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Public goods provision, redistributive taxation, and wealth accumulation ☆

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ABSTRACT

This paper presents an extension of a static model of public goods provision with redistributional taxation, as described by Uler [*Journal of Public Economics* 93 (3–4), pp. 440–453], as a dynamic model of wealth accumulation. Intertemporal consumption and saving behavior strongly affect the relation between redistributive taxation and charitable contribution. Indeed, the analyses presented herein reveal that more patience (i.e. higher saving) engenders a lower redistributional tax rate. However, the optimal redistributive tax rate is not zero because redistributive taxation improves the efficiency of providing public goods that are not improved by balanced growth. This paper fills the gap separating static analysis and dynamic analysis, and generalizes the results presented by static analysis.

1. Introduction

The provision of public goods and redistribution of income have long been studied by numerous public economists. One interesting result is transfer neutrality, as initially implied by Shibata (1971) and later formulated by Warr (1982, 1983). The transfer neutrality theorem states that an income transfer policy does not affect the allocation of goods under voluntary provision of public goods. This surprising result stimulated many subsequent studies (e.g., Bergstrom et al., 1986; Andreoni, 1989, 1990; Boadway et al., 1989; Buchholz and Konrad, 1995; and Ihori, 1996).[1] Especially, Bergstrom et al. (1986) generalized the transfer neutrality theorem. Thereafter the emphasis of analysis has notably centered upon the condition that the neutrality of income transfer does not hold.[2]

As presented recently, Uler (2009) examines the relation between public goods provision and redistribution of income by the introduction of redistributional taxation into the model described by Bergstrom et al. (1986).[3] She not only generalizes the results of previous studies (e.g., Warr, 1982, 1983; Bergstrom et al., 1986); she shows that the supply of public goods increases with the tax rate. This result is interesting to public economists because the privatization of (some types of) public goods provision might thereby be achieved simply through tax reform.

However, we cannot overlook the negative effect of taxes on welfare, especially through a negative impact on saving. Indeed, the literature related to endogenous growth shows that tax policy negatively affects growth and welfare and that the difference in tax rates engenders a difference in the rate of wealth accumulation (King and Rebelo, 1990; Rebelo, 1991). It is important for knowledge related to public economics because the negative impact on income growth also influences the future prices of private and public goods.

The analysis developed in this paper provides a means for us to fill the gap separating static analysis and dynamic analysis, and provides a novel view of public goods provision. Concretely, this paper presents an investigation of the interaction between public goods provision, redistributional taxation, in addition to wealth accumulation in an intertemporal model of saving. As described in this paper, we will explore the relation between public goods provision and a redistributive

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[1] In related literature, numerous studies have examined the relation between public goods provision and the number of members (e.g., Pecorino, 1999; Kawachi and Ogawa, 2006). Pecorino (1999) and Kawachi and Ogawa (2006) investigate public goods provision under a repeated game.

[2] Andreoni (1989, 1990) examines the transfer neutrality in the model of public goods provision with impure altruism. He shows that transfer neutrality is broken under impure altruism. Boadway et al. (1989), Buchholz and Konrad (1995), and Ihori (1996) investigate the transfer neutrality in the model with different costs of providing public goods. Boadway et al. (1989) show that the neutrality theorem holds, although Buchholz and Konrad (1995) and Ihori (1996) show that the neutrality theorem does not hold.

[3] The recent literature related to public goods provision has developed rapidly through studies of incentive mechanism design. Uler (2009) and this paper shares many similarities with reports of the literature (e.g., Falkinger, 1996; Falkinger et al., 2000).

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tax more fully, particularly considering the impact of such a tax on future prices of goods.

The most interesting implication of our analysis is that the balanced growth of wealth cannot reduce the income inequality existing between contributors and non-contributors. This finding implies that the problem of free riders will be not settled by wealth accumulation under balanced growth. It also implies that a means to settle the problem of free riders is the only wealth redistribution policy.

In our analysis, an increase in the redistributional tax reduces income inequality and temporarily increases the supply of public goods. However, a redistributional tax also has a negative effect on the rate of wealth accumulation, which is the growth rate of future income. The effect of redistribution on inequality is weakened by the effect of redistribution on wealth accumulation. Consequently, in our study, there exists the positive optimal tax rate, although the standard literature on macroeconomics holds that the capital income tax should not be taxed. Furthermore, these results are consistent with previous studies. We show that a positive correlation exists between an optimal tax and impatience. If the degree of impatience is sufficiently large, then our model converges to previous studies such as those of Bergstrom et al. (1986) and Uler (2009). Our model provides a natural extension of the static model and generalizes its result.

The remainder of this paper is organized as follows. Section 2 presents a full description of our model. We assume that the agent is infinitely lived (later); our model has an agent with perfect intergenerational altruism. Section 3 characterizes the decentralized equilibrium. The tax incidence affects future prices of goods and the time preference rate serves as a mediator between Uler's analysis and ours. Finally, Section 4 presents conclusions of this paper.

2. The model

Consider an economy with private goods, public goods, and n individuals. Public goods are provided through charitable giving, so that the level of public good provision is equal to total giving: $G=\sum_{j=1}^{n} g_j$ where g_i signifies the ith individual's contribution.

