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Preferences, social capital, and compulsory volunteering

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HIGHLIGHTS

- An OLG model is developed to study the effect of a "compulsory volunteer" policy.
- Volunteer work and social capital are used to produce a public good in the model.
- The policy decreases volunteers' future volunteering if the public good is inelastic.
- It increases the future volunteering if the public good is normal and elastic enough.

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ABSTRACT

An OLG model is developed to study a "compulsory volunteer" policy mandating the young to volunteer. While the policy likely increases the social capital level, its long-run effect on the old depends crucially on the elasticity of a public good.

1. Introduction

Volunteer behavior is interesting to both researchers and policymakers as one of the major channels of voluntary public good provision and as a potential way to create social capital. As per Putnam (1993, 1995), social capital is the combination of networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit. Recently, there have been proposals e.g. by US President Obama (2008) and then UK Prime Minister Gordon Brown (2009) that students be mandated to provide a certain number of "volunteer" hours, either as a requirement for graduation or to qualify for financial support.

Empirical evidence provides mixed results on the post-school effect of such "compulsory volunteering" school policies. While the majority of studies, e.g. Metz and Youniss (2005), Henderson et al. (2007), find evidence that such policies have positive effects on the *attitude* toward volunteering, Stukas et al. (1999) find the opposite effect on *intentions* regarding future volunteering by a set of students who would have been unlikely to volunteer without the compulsory policy. Marks and Jones (2004) and Yang (2012) find evidence of such policies reducing *actual* post-school volunteering.

This study attempts to provide a theoretical framework to examine effects of such a policy on long-run individual volunteering. If volunteering were modeled as a private good, the result would hinge on the intertemporal substitutability or complementarity of volunteering in the school and post-school periods. However proponents of such a policy would regard it as essential that the goods produced by volunteering are public goods and that volunteering builds social capital. Hence the overlapping generations model we employ has these features. For clarity, the model has no intertemporal substitution in the utility function, which is defined as a function of private and public good consumption each period. Social capital serves as a multiplier in the public good production function and exists either at the individual level, e.g. skills, knowledge, or nonprofit entrepreneurial ability (Bilodeau and Slivinski, 1996) or at the community level, e.g. social norms and charitable institutes. Unlike traditional forms of capital, it is not depleted by use, but rather by non-use. Hence we assume that social capital depreciates and is renewed as a byproduct of total volunteer hours in each period.

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The model shows that an increase in the number of compulsory volunteer hours for the young cohort increases their total volunteer hours, the social capital level, and hence public good provision. However, as the policy makes volunteer hours more productive, it also intensifies the free rider problem. The model shows that the overall effect on volunteering after the compulsory period depends crucially upon a public good demand elasticity.

2. The model

Each individual lives for two periods, i.e. the young and old periods (subscript $t = 1, 2$), so that there are two generations in each period (subscript $\tau > 0$). There are n individuals in each generation. Utility is determined by the consumptions of a private good, c, and a public good, P, in the two periods. Utility is also assumed separable both between the private good and the public good and across periods so that the life time utility of individual i is given by:

$$U_i = [u(c_{i1}) + \alpha_i g(P_1)] + \beta[u(c_{i2}) + \alpha_i g(P_2)] \tag{1}$$

where a greater α_i $(0 < \alpha_i < 1)$ indicates a greater preference for the public good. Each individual has one unit of time endowment per period, which can be divided between paid work and volunteer work.[1] Because there is no saving in the model, all income from the paid work is used to purchase the private good. The budget constraints for an individual are:

$$v_{it} + x_{it} = 1 \quad \forall t = 1, 2$$
$$c_{it} = w_t * x_{it} \quad \forall t = 1, 2$$

where v_{it} is volunteer time, x_{it} is time on the paid work, and w_t is the wage rate. Individuals volunteer to produce the public good, which is determined by the total volunteer time contributions by all individuals, V_τ, and the social capital level, S_τ.

$$P_\tau = S_\tau * f\left(\sum_i v_{i\tau}\right) = S_\tau * f(V_\tau).$$

Social capital is a function of total volunteer contributions and depreciates at a constant rate, δ:

$$S_{\tau+1} = (1-\delta) * S_\tau + h(V_\tau), \quad (0 < \delta < 1).$$

Finally, the compulsory volunteer policy is introduced in the young period as setting:

$$v_{i1} \geq \underline{v}$$

where $\underline{v}$ is the minimum compulsory volunteer time and is equal initially to zero if no policy has yet been introduced. We also assume diminishing marginal utility, i.e. $u_c > 0$, $u_{cc} < 0$, and $g' > 0$, $g'' < 0$, and diminishing marginal returns, i.e. $f' > 0, f'' < 0$ and $h' > 0, h'' < 0$.

