Wasteful government, tax evasion, and the provision of public goods

Gareth D. Myles a,b, *

a Institute for Fiscal Studies, 7 Ridgmount Street, London WC1E 7AE, UK
b Department of Economics, University of Exeter, Exeter EX4 4RJ, UK

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Abstract

The paper considers the question of whether public goods should be provided by the government or through private provision. The results cast doubt upon the role of the government as a provider and suggest instead that it may be better employed as a facilitator of private provision. These arguments are strengthened if consumers can engage in tax evasion or the government is wasteful in its use of resources. The paper also reveals that tax evasion can emerge as the best response to inequitable government policy. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

It is a widely accepted principle that the government should supply public goods. From elementary textbooks onwards, government provision of public goods is cited as the natural response to one of the classic forms of market failure. But why should this be so? The existence of a market failure does not imply that the government can solve it, or that one course of action is necessarily preferable to another. Private individuals willingly contribute significant sums to charities,
many of which are engaged in the supply of public goods. This is true even in areas such as health care where the government makes significant provision of its own. Rather than have the government directly engaged in the provision of public goods, can incentives not be designed to encourage private charity and direct it to appropriate ends? The existence of wastefulness in the operation of government, such as that caused through excessive bureaucracy, could only magnify the benefits of such a policy.

Any assessment of these claims needs to take into account the traditional issues of public finance such as the trade-off between efficiency and equity and the limitations on the information set of the government. This is true both in the evaluation of the success of government provision and in the consideration of alternative mechanisms. In addition to this, it must also be realized that the provision of public goods takes place within the political arena and idealized solutions may fall foul of political realities. The political culture of an economy will influence what the government wants to do, how it tries to do it, and how successful it is. The interplay between the government and the governed must have significant implications for how best to provide public goods.

The purpose of the present paper is to explore some of the interconnections between political culture and the provision of public goods. By moving away from standard assumptions, it aims to provide a re-assessment of the motives for tax evasion and to establish how this interacts with public good provision. It reconsiders the correct balance between the government as a facilitator of private provision and as a provider in its own right. In covering this ground, the paper is linked to several branches of the literature. Much of it is built upon recent developments in the analysis of the private provision of public goods, most especially those of Itaya et al. (1997, 1998). It also utilizes important results from Bernheim (1986), Andreoni (1990) and Boadway et al. (1989). In the tax evasion literature, it has close links with Cowell and Gordon (1988) but there are some fundamental differences between the two. Finally, the results on public good provision relate to the literature that has followed Samuelson (1954).

The paper assumes throughout that the government is benevolent and attempts to maximize social welfare. This may be seen as a generous interpretation of government behavior but it serves two useful purposes. Firstly, it allows comparison of the results here with those elsewhere in the literature thus making clear the role of tax evasion and the wasteful government. Secondly, it provides a benchmark for comparisons with alternative assumptions on the motivation of government. Some comments on this are given in Section 6. However, the fact that the government is well intentioned in trying to work in the interests of the population does not mean that it is beyond reproach. Indeed, one of the major features of the analysis is that the government is characterized as being less efficient than the private sector, which can have a variety of interpretations including those of excessive bureaucracy and corruption. The aim of the paper is to investigate the influence of this inefficiency upon tax policy and the provision of public goods.
One of the surprising results in public good theory, which is explained further below, is that inequality-increasing reallocation of income can raise welfare. This is fundamental to understanding many of the policy conclusions that emerge in this area. For instance, since tax policy is set to benefit the rich at the expense of the poor, tax evasion becomes the natural response of the poor. It can also be undertaken by both rich and poor as a means of lessening the damage inflicted upon the economy by government inefficiency. The analysis also addresses important questions about the knowledge that consumers have about the government and the motives for contributing to public goods. There are various responses that could be adopted to these, but what is done here is to analyze the cases that have the most internal logical consistency.

Section 2 provides a brief discussion of the concept of political culture used in the paper and the manner in which it is incorporated. Section 3 provides definitions and describes some results that are fundamental to the analysis that will follow. Public good provision and tax evasion are analyzed in Sections 4 and 5 for two different forms of preferences. Conclusions are given in Section 6.

2. Aspects of political culture

There are many sides to political culture. At the very least, it encompasses the formal and informal rules that govern the behavior of politicians, the objectives pursued in the formulation of policy and their intentions in providing the public with service. Similarly, it involves the public that the politicians govern, and how they behave and relate to the political system. The two sides interact via the voting process, the setting of laws, regulations, taxes, and the provision of public services. Together, they create the atmosphere or Zeitgeist that determines the extent to which formal rules are respected. Naturally, any modeling of such a complex reality will involve considerable simplification.

