

Homework Assignment 7 solution.

1. (1 point) (problem 3 on page 214) In 1990, the ratio of people age 65 or older to people ages 20 to 64 in the United Kingdom was 26.7 percent. In the year 2050, this ratio is expected to be 45.8 percent. Assuming a pay-as-you-go Social Security system, what change in the payroll tax rate between 1990 and 2050 would be needed to maintain 1990 ratio of benefits to wages? If the tax rates were kept constant, what would happen to the ratio of benefits to wages?

In this problem we have to use equation 9.1 from the text (page 206):

$t = (N_b/N_w) * (B/w)$; where t is the tax; N_b and N_w are the number of retiree and workers, respectively; and B and w are the benefit and wage levels, respectively.

Let's write down this equation for both years – 1990 and 2050:

$$t_{1990} = (N_b/N_w)_{1990} * (B/w)_{1990};$$

$$t_{2050} = (N_b/N_w)_{2050} * (B/w)_{2050};$$

Plugging in what we know, we get:

$$t_{1990} = 0.267 * (B/w)_{1990};$$

$$t_{2050} = 0.458 * (B/w)_{2050};$$

Keeping the ratio of benefits to wages (B/w) constant ($(B/w)_{1990} = (B/w)_{2050}$), we have:

$t_{2050}/t_{1990} = 1.715 (= 0.458/0.267)$. In other words, the tax should increase in the same proportion as the ratio of retirees to workers.

If the tax rates are kept constant:

$$t_{1990} = 0.267 * (B/w)_{1990} = t_{2050} = 0.458 * (B/w)_{2050};$$

So, $(B/w)_{2050}/(B/w)_{1990} = 0.267/0.458 = 0.583$.

In other words, the benefits to wages ratio will decrease proportionately to the inverse of the increase in the ratio of retirees to workers.

2. (1 point) Wes works for a large manufacturing company. He is enrolled in the company's insurance plan with the monthly premium equal to \$80. Now suppose that he decided to quit his job. The same (in quality) individual insurance policy would now cost him \$300/month. What could explain the difference in premiums?

Health insurance policies provided by the companies are generally cheaper because of

(1) risk-pooling – if insurance company sells policies to all employees of a large corporation, it faces a lot less risk than by selling to individuals separately. It may be fairly probable that Wes falls sick in any given year. Yet it is extremely unlikely

that all employees fall sick at the same time. It means that the health care expenditures per employee are much less volatile than expenditures of each individual taken separately. The corporation will get a much better deal (premium) because of this.

(2) It is also possible that the Wes's employer may not be able to charge every employee the premium that is related to risk of each individual employee (because it is costly to determine who is risky and who is not). If, instead, Wes's employer charges everyone the same average premium and if Wes is sicker than the average employee at the company, then Wes gets better deal than he would get based on his risk alone.

(3) Large companies may also get cheaper rates from an insurance company because selling a large package allows the insurance company to economize on administrative costs.

There is also a related point: Notice that \$80 that Wes was paying while employed are pre-tax dollars and \$300 that he's paying while not employed are after-tax (employer-provided health insurance is not subject to income tax). So the deal he was getting at work is even better because \$300 after-tax may mean around \$400 pre-tax.

3. (2 points) Read the Policy Debate on Prescription Drug Coverage at: http://www.swlearning.com/economics/policy_debates/drug_coverage.html (read only the main part; do not follow links unless you want to). Briefly summarize both sides of the debate.
4. (2 points) The government has hired you to advise them on the merits of a project that is being proposed. The project is expected to generate benefits of 14 million dollars today, 5 million dollars in one year from today, and 1 million dollars in two years from today. (These are the only years of concern.) The project costs nothing today, but will cost 20 million dollars in two years. Assume the interest rate is 10%. If the benefit-cost ratio is greater than 1, the project should be allowed. What is your policy suggestion?

The present discounted stream of benefits is equal to:

$$B=14+5/(1+0.1)+1/(1+0.1)^2=19.372$$

The present discounted stream of costs is equal to:

$$C=20/(1+0.1)^2=16.523$$

The benefit-cost ratio is then $B/C=1.17>1$, so the project should be allowed. Notice that the Present Value of this project is greater than zero ($PV=B-C>0$), so we would arrive at the same conclusion using either method.

5. (2 points) Suppose that all people living in a suburban neighborhood of some big city work in downtown area and the only way to commute there is to take highway I-1. Now assume that local authorities built a new road I-2 going by the neighborhood, which reduced the commute time to downtown by 10 minutes a day. As a result of this improvement the average house price went up by \$25000.

Based on this information discuss how you would go about measuring the value of time (I don't want the exact numbers, just discuss how you would proceed and what problems you expect).

Ideally, we would just ask residents how much money each of them saves by taking highway I-2 instead of I-1. This may not be possible to do due to a variety of reasons. If you start asking residents how much money 10 minutes is worth, they may either (1) not know or (2) exaggerate/downplay the value of these 10 minutes. If you use everyone's wage rate to determine the value of 10 minutes, it may produce wrong estimate because in reality people are not free to work as many hours as they wish. In other words, the fact that you have 10 more minutes a day to spend however you like, you may not be able to work for 10 more minutes and collect 10 minutes-worth of wages.

What the change in the property prices tell us is how much more money people would demand if they were asked to reallocate to other region. That is, if your house was valued at \$150,000 before and \$175,000 after new highway was built, then you must be requiring more if asked to give up the benefits of new highway I-2. Again, housing prices have a lot of determinants but assuming that all other factors were kept constant, this \$25,000 must be attributed to the new highway (i.e., the \$25,000 is the signal of the net present discounted benefits of the new highway). If other factors were changing too – we'll get biased estimates.

Now, the question is how do we divide \$25,000 among all 10 minutes intervals (days) that you may use the highway? Clearly, the benefits of a highway are consumed over a long period of time (as long as the road itself lasts).

Determining the correct discounting rate may be very difficult task as we discussed in class. Determining how many years the highway will be functioning may also prove difficult. We'll also have to assume that the value of time doesn't change (or changes in some specific way) as years go by. More importantly, the benefits stream resulting in higher housing prices may also be attributed to lower spending on gasoline (you'll purchase less gas if you drive less).

However, provided that we can satisfactorily answer these questions, we can determine the value of 10 minutes using formula 11.1 in the text (we want to solve for R given $PV=25,000$ and some discount rate r).

6. (2 points) Suppose that some state official advocates building a new highway. Among other arguments in favor of this project, he claims that (1) the construction will create a lot of jobs in the state, (2) it will benefit local businesses located along the proposed highway, (3) it will increase the value of the land located along the highway. Discuss the merits of these arguments.

The arguments above pretty much exemplify typical mistakes when performing cost-benefit analysis:

- (1) Labor costs (new jobs) are costs, not benefits.**
- (2) Counting secondary benefits. While there is nothing wrong with this argument per se, this state official would have to count secondary costs as well – businesses in other parts of the state may be hurt, customers of both**

local and other businesses may be hurt (because of increased prices) and so on.

- (3) Double counting. The increased land prices are derived from the stream of benefits of this highway. Assuming that the benefits of the highway were already taken into consideration, increase in land prices constitutes double counting.**