# SOCIAL SENTIMENTS AND THEIR EFFECT ON COMMUNITIES

by

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**Abstract**

Several authors recognize that consumers have social sentiments and therefore derive utility from contributing resources to the provision of public goods. However, there is little discussion in the literature on how these sentiments develop. This paper models how social sentiments develop in communities and how they affect private provision. We propose that increases in the provision of public goods lead to increases in consumers' social sentiments. Given the assumptions of the model a community would converge to an equilibrium level of social sentiments with higher private provision that predicted by traditional theory. Although government provision partially crowds out private provision in the short-run it can increase, or crowds in, private provision in the long run by moving the community to a new equilibrium with higher social sentiments. When consumers have heterogeneous preferences, the government can increase private provision and move the community to an equilibrium with higher social sentiments by redistributing income between consumers.

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## 1. Introduction

The pure theory of public expenditure, first proposed by Samuelson (1954), suggests that private markets under-provide public goods. Andreoni (1988) shows that given the assumptions of the pure theory of public expenditure only the wealthiest consumers would contribute to the provision of public goods and that private provision will be driven to zero in a large economy. Warr (1982) and Roberts (1984) find that, as long as private provision is positive, each dollar that the government spends on the provision of public goods would reduce private provision by exactly a dollar. Warr (1983) also demonstrates that in Nash equilibrium private provision is independent of income distribution. Therefore, government policy cannot affect the total provision of public goods unless the government completely crowds out private provision.

Authors have challenged the pure theory of public expenditure on several grounds. US data collected on private contributions and summarized by Andreoni (1988) reveals that even members of the poorest quintile contribute to charities. Empirical studies by Abraham and Schmitz (1978, 1984) also show that crowding out is quite small. Additionally, Hochman and Rodgers (1973) find that, despite Warr's prediction, contributions to charities are highly dependent on income distribution.

Experiments on voluntary contributions mechanism provide additional evidence against the pure theory of public expenditure. Participants in these experiments typically contribute a significant amount of their resources to the group exchange even when theory predicts that they would contribute nothing (Marwell and Ames 1981; Schneider and Pommerhene 1981; Isaac, Walker and Thomas 1984; Isaac, McCue and Plott 1985; and others). Andreoni (1995) estimates that roughly half of the contributions to the group exchange in public goods experiments are made out of a desire to cooperate (the rest are made in error). In another experiment Andreoni (1993) finds that the imposition of a lump-sum tax that is used to finance investment in the group exchange hardly reduces participants' contributions.

There has been extensive discussion in the literature on why consumers contribute more than predicted by traditional theory and why government provision does not completely crowd out private provision. Andreoni (1989, 1990) asserts that consumers derive a feeling of warm-glow from contributing. Steinberg (1987) and Harbaugh (1998) argue that enjoyment from contributing results from secondary benefits that consumers receive from contributing such as prestige, status and awards of recognition. Becker (1974) claims that consumers contribute to gain social approval and avoid social sanctions.

There may be other reasons why consumers contribute more resources than predicted by traditional theory. Van Dijk and Van Winden (1997) theorize that consumers have social ties with other consumers in their community and they therefore weight the utility of other consumers. Rabin (1993), Van Dijk and Wilke (1994) and Fehr and Schmidt (1999) assert that consumers have an aversion to inequitable outcomes. Consequently, wealthier consumers may contribute resources to the provision of public goods in order to restore some degree of equality between themselves and poorer consumers.

Most of these explanations are founded on the idea that consumers have sentiments to cooperate with other consumers in their community, which we term social sentiments. A consumer's social sentiment can be thought of as an index that measures the consumer's affinity towards her community and its members. The higher the consumer's social sentiment the more utility she derives from contributing.

Although many authors recognize the existence of social sentiments, there is little discussion in the literature on how social sentiments form or how they evolve. In this paper we discuss how social sentiments evolve. We also discuss the effects of changes in the government provision and income distribution on private provision and social sentiments in the short-run and in the long run.

A few authors discussed how social sentiments or cooperation develop in communities. Axelrod (1981) demonstrates that cooperation can emerge in a community of egoists playing a prisoner dilemma game as long as there is a high probability of future interaction amongst players. However, it is difficult to apply Axelrod's analysis to public good games where, unlike prisoner dilemma games, there is no clear mean to determine when a player cooperates and when she defects since contributions are usually continuous, not binary. Additionally, it is impossible to punish (or award) a player in public goods games without punishing (or awarding) all other players.

Van Dijk and Van Winden (1997) theorize that consumers weight the utility of other consumers by some factor that they call social ties and that these ties evolve over time according to an impulse function. They assume that a consumer's social tie with another consumer is more likely to increase if the other consumer contributes more to the group exchange. We use a similar framework to Van Dijk and Van Winden (1997). Our paper differs from the Van Dijk and Van Winden's analysis in two important ways. First, we assume that consumers derive utility directly from the act of contributing rather than from the utility of other consumers with whom they have social ties. This assumption better explain why some individuals give money to homeless people who they do not know or why they contribute to charity organizations even when they do not know who will benefit from their contribution. We therefore use a utility function with impure altruism such as the one developed by Andreoni (1989, 1990). Second, we assume that an increase in the total provision of public goods increases the consumers' social sentiments.

Public goods can strengthen social sentiments by facilitating interaction between members of the community and by increasing community pride. For example, an education system and a justice system can facilitate interaction between members of a community and help them resolve their conflicts. Isaac, McCue and Plott (1985), Isaac and Walker (1988) and others show that allowing participants in public good experiments to interact increases their contributions. These experiments suggest that consumers' social sentiments generally increase when they interact.[1] Parks, museums and cleaner streets can all increase community pride and thus strengthen the social sentiments of the community's members. Schram and Sonnemans (1996) find that group identity increases voting participation in a controlled environment. Kramer and Brewer (1984) and Brewer and Kramer (1986) also find that individual show more restraint in the consumption of a common good when they are identified as part of a group.

We show that if consumers are impurely altruistic and their social sentiments increase with increases in the total provision of the public good, the community will converge to an equilibrium level of social sentiments with higher private provision than predicted by traditional theory. Our paper has several important implications for government policy. First, although government provision of the public goods will partially crowds out private provision in the short-run, it may cause a net increase in private provision in the long run by strengthening the social sentiments of the community's members. Second, governments can increase the total provision of the public good, and move the community to an equilibrium with higher social sentiments, by shifting income from a more impurely altruistic to a less impurely altruistic consumer. Finally, an increase in government provision will cause a larger increase in the total provision of the public good and a larger increase in consumers' social sentiments in the long run if the government levies a higher tax on more impurely altruistic consumers.

## 2. The Static Model

Consider a community of n consumers. A community in this paper is defined as a group of consumers that consume the same public goods. For simplicity, assume that there is only one public good and one private good in the economy. Each consumer i, $i = 1, \ldots, n$, contributes $s_i$, $s_i \geq 0$, to the provision of the public good. Private provision, S, equals the sum of the consumers' contributions.

(1) $$S = \sum_{i=1}^{n} s_i$$

The community's government can allocate resources to the provision of the public good by taxing each consumer i a lump sum tax of $\tau_i$, $\tau_i \geq 0$. Assume that the government must maintain a balanced budget and does not incur any transaction costs. Under these assumptions government provision, G, must equal the sum of the taxes levied on the n consumers in the community.

(2) $$G = \sum_{i=1}^{n} \tau_i$$

For convenience define consumer i's allocation, $y_i$, as the sum of her voluntary contribution and her involuntary contribution (the tax levied on her). $y_i = s_i + \tau_i$. Total provision of the public good, Y, equals the sum of the consumers' allocations.

(3) $$Y = \sum_{i=1}^{n} y_i$$

Let $U^i$ be consumer i's utility, $i = 1, \ldots, n$. Assume that consumer i's utility is a function of her consumption of the private good, $c_i$, her consumption of the public good, Y, her contribution, $s_i$, and her social sentiment, $\alpha_i$.

A consumer's social sentiment can be thought of as an index that measures the consumer's affinity towards her community and its members. The higher a consumer's social sentiment is the more she likes her community. Social sentiments are exogenous from the consumers' perspective but may change from one period to the next as discussed in section 3.