Each individual chooses her volunteer time in both periods taking others' volunteer hours as given. Taking derivatives with respect to v_{i1} and v_{i2}, we have the first order conditions defining the optimal volunteer time for individual i:

$$u_{ci1} w_1 = \alpha_i (g_1' S_1 f_1' + \beta g_2' f_2 h_1') \tag{2}$$

$$u_{ci2} w_2 = \alpha_i g_2' S_2 f_2'. \tag{3}$$

The LHS of both equations are the marginal cost of an hour of volunteer work, which is the wage rate multiplied by the marginal utility of the private good. The RHS gives the marginal benefit. For both the young and the old periods this includes the marginal utility of the public good produced by the additional volunteer hour. In the young period Eq. (2), there is a second term because an additional volunteer hour when young increases social capital and hence public good production in the second period. The second term is the discounted marginal utility of this additional public good.

Since individuals are distinct only in their preference for public goods, those with stronger preferences for public goods would volunteer more hours. The monotonic relationship between the optimal volunteer hours v_{it}^* and α_i implies that there exist threshold values α_1^*, α_2^* such that $v_{i1}^* = \underline{v}, v_{i2}^* = 0$. In the two periods a generation lives, the total volunteer time is $V_\tau = V_o + V_1$ in the first period and $V_\tau = V_y + V_2$ in the second, where V_o is contributed by those old in period one and V_y is contributed by those young in period two. In the steady state, $V_o = V_2$ and $V_y = V_1$. Individuals with $\alpha_i < \alpha_1^*$ volunteer $v_{i1} = \underline{v}$ and $v_{i2} = 0$ because of the compulsory volunteer policy and the nonnegative constraint. Those whose $\alpha_i > \alpha_t^*$ will volunteer v_{it}^*.[2] Therefore, assuming there are m_1 individuals who have $\alpha_i < \alpha_1^*$ in the each generation, the total volunteer hours in the steady state are:

$$V^* = V_1^* + V_2^* = \left(m_1 \underline{v} + \sum_{\alpha_i > \alpha_1^*} v_{i1}^*\right) + \sum_{\alpha_i > \alpha_2^*} v_{i2}^*. \tag{4}$$

The social capital is also stable in the steady state so that:

$$\delta S^* = h\left(V^*\right). \tag{5}$$

3. Comparative static analysis

Our goal is to determine the effects of an increase in mandated volunteer work in the young period on individuals' voluntary time contributions and total public good provision in the steady state. We first linearize Eqs. (2) and (3) for each individual and express the change in volunteer choices $(\mathrm{d}v_{i1}, \mathrm{d}v_{i2})$ as functions of the changes in social capital $(\mathrm{d}S_1, \mathrm{d}S_2)$, in total volunteer time $(\mathrm{d}V_1, \mathrm{d}V_2)$, and in the volunteer mandate $(\mathrm{d}\underline{v})$. Second, all these equations are aggregated using Eq. (4), and, combined with Eq. (5), used to solve $\mathrm{d}V_1$ and $\mathrm{d}V_2$ as functions of $\mathrm{d}\underline{v}$. Finally, substituting into the linearized equations in the first step, we end up with the two equations describing the change in voluntary time contributions in response to a compulsory volunteer policy for those true volunteers who have $\alpha_i > \alpha_t^*$ $\forall t = 1, 2$:

$$\mathrm{d}v_{i1} = \frac{\alpha_i \omega_{i1} \left[a + \frac{1}{\delta} b + \beta \left(e + b + \frac{1}{\delta}(1-\delta) k h'\right)\right] w_2^2}{\left(w_1^2 + B_1\right)\left(w_2^2 + B_2\right) - B_1 B_2} m_1 d\underline{v} \tag{6}$$

