LECTURE 14

PUBLIC GOODS: VOLUNTARY PROVISION

Aim of Lecture 14:

- Solve for equilibrium under private provision
- Gain understanding of the role of income distribution on equilibrium public-goods provision
- Understand the consequences of government intervention

14.1 *Voluntary Provision*

14.1.1 *Introduction*

In a pure public good economy, we typically need government intervention/provision to attain the first best. However, even if there is no government, it does not automatically apply that there will be no public goods. Individuals may choose to provide the public good themselves, but its level will be lower than the efficient one.

14.2 *The Public Good Game*

14.2.1 *The Basic Model*

To set the basic model as simple as possible, we will concentrate on a two-person economy, one private good, x, and one public good, G.

Utilities

$$U^h = U^h(x^h,G)$$

for h=1,2.

Budget constraints

$$x^h+g^h=\omega^h$$

for h=1,2.

Each individual h is making a (non-negative) contribution, $g^h \geq 0$, toward the public good, so the aggregate public good is

$$G=g^1+g^2$$

14.2.2 *Nash Equilibrium*

It is assumed that individuals make their contributions simultaneously, and each individual's choice must be optimal, given the choices of all other individuals (i.e. Nash).

Household 1 solves

$$\max_{g^1} \; U^1\left(\omega^1 - g^1, g^1 + g^2\right)$$

and household 2 solves

$$\max_{g^2} \; U^2\left(\omega^2 - g^2, g^1 + g^2\right)$$

Suppose household 1 is wealthier than household 2, $\omega^1 > \omega^2$, then the first-order condition will hold for at least household 1:

$$-U_x^1\left(\omega^1 - g^1, g^1 + g^2\right) \; + \; U_G^1\left(\omega^1 - g^1, g^1 + g^2\right) \; = \; 0$$

or equivalently

$$\frac{U_G^1\left(\omega^1 - g^1, g^1 + g^2\right)}{U_x^1\left(\omega^1 - g^1, g^1 + g^2\right)} \; = \; 1$$

14.2.3 *Case I: Both contribute*

If household two is wealthy enough (i.e. ω^2 is large enough), then household 2 also contributes and

$$\frac{U_G^2\left(\omega^2 - g^2, g^1 + g^2\right)}{U_x^2\left(\omega^2 - g^2, g^1 + g^2\right)} \; = \; 1$$

Then the sum of the marginal rates of substitution is 2, while the Samuelson Rule states it should equal the marginal rate of transformation, which is unity in our model. Thus the public good is under-provided relative to the first best.

Since public good consumption is same for both individuals and their marginal rates of substitution is also the same (unity) then their private goods consumption must also be the same, i.e.

$$\frac{U_G^1\left(x^1, G\right)}{U_x^1\left(x^1, G\right)} \; = \; \frac{U_G^2\left(x^2, G\right)}{U_x^2\left(x^2, G\right)} \; = \; 1$$

implies $x^1 = x^2$. This means that the richer individual provides more than the poorer one.

Furthermore, since private consumption is equalised, the distribution of endowments does not matter for the total level of contribution. The reason is that anybody's contribution is a perfect substitute for everybody else's. This implies that the government cannot affect the total amount of the public good through redistribution among the contributors, Warr (1983). This kind of equilibrium is more likely when individual endowments are close, i.e. in communities are more homogenous. Otherwise, for larger dispersion in endowments, a situation where not all individuals contribute is more likely.

14.2.4 *Case II: One contributes*

If the endowment of the poorer individual is "small" we may have the situation where only the richer person contributes, and the poorer is in a corner solution:

$$-U_x^1(\omega^1-g^1,g^1) + U_G^1(\omega^1-g^1,g^1) = 0$$

$$-U_x^2(\omega^2,g^1) + U_G^2(\omega^2,g^1) \leq 0$$

14.3 *Government Intervention*

In the Nash equilibrium, government provision of the public good crowds out of private provision, one to one, Warr (1982). If the government taxes individual incomes (lump sum) and subsidises individuals' contributions and uses the tax proceeds to contribute to the public good, then the aggregate level of the public good is invariant with respect to the tax and subsidy rates. This can be shown as follows. Let the subsidy rate (on private provision) be s, and the income/endowment tax rate be τ. An individuals budget constraint is then

$$x^h+g^h=(1-\tau)\omega^h + sg^h$$

for h=1,2.

The government's provision is then

$$g^g = \tau(\omega^1+\omega^2) - s(g^1+g^2)$$

So the problem for household 1 is to

$$\max_{g^1} \; U^1\big((1-\tau)\omega^1-(1-s)g^1,\, g^1+g^2+\tau(\omega^1+\omega^2)-s(g^1+g^2)\big)$$

Giving the first-order condition

$$-U_x^1(x^1,G)(1-s) + U_G^1(x^1,G)(1-s) = 0$$

Since the subsidy rate drops out, the same first-order condition as before is obtained, and G is the same as before.

This suggests that if private and government provision co-exist, the government provision has no effect. Only if the government completely crows out private provision, government intervention has an effect (i.e. driving g^1=g^2=0).

This government neutrality result falls if the basic model is modified. We'll briefly sketch two cases: (I) Warm Glow: Individuals get utility from contributing by itself ("warm glow"), so utility is $U^h = U^h(x^h, G, g^h)$. (II) Impure Public Goods, for example individual 1 is closer to his own contribution than those of others, and therefore gets higher utility of his own provision than from others.