Public Economics: Practice Problem Set 1

July 21, 2017

These practice problems are meant to give you an idea of the types of questions I might ask on the midterm exam. To help you prepare, I have included problems that are at a slightly higher difficulty level (or that have an additional part that is slightly more difficult) than the ones you have seen on previous problem sets.

Problem 1

People in the economy have the utility function $U(C, L) = \frac{4}{5}\log(C) + \frac{1}{5}\log(L)$, where L is a number between 0 and 1 representing the fraction of time spent on leisure activities. Time spent working is therefore $(1 - L)$. The wage people get for spending all their time working is w. Earnings would be equal to $\$w = \$20,000$ if $L = 0$ and actual earnings are $w \cdot (1 - L)$. Assume that earnings from working are the only source of income and that all income is spent on consumption C.

(i) Write down the budget constraint and find the optimal consumption and leisure choice.

(ii) Suppose that full-time earnings increase to \$25,000. How does an individual's optimal labor supply change? Explain the economic intuition underlying this result.

(iii) Assume instead that full-time earnings remain at \$20,000 and the government provides everyone in the economy with a lump-sum transfer of $T = \$5,000$. What fraction of time is spent on working now? Why is the change in labor supply different in this case relative to the change observed in part (ii)?

(iv) Imagine that full-time earnings remain unchanged and there is no transfer, but all earnings are subject to a 20% tax. Compute the optimal consumption/leisure choice and compare the results to the previous three parts of the problem.

(v) Finally, suppose that the tax on labor income levied in the previous part only applies to income above an exemption level of \$5,000. That is, the individual's tax liability is $0.2 \cdot (Y - 5,000)$ when labor income Y is greater than or equal to \$5,000, but there is no tax liability otherwise. Plot the budget constraint, and find the optimal hours of work and consumption.

Problem 2

Note: this problem is more difficult than the typical consumption/leisure choice problems you have seen up until now. However, since it prefaces some of the problems related to tax incentives of transfer programs that we will be analyzing in the second half of the course, I recommend you try to solve it.

Individuals have the utility function $u(C, L) = \frac{1}{6}\log(C) + \frac{5}{6}\log(L)$, where C is consumption and L is leisure. The full-time wage is $w = \$30,000$. Assume as usual that there is no saving and that L is the fraction of time spent in leisure.

(i) Write down the budget constraint and find the optimal consumption and leisure choice.

(ii) If all individuals receive a lump-sum transfer of \$6,600 from the government, how does labor supply change? Determine the new optimal leisure choice.

Consider the following policy: the government provides a transfer of \$3,000 for those who have no earnings and reduces it by 30 cents per dollar of earnings up to the point where the transfer is completely eliminated.

(iii) Write down the individual's budget constraint after the government implements this policy. *Note that the slope of the budget will differ depending on whether the individual crosses an earnings threshold of \$10,000.*

(iv) Find the optimal consumption and leisure choice. *Note that the solution could, in principle, correspond to a level of earnings greater or less than the \$10,000 threshold.*

(v) Suppose now we keep the benefit of \$3,000 for those not working, but rather than reducing the benefit by 30% for each dollar earned we reduce benefits at some other rate t. What is the minimum level of t at which the person chooses to not work at all (i.e. $L^* = 1$).

Problem 3

Consider two markets – one for food purchased at grocery stores and another for take-out food purchased from restaurants. The demand for food purchased at grocery stores is $D_G = 100 - P_G + \frac{1}{2}P_T$, where P_G is the price index for food in supermarkets and P_T is the price index for take-out food. The demand for take-out food is given by $D_T = 100 - P_T + \frac{1}{2}P_G$. The supply curves in the two markets are determined by $S_G = \frac{1}{2}P_G$ and $S_T = \frac{1}{2}P_T$, respectively.

(i) In this problem, are groceries and take-out meals substitutes or complements? Explain how the demand curves for the two markets give you this information.

(ii) Suppose the government imposes a tax of $t = \$40$ on take-out meals. Determine how the incidence of this tax is split between consumers and producers of the two types of food.

Hint: since the markets are related, you need to find a set of prices that yield an equilibrium in both markets at the same time.

(iii) Explain the economic intuition for how the incidence of the tax is split between consumers and producers in each market.

(iv) Compute the deadweight loss (i.e. the excess burden) that is generated in each market by the tax on take-out meals.

