

Solution to Exam 2
Spring 2007

Here are notes on the solution. The graphs are omitted and the explanations are very terse. If you have any questions, please don't hesitate to stop by during office hours or the lab session to talk over things in detail.

Question 1a

Intercepts of the budget constraint:

$$C \text{ axis} = \$10,000/\$15 = 667$$

$$D \text{ axis} = \$10,000/\$20 = 500$$

Equilibrium consumption bundle, via the demand equations:

$$C = \frac{0.6 * 10,000}{15} = 400$$

$$D = \frac{0.4 * 10,000}{20} = 200$$

Question 1b

New prices after adjusting for the tax and subsidy:

$$P_c = \$15 - \$5 = \$10$$

$$P_d = \$20 + \$10 = \$30$$

New consumption bundle, via the demand equations:

$$C = \frac{0.6 * 10,000}{10} = 600$$

$$D = \frac{0.4 * 10,000}{30} = 133\frac{1}{3}$$

The policy is effective at changing consumption of C and D. It increases C by 200 units or $200/400 = 50\%$ and it decreases D by 66.7 units, or by 33.3%. The tax and subsidy revenue can be calculated as follows:

$$\text{Tax Revenue} = \$10 * 133.3 = \$1333$$

$$\text{Subsidy Cost} = \$5 * 600 = \$3000$$

The overall effect on the government's budget is $\$1333 - \$3000 = -\$1667$. That is, the combined effect of the tax and subsidy is a large deficit.

The most likely explanation for the analyst's error is failing to account for the fact that the tax reduces the consumption of D while the subsidy raises the consumption of C. If D and C had remained at their initial values of 200 and 400, the revenue and subsidy cost would both have been \$2000 and there would not have been a deficit.

Question 1c

Calculating the utility associated with the initial consumption bundle:

$$U1 = (400)^{0.6} * (200)^{0.4} = 303.14$$

Inserting this and the new prices into the expenditure function:

$$M3 = 303.14 * \left(\frac{10}{0.6}\right)^{0.6} \left(\frac{30}{0.4}\right)^{0.4} = \$9,221$$

Calculating the CV:

$$CV = M3 - M1 = \$9,221 - \$10,000 = -\$779$$

The fact that the CV is negative indicates that the household is better off under the policy. That is, it would be necessary to take money away from the household to move it back to its original indifference curve.

However, the CV is quite a bit smaller than the deficit caused by the policy. The household gains \$779 but the government loses \$1667. The difference, \$888, is deadweight loss. Put another way, the household only receives $\$779 / \$1667 = 47\%$ of what the government spends on the policy, or \$0.47 for each dollar in the net budgetary cost of the policy.

Question 2a

The present value of Plan A can be calculated several ways. Here's one approach:

$$PVA = \frac{\$80M}{0.05} - \frac{\left(\frac{\$80M}{0.05}\right)}{1.05^4} = \$283.7M$$

The PV of Plan B is easiest to calculate by finding the PV of demolition and the PV of widening the streets and then adding them:

$$PV_{demo} = \frac{\$50M}{1.05} + \frac{\$50M}{1.05^2} = \$93M$$

$$PV_{wide} = \frac{\$30M}{0.05} - \frac{\left(\frac{\$30M}{0.05}\right)}{1.05^{10}} = \$231.7M$$

$$PVB = PV_{demo} + PV_{wide} = \$93M + \$231.7M = \$324.7M$$

The difference in cost is $\$324.7 - \$283.7 = \$41M$. Plan B is considerably more expensive.

Question 2b

The PV of receiving X of revenue from year 11 on will be the following:

$$PVX = \frac{\left(\frac{X}{0.05}\right)}{1.05^{10}}$$

In order for Plan B to be better than Plan A, PVX will have to be at least large enough to cover the difference in cost:

$$PVX > \$41M$$

The break-even value of X will be the value that makes PVX just equal to \$41M. It can be found as follows:

$$\frac{\left(\frac{X}{0.05}\right)}{1.05^{10}} = \$41M$$

$$\left(\frac{X}{0.05}\right) = (\$41M)(1.05^{10})$$

$$X = (\$41M)(1.05^{10})(0.05) = \$3.34M$$

Thus, for Plan B to have a higher NPV than Plan A, X would have to be at least \$3.34 M per year.

Question 3

The PV of the trust fund needed to compensate the employees can be found by computing the amount needed to compensate a single employee and then multiplying it by 10,000:

$$PV1 = \frac{\$20K}{0.05} - \left(\frac{\$20K}{0.05} \right) \frac{1}{1.05^{30}} = \$307K$$

$$PV_{cost} = 10,000 * PV1 = \$3.07B$$

The PV of the benefit is easier to calculate: when the policy is abolished, consumers will save \$250M per year forever:

$$PV_{benefit} = \frac{\$250M}{0.05} = \$5B$$

$$\text{The NPV} = \$5B - \$3.07B = \$1.93 B$$

Question 4

The key elements that needed to be present in an answer were the following: (1) in economics, rational means that someone's preferences are complete and transitive; (2) complete means that all bundles can be compared and are therefore on an indifference curve; (3) transitive means that if $A > B$ and $B > C$ then $A > C$, which implies that indifference curves do not cross; (4) no, economists do not believe people are always rational: people may face many decisions where their preferences are not complete or are not transitive; (5) choices outside the domain where completeness and transitivity hold are really outside the domain of economics.