The models presented below are certainly guilty of this, but it is to be hoped that they do provide insight into some important aspects of political culture. In fact, they incorporate only three aspects of political culture. On the politicians’ side, the model focuses upon their effectiveness in turning tax payments into public goods. There are numerous reasons why the public sector may be wasteful in comparison to the private sector. The extant political culture may have entrenched excessive bureaucracy as an organizational norm. Such a culture would be characterized by resources being squandered, supporting unnecessary bureaucrats, rather than being turned into socially useful output. Corruption may be endemic, which could see resources siphoned into unintended uses. Furthermore, even when resources are correctly spent, production methods may be inefficient and typified by over-manning and aging capital. So, one notion of political culture is about the resources wasted in the bureaucratic process rather than being productively employed.
The model’s representation of political culture for the governed population has two distinct dimensions. Each person is subject to taxation and the interpretation of political culture is captured by the social acceptability of tax evasion. Expressed differently, the existence of taxation represents a political culture in which the formal rules of society are rejected to some extent. Consumers are also potential private contributors to the provision of public goods. Political culture then involves the degree of voluntary provision to public goods. Contribution captures a political culture where there is a desire to be an inclusive part of society. To some extent, evasion and contribution may seem mutually exclusive but, as shown below, they need not be entirely so.

The remainder of the paper will investigate how these aspects of political culture interact to determine the government’s policy and the consumers’ responses. In particular, a focus is placed on the consequences they have for the tax policy of the government and upon its role in the provision of public goods. This role can be either as a provider or as a facilitator.

3. Definitions and preliminary results

Several specifications of preferences and assumptions on consumers’ information about government behavior will be employed in the following sections. It is the purpose here to provide definitions and discussion of these. Some suggestions about interpretations and appropriate applications are also made.

To fix ideas, consider an economy with a single private good and a single public good. There are \( H \) consumers, each with a fixed income \( M^h \). The consumption of the private good by consumer \( h \) is denoted by \( x^h \) and the contribution to the public good by \( g^h \). Government provision of the public good is denoted \( \Gamma \) and total provision \( \Gamma + \sum_{h=1}^{H} g^h \), by \( G \). The production technology is linear and both the public and private good have a per-unit production cost of one. The consumer prices of the private and public good are \( q_s = 1 + t_x \) and \( q_s = 1 + t_g \), respectively, where \( t_x \) and \( t_g \) are the commodity taxes.

3.1. Preferences

The first distinction that needs to be drawn is between different forms of preferences. As will become clear, preferences have major importance in determining the nature of equilibrium and the policies that should be adopted. The early literature on the private provision of public goods focused on the case in which consumers cared about consumption of the private good and total provision of the public good. In this case, the utility function can be written

\[
U^h = U(x^h, G). \tag{1}
\]
The form of preferences in Eq. (1) will be termed instrumental preferences in what follows. This terminology is adopted because the consumer’s utility is derived solely from the total quantity of the public good and there is no benefit per se from the level of individual contribution.

The implications of this form of preference have been extensively studied and surveys can be found in Cornes and Sandler (1996) and Myles (1995). The most important results are that: the Nash equilibrium reached in the absence of any government intervention is not Pareto optimal; the equilibrium is invariant to reallocations of income that do not alter the set of contributors; any government provision crowds-out private provision on a one-for-one basis; and in large populations only the richest consumer contributes.

Empirical and experimental research has provided conflicting evidence on whether these results hold in practice and this has lead to questions about the appropriateness of this model. It should be observed that the working of the model is dependent upon the provision of each consumer having a non-negligible effect upon the total provision of the public good. This is acceptable when the population is small but cannot be when it is large. It is this property that leads to the most stark conflict between this model and data, since it is an empirical fact that charitable donations are significant even in large populations. These observations point to the conclusion that instrumental preferences are most appropriate for provision problems concerning small populations. When a large population is considered, an alternative model is needed.

To explain contributions in large populations, golden glow preferences have been introduced. With such preferences, a contribution to the public good generates both a benefit from the quantity of the public good and from the act of charity itself. Essentially, contributing makes a consumer feel good about themselves and generates a “golden glow” of self-approval. The form of golden glow introduced by Andreoni (1990) can be written as

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

where the extent of the glow depends on the quantity of the public good contributed.