(4) $U^i = U^i(c_i, s_i, Y; \alpha_i) \quad i = 1, \ldots, n$

Assume $U^i$ is twice continuously differential and strictly increasing in its arguments (assumption i). Additionally, assume that $U^i$ is quasiconcave in its arguments (assumption ii).[2] Let $U^i_1$, $U^i_2$ and $U^i_3$ be the derivatives of $U^i$ with respect to its first argument, second argument and third argument respectively.

(i) $U^i$ is $C^2$, $U^i_1 > 0$, $U^i_2 > 0$, $U^i_3 > 0 \quad i = 1, \ldots, n$

(ii) $U^i$ is quasiconcave with respect to $c_i$, $s_i$ and $Y$

The quasiconcavity of the utility function is both necessary and sufficient to assure that the private good, the public good and the consumer's contribution are normal goods. Thus an increase in the consumer's wealth will lead the consumer to increase both her consumption of the private good and her contribution.

The second argument in the utility function is what Andreoni terms "impure altruism". It represents the utility that consumers derive from contributing resources to the provision of the public good. Andreoni argues that consumers are impurely altruistic because they derive a feeling of warm glow from contributing. Steinberg (1987) and Harbaugh (1998) note that consumers may also receive secondary benefits from contributing that are positively related to the size of their contribution such as status and awards of recognition.

We shall assume that an increase in a consumer's social sentiment increases her marginal utility from contributing (assumption iii). Consumers who have higher social sentiments may receive more utility from contributing because they care about other consumers' utility more deeply, because they have a stronger desire to help their community, or because they care more about how other members of the community regard them.

(iii) $\partial U^i_2 / \partial \alpha_i > 0 \quad i = 1, \ldots, n$

The consumer’s expenditure on the private good plus her contribution cannot exceed her disposable income. A consumer's disposable income equals her endowment, $w_i$, minus the lump-sum tax that the government levies on her, $\tau_i$.

For simplicity, assume that the community is too small compared to the entire economy to influence prices and can convert the private good into the public good at a fixed marginal rate of transformation of 1. Each consumer i maximizes her utility subject to her budget constraint.

$$(5) \qquad \text{Max}_{c_i,\, s_i}\, U(c_i, s_i , Y; \alpha_i) \;\; \text{s.t. } c_i + s_i = w_i - \tau_i \qquad i = 1, \ldots, n$$

The budget constraint of consumer i can be rewritten as $c_i + y_i = w_i$. Let $Y_{-i}$ be the total allocation of the public good not including consumer i’s allocation. $Y_{-i} = Y - y_i$. We can rewrite the consumers’ maximization problem by substituting the budget constraint into utility function and $Y - Y_{-i}$ for $y_i$.

$$(6) \qquad \text{Max}_{Y}\, U(w_i + Y_{-i} - Y, Y - Y_{-i} - \tau_i, Y; \alpha_i) \;\; \text{s.t. } y_i \geq \tau_i \qquad i = 1, \ldots, n$$

Assuming an interior solution the first order conditions are:[3]

$$(7) \qquad - U^i_1 + U^i_2 + U^i_3 = 0 \qquad i = 1, \ldots, n$$

Following Andreoni (1989), we can write the total allocation of the public good that consumer i would choose as a function of the exogenous parameters in the model from the perspective of consumer i.

$$(8) \qquad Y = f^i(w_i + Y_{-i},\; Y_{-i} + \tau_i, \alpha_i) \qquad i = 1, \ldots, n$$

Next, we obtain consumer i’s desired allocation by subtracting $Y_{-i}$ from both sides.

$$(9) \qquad y_i = f^i(w_i + Y_{-i},\; Y_{-i} + \tau_i, \alpha_i) - Y_{-i} \qquad i = 1, \ldots , n$$

$f^i$ is the allocation function of consumer i. Let $f^i_1$, $f^i_2$, $f^i_3$ be the derivatives of $f^i$ with respect to its first argument, second argument and third argument respectively. The second argument comes from the impurely altruistic component of the utility function and is non-negative for an impurely altruistic consumer. Andreoni (1989, pp. 1450-52) shows that given the assumption of quasiconcavity (assumption ii) $0 < f^i_1 < 1$, $0 < f^i_2 < 1$ and $0 < f^i_1 + f^i_2 \leq 1$ for an impurely altruistic consumer. Andreoni calls a person who does not derive any utility from contributing a purely altruistic person. If consumer i were purely altruistic than $f^i_2 = 0$.[4]

$f^i_3$ is also strictly positive. From (9) we know that the derivative of $y^i$ with respect to $\alpha_i$ is $f^i_3 d\alpha_i$. Therefore, if an increase in $\alpha_i$ causes consumer i to increase her allocation than $f^i_3$ must be positive. From (7) $-U^i_1 + U^i_2 + U^i_3 = 0$. If $\alpha_1$ increases by some amount $\varepsilon$ to $\alpha_1$', where $\alpha_1' = \alpha_1 + \varepsilon$, then by assumption iii $U_2(c_i, s_i, Y; \alpha_1') > U_2(c_i, s_i, Y; \alpha_i)$. After the increase in $\alpha_1$, $U_2(c_1, s_1, Y; \alpha_1') + U_3(c_1, s_1, Y; \alpha_1') > U_1(c_1, s_1, Y; \alpha_1')$. If consumer i contributes $\nu$ additional resources then the net change in her utility would approximately be $\nu U_2 + \nu U_3 - \nu U_1 = \nu[U_2 + U_3 - U_1] > 0$.Therefore, consumer i will increase her allocation if her social sentiment increases because by doing so she will increase her utility.

By totally differentiating (9) we find that in Nash equilibrium $dy_i/dw_i = f^i_1 > 0$, $dy_i/d\tau_i = f^i_2 > 0$ and $y_i/d\alpha_i = f^i_3 > 0$ for i = 1, …, n. We conclude that an increase in consumer i's endowment, tax or social sentiment will cause her to increase her equilibrium allocation. Proposition I draws conclusions about the change in the total provision of the public good that will result from changes in the exogenous parameters of the model.

Proposition I: Let $Y(\mathbf{w}, \mathbf{t}, \mathbf{a})$ be the total provision that the community will reach in Nash equilibrium given the exogenous parameters of the model. $\mathbf{w}$, $\mathbf{t}$, $\mathbf{a}$ are vectors of endowments, taxes and social sentiments respectively. $\mathbf{w} = [w_1, \ldots, w_n]$, $\mathbf{t} = [\tau_1, \ldots, \tau_n]$ and $\mathbf{a} = [\alpha_1, \ldots, \alpha_n]$. Given assumptions i through iii:[5]

(I-a) Total provision of the public good will increase by less than a dollar when the endowment of consumer i, i = 1, …, n, increases by a dollar.

(10) $0 < \partial Y(\mathbf{w}, \mathbf{t}, \mathbf{a})/\partial w_i < 1 \quad i = 1, \ldots, n$

(II-b) Total provision of the public good will increase by a dollar or less when the tax levied on consumer i, i = 1, …, n, increases by a dollar.

(11) $0 < \partial Y(\mathbf{w}, \mathbf{t}, \mathbf{a})/\partial \tau_i \leq 1 \quad i = 1, \ldots, n$

(I-c) Total provision will increase when the social sentiment of consumer i, i = 1, …, n, increases.

(12) $0 < \partial Y(\mathbf{w, t, a})/\partial\alpha_i \quad i = 1, \ldots, n$

Proof: Without loss of generality suppose consumer i's endowment increases by some amount $dw_i$ but the endowments of all other consumer remain the same, $dw_j = 0$ for all j, $j \neq i$. Totally differentiating (9) and substituting $dY - dy_i$ for $Y_{-i}$ and $dY - dy_j$ for $Y_{-j}$.

(13) $dy_i = [(f^i_1 + f^i_2 - 1)/(f^i_1 + f^i_2)]dY + [f^i_1/(f^i_1 + f^i_2)]dw_i \quad i = 1, \ldots, n$

(14) $dy_j = [(f^j_1 + f^j_2 - 1)/(f^j_1 + f^j_2)]dY \quad j = 1, \ldots, n; j \neq i$

We solve for the general equilibrium by summing (13) and the n − 1 equations in (14)

(15) $dY = dY \sum_{i=1}^{n} [(f^i_1 + f^i_2 - 1)/(f^i_1 + f^i_2)] + [f^i_1/(f^i_1 + f^i_2)]dw_i \quad i = 1, \ldots, n$

Rearranging we find out that:

(16) $\partial Y/\partial w_i = c\gamma_i \quad i = 1, \ldots, n$

$$c = [1 + \sum_{i=1}^{n} (1 - f^i_1 - f^i_2)/(f^i_1 + f^i_2)]^{-1} \text{ and } \gamma_i = f^i_1/(f^i_1 + f^i_2)$$

Since $0 < f^i_1 + f^i_2 \leq 1$ and $0 < f^i_1 < 1$ then $0 < c \leq 1$ and $0 < \gamma_i < 1$.Hence, $0 < \partial Y/\partial w_i < 1$.

