suggests that increasing the deficit by 1% of GDP increases long-term interest rates by .5-1%.

4) The research points out a correlation, not causation. Single-mother families in which the mother works may differ in any number of ways from families in which the mother does not work, so getting non-working mothers to work will not necessarily improve children's school performance. In addition, a cut in welfare benefits will not necessarily cause non-working mothers to work, and will decrease utility of those who continue not to work, so even if there is a causal relationship between work and school performance it may not be worthwhile to cut benefits.

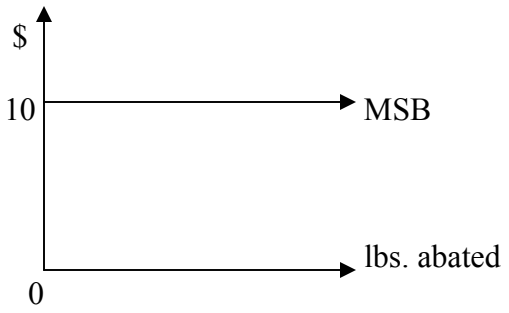
5) This will be true only if the Sudanese government is maximizing social welfare *and* the government is not credit-constrained, so it can afford to provide education until its marginal cost is $200. Given the genocide now occurring in the Sudan, it is particularly ridiculous to assume that the Sudanese government is maximizing social welfare.

Problem 1

a) The most reasonable assumptions are that no one has property rights to the air and that bargaining is costly, since there are many residents and since it is difficult to assign blame to the factory for any given death. Thus the Coase theorem will not apply and the town should intervene. Under other assumptions, the Coase theorem may apply, in which case the town should not intervene.

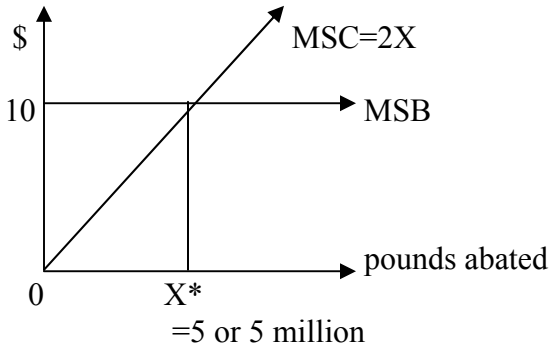
b) In equilibrium, salaries must be such that all the residents (since they're identical) are indifferent between the two jobs. That implies that a 0.2% chance of death is worth a $20,000 salary premium, so a life is worth $20,000/0.002, or $10 million.

c) A 1-million pound reduction is worth $10 million, so a 1-pound reduction is worth $10.



Since MSB is perfectly flat, if there is uncertainty about costs price regulation is best.

d) [Note: there was confusion over whether the cost function was in pounds or millions of pounds. You were not penalized for either assumption. The quantity regulation answer to part d) simply increases by a factor of 10^7 if you assume millions of pounds as opposed to pounds. The solution in part e) changes both by a factor of 10^7 and by whether the investment is worth it or not.]



The optimal quantity regulation is to require that MSC=MSB, or 2X=10

→ X*= 5 or 5 million

The factory should be required to abate 5 or 5 million pounds.

The optimal price regulation is to set P=MSB, so P (either a tax on polluting or a subsidy for abatement) should be $10/pound.

e) With optimal price regulation (either tax or subsidy), the factory is better off by $10 for each pound it abates. Currently it abates 5 or 5 million pounds, for a gross savings of $50 or $50 million. Its total cost of abatement is:

$$\$X^2 = \$25 \text{ or } \$25 \text{ million}$$

so its current net savings is

$$\$10*X - \$X^2 = \$50 - \$25 = \$25$$

or

$$\$50 \text{ million} - \$25 \text{ million} = \$25 \text{ million}$$

With the new machine, the optimal abatement would be where:

$$d/dx[0.5X^2] = X = SMC = SMB = \$10$$

or

$$X = 10 \text{ or } 10 \text{ million pounds}$$

The factory's gross savings would be $100 or $100 million. Its total cost of abatement would be:

$$\$0.5X^2 = \$50 \text{ or } \$50 \text{ million}$$

so its net savings would be:

$$\$10*X - \$0.5X^2 = \$100 - \$50 = \$50$$

or

$$\$100 \text{ million} - \$50 \text{ million} = \$50 \text{ million}$$

Thus the gains from the machine would be the new savings ($50 or $50 million) less the old savings ($25 or $25 million), so $25 or $25 million per year. The present discounted value of the machine, given a 5% discount rate, is:

$$PDV(\text{machine}) = \$25/.05 = \$500$$

or

$$= \$25 \text{ million}/.05 = \$500 \text{ million}$$

Will the factory buy the machine? The cost of the machine is $50 million, so it is worth it if you assumed the cost function was in millions of pounds, and is not worth it if you assumed the cost function was in pounds.

Problem 2

a) Each family wants to choose consumption C, given income Y:

$$U = 9 \ln (C) + \ln (Y-C)$$
$$\rightarrow \text{FOC: } 9/C=1/(Y-C)$$
$$C=0.9Y$$
$$\text{and } S = Y - C = 0.1Y$$

So families earning $20,000 will want $2000 of schooling, families with $50,000 will want $5000 of schooling, and families with $80,000 will want $8000 of schooling.

By the Median Voter Theorem, $5000 will prevail.

b) Since the tax is flat, the families that earn $50,000 will get $1 of schooling for each $1 they are taxed. (Note that this is *not* true for the other families: the poor families ges more than $1 of schooling for each $1 they are taxed, and the rich families get less than $1 of schooling for each $1 they are taxed.) Therefore their decision is the same as in a), where the price of schooling was 1. They will want $5000 of schooling, which can be provided by a 10% tax.

Social welfare goes up, but *not* because everyone is now paying the amount they want to pay—the rich families only wanted to pay $8000 if they got $8000 in schooling back! Welfare increases because the level of schooling is the same as in a), but income has been redistributed from the rich families (which now have $72,000 in consumption, compared to $75,000 above) to the poor families (which now have $18,000 in consumption, compared to $15,000 above). Since utility is concave, there are diminishing marginal returns to income, and $3000 increases the poor families' utility by more than the rich families'. If we weight the families equally, then a transfer from the rich to the poor increases average welfare, even though it decreases the welfare of the rich families.

c) The $80,000 families will hightail it to their own town, since they don't like paying $8000 for $5000 in schooling. Once the rich families leave, the $50,000 families will also leave to form their own town, since they are now paying $5000 and only getting $3500 in education. The $20,000 families will be left on their own in the original town.

The $20,000 families will now spend $2000 and get $2000 in education.
The $50,000 families will now spend $5000 and get $5000 in education.
The $80,000 families will now spend $8000 and get $8000 in education.

Everyone is now paying the same amount they paid in b), but the rich families are getting more schooling—so they're better off—while the poor families are getting less schooling—so they're worse off. Social welfare has *decreased*, because there

are diminishing marginal returns to schooling, so the extra $3000 in schooling that the rich families get doesn't increase their utility as much as the loss of $3000 in schooling decreases the poor families' utility.

[Note: you were not penalized if you answered that social welfare increased because Tiebout predicts efficiency. You should take note for the final, however, that what's missing from that explanation is that redistribution between the towns increases the social welfare of the entire society, while each town only takes into account the welfare of its own residents. If you calculate the average utility in each part of the problem, you will find that welfare falls from b) to c).]

d) i) Matching grants have both income and substitution effects towards education. They will increase education provision in all three towns.

ii) State-funded schools increase schooling in the $20,000 town and the $50,000 town, as both towns send their children to the new schools rather than the old $2000 and $5000 schools.

The effect on the $80,000 town, however, will not be to increase schooling. Either the town will continue to send its children to $8000 schools, in which case there is no effect, or they will send their children to the $6000 state schools, in which case schooling will decrease. Which they decide to do depends on whether they value an increase in consumption from $72,000 to $80,000 more or less than a decrease in schooling from $8000 to $6000:

$$9*\ln(80{,}0000) - 9*\ln(72{,}000) = 0.95 \quad > \quad 0.29 = \ln(8000) - \ln(6000)$$

so they will decide to send their children to the state schools, decreasing education.

[Note: you were not penalized if you didn't make the calculation, but just said that their behavior was uncertain.]