Such preferences ensure that contributions remain positive in large populations since the golden glow is essentially a private good. Consumers will continue to want this even if their effect on total provision is negligible. Furthermore, neither the crowding-out or invariance results apply in an economy with golden glow preferences. Despite this, the equilibrium will not in general be Pareto optimal since the positive externality of contributions is not taken into account by each consumer.

3.2. See-through

The second distinction between alternative models can be motivated by the question: when a consumer makes a change in consumption plan which alters their
tax payment, are they aware of the response that this will elicit from the
government? If the government is content to run a surplus or a deficit, then it is
not possible to know how it will respond. In contrast, consider a government that
is known to spend all its revenue on the provision of a public good. If a change in
behavior increases revenue, then an increase in public good supply from the
government can be correctly predicted by a well-informed consumer. The converse
is true for a decrease in revenue. The distinction then revolves about how
well-informed consumers are.

When consumers can predict the reaction of the government, we say that the
see-through assumption applies (see Boadway et al., 1989). In a small economy
with a government that is committed to providing the public good, it is hard to
avoid concluding that this assumption must be satisfied. Applying economic
rationality makes it difficult to arrive at any other conclusion. Despite this, it is not
impossible to conceive of a situation in which consumers act in ignorance and do
not fully perceive the consequences of their actions. In such cases, the see-through
assumption can be denied and we say non-see-through holds. When a large
economy is considered, the application of the see-through assumption is not as
critical since the effect of a change in action by a single consumer will only have a
negligible effect upon the government’s behavior. It is then approximately true (in
the same way the competitive assumption can only be approximately true in a
finite economy) that non-see-through holds.

Consequently, the analysis below chooses to pair instrumental preferences with
see-through on the grounds that such preferences are inconsistent with the implicit
large-number assumption of non-see-through. The consequences of golden-glow
preferences are considered under both scenarios. In the see-through case, the effect
of individual provision on total provision is taken into account; with non-see-
through it can be ignored.

3.3. Nonconcavity

At the heart of the private provision model is the choice by consumers of
whether or not they contribute to the provision of the public good. The decision
will depend upon their income level and the contributions of other consumers: if
contributions of others are high or the consumer’s income is low, then noncontri-
bution will be chosen. The possibility of noncontribution is critical since it leads to
nonconcavity of the social indifference curves and hence has major implications
for policy.

This result, which was first shown in Itaya et al. (1997), is now briefly
described. Assume there are two consumers with identical preferences who play a
noncooperative contribution game. Consumer $h$, $h = 1, 2$, has lump-sum income
$M^h$, purchases $x^h$ of the private good and contributes $g^h$ towards the public good.
The budget constraint is

\[ x^h + g^h = M^h. \] (3)
The consumers have identical preferences, which can be expressed in terms of the individual contributions as

\[ U^h = U(x^h, g^1 + g^2). \]  

(4)

The choice of \( h \) is made to maximize Eq. (4) subject to Eq. (3), taking the decision of the other as given. The solution of this optimization is expressed by

\[ x^h = x(M^h, g^h) > 0, \quad g^h = g(M^h, g^h) \geq 0, \quad h \neq \bar{h}. \]  

(5)

The Nash equilibrium level of contributions is found by simultaneously solving the public good reaction functions, \( g(M^h, g^h) \), to give

\[ \hat{g}^h = \hat{g}(M^h, M^h) \geq 0, \quad h = 1, 2, \quad h \neq \bar{h}. \]  

(6)

Substituting Eq. (6) into Eq. (5) determines consumption of the private good and labor supply. The level of utility attained by consumer \( h \) at the Nash equilibrium is

\[ U^h = U(\bar{x}(M^1, M^2), \hat{g}(M^1, M^2) + \hat{g}(M^2, M^1)). \]  

(7)

The Inada conditions ensure at least one of the consumers will contribute towards the public good and the identical preferences imply this must be the consumer with the highest lump-sum income. A pair of income levels \( (M^1, M^2) \) will make noncontribution by consumer 1 an equilibrium strategy if \( \hat{g}(M^1, M^2) = 0 \). This requires

\[ M^1 \leq x^2 = M^2 - g^2. \]  

(8)

so the total income of consumer 1 is less than or equal to the amount spent on the private good by consumer 2. Noncontribution therefore arises when there are significant income differentials between the consumers. Given a value of \( M^2 \), there will be a unique value of \( M^1 \) at which 1 ceases contributing. From this, define the function \( \nu(M^2) \) where \( \nu(M^2) \geq M^1 \) implies \( g^1 = 0; \nu(M^2) \) is strictly increasing in \( M^2 \). Symmetrically, if \( \nu(M^1) \geq M^2 \) then \( g^2 = 0 \).