$$\mathrm{d}v_{i2} = \frac{\alpha_i \omega_{i2} \beta \left(a + \frac{1}{\delta} b\right) w_1^2}{\left(w_1^2 + B_1\right)\left(w_2^2 + B_2\right) - B_1 B_2} m_1 d\underline{v} \tag{7}$$

where $a_t = S_t^2 g_t'' f_t'^2 + S_t g_t' f_t''$ $\forall t = 1, 2$ ($a_1 = a_2 = a$ at the steady state), $e = g_2'' f_2^2 h_1'^2 + g_2' f_2 h_1''$, $b = S_2 g_2'' f_2' f_2 h_1' + g_2' f_2' h_1'$, $k = g_2'' f_2^2 h_1'$, $B_1 = -\sum_{\alpha_i > \alpha_1^*} \alpha_i \omega_{i1} [a + \frac{1}{\delta} b + \beta(e + b + \frac{1}{\delta}(1-\delta) k h')]$, $B_2 = -\sum_{\alpha_i > \alpha_2^*} \alpha_i \omega_{i2} [a + \frac{1}{\delta} b]$, and $\omega_{it} = |1/u_{ccit}|$ $\forall t = 1, 2$.[3] For simplicity, we assume that the policy does not change the number of (true) volunteers. Mathematically, when α_t^* changes to $\alpha_t^{*'}$ in response to a change in $\underline{v}$, we assume $\alpha_1 < \cdots < \alpha_{m_1} < \alpha_t^*, \alpha_t^{*'} < \alpha_{m_1+1} \cdots < \alpha_n$.[4]

[1] For simplicity, we do not model schooling itself, although we think of the young period as school and the old period as post-school. The key feature of the model is that volunteering has an opportunity cost.

[2] Since v_{i1}^* and v_{i2}^* are non-decreasing with α_i, an individual with $\alpha_i = \alpha_1^*$ chooses $v_{i1}^* = \underline{v}$ so that $\alpha_1^* = \frac{w_1 u_c(w_1(1-\underline{v}))}{S_1 g_1' f_1' + \beta g_2' f_2 h_1'}$ by Eq. (2). Similarly, $\alpha_2^* = \frac{w_2 u_c(w_2)}{S_2 g_2' f_2'}$ by Eq. (3).

[3] The full derivation is available upon request and posted on the author's web page.

[4] An alternative approach is to assume α_i is distributed continuously on the support between zero and one, which does not change the result.

At the steady state, there are the young and old generations in each period. The increase in compulsory volunteer hours would change the total volunteer hours of both generations.

$$\mathrm{d}V_1 = \frac{w_1^2(w_2^2+B_2)}{\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2} m_1 \mathrm{d}\underline{v} \tag{8}$$

$$\mathrm{d}V_2 = \frac{-w_1^2 B_2}{\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2} m_1 \mathrm{d}\underline{v} \tag{9}$$

$$\mathrm{d}V = \mathrm{d}V_1 + \mathrm{d}V_2 = \frac{w_1^2 w_2^2}{\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2} m_1 \mathrm{d}\underline{v}. \tag{10}$$

Eqs. (6) and (7) provides the effect of an increase in compulsory volunteer hours in the young period ($\mathrm{d}\underline{v}$) on the noncompulsory voluntary time contribution of individual i on the young and old periods ($\mathrm{d}v_{i1}, \mathrm{d}v_{i2}$). Eqs. (8)–(10) are the effects on total volunteer time ($\mathrm{d}V$), and on the volunteer time provided by the young generation ($\mathrm{d}V_1$) and the old generation ($\mathrm{d}V_2$). At the individual level, the policy forces less private good consumption in the young period, which will affect an individual's optimal choices in both periods. On the aggregate level, it affects public good provision and the social capital stock.

Proposition 1. *If* $\varepsilon \stackrel{\text{def}}{=} \left|\frac{\mathrm{d}P/P}{\mathrm{d}g'(P)/g'(P)}\right| < 1$, *then an increase in the number of compulsory volunteer hours required of the young generation will increase total volunteer time (V) and the volunteer time provided by the young generation (V_1), but decrease that by the old generation (V_2). It will also decrease the noncompulsory voluntary time contribution in both periods* ($\mathrm{d}v_{i1}, \mathrm{d}v_{i2}$).

