University of Toronto
Economics 336Y – Public Expenditures

Autumn midterm examination
1 November 2004

General Instructions: Write your name in block (capital) letters and your student number on all exam booklets you use. If you use additional booklets, place them inside the first one before handing them in. You may use pocket calculators (but you won't need to). You must not refer to books, computers, or any other aids. You have 110 minutes. Allocate your time appropriately, and be sure to attempt all parts of all the questions you choose.

This exam includes limited choice. Read the instructions to each section carefully before answering the questions.

Part A. Short answer questions: Answer SIX of the following questions. In all cases your answer should include definitions of the words in italics. ***Be very brief!*** *(60 points.)*

1. Explain how the *sum of individual willingnesses to pay* can be used as a welfare criterion to evaluate alternative social decisions. Why does this criterion make intuitive sense, and what problems can arise in its use?

If the sum of willingnesses to pay is positive, it is often held that the policy change improves welfare because , "winners could in principle compensate losers for the change and still be better off". The main problem with this criterion is distributional insensitivity: it assumes a "dollar is a dollar" for everybody. In contrast, most people believe the marginal utility of income is decreasing in income. A good answer might also refer to the "Boadway paradox" that the sum of willingnesses to pay for a move between two efficient allocations is always non-negative, which leads to logical contradictions.

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2. True or false: According to the *Pareto principle*, society should prefer any point on the *utility possibilities frontier* to any point inside the frontier. Define the terms in italics, and explain.

False: The Pareto principle states society should prefer any allocation that leads to higher utility for everyone. The utility possibilities frontier is the set of utility levels such that it is not possible to increase the utility of all citizens. So, the Pareto principle cannot rank a point A on the frontier versus a point B inside the frontier that gives higher utility to some consumer than at point A.

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3. Explain the *Condorcet paradox* or voting cycle. Give two examples of voter preferences over a set of alternatives, one in which a voting cycle occurs, and the other in which it does not. In your examples, does the ability to *control the agenda* of voting affect the final outcome? Explain your answer.

The paradox is that a majority voting equilibrium need not exist, as every proposal can be beaten by another proposal that attracts a majority of votes. The cycle occurs for preferences of 3 voters and 3 alternatives corresponding to that given in the lecture notes; any other preference profile does not have a cycle. Agenda control matters only for Condorcet preferences, for the intuitive reason.

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4. Define a *pure public good*. Assuming that government has access to lump-sum taxes and transfers among citizens, write down an equation defining levels of public goods provision that are Pareto efficient, and explain your answer with graphs or intuitive economic reasoning. Under what conditions is the efficient level of provision of the public good independent of society's preferences for redistribution from rich to poor? Explain.

A pure public good is non-rival: consumption by one citizen does not reduce the amount available for others. A pure public good is also non-excludable: it is not possible to exclude citizens from consuming the amount provided to all. The Samuelson condition is $\sum_i MRS_i = MRT$. The sum of marginal willingnesses to pay for additional units should equal the marginal cost. Efficient provision levels in general depend on redistributive choices, and there is no single efficient level of provision. But this is not the case if: (i) there are no income effects in the demand for the good; or (ii) all citizens have income elasticity of demand for the good equal to one.

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5. "Government spending on public goods must be financed with taxes that cause deadweight efficiency costs for the economy. Since the government's *marginal cost of funds* is greater than one, the efficient level of spending on the public good should be lower than Samuelson argued for." Do you agree with this argument? How should the Samuelson conditions be modified to take into account the deadweight costs of taxation?

The Samuelson condition $\sum MRS_1 = MRT$ with distortionary taxation becomes $\sum MRS_i = MCF(MRT - MR)$ where MCF is the marginal cost of funds to government, including deadweight costs, and MR is marginal government revenue generated by public spending. For example, governmentr spending on education might increase future labour incomes, which would increase tax revenue. Therefore, the efficient level with distortionary taxation is *not* generally lower than the efficient level with lump-sum taxation.

Exam continues overleaf. . . .

6. Sally is "selfish" and derives utility only from her own consumption of private goods:

$$U_s = x_s$$

Alice is "altuistic" and derives utility from her consumption of private goods and from Sally's utility:

$$U_a = x_a + \sqrt{U_s}$$

Total resources available for consumption are $x_a + x_s = Y$. Calculate an equation for the *utility possibilities frontier* and sketch its graph. (*Hint:* What is the slope of the UPF when U_s is small? large?)

$U_a^*(u_s) = Y - u_s + \sqrt{u_s}$: the UPF is initially increasing in u_s, then decreasing.

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7. Critics sometimes argue that government provision of public goods merely leads to dollar-for-dollar "crowding out" of *voluntary private provision.* Do you agree? Give one reason why and why not.

Government provision leads to crowding out when individuals regard government spending as a perfect substitute for their own contributions. This may not be the case if: (i) some individuals are contributing zero (and so cannot contribute less); or (ii) contributors derive private gain from the act of contributing.

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8. Define the Rawlsian *social welfare function* and discuss the ethical principles it embodies. If government maximizes a Rawlsian welfare function, would it necessarily choose to equalize the after-tax income of all citizens? Explain why or why not.

The Rawlsian SWF is (for a 2-consumer society) $W(u_A, U_B) = \min\{u_A.u_B\}$; the welfare of society is equal to the welfare of its worst-off citizen. Nevertheless, a Rawlsian government would not necessarily equalize incomes completely, if income taxation has disincentive effects that reduce the total amount of income aailable to be redistributed.

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*Part B. Problem-solving question: You **MUST** answer the following question. (40 points.)*

9. Ahmed and Bob are the only two residents on a street in a new subdivision, who must decide how much to spend on street lighting, a pure public good. Suppose that they have

identical preferences for wattage of street lighting G and composite private consumption x_i given by the utility function

$$u_i(G, x_i) = 50 \log G + x_i \qquad (i = A, B)$$

Street lighting costs 1 unit of private consumption per Watt, and each has the same total income, equal to Y.

(a) Calculate the efficient level of spending of street lighting. Is this level unique, or does it depend on the distribution of utility between Ahmed and Bob? Explain why or why not.

(b) Now suppose that Ahmed and Bob independently decide how much to spend on street lighting, taking the amount supplied by the neighbour as given. Calculate the total amount of lighting that is supplied in equilibrium, and contrast it with your answer to part (a).

(c) Now suppose Bob is richer than Ahmed: $Y_B > Y_A$. How would total spending on street lighting from part (b) change? Would Ahmed contribute a positive amount or not?

(d) Now suppose that there were ten residents of the street, rather than just two. How would the efficient and equilibrium levels of wattage from parts (a) and (b) change? Comment on the difference: do you think the equilibrium prediction of this theory is realistic, and what extensions to the model would change this result?

(a) $\sum MRS_i = 2 \times (50/G^{eff}) = 1$ implies $G^{eff} = 100$.

(b) $MRS_i = 50/G^{eq} = 1$ implies $G^{eq} = 50$.

(c) The previous answer shows G^{eq} is independent of private incomes. In both cases, however, individual contributions are not uniquely determined: Ahmed might contribute or not.

(d) We now have $G^{eff} = 1000$ and $G^{eq} = 50$. The efficient provision level is proportional to number of citizens, while the equilibrium level is independent of the number of citizens. This is a rather extreme version of the free-rider problem. The model would change if: (i) there were a "warm glow effect" of private contributions; and (ii) if we considered different preferences that caused some (e.g. low-income) consumers to reduce their contributions to zero as the number of contributors became large.