The next result is taken from Itaya et al. (1997).

**Lemma 1.** If \( \nu(M^2) \leq M^1 \) and \( \nu(M^1) \leq M^2 \) then \( \bar{x}(M^1, M^2) = \bar{x}(M^2, M^1), \) \( \hat{g}(M^1, M^2) + \hat{g}(M^2, M^1) = G(M^1 + M^2), \) and \( U^1 = U^2 \). Furthermore, \( W = U^1 + U^2 \) is constant as income is redistributed within the specified limits.

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1 Throughout the paper, the utility function is assumed to be strictly concave, strictly increasing in private good and public good consumption, strictly decreasing in labour supply and twice continuously differentiable. It is assumed to satisfy the Inada conditions so that a positive quantity of both goods must be consumed at equilibrium. Both goods are also normal.
Fig. 1. Social indifference curves.

Consider now the gradient of the social indifference curve as it crosses the locus $M^2 = \nu(M^1)$. Using the conditions for optimal consumer choice and the budget constraints, the gradient of the indifference curve defined by Eqs. (11) is

$$\frac{dM^2}{dM^1} = -\frac{U_i^2 + U_G^2 \frac{\partial g^1}{\partial M^1}}{U_G^1}.$$  (9)

where the superscripts denote consumers (the marginal utilities are different within exterior region 1) and the subscripts on $U$ denote partial derivatives. Taking the limit of Eq. (9) as $M^2 \to \nu(M^1)$ from below, and consumer 2 reaches the margin of contributing, gives

$$\frac{dM^2}{dM^1} \bigg|_{M^2 = \nu(M^1)} = -\left(1 + \frac{\partial g^1}{\partial M^1}\right).$$  (10)

since the marginal utilities are equated when they are evaluated at $M^2 = \nu(M^1)$. As $(\partial g^1/\partial M^1) > 0$, Eq. (10) shows that the social indifference curve is kinked downwards as it crosses the $M^2 = \nu(M^1)$ locus; similarly it is also kinked as it crosses the locus $M^1 = \nu(M^2)$. The social indifference curves thus have the structure shown in Fig. 1.

The key fact is that the onset of noncontribution introduces kinks into the social indifference curves so the social welfare function is a nonconcave function of income.\(^2\) This nonconcavity arises because of the change in the nature of the game

\(^2\) This nonconcavity is present for more general social welfare functions and for heterogeneous preferences See Itaya et al. (1997) for further discussion of this result.
between the consumers when the corner solution is reached. The remaining contributor can no longer free-ride on the other, which provides an incentive for raising their contribution. From an economic perspective, it results in inequality being desirable since gains in welfare can be achieved by choosing an income allocation beyond the kink. This leads to further surprising conclusions when policy is analyzed.

4. Public good provision

The standard working assumption – that the consumers are engaged in a Nash contribution game with each maximizing utility taking the contributions of the others as fixed – is maintained throughout. What is different from existing treatments is that the government can levy taxes and supply the public good — if it wishes to do so. In addition, political culture in the form of tax evasion and inefficiency of government are also considered. The intention is to relate the optimal mix of government and private contribution to the public good to political culture.

4.1. Perfect political culture

As a baseline case, the situation of ‘‘perfect political culture’’ is studied first. By this it is meant that the government is as efficient as the private sector in providing public goods and that consumers never consider the possibility of tax evasion. These restrictions are gradually relaxed in later sections.

Under the see-through assumption, it is clear that Bernheim’s (1986) equivalence result applies. That is, if all consumers contribute towards provision of the public good, the equilibrium of the provision game is independent of any tax system, which does not change the set of contributors. To show this, denote the income tax function by $T(M^h)$ so the budget constraint of $h$ is

$$M^h - T(M^h) = q_x x^h + q_y y^h.$$  

(11)

Government provision of the public good is

$$\Gamma = \sum_{h=1}^{H} [T(M^h) + (q_x - 1)x^h + (q_y - 1)y^h].$$  

(12)

Using Eqs. (11) and (12), total provision of the public good is

$$G = \sum_{h=1}^{H} k^h = \sum_{h=1}^{H} [M^h - x^h].$$  

(13)

In response to a change in tax rates, the consumers can reallocate their expenditures between the public and private goods so as to keep $x^h$, and hence $G$. 


constant. Any change in government provision is simply offset by an opposite change in private — which is only possible if all are contributors. The equilibrium established under one tax system can then be maintained under any other. The consequence of this equivalence result is that within the region where all consumers contribute, tax policy is redundant. Its only effect is to vary the mix between government and private provision but it leaves the total provision unchanged.