Without loss of generality suppose the tax on consumer i is increased by some amount $d\tau_i$ but the taxes levied on all other consumers remain the same, $d\tau_j = 0$ for all j, $j \neq i$. Andreoni (1989, pp. 1452-53) demonstrates that the net change in total provision of the public good that results from the increase in $\tau_i$ is:

(17) $\partial Y/\partial\tau_i = c\beta_i \quad i = 1, \ldots, n$; where c is as previously defined and $\beta_i = f^i_2/(f^i_1 + f^i_2)$

Finally, without loss of generality, suppose that $\alpha_i$ change by some amount $d\alpha_i$, but the social sentiments of all other consumers remain constant, $d\alpha_j = 0$ for all j, $j \neq i$. Totally differentiating (9) and substituting $dY - dy_i$ for $dY_{-i}$ and $dY - dy_j$ for $Y_{-j}$.

(18) $\quad dy_i = [(f^i_1 + f^i_2 - 1)/(f^i_1 + f^i_2)]dY + [f^i_3/(f^i_1 + f^i_2)]d\alpha_i \qquad i = 1, \ldots, n$

(19) $\quad dy_j = [(f^j_1 + f^j_2 - 1)/(f^j_1 + f^j_2)]dY \qquad j = 1, \ldots, n, j \neq i$

Combining (18) with $n - 1$ equation in (19) and rearranging:

(20) $\quad dY/d\alpha_i = c\eta_i \qquad i = 1, \ldots, n$; where c is as previously defined and $\eta_i = f^i_3/(f^i_1 + f^i_2)$

Since $f^i_3 > 0$ then $\eta_i > 0$. Therefore, $\partial Y/\partial\alpha_i > 0$.

Part b of proposition I is of particular importance because it shows that when consumers are impurely altruistic than government provision only partially crowds out private provision. The existence of impure altruism helps explain why empirical studies and laboratory experiments conclude that crowding out is incomplete.

We can now make conclusions about how changes in the exogenous variables affect the welfare of a given consumer i. Define $y^i(\mathbf{w}, \mathbf{t}, \mathbf{a})$, i = 1, …, n, as the equilibrium allocation of consumer i. As we previously shown $y^i(\mathbf{w}, \mathbf{t}, \mathbf{a})$ increases in $w_i$, $\tau_i$ and $\alpha_i$. An increase in $w_j$, $\tau_j$ or $\alpha_j$, j = 1, …n, $j \neq i$ will increase $y^j(\mathbf{w}, \mathbf{t}, \mathbf{a})$ and therefore decrease (or not change) $y^i(\mathbf{w}, \mathbf{t}, \mathbf{a})$. To see why differentiate (9) with respect to $Y_{-k}$ for some consumer k, k = 1, …, n, $k \neq j$, we find that $dy_k/dY_{-k} = f^k_1 + f^k_2 - 1 \leq 0$. Therefore, any change in an exogenous variable that will cause consumer j to increase his allocation will cause all other consumers, including consumer i, to decrease (or not change) their allocations. We can now draw conclusions about how changes in the exogenous parameters affect the welfare of the consumers.

Proposition II: Let $V^i(\mathbf{w}, \mathbf{t}, \mathbf{a})$ be the indirect utility function of consumer i, defined as the utility that consumer i receives when all the consumers select their equilibrium allocations given $(\mathbf{w}, \mathbf{t}, \mathbf{a})$. $V^i(\mathbf{w}, \mathbf{t}, \mathbf{a}) = U^i(w_i - y^i(\mathbf{w}, \mathbf{t}, \mathbf{a}), y^i(\mathbf{w}, \mathbf{t}, \mathbf{a}) - \tau_i, Y(\mathbf{w}, \mathbf{t}, \mathbf{a}))$. Let $\partial V_i/\partial a$ denote the change in consumer i's indirect utility due to a change in parameter a, $a = [w_1, \ldots, w_n, \tau_1, \ldots, \tau_n, \alpha_1, \ldots, \alpha_n]$. Given assumptions i through iii:

(II-a) An increase in consumer i's endowment will increase her welfare and the welfare of all the consumers in the community.

(21) $\partial V^j/\partial w_i > 0 \quad i = 1, \ldots, n; j = 1, \ldots, n$

(II-b) An increase in the tax levied on consumer i will decrease consumer i's welfare but will increase the welfare of all the other consumers in the community.

(22) $\partial V^i/\partial \tau_i < 0 \quad i = 1, \ldots, n$

(23) $\partial V^j/\partial \tau_i > 0 \quad i = 1, \ldots, n; j = 1, \ldots, n, j \neq i$

(II-c) An increase in consumer i's social sentiment will increase the welfare of all the other consumers in the community.

(24) $\partial V^j/\alpha_i > 0 \quad i = 1, \ldots, n; j = 1, \ldots, n, j \neq i$

Proof: From Proposition I an increase in consumer i's endowment will lead to an increase in the total provision of the public good. By our assumption of normality, consumer i will increase her contribution and her consumption of the private good. Since all three arguments of the utility function would increase as a result of the increase in the consumer's endowment then consumer i's welfare must increase as well. From (7) $-U^i_1 + U^i_2 + U^i_3 = 0$. Taking the derivative of $V^i$ with respect to $\tau_i$ we find that $\partial V^i/\partial \tau_i = dy_i/d\tau_i(-U^i_1 + U^i_2 + U^i_3) - U^i_2 + U^i_3 \sum_{j \neq i}^{n} dy^j/d\tau_i$. From (7) $-U^i_1 + U^i_2 + U^i_3 = 0$. Therefore, $\partial V^i/\partial \tau_i = -U^i_2 + U^i_3 \sum_{j \neq i}^{n} dy^j/d\tau_i < 0$.

Looking at the effect that a change in $w_i$ will have on other consumers we note that, $\partial V^j/\partial w_i = dy^j/dw_i(-U^i_1 + U^i_2 + U^i_3) + U^i_3 \sum_{k \neq j}^{n} dy^k/dw_i = U^i_3 \sum_{k \neq j}^{n} dy^k/dw_i > 0$. $\sum_{k \neq j}^{n} dy^k/dw_i$ must be positive because $dy^j/dw_i < 0$ but $dY/dw_i > 0$ from proposition I. An increase in consumer i's tax or social sentiment will also have a positive effect on the welfare of all other j consumers. $\partial V^j/\partial \tau_i = dy^j/d\tau_i(-U^i_1 + U^i_2 + U^i_3) + U^i_3 \sum_{k \neq j}^{n} dy^k/d\tau_i = U^i_3 \sum_{k \neq j}^{n} dy^k/d\tau_i > 0$. Similarly, $\partial V^j/\partial \alpha_i = dy^j/d\alpha_i(-U^i_1 + U^i_2 + U^i_3) + U^i_3 \sum_{k \neq j}^{n} dy^k/d\alpha_i = U^i_3 \sum_{k \neq j}^{n} dy^k/d\alpha_i > 0$. $\sum_{k \neq j}^{n} dy^k/d\tau_i > 0$ and $\sum_{k \neq j}^{n} dy^k/d\alpha_i$ because $dy^j/d\tau_i < 0$ and $dy^j/d\alpha_i < 0$ but $\partial Y/\partial \tau_i > 0$ and $\partial Y/\partial \alpha_i > 0$ from Proposition I .

An increase in the tax levied on the consumer will tighten her budget constraint and leave her worse off while making all other consumers better off. All the other consumers will benefit when consumer i increases her allocation as this will allow them not only to increase their consumption of the public good but to also increase their consumption of the private good by reducing their contribution.

Suppose that the government increases its provision by levying a tax of $\tau_i$ on every consumer i, $d\tau_i \geq 0$ instead of only on one consumer. From (22) we know that the tax levied on consumer i will decrease her welfare because it will decrease her disposable income. However, from (23) we know that the tax levied on all other consumers will increase consumer i's welfare because it will lead other consumers to increase their allocations.