Problem 4

In Manhattan, every individual's decision to drive generates an externality: an extra car on the road increases congestion and reduces the welfare of all other commuters taking a car or bus to their

destination. The price of driving a car on any given day is $p = 210$ (this price includes aspects such as the cost of gasoline, depreciation of the value of the car itself, etc.). Given q cars already on the road, the private marginal benefit of driving is $300 - q$. At the same time, an additional car on the road reduces welfare of drivers already on the road by $2q$.

(i) Plot a graph showing the private and social marginal benefit and the private and social marginal cost of driving.

(ii) Find the price and quantity that prevail in market equilibrium (without any government intervention).

(iii) Find the socially efficient quantity and the deadweight loss from this externality.

(iv) Suppose that the government wanted to implement the efficient quantity of drivers by imposing a constant fee (e.g. via a toll), for each car driving in Manhattan. What should the fee be?

(v) Imagine instead that you did not know the marginal damage from this externality. If you were interested in estimating the marginal damage (in terms of dollars for each additional driver on the road) in this scenario using a market-based approach, from which type of market(s) would you require data? Describe the statistical relationship you would expect to observe in this market between prices for the good/service and the number of drivers on the road.

Problem 5

Imagine there are three firms (A,B,C) in the steel industry that have total costs of eliminating pollution given by $R_A^2, 5R_B^2/3$, and $5R_C^2/2$, respectively. Denote total pollution reduction in the steel industry by R^*.

(i) Suppose that we want to reduce aggregate pollution in a way that minimizes the total cost of reduction. Derive the marginal cost of doing so as a function of total pollution reduction R^*.

(ii) The government has a pollution reduction target of $R^* = 60$ units (you can think of the units here as tons of carbon compounds emitted into the atmosphere). What is the optimal allocation of pollution reduction across the three firms?

(iii) Now suppose the government raises the pollution reduction target to $R^* = 150$ and requires each firm to reduce pollution by 50 units. The firms are allowed to meet their reduction quota by trading rights to pollute amongst themselves. What is the market price of a right to pollute? How many rights to pollute will each firm buy or sell?

For the rest of the problem, consider what occurs when the government implements a cap-and-trade policy: it asks each firm to reduce pollution by 70 units and puts 60 carbon credits up for sale. Note that firms can still trade rights to pollute amongst themselves, but now the supply of these rights, or carbon credits, is restricted. The market for carbon credits determines the price of a right to pollute.

(iv) What pollution reduction target does this cap-and-trade policy achieve? At what price do firms buy and sell a carbon credit? Is the distribution of pollution reduction across the three firms efficient?

(v) A key difference between the policies in parts (iii) and (iv) is that under cap-and-trade the government collects some revenue from the carbon credits it sells. Calculate each firm's contribution to government revenues under the cap-and-trade policy.

Problem 6

Consider an individual with initial resources of \$40,000 who faces a 5% probability of suffering a loss of \$30,000. The utility function in each state of the world is given by $24 \cdot \sqrt{C}$, where C is consumption. This individual is an expected utility maximizer who has no access to savings.

(i) What is the maximum price at which the individual would buy some positive amount of insurance?

(ii) What would be the actuarially fair per-dollar price of insurance given the risk-profile of this individual? Give the economic intuition for why this price is lower than the price you computed in part (i).

(iii) What is the maximum amount this individual is willing to pay for full coverage?

(iv) Suppose insurance companies offer a contract at the price per-dollar of coverage of $q = 0.3$. How much insurance coverage will this individual purchase? What type of insurance market condition(s) would lead an insurer to offer this price instead of the actuarially fair price?

Problem 7

Don has total income $y = 100$. There are three periods (0,1,2) and Don has to decide how to distribute his consumption across the three different time periods. Suppose the net interest rate is positive, so $r > 0$.

(i) Write down the intertemporal budget constraint Don faces.

(ii) Suppose Don is a geometric discounter with utility:

$$u(c_0) + \beta u(c_1) + \beta^2 u(c_2)$$

where $u(c) = \log(c)$ and $\beta < 1$. Solve for the optimal consumption bundle (c_0^*, c_1^*, c_2^*) when the interest rate is $r = 0.1$.

(iii) Now suppose instead that Don is a present-bias discounter with utility:

$$u(c_0) + \delta\beta u(c_1) + \delta\beta^2 u(c_2)$$

where $\beta < 1$, $\delta < 1$, and as before $u(c) = \log(c)$. From the perspective of period 0, what is the optimal consumption bundle (c_0^*, c_1^*, c_2^*)?

