

1) Here we consider the supply of a public good  $G$ , which is a good that is non-rivalrous and non-excludable.<sup>1</sup> Preferences are  $u(c, G)$ , where  $c$  is a private good, which is both rivalrous and excludable. The economy has an endowment of  $N$ , which can be allocated between the private and public good, where  $N > 1$  also denotes the population size (i.e., the average endowment is one).

- a. Describe the efficient allocation of the economy's resources between private and public goods.
- b. Suppose that individuals each have a part of the aggregate endowment, which they can unilaterally allocate between private and public good. Assume for the moment that individuals do not cooperate in any way. Would any of the public good be supplied? Would each individual make the same contribution?
- c. Now suppose that, with individuals still acting unilaterally, they pay an excise tax on private consumption and receive a subsidy for public consumption. Specifically, the tax comes out of their endowment in an amount that is a proportion  $t$  of the amount of their private consumption. They receive extra endowment in an amount that is a proportion  $s$  of what they allocate toward the public good. Are there tax and subsidy rates that achieve the efficient allocation from (a) and balance the aggregate tax+subsidy budget?
- d. Real-world governments have the legal authority to levy excise taxes. Does that result in an efficient allocation of resources between public and private goods?

Now let  $M < N$  of the individuals act cooperatively, with the remaining  $N - M$  acting unilaterally. Specifically, each member of the group makes the same contribution to the public good, with the group deciding together as to the amount of the contribution.

- e. Without taxes or subsidies, will the allocation be efficient? Will any of the unilateral actors allocate any of her endowment toward the public good?
- f. Suppose that every individual were subject to the budget-balancing excise tax and subsidy rates that achieve the same after-tax relative price you calculated in (c). What can you say about the efficiency of the allocation? Does the excise policy encourage group members to allocate more toward the public good? The unilateral actors?
- g. Are unilateral actors worse off than the  $M$  cooperators in (e)? in (f)?

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<sup>1</sup> A non-rivalrous consumption good is one in "which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good..." An excludable good is one for which it is possible for a person or persons to consume without creating any opportunity for others to consume it.

2) *True, False, or Uncertain*: Because worker productivity declines as workers enter old age, a law that mandates retirement can enhance efficiency. [your grade is based on how well you justify your answer]