From the proof of proposition II the tax levied on consumer i will decrease her welfare by $-U^i_2 + U^i_3\sum_{j\neq i}^{n} dy^j/d\tau_i < 0$ while the tax levied on any other j consumer will increase consumer i's welfare by $U^i_3\sum_{k\neq j}^{n} dy^k/d\tau_j$. Let $\partial V^i/\partial G(\mathbf{t})$ represent the change in consumer i's indirect utility caused by a government provision that is financed by a vector taxes $\mathbf{t}$, $\mathbf{t} = [\tau_1, \ldots, \tau_n]$.

$$(25) \qquad \partial V^i/\partial G(\mathbf{t}) = -U^i_2 + U^i_3[\sum_{j\neq i}^{n} dy_j/d\tau_i + \sum_{j\neq i}^{n}\sum_{k\neq j}^{n} dy_k/d\tau_j] \qquad i = 1, \ldots, n;\ j = 1, \ldots, n;\ j \neq i$$

From (25) we learn that the effect of an increase in government provision on the welfare of individual consumers is ambiguous. We can also deduce that regardless of whether the net effect on consumer i's welfare is positive or negative it will be smaller the higher consumer i's marginal utility from contributing is. Consumers who have strong social sentiments and therefore high marginal utility from contributing have a strong preference for voluntary contribution over involuntary contribution.

From II-c we know that an increase in one of the consumer's social sentiment will lead to a welfare increase for all other consumers. That is because the consumer whose social sentiment increases will increase her contribution. Unfortunately we cannot make any conclusions about how changes in a consumer's social sentiment would affect her own welfare. A change in consumer i's social sentiment will cause a shift in her preferences. Therefore, we cannot compare consumer i's utility before and after the change in her social sentiment.

## 3. The Dynamic Model

In the previous section we discussed the effects of changes in consumers' social sentiments on the total provision of the public good and on consumers' welfare. In this section we shall theorize how social sentiments evolve over time. In particular we shall assume that the social sentiment of each consumer change from one period to the next according to an impulse function. We shall show that given some basic assumptions about consumers' impulse functions there exist at least one equilibrium level of social sentiments that the community will converge to.

In the proceeding sections we shall assume that the community consists of only two consumers, consumer 1 and consumer 2, or, equivalently, that the community consists of two groups of identical consumers.[6] Let $H^i$ be the impulse function of consumer i, i = 1, 2. Assume that $H^i$ is a function of the total provision of the public good and the consumer's social sentiment.

(26) $d\alpha_i/dt = H^i(\,Y(\mathbf{w}, \mathbf{t}, \mathbf{a}), \alpha_i)$ $\quad i = 1, 2$

We shall make the following assumptions about the consumers' impulse functions. First, we shall assume that the impulse function of each consumer is strictly increasing in total provision of the public good (assumption iv). Increases or improvements in public goods (such as more schools, more parks, and a better justice system) tend to increase community pride and facilitate interaction amongst members of the community.[7] Let $H^i_k$ be the derivative of the impulse function with respect to its $k^{th}$ argument, k = 1, 2.

(iv) $H^i_1 > 0 \quad i = 1, 2$

Additionally, assume that the impulse function is decreasing in the consumer's social sentiment (assumption v). Therefore, if consumer i's social sentiment increases but the total provision of the public good remains constant then the change in consumer i's social sentiment would decrease. Without assumption v the dynamic model would be unstable because for some high levels of Y $\alpha_i$, i = 1, 2, will continue to increase indefinitely and for some low levels of Y $\alpha_i$ will continue to decrease indefinitely.[8]

(v) $H^i_2 < 0 \quad i = 1, 2$

Consumers are assumed to be myopic[9], which means that they do not consider how social sentiments will change in future periods when they decide how to allocate their resources in a given period. Assuming that consumers are myopic is reasonable because people do not generally consider how a given action in the present will change their attitudes or emotions in the future.

Next, we find the combinations of $\alpha_1$ and $\alpha_2$ that will keep $\alpha_1$ growing at a constant rate x, $[H^1 = x]$ locus, and the combinations of $\alpha_1$ and $\alpha_2$ that will keep $\alpha_2$ growing at a constant rate x, $[H^2 = x]$ locus. Let $d\alpha_2/d\alpha_1\bot_{H^1 = x}$ be the slope of the $[H^1 = x]$ locus and $d\alpha_2/d\alpha_1\bot_{H^2 = x}$ be the slope of the $[H^2 = x]$ locus in $(\alpha_1, \alpha_2)$ space. We can find $d\alpha_2/d\alpha_1\bot_{H^1 = x}$ and $d\alpha_2/d\alpha_1\bot_{H^2 = x}$ by setting the impulse functions equal to x and applying the implicit function theorem. Define $\chi^i = - H^i_1/H^i_2$, $i = 1, 2$. $\chi_i > 0$ since $H^i_1 > 0$, by assumption iv, and $H^i_2 < 0$, by assumption v.

(27) $\quad d\alpha_2/d\alpha_1\bot_{H^1 = x} = (\chi^1 - \partial Y/\partial\alpha_1)/\partial Y/\partial\alpha_2$

(28) $\quad d\alpha_2/d\alpha_1\bot_{H^2 = x} = \partial Y/\partial\alpha_1 / (\chi^2 - \partial Y/\partial\alpha_2)$

Of a particular interest are the combinations of $\alpha_1$ and $\alpha_2$ that will keep $\alpha_1$ constant, $[H^1 = 0]$ locus, and the combinations of $\alpha_1$ and $\alpha_2$ that will keep $\alpha_2$ constant, $[H^2 = 0]$ locus. Lemma 1 and Lemma 2 characterize the shape of the $[H^1 = 0]$ and $[H^2 = 0]$ loci.

Lemma 1: Given assumptions i through v:

(L1-a) As the social sentiment of consumer i, i = 1, 2, approaches infinity or negative infinity the marginal change in total provision of the public good due to a unit change in consumer i's social sentiment approaches zero.

(29) $\quad \lim_{\alpha_i \to \infty} \partial Y/\partial\alpha_i = 0 \quad i = 1, 2$

(30) $\quad \lim_{\alpha_i \to -\infty} \partial Y/\partial\alpha_i = 0 \quad i = 1, 2$

(L1-b) As the social sentiment of consumer i, i = 1, 2, approaches infinity or negative infinity the marginal change in the total provision of the public good due to a unit change in consumer j's social sentiment, j = 1, 2, j ≠ i, approaches zero.

(31) $\lim_{\alpha_i \to \infty} \partial Y/\partial\alpha_j = 0$ i = 1, 2; j = 1, 2; j ≠ i

(32) $\lim_{\alpha_i \to -\infty} \partial Y/\partial\alpha_j = 0$ i = 1, 2; j = 1, 2; j ≠ i

Proof: Define W as the total endowment. With two consumers, $W = w_1 + w_2$. Y cannot be smaller than 0 or larger than W, $0 \leq Y \leq W$. From Proposition I, $\partial Y/\partial\alpha i \geq 0$ at all levels of $\alpha_i$. Therefore, there must exist some Y*, Y* ≤ W, such that:

(33) $\lim_{\alpha_i \to \infty} Y(\mathbf{w}, \mathbf{t}, \alpha_i, \alpha_j) = Y^*$ i = 1, 2; j = 1, 2; j ≠ i

If not, then for $Y(\mathbf{w}, \mathbf{t}, \alpha_i, \alpha_j) = W$ there will exist some $\alpha_i'$, $\alpha_i' > \alpha_i$, such that $Y(\mathbf{w}, \mathbf{t}, \alpha_i', \alpha_j) > Y(\mathbf{w}, \mathbf{t}, \alpha_i, \alpha_j)$, which cannot be true since that implies that $Y(\mathbf{w}, \mathbf{t}, \alpha_i' \alpha_j) > W$. $\partial Y/\partial\alpha i$ and $\partial Y/\partial\alpha_j$ must approach zero as $\alpha_i$ approaches infinity. Otherwise, Y > Y* for some sufficiently high $\alpha_i$ or $\alpha_j$.