(iv) Does Don follow the optimal consumption plan when he is a present-bias discounter? Solve for the optimal consumption bundle (c_1^{**}, c_2^{**}) from the perspective of period 1. Compare this to your answer to part (iii) and give an economic interpretation for your findings.

Problem 8

Consider our discussion in lecture of unemployment insurance (UI).

(i) Both adverse selection and moral hazard may be present in a private market for unemployment insurance. Give a specific example of how each of these asymmetric information problems may cause functionality issues in a UI market.

(ii) Summarize the existing empirical evidence for adverse selection and moral hazard in unemployment insurance. Why in OECD countries like the U.S. is it difficult to accumulate evidence for adverse selection in markets for UI?

(iii) Many governments provide UI benefits to unemployed workers. Are such public UI programs immune to the problems you identified in part (i)? If not, would there still be a rationale for government intervention in an unemployment insurance market? Explain your reasoning.

Problem 9

An insurance company offers a standardized health insurance contract (i.e. customers do not get to choose from a menu of possible contract features such as the extent of coverage, deductible, care-provider network, etc.). There are 800 potential health insurance customers. At price p, $\min\{1000-p, 800\}$ of them are interested in buying the insurance (in particular, everybody will buy insurance if the price is lower than \$200). Buyers differ with respect to their health. Hence the cost to the insurer of providing insurance depends on the number of buyers. Suppose that the insurance company's total cost of serving the first q customers is $900q - 3q^2/8$.

(i) What is the supply curve here assuming that the firm makes zero profits (due to free entry/exit)?

(ii) What is the equilibrium price and the number of insurance policies sold?

(iii) What is the efficient number of insured individuals that would prevail under full information?

(iv) Calculate the deadweight loss corresponding to equilibrium provision.

(v) Suppose that the government provides a subsidy to every individual if they purchase health insurance. What should the subsidy be to ensure that the insurance is bought by all individuals for whom the marginal benefit of having insurance exceeds the marginal cost of providing it?

Problem 10

The two main justifications for government intervention in the economy are failures of the First and Second Welfare Theorems. Explain how each of the Welfare Theorems might fail and why government intervention may be justified when either theorem fails.

Problem 11

Using a demand and supply diagram(s), show how allocative inefficiencies (or misallocations) in a rental market with housing lotteries may severely increase the deadweight loss from rent-controlled prices. *Note that while you do not have to label your diagram(s) with the level of detail at which we discussed this problem in lecture, your answer should distinguish between the cases with and without randomized allocation of housing.*

Problem 12

Explain what is the moral hazard problem in an (general) insurance market and why in the presence of moral hazard it is never optimal for an insurance company to offer full insurance at actuarially fair prices for anyone. Does the moral hazard problem exist in the case of social (i.e. government-provided) insurance?

Problem 13

The unemployment insurance (UI) program in the U.S. is imperfectly experience rated for firms. Explain one potential rationale for why a government that funds its UI system through a payroll tax might not want to make the tax rate on firms perfectly experience rated. What is a potential moral hazard problem in terms of firm behavior when the UI program is only partially experience rated?

Problem 14

Bernheim, Skinner, & Weinberg (2001) found that individuals' food expenditures drop sharply and significantly shortly after retirement. Their Figure 4 (below) illustrates this expenditure pattern. Does their finding suggest that individuals are not adequately saving for retirement? Why, or why not? Cite empirical evidence to support your explanation.