Now assume that some consumers do not contribute and choose the labeling of consumers so that \( g_h = 0 \) for \( h = 1, \ldots, \eta \). Then

\[
G = \sum_{h=1}^{\eta} T(M^h) + \sum_{h=\eta+1}^{H} M^h - \sum_{h=1}^{H} x^h + q_s \sum_{h=1}^{\eta} x^h = \sum_{h=1}^{H} [M^h - x^h].
\]

as before. What is now different is that the consumers who do not contribute cannot change their contribution to maintain the constancy of \( x^h \) as the tax system changes. For \( h = 1, \ldots, \eta \)

\[
x^h = \frac{M^h - T(M^h)}{q_s},
\]

which is determined directly by the tax system. Consequently, when there are noncontributors, the Bernheim equivalence result breaks down and tax policy can affect the equilibrium.

Following these preliminaries, it is now possible to analyze the question of the optimal division of provision. It should be noted here that the inefficiency of the Nash equilibrium is due to an externality that would be cured if the correct pricing could be obtained. Although income reallocation may raise the level of welfare (recall the discussion of the nonconcavity in Section 3), it is not the solution to the failure of efficiency. Income distribution therefore has a secondary role in the analysis of policy. Consequently, the focus here is placed upon the effect of commodity taxation and its function in raising welfare. This emphasis is further supported by the analysis of Itaya et al. (1998), which shows that because of the see-through assumption, all linear tax systems are equivalent to a tax on the private good alone.

Hence assume that the tax on the private good is denoted by \( t \), so \( q_s = 1 + t \), that the public good is untaxed, so \( q_g = 1 \), and that no income tax is levied. When \( t = 0 \), the public good is entirely privately provided; as \( t \) increases, so does the government provision. The decision problem of the government is to choose this tax rate to maximize a utilitarian social welfare function.\(^3\) In doing so, the

\(^3\) The assumption that the social welfare function is utilitarian is not critical.
government must take into account the fact that the decision of a consumer on whether or not to be a contributor is endogenously determined by the tax rate. As the tax rate changes, so does the set of contributors.

To describe the solution to the government’s tax rate optimization, the approach is taken of characterizing what happens as the tax rate is raised from zero upwards. Choosing the labeling of the consumers so that \( M^1 < M^2 < \ldots < M^H \), Theorem 1 relates the level of welfare to the tax rate.

**Theorem 1.** Assume that \( g^h > 0 \) for all \( h \) when \( t = 0 \). Then there is a tax rate \( t^1 > 0 \) such that (i) welfare is constant for \( t \in [0, t^1] \); (ii) consumer 1 ceases contributing at \( t^1 \); and (iii) the right derivative of social welfare (with respect to \( t \)) is positive at \( t^1 \).

**Proof.** Since all consumers are contributors when the tax rate is zero, the equivalence result applies for the range of taxes up until one of the consumers decides to become a noncontributor. Let the tax rate at which this happens be denoted \( t^1 \). Then it follows that social welfare is constant on the range \([0, t^1]\). It is straightforward to show that the first consumer to decide to become a noncontributor is the lowest-income consumer. To see this, note that with all contributing, the solution to the Nash game is dependent on \( t \) alone, so \( x^h = x(t) \), again employing the fact that consumption levels are the same for all contributors. Noncontribution begins when \([1 + t]x(t) = M^h\), which must happen first for the lowest-income consumer.

When consumer 1 has ceased contributing, the social welfare function is

\[
W = U \left( \frac{M^1}{1 + t}, \frac{tM^1}{1 + t} + \sum_{h=2}^{H} M^h - \sum_{h=2}^{H} x^h \right) \\
+ \sum_{i=2}^{H} U \left( x^i, \frac{tM^1}{1 + t} + \sum_{h=2}^{H} M^h - \sum_{h=2}^{H} x^h \right). 
\]  

Taking the derivative of Eq. (16) with respect to \( t \), using the envelope theorem for individual choice and evaluating at \( t^1 \) gives

\[
\frac{\partial W}{\partial t} \bigg|_{t^1} = [H - 1]U' \left( \frac{M^1}{[1 + t]^2} - [H - 1] x' \right). 
\]  