(34) $\lim_{\alpha_i \to \infty} \partial Y/\partial\alpha_i = 0$ i = 1, 2

(35) $\lim_{\alpha_i \to \infty} \partial Y/\partial\alpha_j = 0$ i = 1, 2; j = 1, 2; j ≠ i

There must also exist some Y`, Y` ≥ 0, such that:

(36) $\lim_{\alpha_i \to -\infty} Y(\mathbf{w}, \mathbf{t}\ \alpha_i, \alpha_j) = Y`$ i = 1, 2; j = 1, 2; j ≠ i

If not then for $Y(\mathbf{w}, \mathbf{t}, \alpha_i, \alpha_j) = 0$ there will exist some $\alpha_i''$, $\alpha_i'' < \alpha_i$, such that $Y(\mathbf{w}, \mathbf{t}, \alpha_i'', \alpha_j) < Y(\mathbf{w}, \mathbf{t}, \alpha_i, \alpha_j)$, which cannot be true since that implies that $Y(\mathbf{w}, \mathbf{t}, \alpha_i'', \alpha_j) < 0$.
$\partial Y/\partial\alpha_i$ and $\partial Y/\partial\alpha_j$ must approach zero as $\alpha_i$ approaches negative infinity. Otherwise, Y < Y` for some sufficiently small $\alpha_i$ or $\alpha_j$.

(37) $\lim_{\alpha_i \to -\infty} \partial Y/\partial\alpha i = 0$ i = 1, 2

(38) $\lim_{\alpha_i \to -\infty} \partial Y/\partial\alpha_j = 0$ i = 1, 2; j = 1, 2; j ≠ i

Now that we showed what happens to the derivative of total provision with respect to $\alpha_1$ and $\alpha_2$ at the limits we can show what happens to the slopes of the $[H^1 = 0]$ and $[H^2 = 0]$ loci as $\alpha_1$ or $\alpha_2$ approach infinity and negative infinity. We shall make the additional assumptions that $\lim_{\alpha_i \to \infty} \chi^i$ and $\lim_{\alpha_i \to -\infty} \chi^i$ is not infinity, assumptions (vi) and (vii).

(vi) $\lim_{\alpha_i \to \infty} \chi^i < \infty \quad i = 1, 2$

(vii) $\lim_{\alpha_i \to -\infty} \chi^i < \infty \quad i = 1, 2$

From assumptions (iv) and (v), $\chi^i$ must be strictly positive. Therefore, given assumptions (vi) and (vii), $0 < \lim_{\alpha_i \to \infty} \chi^i < \infty$ and $0 < \lim_{\alpha_i \to -\infty} \chi^i < \infty$.

Lemma 2: Given assumptions i through vii:

(L2-a) The slope of $[H^1 = 0]$ locus approaches infinity as consumer 1's social sentiment approaches infinity or negative infinity in $(\alpha_1, \alpha_2)$ space.

(39) $\lim_{\alpha_1 \to \infty} d\alpha_2/d\alpha_1 \perp_{H^1 = 0} = \infty$

(40) $\lim_{\alpha_1 \to -\infty} d\alpha_2/d\alpha_1 \perp_{H^1 = 0} = \infty$

(L2-b) The slope of $[H^2 = 0]$ approaches zero as consumer 2's social sentiment approaches infinity or negative infinity in $(\alpha_1, \alpha_2)$ space.

(41) $\lim_{\alpha_2 \to \infty} d\alpha_2/d\alpha_1 \perp_{H^2 = 0} = 0$

(42) $\lim_{\alpha_2 \to -\infty} d\alpha_2/d\alpha_1 \perp_{H^2 = 0} = 0$

Proof: From (27) $\lim_{\alpha_1 \to \infty} d\alpha_2/d\alpha_1 \perp_{H^1 = 0} = (\lim_{\alpha_1 \to \infty} \chi^1 - \lim_{\alpha_1 \to \infty} \partial Y/\partial \alpha_1) / \lim_{\alpha_1 \to \infty} \partial Y/\partial \alpha_2$. From Lemma 1, $\lim_{\alpha_1 \to \infty} \partial Y/\partial \alpha_1 = {}_{\alpha_1 \to \infty} \partial Y/\partial \alpha_2 = 0$. Therefore, $\lim_{\alpha_1 \to \infty} d\alpha_2/d\alpha_1 \perp_{H^1 = 0} = (\lim_{\alpha_i \to \infty} \chi^i - 0)/0 = \infty$. Similarly, $\lim_{\alpha_1 \to -\infty} d\alpha_2/d\alpha_1 \perp_{H^1 = 0} = (\lim_{\alpha_1 \to -\infty} \chi^1 - \lim_{\alpha_1 \to -\infty} \partial Y/\partial \alpha_1) / \lim_{\alpha_1 \to -\infty} \partial Y/\partial \alpha_2 = (\lim_{\alpha_i \to -\infty} \chi^i - 0)/0 = \infty$.

By the same logic, from (28), $\lim_{\alpha_2 \to \infty} d\alpha_2/d\alpha_1 \perp_{H^2 = 0} = 0/(\lim_{\alpha_2 \to \infty} \chi^2 - 0) = 0$ and $\lim_{\alpha_2 \to -\infty} d\alpha_2/d\alpha_1 \perp_{H^2 = 0} = 0/(\lim_{\alpha_2 \to -\infty} \chi^2 - 0) = 0$.

We are finally ready to characterize the equilibria of the community. We will only discuss a community with a single equilibrium. A community with multiple equilibria is discussed in the Appendix.

Proposition III: Given assumptions i through vii, there exist an equilibrium level of social sentiments that the community will converge to.

Proof: It follows from Lemma 2 that the [$H^1 = 0$] and [$H^2 = 0$] loci must intersect one another at least once. From Lemma 2 the slope of the [$H^2 = 0$] locus must approach zero when $\alpha_2$ approaches infinity and when $\alpha_2$ approaches negative infinity and the slope of the [$H^1 = 0$] must approach infinity when $\alpha_1$ approaches infinity and negative infinity. Since [$H^1 = 0$] is vertical when $\alpha_1$ approaches infinity or negative infinity and [$H^2 = 0$] is horizontal when $\alpha_2$ approaches infinity or negative infinity they must intersect at least once.

At any point left of the [$H^1 = 0$] locus $\alpha_1$ will increase and at any point to the right of the [$H^1 = 0$] locus $\alpha_1$ will decrease over time. Similarly, at any point above the [$H^2 = 0$] locus $\alpha_2$ will decrease and at any point below the [$H^2 = 0$] locus $\alpha_2$ will increase over time. Given the dynamics of the model, if the two loci only intersect once the intersection will be a globally stable equilibrium as illustrated in Figure 1.

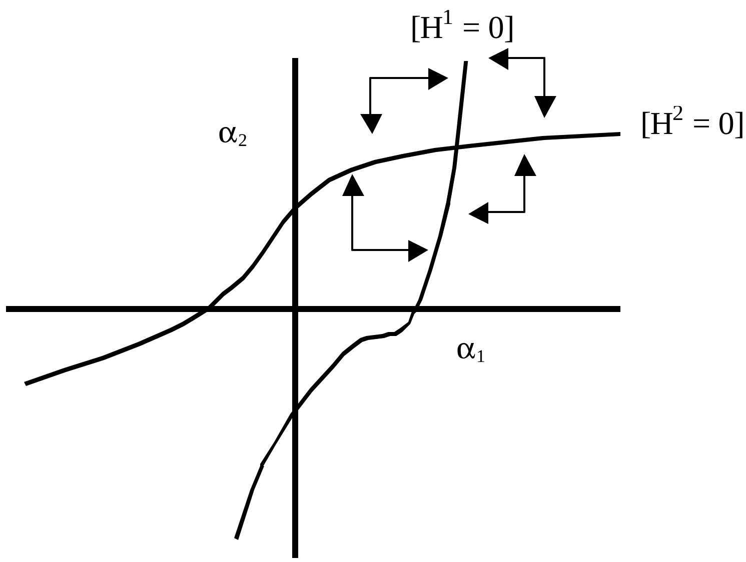


**Figure 1**

Figure 1 shows the [$H^1 = 0$] and [$H^2 = 0$] loci in ($\alpha_1, \alpha_2$) space. If there is only a single equilibrium it must be globally stable. (The community will converge to that equilibrium regardless of the level of social sentiments it starts with.)

Thus far we assigned no meaning to the values of $\alpha_1$ and $\alpha_2$. We can better explain how communities develop by adding the assumption that when the consumers' social sentiments are zero they do not derive any enjoyment from contributing. Suppose two consumers (or groups of identical consumers) who have no social ties with one another decide to form a community in order to jointly provide a public good. Suppose that when the community is formed both of the consumers' social sentiments equal zero. As long as private provision is positive in Nash equilibrium with zero social sentiments then the community would build towards a new equilibrium, such as the one shown in Figure 1, with positive levels of social sentiments. [10] We define a building community as a community in which the social sentiments increase over time and, as a result, private provision increases. Since $\partial Y/\partial \alpha_i > 0$ from proposition I the equilibrium that the community builds to will have a higher private provision than the Nash equilibrium with zero social sentiments.

