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**Final exam, Economics 149: Health economics, Spring 2007**

**Instructions:** All points on the true/false and short answer questions will be given for the explanation. Note that you can choose which questions to answer in the short answer section. You must answer all of the true/false questions. You may choose which 2 of the 3 short answer questions (8, 9, and 10) to answer. You must answer all 3 of the long answer questions (11, 12, and 13). Be concise. Note that the last page of the exam contains extra credit questions. The exam is worth a total of 133 points. Each of the long answer questions is worth 25 points, the 2 short answer are worth 15 each, and the 7 true/false are each worth 4 points. Verify that you have 12 pages.

**True or false questions (explain)—answer all 7 questions. Each question is worth 4 points.**

1. T/F (4 points) Defensive medicine (due to malpractice and other causes) has increased rapidly over the last 20 years.

*F Some amount of tort reforms have cut defensive medicine, as has the spread of managed care.*

2. T/F (4 points) HMOs who pay doctors a set fee per patient give doctors an incentive to not engage in excessive testing.

*T By paying a capitated fee to doctors, HMOs remove the moral hazard opportunity for doctors. Doctors will no longer get higher revenues for ordering unnecessary extra tests.*

3. T/F (4 points) HMOs who pay doctors a set fee per patient will engage in the right amount of care for patients with hard to manage conditions.

*F If patients do not remain in the HMO in the long run, then the HMO may not be able to reap the benefits of preventive care or management of expensive conditions. Thus, with lots of switching of plans, HMOs may not give patients the optimal amount of care. By contrast, doctors who are reimbursed from FFS plans will be paid for all the care they provide, and will likely not underprovide care.*

4. T/F (4 points) Government mandated health insurance coverage for all would not solve the problems caused by asymmetric information/adverse selection (e.g., low risk people are more likely to be uninsured without mandates).

*F Mandated coverage likely would help some of issues with adverse selection. If cost is average risk price, then everyone will be covered but may involve some redistribution.*

5. T/F (4 points) The controversy over the branded pharmaceutical Vioxx (a pain reliever that didn't cause stomach bleeding) arose because of its high costs due to too much direct advertising of the expensive drug to senior citizens.

*F The controversy arose because it was discovered that long term use of the drug was associated with a big increase in the risk of heart attacks and strokes.*

6. T/F (4 points) Education is strongly correlated with better health, but there is no evidence that the relationship is causal.

*F Research shows that the introduction of compulsory schooling laws suggest that more schooling (at around age 16) is associated with lower mortality levels many years later.*

7. T/F (4 points) Coinsurance levels below 100% make demand for health care more elastic.

*F Coinsurance levels below 100% mean that patients pay some share but not the full share of their health care. This makes their demand curve for health care less elastic.*

**Short answer questions—pick 2 of questions 8, 9, and 10 to answer. Each question is worth 15 points.**

8. Short answer (15 points, answer only 2 of 3). For each pair of groups below, explain which one is more likely to be uninsured and why.

- (a) Undocumented adults or citizen adults

*Citizen adults are more likely to have insurance, in part because undocumented adults are healthier and younger than citizens on average and in part because undocumented adults are less likely to have access to group insurance (public or private employer provide).*

- (b) Older adults or younger adults

*Younger adults are less likely to have coverage than older adults in part because some of them are healthy and choose no coverage, and in part because almost all adults 65 and older are covered by the Medicare program.*

- (c) Part-time workers or full-time workers

*Part time workers are less likely to have coverage, in part because they are less likely to work in firms that offer coverage.*

- (d) Workers in small firms or workers in large firms

*Workers in small firms are less likely to have coverage, in part because they are less likely to work in firms that offer coverage.*

- (e) Hispanics or white non-Hispanics

*Hispanics are less likely to have coverage, in part because they are low income and also less likely to be citizens, both groups have less coverage than the average person, and less than white non-Hispanics.*

- (f) College graduates or high school dropouts

*High school dropouts have less coverage, also due in part to their being relatively low income and less likely to work in jobs with employer provided coverage.*

- (g) Adults in 1920 or adults today

*Adults in 1920 were much less likely to have coverage because private health insurance only began to be available during the depression, and the largest public programs (Medicare and Medicaid) were only founded in 1965.*