The term \( x' \) can be evaluated by returning to the Nash game being played. The contributors each solve

\[
\max_{(x^h)} \left( x^h, \frac{tM^1}{1 + t} + \sum_{h=2}^{H} M^h - \sum_{h=2}^{H} x^h \right). 
\]
Since the solution is symmetric between the contributors (so all $x^h = x$ for all $h$), the first-order condition can be used to calculate

$$x^* = -\frac{M^1}{[1 + t]^2} \left[ \frac{U_{xG} - U_{GG}}{U_{xx} - HU_{xG} + [H - 1]U_{GG}} \right].$$

(19)

Substituting Eq. (19) into Eq. (17) gives

$$\frac{\partial W}{\partial t} = -\frac{[H - 1]U_G M^1}{[1 + t]^2} \left[ \frac{U_{xG} - U_{GG}}{U_{xx} - HU_{xG} + [H - 1]U_{GG}} \right],$$

(20)

which is positive under standard assumptions on preferences.

Theorem 1 shows that the gradient of social welfare as a function of the tax rate is zero until $t^1$ (this is the region where the equivalence result holds) and then is kinked upwards at this tax rate. The source of this kink has already been identified in Section 3. Its existence shows that social welfare must be greater for some tax rates above $t^1$ than it is for those below. Hence it is always optimal to set a tax rate that forces the lowest-income consumer to become a noncontributor.

The argument of Theorem 1 can be extended to prove that the social welfare function is kinked upward each time a critical tax rate is reached at which a further one becomes a noncontributor. Although welfare is locally higher to the right of each kink than it is to the left, this does not imply that all consumers should be forced into noncontribution. The reason for this is that the gradient prior to the kink may be negative, i.e., social welfare may reach a maximum between a pair of kinks. These two possibilities are illustrated in Fig. 2.

The most important conclusion from this section is that the see-through assumption supports government provision. The reason for this is that the ability

![Fig. 2. Social welfare.](image-url)
of consumers to see what the government is doing allows them to undo its
endeavours — provided all are contributing. The increase in the tax rate that
forces some to be noncontributors then makes it impossible for them to respond to
government behavior and this allows the government to influence the economy.
Therefore, government provision of the public good is justified. Since some
crowding-out must occur, the region of equivalence is left and the tax system will
be distortionary. It is worth noting one further result. Even though incomes are
fixed, the first-best cannot be attained in this model. This arises because the
marginal rates of substitution for those consumers crowded out cannot be manipu-
lated by the use of a single tax instrument in a sufficient way to obtain efficiency.

The important observation for understanding the results of Section 4.2 is that
the optimal tax system chosen by the government is damaging for the low income
consumers. Their utilities are unaffected within the region of equivalence but once
they cease contributing, any further tax increase simply lowers their private
consumption. This is offset to some degree by increased provision of the public
good, but their utilities do fall. Hence it is natural that they should look for some
way to alleviate this — and tax evasion is one obvious possibility.

4.2. Tax evasion

As a first step towards understanding how political culture might affect these
conclusions, this section will introduce the possibility of tax evasion. The standard
Allingham and Sandmo (1972) model of tax evasion is used in which each
consumer has to decide how much of their income to declare to the government. If
they make a false declaration, there is a fixed probability that they may be
detected. In addition, each consumer must also choose the extent of their contribu-
tion to the public good. These decisions are made to maximize expected utility.

Denote by $M^h$ net income (after taxes) when evasion is successful and by $M^c$
net income (after taxes and fines) when the taxpayer is caught evading. If the
declaration is $X^h$, the income tax rate $\tau$, and the fine rate $f > 1$, then

$$ M^e = M^h - \tau [X^h - g^h], $$

and

$$ M^c = M^h - \tau [X^h - g^h] - f\tau [M^h - X^h], $$

where it has been assumed that the contribution to the public good is tax
deductible and is made prior to the resolution of the uncertainty about successful
evasion. These income levels imply that the level of consumption of the private
good when evasion is successful is

$$ x^e = \frac{1}{1 + f} \left[ M^h - \tau X^h - \left[ 1 - \tau \right] g^h \right]. $$
and when the evader is caught
\[ x^h = \frac{1}{1 + \tau} \left[ (1 - f \tau) M^h - \tau (f - 1) X^h - [1 - \tau] g^h \right]. \tag{24} \]

Although the private contributions to the public good are unaffected by whether a taxpayer is caught or not, the total amount of the public good provided is affected. It is assumed that the revenue from both the taxes and the fines are turned into public good and the latter will vary depending on the number of tax evaders caught. Given the externality between consumers via the public good, the utility of each consumer is then dependent upon whether the other consumers are subject to fines or not. So, with a population that is too small to apply the law of large numbers, expected utility can only be evaluated by taking into account each possible combination of consumers being caught or evading successfully. This complication is consequence of taking the small number model literally.