Proof. $\varepsilon < 1 \Rightarrow \left|\frac{\mathrm{d}P_2/P_2}{\mathrm{d}g'(P_2)/g'(P_2)}\right| < 1 \Rightarrow \frac{-g_2'}{S_2 g_2'' f_2} < 1 \Rightarrow S_2 g_2'' f_2' f_2 h_1' + g_2' f_2' h_1' < 0 \Rightarrow b < 0$.
Since $a < 0, e < 0, b < 0 \Rightarrow B_1 > 0, B_2 > 0$, and $\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2 > 0$.
By Eqs. (6)–(10), $\Rightarrow \frac{\mathrm{d}v_{i1}}{\mathrm{d}\underline{v}} < 0$, $\frac{\mathrm{d}v_{i2}}{\mathrm{d}\underline{v}} < 0$, $\frac{\mathrm{d}V_1}{\mathrm{d}\underline{v}} > 0$, $\frac{\mathrm{d}V_2}{\mathrm{d}\underline{v}} < 0$, and $\frac{\mathrm{d}V}{\mathrm{d}\underline{v}} > 0$. $\square$

The numerator of ε is the percentage change in the amount of the public good, and the denominator is the percentage change in the marginal utility, or the shadow price, of the public good. Hence this could be considered as the price elasticity of the public good. Proposition 1 indicates that if the public good is price inelastic, the policy decreases the voluntary time contribution even though the total volunteer time and the social capital level are increased.

Proposition 2. *In the case*[5] *when* $\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2 > 0$, $\frac{\mathrm{d}V_2}{\mathrm{d}\underline{v}} > 0$ *and* $\frac{\mathrm{d}v_{i2}}{\mathrm{d}\underline{v}} > 0$ *if and only if* $\varepsilon > 1 + \frac{1}{\phi-1}$ *and* $\eta > \Delta$, *where* $\theta \stackrel{\text{def}}{=} \frac{\mathrm{d}f/f}{\mathrm{d}V/V} > 0, \eta \stackrel{\text{def}}{=} \frac{\mathrm{d}h/h}{\mathrm{d}V/V} > 0,\ \Delta \stackrel{\text{def}}{=} -\frac{\mathrm{d}f'/f'}{\mathrm{d}V/V} > 0, \phi \stackrel{\text{def}}{=} \frac{\theta+\eta}{\theta+\Delta} > 0$.

Proof. $\frac{\mathrm{d}V_2}{\mathrm{d}\underline{v}} > 0,\ \frac{\mathrm{d}v_{i2}}{\mathrm{d}\underline{v}} > 0 \stackrel{\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2>0}{\Longleftrightarrow} \left(a + \frac{1}{\delta} b\right) > 0$

$$\Leftrightarrow Sg'f'\left\{\left[\frac{f'}{f}\left(1+\frac{Sfg''}{g'}\right)+\frac{f''}{f'}-\frac{f'}{f}\right] + \left[\frac{h'}{h}\left(1+\frac{Sfg''}{g'}\right)\right]\right\} > 0$$

$$\stackrel{\varepsilon=-\frac{g'}{Sfg''}}{\Longleftrightarrow} \left(\frac{f'}{f}+\frac{h'}{h}\right)\left(1-\frac{1}{\varepsilon}\right)+\frac{f''}{f'}-\frac{f'}{f} > 0$$

$$\Leftrightarrow \frac{1}{\varepsilon} < \left(\frac{f''}{f'}+\frac{h'}{h}\right)\Big/\left(\frac{f'}{f}+\frac{h'}{h}\right)$$

$$\stackrel{\varepsilon>0}{\Longleftrightarrow} \begin{cases} \dfrac{h'}{h} > -\dfrac{f''}{f'} \\ \varepsilon > 1 + \dfrac{1}{\left(\frac{f'}{f}+\frac{h'}{h}\right)\Big/\left(\frac{f'}{f}-\frac{f''}{f'}\right)-1} \end{cases}$$

$$\Leftrightarrow \begin{cases} \eta > \Delta \\ \varepsilon > 1 + \dfrac{1}{\frac{\theta+\eta}{\theta+\Delta}-1}. \end{cases} \quad \square$$

Proposition 2 indicates that there are two conditions for the increase in compulsory volunteer hours for the young to have a positive effect on the amount of volunteering when old. First, as the total volunteer time increases by one percent, the percentage increase in social capital, η is larger than the percentage decrease in marginal product, Δ, so that the marginal product of a volunteer hour, i.e. hf', increases in the new steady state. Second, the price elasticity of the public good exceeds a threshold, $1 + \frac{1}{\phi-1}$. The threshold goes to infinity when η converges to Δ, and converges to one as η goes to infinity.