9. Short answer (15 points, answer only 2 of 3). For each subquestion below, you are given two quantities separated by an inequality. Holding all else equal, circle the inequality that best identifies the relationship between the two quantities and **explain why this is the case**.
- (a) SID with fee-for-service reimbursement  $>$   $<$  SID with capitated reimbursement  
*>: SID will be greater under FFS because doctors have no incentive to restrain costs.*
- (b) Family income of a child covered by SCHIP  $>$   $<$  Family income of a child covered by Medicaid  
*>: SCHIP was designed to cover children who were uninsured but whose family was not poor enough to qualify for Medicaid.*
- (c) Age of people in HMOs  $>$   $<$  Age of people in FFS plans  
*<: People who sign up for HMOs are less likely to get sick and more likely to be young.*
- (d) Demand for employer-provided HI with a marginal tax rate of 20%  $>$   $<$  demand for employer-provided HI with a marginal tax rate of 30%  
*<: The tax subsidy for HI is equal to the MTR, so a higher MTR implies greater demand for HI.*
- (e) Severity of job lock for a worker with two kids  $>$   $<$  severity of job lock for a worker with a spouse who gets health insurance from her own employer  
*>: You might not change your job if it meant your kids couldn't see a doctor, but if your spouse has insurance through his or her employer, he or she will have it regardless.*
10. Short answer (15 points, answer only 2 of 3). According to what we've learned in class, which of the following is or is not a cause for the rapid rise in health expenditures over the past 30 years in the US? Or can we not tell if a factor is a cause (we didn't see any evidence about this in class)?
- (a) The aging population  
*This is a cause, as older persons have higher expected health care use and the population over 65 has grown rapidly and will continue to do so.*
- (b) The large share of people with health insurance coverage  
*This is a cause. We know from the RAND HIE that more insurance means more use of care. Back of the envelope calculations from the RAND HIE suggest widespread HI likely caused less than 20% of the rise in expenditures.*
- (c) The spread of managed care  
*This is not a cause, if anything it has likely caused a one time reduction in some costs, but will likely have no long term effects on the medical care inflation rate.*
- (d) Technological change  
*This is likely a cause (most new technologies are expensive). However, the quality improvements in treating heart attacks as one example have been large and are often omitted from the calculation of medical care inflation.*

**Long answer questions—answer all three of questions 11, 12, and 13. Each question is worth 25 points.**

11. Long answer (25 points). This question is about risk and expected wealth and utility. Suppose that you live in a town with only two types of jobs: relatively dangerous jobs and relatively safe jobs. Workers at safe jobs make  $Y = X$  per year and are injured on the job with probability  $P_S$ . Workers at dangerous jobs are injured on the job with a higher probability  $P_D$ , so they make a greater salary of  $Y = X + D$  per year. In either industry, an injury leads to a loss of  $3/4$  of the worker's salary, so an injured worker in the safe job ends up with  $X/4$  and an injured worker in the dangerous job ends up with  $(X + D)/4$ .

- (a) Calculate the expected income in the safe industry and the expected income in the dangerous industry.

$$E_S(Y) = (1 - P_S)X + P_S X/4 = (1 - 3P_S/4)X$$

$$E_D(Y) = (1 - P_D)(X + D) + P_D(X + D)/4 = (1 - 3P_D/4)(X + D)$$

- (b) Suppose that workers are risk neutral and choose jobs only based on expected income. Find the value of the salary premium for dangerous jobs,  $D$ , that will make risk-neutral workers indifferent between jobs. (Assume that worker flows do not affect the base salary  $X$ .)

*Equate expected income in the two jobs:*

$$E_S(Y) = E_D(Y) \iff (1 - 3P_S/4)X = (1 - 3P_D/4)(X + D) \iff D = \frac{P_D - P_S}{4/3 - P_D} X$$

- (c) Now suppose that workers are risk averse and that every worker has the utility function  $U = \sqrt{Y}$ . Calculate the expected utility of a worker who has a safe job and the expected utility of a worker who has a dangerous job.

$$E_S(U) = (1 - P_S)U(X) + P_S U(X/4) = (1 - P_S)\sqrt{X} + P_S \sqrt{X/4} = (1 - P_S/2)\sqrt{X}$$

$$E_D(U) = (1 - P_D)U(X + D) + P_D U((X + D)/4) = (1 - P_D)\sqrt{X + D} + P_D \sqrt{(X + D)/4} = (1 - P_D/2)\sqrt{X + D}$$

- (d) Using the expected utilities, find the value of  $D$  that will make risk-averse workers indifferent between jobs.