The ith individual's income is $y_i = Ak_i$ $(A>0)$: the income y_i depends linearly on each individual's wealth k_i.[4] Government taxes on income net of contributions and the collected tax revenue are distributed equally among individuals. Therefore, the budget constraint of the ith individual is

$$\dot{k}_i = (1-\tau)(y_i-g_i)-c_i + \frac{\tau}{n}\cdot\sum_{j=1}^{n}(y_j-g_j), \tag{1}$$

where $\dot{k}_i$ is the increment of wealth, c_i stands for the ith individual's consumption, τ is the tax rate, and $\tau\cdot\sum_{j=1}^{n}(y_j-g_j)/n$ denotes the income transfer.[5]

Lifetime utility is an improper integration of instantaneous utility. Presuming that the instantaneous utility function is defined over the consumption of private goods and public goods and that it takes a logarithmic form, then the lifetime utility function is

$$U_i = \int_0^{\infty}[\alpha\ln c_i + (1-\alpha)\ln G]\exp(-\rho t)dt, \tag{2}$$

where ρ stands for the subjective discount rate.

Each individual maximizes lifetime utility (2) subject to Eq. (1) and $g_i \geq 0$ for a given $k_i(0)$. The optimality conditions lead to

$$\left(\frac{1-\alpha}{\alpha}\right)\left(\frac{c_i}{G}\right)\leq\left[1-\left(\frac{n-1}{n}\right)\tau\right], \tag{3}$$

$$\frac{\dot{c}_i}{c_i} = \left[1-\left(\frac{n-1}{n}\right)\tau\right]A-\rho\equiv\gamma, \tag{4}$$

where $\gamma\geq 0$ is assumed.[6] Furthermore, the growth rate of private consumption is characterized as $\partial\gamma/\partial\tau = -(n-1)A/n<0$. Eq. (3) becomes an equality if $g_i>0$. On the other hand, Eq. (3) is a strict inequality if $g_i=0$. Eq. (4) shows that the private consumption grows at a constant rate γ; $c_i(t)=c_i(0)\exp(\gamma t)$.

Summing up Eq. (1) from 1 to n, we obtain

$$\dot{K} = AK-G-C = Y-G-C, \tag{5}$$

where $K\equiv\sum_{i=1}^{n}k_i$, $Y\equiv\sum_{i=1}^{n}y_i$, and $C\equiv\sum_{i=1}^{n}c_i$. Eq. (5) denotes the resource constraint of this economy.

3. Consequences in a decentralized equilibrium

In this section, we investigate the equilibrium properties of the decentralized economy. First, we consider the case in which everyone contributes to public goods provision. The economy is always in an equilibrium in which all endogenous variables grow at the same rate γ.[7] Therefore, we have $c_i = C/n$, $c_i(t)=C(0)\exp(\gamma t)/n$, and $G(t)=G(0)\exp(\gamma t)$, where

$$C(0) = \frac{[n-(n-1)\tau](A-\gamma)\alpha}{1+(n-1)(1-\tau)\alpha}K(0) \text{ and } G(0) = \frac{(A-\gamma)(1-\alpha)}{1+(n-1)(1-\tau)\alpha}K(0). \tag{6}$$

Using the equations presented above and Eq. (2), we can calculate the ith individual's welfare as shown below.

$$W_i = [\gamma/\rho + \ln(A-\gamma) + \alpha\ln\{n-(n-1)\tau\} - \ln\{1+(n-1)(1-\tau)\alpha\} - \alpha\ln n + \alpha\ln\alpha + (1-\alpha)\ln(1-\alpha) + \ln K(0)]/\rho \tag{7}$$

Outcomes of our analysis are summarized as the following proposition.

Proposition 1. *Presuming that each individual is a contributor in the equilibrium, then the following are true. (a) The current level of public goods provision is positively affected by a rise in taxation, but the future supply of public goods will be negatively affected by it. (b) There exists an optimal degree of redistribution* $0<\tau^*<1$. *(c) The optimal tax rate is increasing in the subjective discount rate, and decreasing in productivity. (d) Both total contributions and welfare are unaffected by the distribution of initial (pre-tax) wealth.*

Outcomes *(a)–(d)* are explained as follows. *(a)*: At time t, the level of public goods provision is given as $G(t)=G(0)\exp(\gamma t)$. The logarithmic derivation of $G(t)$ yields

$$\frac{1}{G(t)}\frac{\partial G(t)}{\partial\tau} = \underbrace{\left(t-\frac{1}{A-\gamma}\right)\cdot\frac{\partial\gamma}{\partial\tau}}_{\ominus} + \underbrace{\frac{(n-1)\alpha}{1+(n-1)(1-\tau)\alpha}}_{\oplus}.$$

The second term of the equation presented above represents the effect of redistributional taxation. This effect is fundamentally equivalent to that of Uler (2009). Specifically addressing the relative prices of private and public goods, an increase in the tax rate

[4] We assume that the wealth is not depreciated.

[5] This taxation implies perfect deduction of charitable giving from income taxes. See Uler (2009) for details of this taxation.

[6] These conditions are derived in Appendix A.

[7] See the Appendix A for proof of this property. Furthermore, derivations of Eqs. (6) and (7) are explained in the Appendix A.