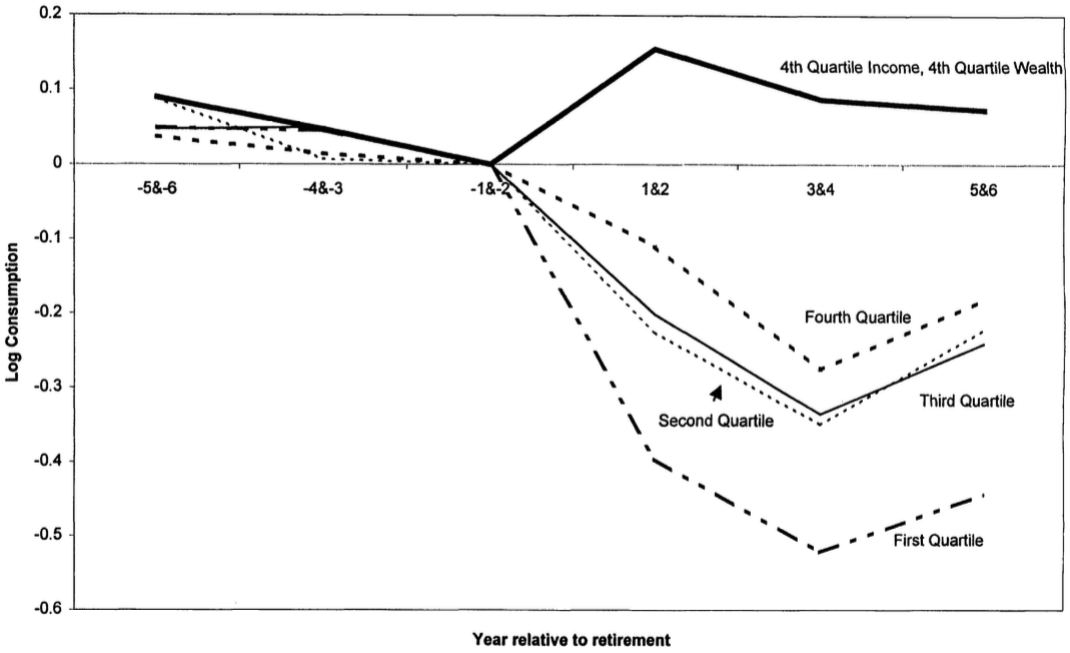


FIGURE 4. CHANGE IN CONSUMPTION AT RETIREMENT, BY WEALTH QUARTILE

Problem 15

Medicare moved from retrospective physician reimbursements (fee-for-service payments) to prospective reimbursements (partial capitation) in 1983. Why did some policymakers argue in favor of this change to Medicare reimbursements on the grounds that fee-for-service schemes increase health care costs in the U.S.? As a counterpoint, can you think of a drawback to the switch from free-for-service to partial capitation?

Problem 16

Compare and contrast two ways we discussed in lecture to measure intergenerational mobility. What aspect of persistence in mobility across generations might not be captured by mobility measures that rely on measuring income or educational attainment alone?

Problem 17

Policymakers are working on tax reform legislation with a goal to reduce the level of inequality in after-tax income in the U.S. (e.g. as measured by the Gini coefficient). With this aim in mind, one senator argues that the new tax laws should focus on reducing the after-tax income of the top 1% in the after-tax income distribution. Given the evidence reviewed in lecture, why might such a broad focus on the top 1% be misguided? If the goal is to redistribute away from those at the very top of the income distribution, what source of income should the reform target?

Problem 18

Disability insurance (DI) in the U.S. provides benefits to individuals who have not earned any income in the past 5 months due to an infirmity. Imagine you are working as a data analyst for the government and are asked to estimate the effect of increasing the generosity of DI on the number of applications to the program. As a result of the policy change, the value of disability insurance increased for people with average past earnings below the U.S. median, and did not change for those above the median. The table below gives the data on the number of applications from applicants above and below the median level of earnings separately for "moderate" and "severe" levels of disability.

	Below median		Above median	
	Moderate	Severe	Moderate	Severe
Pre-reform	600	600	160	100
Post-reform	780	840	200	140

(i) Find the difference-in-differences (DD) estimates of the effect of an increase in disability insurance generosity on the number of applications from people with moderate and severe levels of disability.

(ii) Your colleague suggests that the DD estimates should be based on percentage differences rather than the differences in levels you computed in part (i). Redo the calculations in percentages.

(iii) How would you determine which of the two approaches in parts (i) and (ii) is preferred?

Problem 19

Consider Figure 3 from the Card, Dobkin, & Maestas (2008) paper we discussed in the lecture on health insurance. The authors use this figure to argue that access to Medicare increases utilization of health care services.

(i) Briefly explain the authors' research design. In particular, do the authors employ a difference-in-differences or a regression discontinuity strategy? How do you know?

(ii) What assumption(s) do the authors need to make about the characteristics and behavior of patients around age 65 in order for their research design to be valid?

(iii) Based on the relationship between the two variables pictured in this figure, what is one reason why the authors' assumption(s) you identified in part (ii) might not hold?