*Equate expected utility in the two jobs and solve for  $D$ :*

$$E_S(U) = E_D(U) \iff (1 - P_S/2)\sqrt{X} = (1 - P_D/2)\sqrt{X + D} \iff (1 - P_S/2)^2 X = (1 - P_D/2)^2 (X + D) \iff D = \left[ \frac{(1 - P_S/2)^2}{(1 - P_D/2)^2} - 1 \right] X$$

- (e) Now, suppose you're a worker in a **dangerous** job and you want to buy insurance to cover you in case of an on-the-job injury. Find the actuarially fair premium (defined as the insurance company's expected loss). Using this premium and keeping  $D$  as a variable, calculate your expected utility with the insurance policy.

$$\text{Actuarially fair premium} \equiv E(\text{loss}) = (1 - P_D)0 + P_D \frac{3}{4}(X + D)$$

$$E(U) = (1 - P_D)\sqrt{\left(1 - \frac{3P_D}{4}\right)(X + D)} + P_D\sqrt{\left(1 - \frac{3P_D}{4}\right)(X + D)} = \sqrt{\left(1 - \frac{3P_D}{4}\right)(X + D)}$$

- (f) All else equal, would a worker in a dangerous job or a worker in a safe job be willing to pay more for an insurance policy that compensates for on-the-job injuries?

*A worker in a dangerous job would be willing to pay more.*

12. Long answer (25 points). Suppose that we have a labor market in equilibrium. The labor demand curve is  $L_d = 1000 - 25w$ , and the labor supply curve is  $L_s = 100 + 20w$ . Suppose the government decides that everyone who works ought to exercise. They are considering two ways to do this, either through a payroll tax on workers of \$3 per hour per worker which would then be used to provide workers with free health club memberships or through mandating provision of access to health clubs at work (which would also cost \$3 an hour per worker).

- (a) What is the equilibrium before the policies are implemented?

*Inverse demand:  $w = 40 - L_d/25$ , inverse supply:  $w = L/20 - 5$ .  $40 - L/25 = L/20 - 5$ ,  $L = 500$ ,  $w = 20$ . Which factor is more elastic? Is  $|\frac{1}{20}| >$  or  $< |-\frac{1}{25}|$ ?  $\frac{1}{20} > \frac{1}{25}$ , so the absolute value of the slope of labor demand is smaller than the slope of labor supply. Labor demand is more elastic than labor supply.*

- (b) Suppose the policy is implemented through a payroll tax. What is the new equilibrium wage, total compensation for a worker, cost of employing a worker, and labor supplied? What is the tax revenue and DWL? Who bears more of the burden of the tax?

*Cost of hiring one worker is  $w + 3$  where it used to be  $w$ . New inverse demand:  $w + 3 = 40 - L_d/25$ . Equilibrium:  $L/20 - 5 = 37 - L/25$ . Equilibrium is  $L = 1400/3 = 466\frac{2}{3}$ ,  $w = 55/3 = 18\frac{1}{3}$ , total compensation is the wage, cost of hiring one worker is  $21\frac{1}{3}$ , tax revenue is  $466\frac{2}{3} * 3 = 1400$ , and  $DWL = 3 * (500 - 466\frac{2}{3}) * 1/2 = 50$ . Labor demand is more elastic so the firm will bear less of the tax burden. What share does the firm bear? Firm pays  $(21\frac{1}{3} - 20) * 466\frac{2}{3}$  and workers pay  $(20 - 18\frac{1}{3}) * 466\frac{2}{3}$ , or firm pays  $\frac{4}{3}/3 = \frac{4}{9}$  and worker pays  $\frac{5}{3}/3 = \frac{5}{9}$ .*

- (c) Suppose the government instead imposes a mandate. What is the new equilibrium wage, total compensation for a worker, cost of employing a worker, and labor supplied? What is the DWL? Who bears more of the burden of the cost of the mandate?

