MIT 14.41 – Problem Set 6

Due December 2, 2022
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QUESTION 1: Redistribution and moral hazard [40 points]

In this problem, we will consider multiple types of redistribution in a society in which there are three types of families:

- Families of type H can earn a market wage of \$45 per hour to support three people – a working parent, a stay-at-home parent, and a child. They have a family utility function $U_H = 3ln(C) + ln(L)$.
- Families of type P can earn a market wage of \$15 per hour to support three people – a working parent, a stay-at-home parent, and a child. They have a family utility function $U_P = 4ln(C) + ln(L)$.
- Families of type S can earn a market wage of \$15 per hour to support two people – a working parent and a child, but have to pay \$10 per hour for childcare when working. They have a family utility function $U_S = 4ln(C) + ln(L)$ (but note that unlike the other families who have $C = Y$, their $C = Y - 10H$ if Y is income).

where C is all non-childcare consumption of the family which has a unit price of \$1, L is units of leisure (time spent not working) of the worker, and H is hours the worker spends working. All working parents have a maximum of 2,000 hours per year of work/leisure, and there is no saving.

1. (6 points) Calculate the choice over consumption and leisure that each family will make. What is the per-person consumption in each family?

Suppose that a transfer program is introduced that provides any family a guaranteed benefit level (G) of \$12,000 with a benefit reduction rate (τ) of 0.5. Childcare spending is tax-deductible, and the benefit reduction rate is based on taxable income.

2. (6 points) Draw the budget constraints faced by each type under this new transfer program and the point at which they originally optimized their utility from the previous part. Label each point, and make sure to label any kinks in your budget constraint on both axes. (You probably want to put each type of family on a separate graph)
3. (6 points) What effect does this policy have on each family type's labor supply decision? (Hint: contrast their leisure/labor supply decisions with and without the transfer program)
4. In this part only, imagine that the benefit reduction rate was zero.
   (a) (2 points) What is the popular name for this type of redistribution policy?
   (b) (6 points) Draw another graph with each type's original budget constraint and their new budget constraint under this policy. Relative to their original labor supply decisions, what effect does this policy have on each type's labor supply decision? Add the families' new leisure-consumption choices to your graphs. (Again, you should put each family type on a different graph).

(c) (5 points) How does the effect of the policy on labor supply change when $\tau = 0$ compared to when $\tau > 0$, and why?

(d) (2 points) Why might the government prefer to have $\tau > 0$? Why might they prefer $\tau = 0$?

5. In this part only, suppose that the government instead provides a child tax credit of \$15 per hour worked that is restricted to single-parent families.

   (a) (3 points) Relative to their original labor supply decisions, what effect does this policy have on each family type's labor supply decision and consumption?

   (b) (4 points) Besides the effects on labor supply you found above, what are two other economic reasons the government might prefer this policy to their original transfer program?

QUESTION 2: Place-based redistribution policy [30 points]

The newly-elected governor of Massachusetts wants to reduce inequality in the state. To simplify the problem, assume that there are two cities in the state: City W is relatively wealthy, and City P is relatively poor. City W has residents who earn a higher average income, its workers are more productive due to substantial public and private investment, its schools are better-funded through local taxes, and its crime rates are lower.

1. (7 points) At first, Gov. Healey is considering two proposals to achieve her goal. One proposal involves making the tax rate more progressive: lowering the marginal tax rate for the first dollars of income, and raising the marginal tax rate for those at the top of the income distribution. The second proposal is place-based: it involves collecting a lump-sum tax from people living in City W and giving a cash grant to each person living in City P.

   In terms of efficiency and redistribution, discuss the pros and cons for each policy, making sure to describe what must be true for the income tax change to be a better policy choice than the place-based tax-and-grant system and vice versa.

2. (5 points) A group is lobbying against the cash grant policy, arguing that it is unfair. Give one argument that they could make, relating the properties of the policy to the equity concepts discussed in class.

3. (7 points) Another group is lobbying for a different policy: Instead of an unconditional cash grant, residents of city P would receive a moving subsidy if they decide to move to city W, again to be funded by a tax on existing residents of city W. Give one argument that they could make, explaining conditions under which the subsidy will have a positive effect on efficiency. What does the evidence discussed in class suggest about what the effects of this policy might be?

4. (5 points) Another group is lobbying against the moving subsidy on redistributive grounds, arguing that many people can be made worse-off by the policy. Give one argument that they could make, relating the properties of the policy to the equity concepts discussed in class, and discuss how this may go against Gov. Healey's original goal.

5. (6 points) A final group is arguing that the government should instead use the tax revenue from City W to provide a free job-training program for the residents of City P and to provide grants to the schools in City P, so that City P becomes more like City W in terms of investment and infrastructure. On theoretical grounds, why might this be less preferred than the policies discussed so far? What must be true in order for this policy to make those in City P better off? Empirically, what does the evidence suggest about the effects of job training and school spending?

QUESTION 3: Incidence of a Pigouvian tax [30 points]

Suppose that the total private marginal benefit to consumers from using Q gallons of gasoline is

$$PMB(Q) = Q^{-\frac{1}{\alpha}}$$

where $\alpha > 0$ is a constant. The marginal cost of supplying Q gallons of gas is

$$PMC(Q) = Q^{\frac{1}{\beta}}$$

where $\beta > 0$ is a constant. We assume that the market is competitive. This means that producers supply gas so that the price equals the private marginal cost, and consumers demand gas so that the price equals the private marginal benefit:

$$D(P) = P^{-\alpha}, S(P) = P^{\beta}$$

In equilibrium, $D(P) = S(P) = Q$.

However, consuming Q gallons of gas produces carbon emissions of E kg, which has negative externalities that producers and consumers of gas do not take into account. The EPA estimates that each gallon of gas consumed produces 8.887 kilograms of carbon emissions, $E = 8.887Q$, and that the social cost of these emissions is constant at 5.1 cents per kilogram.

1. (3 points) Calculate the optimal per-unit (per-gallon) Pigouvian tax on gasoline.
2. (4 points) Calculate the demand elasticity η_D and the supply elasticity η_S of gasoline.
3. (5 points) Suppose that consumers pay a tax of τ per unit of gas they buy, so producers receive P per gallon while consumers pay $P + \tau$. Calculate:
   (a) The change in the pre-tax price
   (b) The change in the price consumers have to pay for gas, including the tax
4. (3 points) Suppose that $\alpha = 0.1$, $\beta = 1$. What percentage of the burden of the tax is borne by consumers, and what percentage by producers?
5. (2 points) Suppose the equilibrium price of gas without a tax is \$3.50 per gallon. If the tax is set at the optimal level you calculated in part 1, and $\alpha = 0.1, \beta = 1$, calculate the new pre-tax and after-tax prices of gas (rounded to the nearest cent).
6. (4 points) A politician complains that consumers are bearing too much of the burden of gasoline taxes, and argues that instead producers should be made to pay a tax τ for each unit of gas that they sell, so that producers receive $P - \tau$ for every gallon of gas while consumers pay P. Show that this would have no impact on who bears the burden of the tax.
7. (4 points) Another politician, who has a hazy memory of taking a class in public finance when he was in college many years ago, argues that the tax should be abolished completely, because it is distorting the market for gasoline and causing a deadweight loss. Comment on this argument.
8. (5 points) The analysis above is in partial equilibrium, and considers the market for gasoline in isolation. If we did a complete general equilibrium analysis, suggest and explain one possible reason why part of the incidence of the tax might be borne by people who do not own a gas-powered vehicle and never buy gasoline (i.e. people who do not participate in the market we analysed above).

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