Changes in endowments and government provision will change the location of the equilibrium. If the resulting equilibrium were to the Northeast of the initial equilibrium in ($\alpha_1$, $\alpha_2$) space it would have higher levels of social sentiments and, consequently, higher private provision. Conversely, if the resulting equilibrium were to the Southwest of the initial equilibrium it would have lower levels of social sentiments and lower private provision. Hereinafter, when we compare two equilibria we will refer to the equilibrium with higher social sentiments as the higher-contributions equilibrium and to the equilibrium with lower social sentiments as the lower-contributions equilibrium.

In order to analyze the effects of changes in endowments and government policy define the short-run as the period immediately following a change in government provision or endowment and the long run as the period after the community settles on a new equilibrium. Suppose that consumer 1's endowment increases. From proposition I we know that an increase in any of the consumers' endowments will increase the total provision of the public good. By assumptions iv and v, higher total provision requires higher levels of social sentiments in order to keep social sentiments constant over time. Therefore, the increase in consumer 1's endowment will shift the [$H^1 = 0$] locus and the [$H^2 = 0$] locus outwards as illustrated in Figure 2.[11] In the long run the community will build towards a higher-contributions equilibrium with higher private provision as shown in Figure 2.

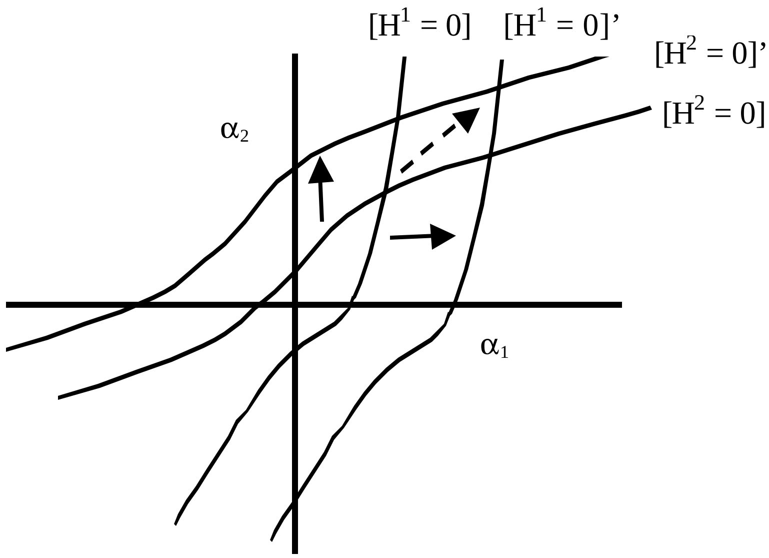


**Figure 2**

If consumer i’s endowment increases consumer j, j = 1, 2, j ≠ i, will decrease his allocation in the short-run. However, as the community builds towards a higher-contributions equilibrium consumer j’s social sentiment will increase and he will increase his allocation compared to his short-run allocation. If the change between consumer j's allocation in the short-run and the long run exceeds the decrease in his allocation in the short-run then an increase in consumer i’s endowment will cause a net increase in consumer j’s allocation in the long run.

On the other hand, if either of the consumers’ endowments decreases total provision of the public good will fall. The decrease in Y will cause the [$H^1$ = 0] and the [$H^2$ = 0] loci to shift inwards. As a result the community will deteriorate towards a lower-contributions equilibrium. A community in this paper is said to be deteriorating if the social sentiments of the community’s members decrease over time and, as a result, private provision falls.

From proposition II we know that an increase in either of the consumers’ endowments will make both consumers better off in the short-run. Since an increase in either of the consumers’ endowments will cause the community to build towards a higher-contributions equilibrium it may lead to further increases in consumers’ welfare in the long run. Conversely a decrease in either of the consumers’ endowment will make both consumers worse off in the short-run and may lead to further decreases in consumers’ welfare in the long run.

## 4. Government Policy

In section 3 we show that there exist at least one equilibrium level of social sentiments that the community converges to in the long run. In this section we discuss how government policy affect the total provision of the public good and welfare in a community of impurely altruistic agents in the long run. We focus our attention on increases in government provision and on income redistribution.

Warr (1982) and Roberts (1984) demonstrate that when consumers are purely altruistic government provision will completely crowd out private provision. Therefore, increases in government provision will not change the total provision of the public good unless private provision is zero. Warr (1983) also shows that redistributing income amongst consumers will not affect the total provision of the public good.

When consumers are impurely altruistic, as is assumed in this paper, government provision only partially crowds out private provision. In this section we will show that under certain circumstances, government provision can crowd in, or increase, private provision in the long run by strengthening the social sentiments of the community's members. We will also demonstrate that the government can increase the total provision of the public good by redistributing income from more impurely altruistic consumers to less impurely altruistic consumers. We begin the section by showing that private charity alone will under-provide the public good and therefore there may be a justification for government intervention.

Samuelson (1954) shows that when consumers are purely altruistic private markets under-provide public goods. Impurely altruistic consumers will also under-provide public goods under voluntary-contributions mechanism. Rearranging the first order conditions of the utility maximization problem, equation (7), we find that $U^i_2/U^i_1 + U^i_3/U^i_1 = 1$. $U^i_3/U^i_1$ is consumer i's Marginal Rate of Substitution of the public good for the private good, denoted as $MRS^i_Y$, and $U^i_2/U^i_1$ is consumer i's Marginal Rate of Substitution of his contribution for the private good, denoted as $MRS^i_S$. Recall that the Marginal Rate of Transformation, MRT, is one by assumption. Therefore, under voluntary-contributions mechanism:

$$(43) \qquad MRS^i_Y + MRS^i_s = MRT \quad i = 1, 2$$

In a community with two consumers and no government provision the Pareto optimal level of contributions is the level that maximizes $U^i$, i = 1,2, subject to the constraint $U^j$, j = 1, 2, j ≠ i, equals some level of utility $\upsilon$.

$$\text{(44)} \qquad \text{Max } U^i(w - s_i, s_i, s_i + s_j)$$
$$\text{s.t. } U^j(w - s_j, s_j, s_i + s_j) = \upsilon \qquad i = 1, 2;\ j = 1, 2;\ i \neq j$$

From the first order conditions the Pareto optimal level of $s_i$ solves the following equation.

$$\text{(45)} \qquad MRS^i_Y + MRS^i_s + MRS^j_Y = MRT \qquad i = 1, 2;\ j = 1, 2;\ i \neq j$$

Since $U^i_2$ and $U^i_3$ decrease with increases in $s_i$ by assumption of quasi-concavity, the level of consumer i's contribution that solves (43) must be smaller than the level that solves (45). Therefore, consumer i contributes less than the Pareto optimal amount. She contributes less than is Pareto optimal because she does not account for the positive externality that her contribution brings to other consumers by increasing the total provision of the public good.

From Proposition I we know that an increase in government provision will increase the total provision of the public good. An increase government provision, financed by a proportional tax, will also reduce consumers' disposable income and will lead them to decrease their consumption of the private good. Given our assumption of quasi-concavity (assumption ii) if government provision increases $U^i_3$ must increase and $U^i_1$ must decrease for every i. Therefore, $MRS^i_Y$ will decrease for every consumer. However, since $U^i_{23} \geq 0$, by assumption of quasiconcavity, $MRS^i_s$ may increase, decrease or remain the same as a result of the increase in government provision. Thus, even though private charity alone will under-provide the public good when consumers are impurely altruistic, an increase in government provision may not move the community to a Pareto optimal outcome.

From proposition II we know that an increase in government provision, financed by a proportional tax, may increase or decrease the welfare of a given consumer in the short-run. However, the effects of changes in government provision on private provision welfare are different in the long run and in the short-run. The differences in the effects of government provision between the short-run and the long run are summarized in Proposition IV.

Proposition IV: Given assumptions i through vii:

(IV-a) An increase in government provision will increase the total provision of the public good in the long run by more than it increases it in the short-run.

(IV-b) An increase in government provision can cause a net increase in private provision in the long run. Thus, government provision can crowd in private provision in the long run.