*Equilibrium is the same as in the previous part. The DWL is the same as in the previous part. The firm bears less of the cost of the mandate.*

- (d) Suppose the workers value the benefit at \$2 per hour. What is the new equilibrium wage, cost of employing a worker, and labor supplied? Are the disemployment effects of the policy bigger than if the workers did not value the benefit? Is the new DWL larger or smaller than with a payroll tax? Who bears more of the burden of the mandate?

Cost of hiring one worker is  $w + 3$  where it used to be  $w$ . New inverse demand:  $w + 3 = 40 - L_d/25$ . The benefit of working is now  $w + 2$  where it used to be  $w$ . New inverse supply:  $w + 2 = -5 + L_s/20$ . Equilibrium:  $37 - L/25 = -7 + L/20$ . Equilibrium is  $L = 4400/9 = 488\frac{8}{9}$ ,  $w = 157/9 = 17\frac{4}{9}$ , total compensation for the worker is  $19\frac{4}{9}$ , cost of hiring one worker is  $20\frac{4}{9}$ . The disemployment effect with the worker valuing the benefit at \$2 is  $500 - 488\frac{4}{9} = \frac{100}{9} = 11\frac{1}{9}$ . The disemployment effect with the worker valuing the mandated benefit at \$0 or with the payroll tax is  $500 - 466\frac{2}{3} = \frac{100}{3} = 33\frac{1}{3}$ . The disemployment effects are smaller if the workers value the benefit than with the payroll tax.  $DWL = (3 - 2) * (500 - 488\frac{4}{9}) * 1/2 = \frac{50}{9}$ . The disemployment effects are smaller than with the payroll tax (or with the worker valuing the mandated benefit at 0) and the DWL is smaller than with the payroll tax (or with the worker valuing the mandated benefit at 0). The money wage is lower in part (d) but total compensation is higher. What share of the cost does the firm bear (for this we leave out the benefit to the worker or value to them)? Firm pays  $(20\frac{4}{9} - 20) * 488\frac{8}{9}$  and workers pay  $(20 - 17\frac{4}{9}) * 488\frac{4}{9}$ , or firm pays  $\frac{4}{9}/3 = \frac{4}{27}$  and worker pays  $\frac{23}{9}/3 = \frac{23}{27}$ . The firm pays less of the cost, but here the worker gets \$2 in benefit.

- (e) Suppose the workers value the benefit at \$3 per hour. What is the new equilibrium wage, total compensation for the worker, cost of employing a worker, and labor supplied? Are the disemployment effects of the policy bigger than if the workers valued the benefit at \$0 or \$2 an hour? What is the new DWL and is it larger or smaller than with a payroll tax, larger or smaller than if the workers value the benefit at \$2 an hour? Who bears more of the burden of the mandate?

The new equilibrium wage is 17, total compensation is 20, cost of employing a worker is 20, labor supplied is 500. There are no disemployment effects (so they are smaller than if the workers valued the benefit at \$0 or \$2 an hour). The DWL is 0 (and thus smaller than the other cases). The worker pays the full cost of the benefit in foregone wages, but fully values that cost.

- (f) Suppose there were a TV ad describing the mandate, in a world where workers value the benefit at \$3 an hour. The TV ad is put out by the firm and complains that the mandate is causing the firm to be unable to compete in the world market because the cost of providing the mandated benefit is \$3 an hour, 15% of the total cost of hiring a worker. Is this misleading (briefly)?

Yes, in the last case the workers fully value the benefit and give up wages in order to get the benefit. So, there is no excess cost to the firm of the mandated benefit, it still costs them \$20 an hour to hire a worker. This is extreme, in that likely not all workers do fully value all their benefits, but it suggests that such arguments are overblown.

13. Long answer (25 points). Suppose that the market for heroin in the US is characterized by the following supply and demand functions.  $Q_d = 100 - p$ ,  $Q_s = 40 + 2p$  (prices in dollars per bag, quantities in millions of tons).

(a) What is the equilibrium?