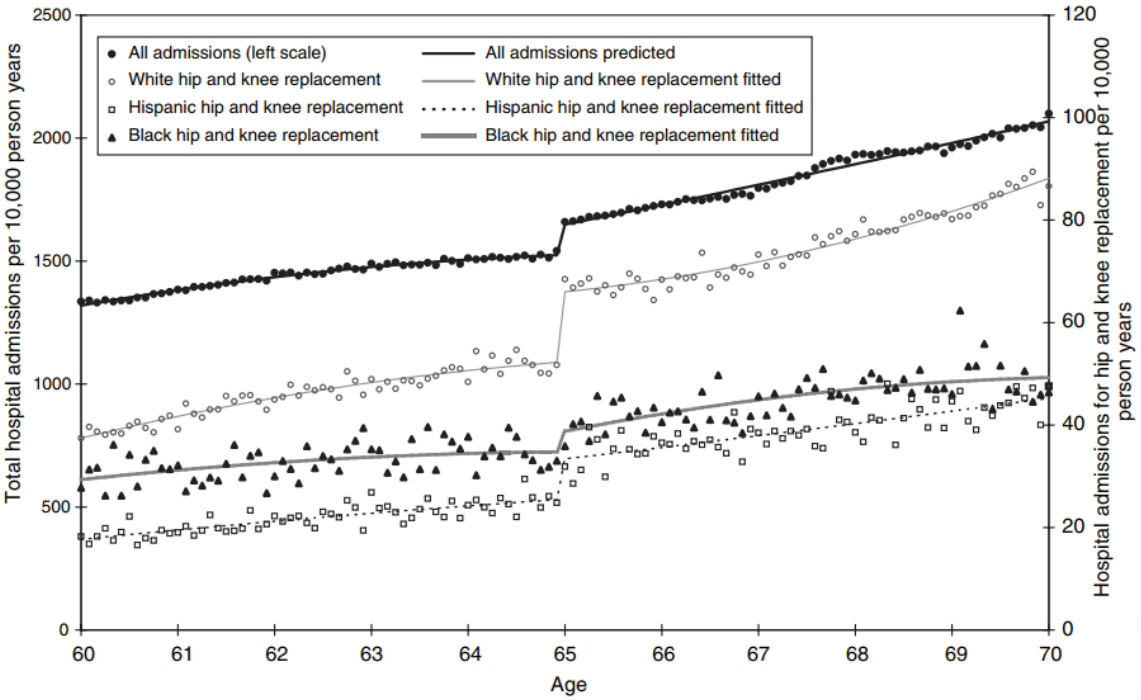
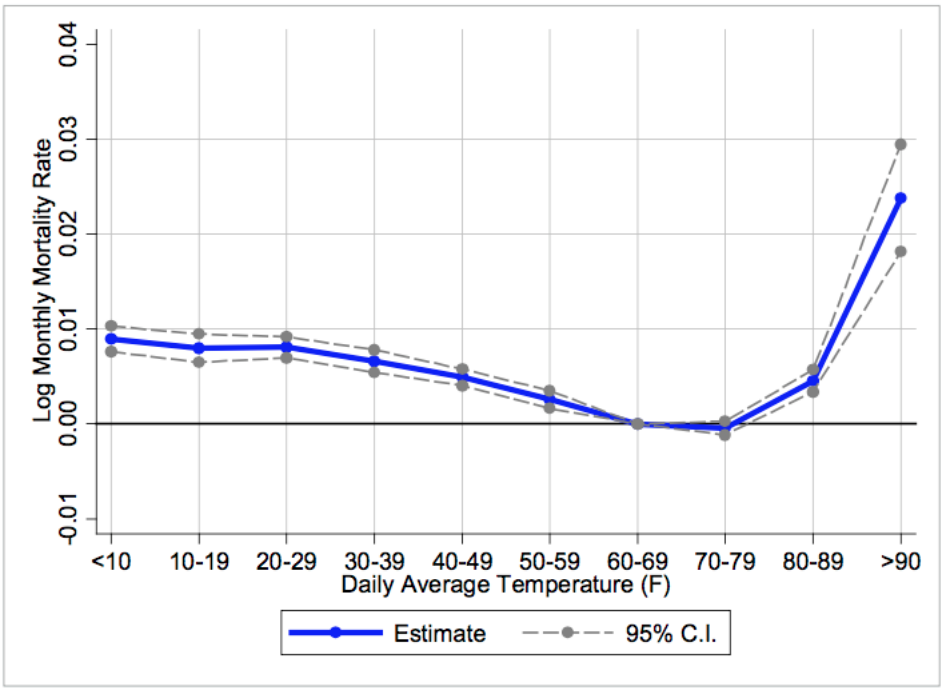


FIGURE 3. HOSPITAL ADMISSION RATES BY RACE/ETHNICITY

Problem 20

The two figures below were used in lecture to illustrate one difficulty when trying to quantify the marginal damage from an externality (or the marginal benefits from addressing it). Explain what this difficulty is and how the two figures illustrate it.

(c) 1929-1959



(d) 1960-2004