Proof: From Proposition I we know that an increase in government provision will increase the total provision of the public good in the short-run. An increase in total provision will shift the $[H^1 = 0]$ locus and the $[H^2 = 0]$ locus outwards as shown in Figure 2. As a result the community will move to a new higher-contributions equilibrium with higher private provision. Part (IV-b) immediately follows from part (IV-a). An increase in government provision will crowd in private provision in the long run if and only if the increase in private provision in the long run exceeds the decrease in private provision that occurs in the short-run because of crowding out.

Therefore, if consumers are impurely altruistic, not only does an increase in government provision only partially crowds out private provision in the short-run, but it may actually crowd in private provision in the long run. The community's government must therefore consider both the short-run and the long run ramifications of its fiscal policy.

From (25) we learn that an increase in government provision financed by a vector of taxes $\mathbf{t}$, $\mathbf{t} = [\tau_1, \ldots, \tau_n]$ may increase or decrease the welfare of a given consumer i. Therefore, an increase in government provision may not be Pareto improving in the short-run. However, an increase in government provision will also increase the social sentiments of the community's members in the long run. From proposition II we know that an increase in one of the consumers' social sentiments will increase the welfare of other consumers. When the social sentiments of both consumers increase simultaneously we cannot make any conclusions about the welfare of either consumer because changes in the consumers' social sentiments alters their preferences. However, it is possible that an increase in government provision will make all the consumers better off in the long run even if it decreases the utility of some of the consumers in the short-run.[12] As the community builds towards a higher-contributions equilibrium not only does the total provision of the public good increase but consumers also derive more enjoyment from contributing.

Increasing government provision is one way in which the government can increase the total provision of the public good, but it is not the only way. The government can also increase private provision by redistributing income from the more impurely altruistic consumer to the less impurely altruistic consumer.[13]

Without loss of generality suppose that the government redistributes income between the two consumers by taxing consumer 1 a lump-sum amount of $d\tau$ and reducing consumer 2's tax by $d\tau$. We only discuss an income transfer in which the government taxes one consumer and provides the other consumer a tax credit. However, decreasing consumer 1's endowment by some amount dw and increasing the other consumer by a lump-sum payment of dw will have an identical effect.[14] The net change in the total provision of the public good is:

(46) $$\partial Y/d\tau = \partial Y/\partial\tau_1 - \partial Y/\partial\tau_2$$

Substituting $\partial Y/\partial\tau_i = c\beta_i$ from (17) for i = 1, 2, and rearranging:

(47) $$\partial Y/\partial\tau = c(\beta_1 - \beta_2)$$

Since $c > 0$ and $\beta_i > 0$ the transfer will cause an increase (decrease) in the total provision of the public good if $\beta_1$ is larger (smaller) than $\beta_2$. If $\beta_1 = \beta_2$ the transfer will have no net effect on the total provision of the public good. Recall from (17) that $\beta_i = f^i_2/(f^i_1 + f^i_2)$. $\beta_i$ is a measure of how impurely altruistic consumer i is. If consumer i derives no enjoyment for contributing ($f^i_2 = 0$) then $\beta_i = 0$. The more enjoyment the consumer derives from contributing (the higher $f^i_2$) the higher $\beta_i$ is.

To understand why transferring income to the less impurely altruistic consumer would increase private provision suppose that consumer 2 was purely altruistic ($\beta_2 = 0$) but consumer 1 was impurely altruistic ($\beta_1 > 0$). Since consumer 1 sees government provision and her own contribution as imperfect substitutes she will increase her allocation when the government increases the tax levied on her. On the other hand, consumer 2 sees government provision and his contributing as perfect substitutes. Therefore, when the government reduces his tax by some amount he will increase his contribution by the same amount leaving his allocation unchanged. Private provision will increase as a result of consumer 1 increasing her allocation and consumer 2 not changing his.

The government can therefore increase private provision by taxing the more impurely altruistic consumer and transferring the money to the less impurely altruistic consumer (using a tax credit or a lump-sum payment). From Proposition II an increase in the tax levied on consumer i will reduce her utility in the short-run. Nonetheless, shifting income to the less impurely altruistic consumer will increase the total provision of the public good and will shift the community to a higher-contributions equilibrium in the long run. Although we cannot make any direct conclusions about how consumers utility will be affected we can conclude that in the long run consumers will enjoy a higher total provision of the public good and will derive more utility from contributing. Therefore, it is possible that a redistribution of income will leave all the consumers better off in the long run.

This paper expands our perspective on the role of governments. A community's government should consider both the short-run and the long run ramifications of its fiscal policy. Even when an increase in government provision leaves some consumers worse off in the short-run, in the long run all the consumers may end up better off as their social sentiments improve. Similarly, even though redistributing income between consumers will leave some consumers worse off in the short-run, in the long run all the consumers in the community may potentially benefit from a transfers of income from the more impurely altruistic consumers to the less impurely altruistic consumer.

An increase in government provision would be more effective if the government levies higher taxes on consumers that are more impurely altruistic. Suppose the government chooses a vector of taxes $\mathbf{t}$. From (17) the resulting change in total provision of the public good is:

$$(48) \qquad dY = c \sum_{i=1}^{n} \beta_i d\tau_i \qquad i = 1, \ldots, n$$

Government provision will have a larger effect on the total provision of the public good if it sets a higher tax for more impurely altruistic consumers (consumers with higher $\beta$s). However, from (25), the more impurely altruistic consumer i is (the higher $U^i_2$) the more she would suffer from an increase in the tax levied on her. The community's government therefore faces a dilemma. Levying a higher tax on the more impurely altruistic consumers will lead to a larger increase in the total provision of the public good. However, in the short-run the more impurely altruistic consumers would suffer more from the increase in their tax.

## 5. Summary and Concluding Remarks

There is substantial evidence that consumers have some sort of social sentiments and therefore derive utility from contributing. Although several authors recognized that consumers have social sentiments there is little discussion in the literature on how these sentiments evolve. We assume that public goods play a role in increasing consumers' social sentiment. Public goods tend to facilitate interaction amongst community members and increase their community identity. For instance, a good education system can help members of a community develop important social values and become better citizens. A fair and effective justice system can help members of the community peacefully resolve their conflicts. A recreational park allows consumers to engage group activities that may strengthen their social ties.

We show that given some basic assumptions about consumers' preferences, an increase in consumers' endowments, taxes or social sentiments will increase the total provision of the public good. We also show that, given the assumptions of the model, there exists at least one equilibrium level of social sentiments that the community will converge to. In a two persons community, an increase in one of the consumers' endowments will move the community to a higher-contributions equilibrium and may lead the other consumer to increase his contribution in the long run.

If consumers are impurely altruistic an increase in government provision (via lump-sum income taxes) will not completely crowd out private provision in the short-run. Thus government provision can potentially increase, or crowd in, private provision in the long run by increasing the total provision of the public good and strengthening the social sentiments of the community's members. The government can also increase the total provision of the public good by taxing the more impurely altruistic consumer and transferring the money to the less impurely altruistic consumer. Such a redistribution of income will cause the community to build towards a higher-contributions equilibrium and may increase the welfare of all the consumers in the long run. Additionally, we show that an increase in government provision would lead to a higher increase in the total provision of the public good if the government levies higher taxes on more impurely altruistic consumers.

There are, however, two objections against the government levying a disproportional higher tax on more impurely altruistic consumers. First, impurely altruistic consumers will suffer more from the tax then purely altruistic consumers. Secondly, if consumers knew that the government determined the tax levied on them based on how impurely altruistic they were they would have the incentive to hide their true preferences. In particular, consumers may opt to reduce their contributions since it would signal to the government that they do not derive much enjoyment from contributing.[15]

The paper expands our view on the role of the government. A government should consider both the short-run and the long run effects of its policy on the consumers' social sentiments and welfare. Generally, a government should help the community build by strengthening the social sentiments of its members. The community's government can do so by providing public goods that promote positive interaction between members of the community and raise community pride.

In this paper we assume that there is one public good. However, different public goods serve different purposes. Public goods can be classified into one or more of three categories depending on the purpose that they serve the community. Some public goods such as public parks and roads are directly consumed by members of the community. Other public goods such as charity and biodiversity are not directly consumed by most of the community's members but consumers may still derive utility from contributing resources to the provision of those goods because they have some sentimental value. Other public goods such as a justice system help increase consumers' social sentiments by facilitating interaction between consumers and increasing community identity. Logically, many public goods fall under more than one of these categories. Future research can offer additional discussion about how these different types of public goods affect the community and what is the optimal provision of each type of public goods.