*Inverse demand:  $p = 100 - Q_d$ , inverse supply:  $p = Q_s/2 - 20$ . Equilibrium:  $Q = 80, p = 20$ . Which factor is more elastic? The absolute value of the slope of demand is 1, absolute value of the slope of supply is 1/2. Demand curve is steeper so demand is more inelastic.*

(b) Suppose there is a supply intervention. All imports of heroin from Mexico are stopped for a year. This has the following effect on the supply, at any aggregate quantity of heroin, market prices are \$10 higher. What is the new equilibrium?

*New inverse supply  $p - 10 = Q_s/2 - 20$ , or  $p = Q_s/2 + 10$ . Equilibrium:  $Q = 220/3 = 73\frac{1}{3}, p = 80/3 = 26\frac{2}{3}$ .*

(c) Suppose a new president has been elected who is in favor of legalizing drugs. What tax would end up with the same equilibrium quantity of heroin consumed (with no supply intervention) as the supply intervention accomplished? What would be the price paid by consumers? What would be the tax revenue if that were the tax rate? What share of the tax is paid for by consumers and drug sellers?

*The tax would be \$10. The new equilibrium price paid (which includes the tax) would be  $26\frac{2}{3}$ , and the quantity would be  $73\frac{1}{3}$ . Sellers would only get  $16\frac{2}{3}$ , the rest would go to the government. Tax revenue would be  $73\frac{1}{3} * 10 = 2200/3$ . Drug consumers would pay  $(26\frac{2}{3} - 20) * 2200/3$  of the tax, and drug sellers would pay  $(20 - 16\frac{2}{3}) * 2200/3$  of the total tax revenue. So consumers pay for  $(20/3)/10$  or  $2/3$  of the tax and drug sellers pay for  $(10/3)/10$  or  $1/3$  of the tax. The more inelastic factor (consumers) pays more of the tax.*



- (d) What are the costs of a drug legalization plan like the one described (compared to supply interruptions)?

*If legalized, demand for heroin may increase a lot. If so, given that this is a highly addictive drug with negative health effects, the costs may well outweigh any tax revenues.*

- (e) What are the benefits?

*A possible benefit under the assumption that there was no increase in demand if the drug were legalized would be the increased tax revenue from imposing the tax indefinitely as opposed to the costs of what often end up being temporary supply interruptions. If demand increases, then the gain from tax revenues plus not paying for the war on drugs may be offset by negative health consequences of more addiction.*

- (f) How would your answer to the previous 2 questions change if heroin were not highly addictive and didn't have big negative health effects?

*If it were not addictive with negative health effects, there might be less of an argument for concern if demand increased with the tax.*

### Extra credit

- (a) Extra credit (3 points). What are 3 diseases (other than HIV / AIDS) that are a big burden in the developing world ?

*Tuberculosis, malaria, and diarrhea were discussed in class. There are many others.*

- (b) Extra credit (1 point). T/F (You must explain the answer to get credit.) Research shows that HIV / AIDS is responsible for the lack of growth in sub-Saharan Africa over the last 2 decades.

*F Existing research suggests that AIDS/HIV is not strongly associated with declines in GDP or lower growth rates.*

- (c) Extra credit (1 point). T/F (You must explain the answer to get credit.) The theory of the second best says that if we remove characteristics of the market that deviate from perfect competition, the outcome will be closer to the perfectly competitive Pareto-optimal outcome.

*F If there is more than one deviation from perfect competition, there is no guarantee that fixing one deviation from perfect competition will move us closer to the best outcome.*

- (d) Extra credit (2 points). Name one reason why the US has higher pharmaceutical prices than some other OECD countries that is not tied to either patent extensions or the fact that the other governments bargain for lower prices or set price caps.

*If pharmaceutical companies price discriminate it could be that the US consumers have a higher willingness to pay.*

- (e) Extra credit (2 points, you must explain your answer). Will having a large deductible for your health insurance policy (compared to a policy which fully insures you) encourage you to avoid spending too much on health care? Will it change demand for health insurance?

*This depends. If you expect to have a high level of expenditures, this should have no impact on your total spending. If you expect to have a low level, it might result in your self-insuring, and spending less than you might with full coverage. It may lead to lower demand for health insurance.*