In order to prove some concrete results, it is best to assume that there are just two consumers. Labeling the consumers 1 and 2, the four events that can arise are:

- ee: both evade successfully, probability \([1 - p][1 - p]\);
- ec: 1 evades successfully, 2 is caught, probability \([1 - p]p\);
- ce: 1 is caught, 2 evades successfully, probability \(p[1 - p]\);
- cc: both are caught, probability \(pp\).

Using these, the expected utility of consumer 1 is given by
\[
EU^1 = [1 - p]^2 U(x^h_1, G_{ee}) + [1 - p] p U(x^h_1, G_{ec}) + p[1 - p] U(x^h_1, G_{ce}) + p^2 U(x^h_1, G_{cc}). \tag{25}
\]
The public good contribution and the level of evasion are chosen to maximize this, taking into account the relations in Eqs. (21)–(25) and taking as given the choices of the other consumer.

The first theorem of this section now follows.

**Theorem 2.** If both the consumers choose to make contributions to the public good, then there is no tax evasion. That is, if \(g^h > 0, h = 1,2\) at the Nash equilibrium, then \(X^h = M^h, h = 1,2\).

**Proof.** If \(g^h > 0\), the first-order condition for the choice of contribution must hold with equality. Using this, the derivative of expected utility with respect to declaration reduces to
\[
\frac{\partial EU^1}{\partial X} = [p[1 - p][U^1_{ic} - U^1_{i_G,ic}] + pp[U^1_{ic} - U^1_{i_G,ic}]] \frac{\tau f}{1 + \tau}. \tag{26}
\]
Evaluating this at $X^h = M^h$, $h = 1, 2$ implies that $U^{1}_{za} = U^{1}_{cza} = U^{1}_{z}$, $z = x, G$ so

$$\frac{\partial EU^1}{\partial X} = \left[ p[U^1_U - U^1_U] \right] \frac{\tau f}{1 + r}. \quad (27)$$

But evaluated at $X^h = M^h$, $h = 1, 2$ the first-order condition for the contribution implies $U^1_U = U^1_U$, hence $\partial EU^1 / \partial X = 0$ and the theorem is proved.

The explanation for this theorem is straightforward. Tax evasion has the effect of leading to different incomes and public good provision in each state. Since the utility function is concave, this is not an optimal allocation. In the standard model, the extra income obtained when evasion is successful more than offsets this, making evasion worthwhile. What is different here is that successful evasion lowers government public good provision, which further unbalances the allocation between the four events. It does this to such an extent that evasion is just not desirable.

Returning to the main theme, the consequence of Theorem 2 is that this model has exactly the same properties as that without evasion, up until the first consumer becomes a noncontributor. The Bernheim equivalence result applies, and the equilibrium is independent of taxes until they reach a sufficiently high level. If the rate of income tax is held fixed and the commodity tax is increased, it also follows that there is also an upward kink in the welfare function at the critical tax level. This claim can be demonstrated by taking the derivatives of the utility functions with respect to the commodity tax rate when only consumer 2 is a contributor and evaluating at the critical tax rate. Since there is no evasion at the critical tax rate, the limiting values of the derivatives are just as they were for Lemma 2 and the same arguments apply.

Once the critical tax rate is passed, the focus of interest becomes the evasion behavior of consumer 1. To see what is involved, note that the derivative of expected utility with respect to declaration is

$$\frac{\partial EU}{\partial X^1} = \frac{\tau f}{1 + r} \left[ p[1 - p][U^1_{za} - U^1_{cza}] + p^2[U^1_{cza} - U^1_{cza}] \right]$$

$$+ \frac{\tau}{1 + r} \left[ (1 - p)^2[U^1_{za} - U^1_{za}] + (1 - p)p[U^1_{cza} - U^1_{za}] \right]$$

$$+ p[1 - p][U^1_{za} - U^1_{za}] + p^2[U^1_{cza} - U^1_{za}]. \quad (28)$$

Evaluating at $X^1 = M^1$ this reduces to

$$\frac{\partial EU}{\partial X^1} = \frac{\tau}{1 + r} \left[ pf - 1 \right][U^1_x - U^1_x]. \quad (29)$$

But since contributions to the public good are at a corner solution, $U^1_x - U^1_x > 0$. Hence consumer 1 will evade if $pf < 1$, which is the standard condition for tax
evasion to take place. Using the same argument as before, it can also be established that consumer 2 will never simultaneously make a positive contribution to the public good and evade tax, even if consumer 1 is evading.