4. Welfare analysis based on a parametric case

We assume the utility function follows: $U_i = [i_c c_{i1}{}^{1-\frac{1}{\sigma}} + \alpha_i i_P P_1{}^{1-\frac{1}{\varepsilon}}] + \beta[i_c c_{i2}{}^{1-\frac{1}{\sigma}} + \alpha_i i_P P_2{}^{1-\frac{1}{\varepsilon}}]$ where σ is the own-price elasticity of private consumption good c, $i_c = 1$ if $\sigma > 1$ and $i_c = -1$ if $\sigma < 1$, ε is the own-price elasticity of public good P, $i_p = 1$ if $\varepsilon > 1$ and $i_p = -1$ if $\varepsilon < 1$, $f(V_\tau) = \rho V_\tau{}^{\theta}$, where $\rho > 0$ and $\theta > 0$, $h(V_\tau) = \gamma V_\tau{}^{\eta}$, where $\gamma > 0$ and $\eta > 0$, and α_i follows a continuous uniform distribution between $[0, 1], f(\alpha) = \begin{cases} 1\ \forall\ 0 \le \alpha \le 1 \\ 0 \text{ otherwise} \end{cases}$.

For the parametric model, the sufficient and necessary condition for an increase in compulsory volunteer hours to have a positive long-run effect is $\theta + \eta > 1$ and $\varepsilon > 1 + \frac{1}{\theta+\eta-1}$.[6] Recalling $P = Sf(V) = \frac{\gamma\rho}{\delta} V^{\theta+\eta}$, the first condition requires the public good production function demonstrate increasing return to scale in terms of the volunteer input. Considering production functions with multiple inputs, it implies that other factors have to simultaneously increase. The second condition states that, as the public good increases by one percent, the percentage decrease in its marginal utility has to be less than $\frac{\theta+\eta-1}{\theta+\eta}$.

The parametric model also highlights some welfare implications of a policy to increase compulsory volunteer hours. First, the policy decreases the utility of individuals with $\alpha_i < \acute{\alpha} = \frac{\theta+\beta\eta\gamma}{(1+\beta)(\eta+\theta)}(1+D_1+D_2)$, which is strictly positive given the normality assumption, i.e. $1+D_1+D_2 > 0$. This implies the policy cannot be a Pareto improvement since all individuals with $0 < \alpha_i < \acute{\alpha}$ are worse off. Second, when $\varepsilon < 1$, all (true) volunteers benefit not only from the increase in the public good but also from the decrease in their volunteer hours. Lastly, the impact on aggregate welfare is indeterminate.

5. Conclusion and discussion

The model suggests that, even though a policy that introduces or increases compulsory volunteer hours by the young can stimulate social capital accumulation and hence encourage subsequent

5 Eq. (10) shows that the sign of $\mathrm{d}V$ is determined by the denominator, $\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2$. For those who have $\alpha_i > \alpha_t^* \ \forall t = 1, 2$, an increase in $\underline{v}$ will increase virtual income, i.e. private income plus the resources donated by all other individuals. They would then consume more of the public good ($\frac{\mathrm{d}P}{\mathrm{d}\underline{v}} > 0$ and $\frac{\mathrm{d}V}{\mathrm{d}\underline{v}} > 0$) as long as it is a normal good. Therefore, a sufficient condition for $\left(w_1^2+B_1\right)\left(w_2^2+B_2\right)-B_1B_2 > 0$ is that the public good is a normal good.

6 The full derivation is available upon request and posted on the author's web page.

volunteering, it may not increase post-school volunteering unless a price elasticity of the public good has sufficient magnitude. Yang (2012) studies empirically a compulsory volunteer policy in Ontario, Canada and does not find any positive effect on post-school volunteer behavior.

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