**Appendix: A community with multiple equilibria**

Lemma 2 only describes how the [$H^1 = 0$] and [$H^2 = 0$] loci behave at the limits (when $\alpha_1$ or $\alpha_2$ approach infinity and negative infinity) but imposes no restrictions on the characteristics of the loci at finite values of $\alpha_1$ and $\alpha_2$. The [$H^1 = 0$] locus can intersect the [$H^2 = 0$] locus any odd number of times. The two loci must intersect an odd number of time since when $\alpha_1$ approaches negative infinity [$H^1 = 0$] locus must be below the [$H^2 = 0$] locus and when $\alpha_1$ approaches infinity [$H^1 = 0$] locus must be above the [$H^2 = 0$] locus. Assertions A1 and A2 characterizes a community with multiple-equilibria.

If there are multiple equilibria in a given community

(A1) Any equilibrium ($\alpha_1$*, $\alpha_2$*) where [$H^1 = 0$] is higher (has a larger value of $\alpha_2$) than [$H^2 = 0$] at some $\alpha_1'$, $\alpha_1' = \alpha_1^* + \varepsilon$ where $\varepsilon > 0$, is globally stable.

(A2) Any equilibrium ($\alpha_1$**, $\alpha_2$**) where [$H^1 = 0$] is lower (has a smaller value of $\alpha_2$) than [$H^2 = 0$] for a some $\alpha_1'' = \alpha_1^{**} + \varepsilon$ where $\varepsilon > 0$, will have saddle stability.

Assertions (A1) and (A2) follow immediately from the dynamics of the model, which are explained in the proof for Proposition III. Figure 3 illustrates a community with multiple equilibria.

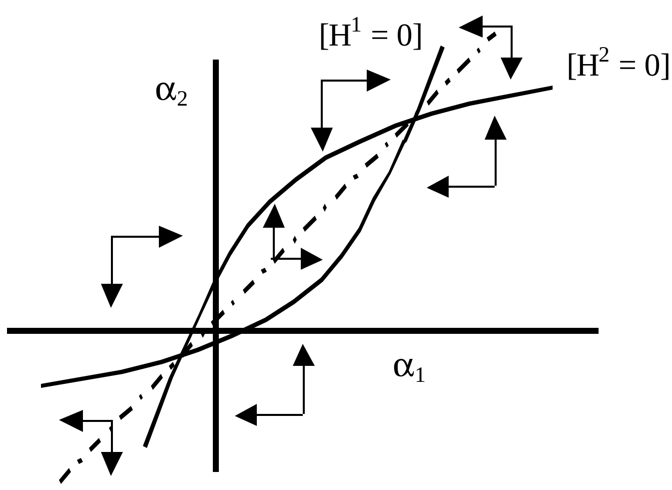


**Figure 3**

If there are three equilibria in the community, the equilibrium with the highest level and the equilibrium with the lowest level of social sentiments are globally stable. The intermediate equilibrium has saddle stability, as shown in Figure 3. (Figure 3 does not show the lowest of the three equilibria.)

Northeast of the intermediate equilibrium social sentiments continue to increase until the community reaches a globally stable, higher-contributions equilibrium. Southeast of the intermediate equilibrium social sentiments will continue to decline until the community reaches a new globally stable, lower-contributions equilibrium.

A temporary increase (decrease) in endowment or government provision will shift the [$H^1 = 0$] locus up (down) and shift the [$H^2 = 0$] to the right (left). If the community is on an equilibrium with saddle stability, a temporary (one time) increase in either of the consumers' endowments or in government provision will cause the community build to a higher-contributions equilibrium. Conversely, a temporary decrease in either of the consumers' endowments or in government provision will cause the community to deteriorate towards a lower-contributions equilibrium. Therefore, if the community is on an equilibrium with saddle stability the government can potentially 'jump start' the community on a dynamic path towards a higher-contributions equilibrium by temporarily increasing government provision.

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[1] We cannot observe changes in consumers' social sentiments directly. However, we can infer that a consumer's social sentiment increases if she increases her contribution when all other exogenous variables remain constant. As shown in section 2, an increase in a consumer's social sentiment will lead her to increase her contribution.
[2] The utility function will be quasiconcave if and only if its bordered Hessian matrix is negative semi-definite.
[3] Andreoni (1989) notes that as long as we assume that $\lim_{s_i \to 0} U^i_2 = \infty$ than an impurely altruistic consumer will always choose to make a positive contribution.
[4] The term impurely altruistic is not synonymous with selfish nor is the term purely altruistic synonymous with selfless. A purely altruistic consumer only derives utility from the consumption (or provision) of public goods while an impurely altruistic consumer also derives enjoyment from her contribution to the provision of public goods.
[5] Andreoni (1989) shows the effect of changes in the tax levied on consumer i on the total provision of the public good. We also show the effects of changes in consumer i's endowment and social sentiment on the total provision of the public good.
[6] Some of the results of the dynamic model also generalize to n identical consumers (consumers with identical preferences and an identical endowments). For instance, our conclusions about the effects of changes in government provision still hold for n identical consumers as long as the provision is financed by a proportional tax. On the other hand, we cannot guarantee the existence of an equilibrium when income is redistributed since after the redistribution the consumers will no longer be identical (they will have different disposable incomes).
[7] With one composite public good we can think of an increase in the total provision of the public good as an increase in the quantity or an increase in the quality of public goods.
[8] Assumption v implies that if consumer i's social sentiment increases then the total provision of the public good must also be higher to keep consumer i's social sentiment constant over time. To see why this is the case let $(Y', \alpha_i')$ be some combination of Y and $\alpha_i$ such that $H^i(Y', \alpha_i') = 0$. Given assumptions iv and v, in order to maintain $\alpha_i$ constant over time, that is have $H^i(Y, \alpha_i) = 0$, we must have a higher level of Y for a higher level of $\alpha_i$.
[9] This assumption is also made by Van Dijk and Van Winden (1997).
[10] Both consumers would contribute a positive amount to the provision of the public good even when their social sentiments are zero because their utility function is quasi-concave over the total provision of the public good by assumption ii.
[11] We can determine the direction of the shift in the $[H^1 = 0]$ locus by establishing how $\alpha_2$ must change when Y increases. Since $H^1(Y(\mathbf{w}, \mathbf{t}, \mathbf{a}), \alpha_1) = 0$ along the $[H^1 = 0]$ locus, then if Y increases for some reason than $\alpha_2$ must decrease to in order to keep $Y(\mathbf{w}, \mathbf{t}, \mathbf{a})$ constant. Therefore, an increase in endowment or taxes will shift the $[H^1 = 0]$ locus down (or outwards). Similarly, since $H^2(Y(\mathbf{w}, \mathbf{t}, \mathbf{a}), \alpha_2) = 0$ along the $[H^2 = 0]$ locus then if Y increases $\alpha_1$ must decrease (thus shifting the locus to the left or outwards) to keep Y the same.
[12] We cannot conclude how consumers' utility is going to change in the long run as a result of changes in government policy because the consumers' preferences change as their social sentiments evolve. However, we can conclude that the consumers' welfare increase if their utility in the long run is higher than before the change in government policy regardless of whether they have the old level of social sentiments or the new level of social sentiments. In other words, a consumer's welfare clearly increases if she prefers the new levels of the private good, public good and contribution even if her social sentiment does not change. This may be case if the public good is under-provided in the short-run since the total provision of the public good will increase in the long run.
[13] This assertion was made, but not proven, by Andreoni (1989).
[14] From (16) $\partial Y/\partial wi = c\gamma_i$ where $\gamma_i = f^i_1/(f^i_1 + f^i_2)$. If we reduce consumer 1's income by dw and transfer the amount as a lump-sum payment to consumer 2 the net effect on Y would be $c[f^2_1/(f^2_1 + f^2_2) - f^1_1/(f^1_1 + f^1_2)]dw$. Adding and subtracting 1, $dY/dw = c[(1 - f^1_1/(f^1_1 + f^1_2)) - (1 - f^2_1/(f^2_1 + f^2_2))]$ Simplifying, $dY/dw = c(\beta_1 - \beta_2)$. This result is identical to (47).
[15] If the two consumers are identical in all respects except for their marginal utility from contributing, the consumer with the higher marginal utility from contributing would choose a higher level of contribution.