This reasoning can be summarized as Theorem 3.

**Theorem 3.** For a fixed value of $\tau$, assume that $g^h > 0$ for all $h$ when $t = 0$. Then there is a tax rate $t^1 > 0$ such that (i) welfare is constant for $t \in [0,t^1]$; (ii) neither consumer will evade tax payment if $t \in [0,t^1]$; (iii) consumer 1 ceases contributing at $t^1$; (iv) consumer 1 begins evading tax at $t^1$ if $pf < 1$; (v) the right derivative of social welfare (with respect to $t$) is positive at $t^1$.

The interpretation of the theorem is that the government must choose a tax rate above $t^1$ in order to maximize welfare, otherwise it will have no effect upon the equilibrium. However, by doing this it forces consumer 1 to become a tax evader and to make a false income declaration. This results from the fact that they perceive public good provision to be excessive relative to their private consumption. The additional public good is being provided to meet the tastes of the richer consumer 2 who is still contributing privately after consumer 1 has commenced evading tax.

These results characterize an economy in which the poor consumers are forced into tax evasion with the risk of punishment because a utilitarian government is being driven by the preferences of the rich. Tax evasion here is not an attempt to obtain the public good without paying but rather an attempt to mitigate some of the damage of excessive provision. One issue that arises here is whether the contribution to the public good can be used as a signal of income. But clearly this contains no more information than does the declaration itself, so the situation is no different to a standard analysis of tax evasion.

### 4.3. Evasion and inefficiency

The motivation for tax evasion in Section 4.2 was to try and offset the excessive provision of public goods. Unless taxes are raised so high that all consumers cease contributing towards the public good, this motive can only apply to the lower income consumers. For rich consumers to choose to evade tax, there must be some additional incentive. As will be shown, this can be provided by the government being less efficient than the private sector in the provision of public goods.

Such inefficiency can be modeled by letting each unit of tax revenue generate $8 < 1$ units of the public good whereas a unit of private provision generates the public good on a one-for-one basis. It should be noted that this does not imply that there are no administrative costs etc. in private provision, but only that these are relatively less in the private sector.
The first consequence of inefficiency can be seen by assuming that there is no tax evasion. The level of public good provision (the sum of tax revenue and private provision) is

\[ G = \xi \sum_{h=1}^{H} \left[ \tau \left( M^h - g^h \right) \right] + \sum_{h=1}^{H} g^h, \]  

(30)

where the inclusion of \( \xi \) captures the relative inefficiency of the government. Using the budget constraint of consumer \( h \),

\[ M^h - \tau \left( M^h - g^h \right) = \left[ 1 + \tau \right] x^h + g^h. \]  

(31)

Eq. (30) becomes

\[ G = \sum_{h=1}^{H} \left[ M^h - \left[ 1 + \left( 1 - \xi \right) \tau \right] x^h + \left[ 1 - \xi \tau \right] g^h \right]. \]  

(32)

It is clear from Eq. (32) that the equivalence theorem does not hold in this model. In the previous models, as long as private consumption was held constant as tax policy was changed, with all changes being in the contribution to the public good, the total provision of the public good would not be affected. This is not true here. Even if \( x^h \) is held constant, the variation in \( g^h \) will affect \( G \). This finding is simply a consequence of the differing efficiencies of the government and the private sector.

This model with inefficiency therefore differs from the previous analysis in two ways. Firstly, the failure of equivalence to hold means that taxation will be effective even when all consumers are contributors. Consequently, the flat section of the welfare function will no longer exist. This raises the question of whether the introduction of taxes can improve upon the no-tax equilibrium. Secondly, it opens the possibility that tax evasion and contribution to the public good may coexist — both being motivated by the fact that the government is inefficient.

These questions can be investigated by considering the four outcomes identified in the previous section. The level of public good in each is given by

\[ ee: \quad G_{ee} = \sum_{h=1}^{H} \frac{\xi t}{1 + t} \left[ M^h + X^h \right] + \left[ \xi \frac{t + \tau}{1 + t} \right] g^h. \]  

(33)

\[ ec: \quad G_{ec} = \frac{\xi t}{1 + t} \left[ M^e + X^e \right] + \frac{\xi \left[ f \tau + t \right]}{1 + t} M^2 - \frac{\xi \left[ f - 1 \right]}{1 + t} X^2 \]
\[ + \sum_{h=1}^{H} \left[ 1 - \frac{\xi \left[ 1 + \tau \right]}{1 + t} \right] g^h. \]  

(34)
These can be used to prove the following theorem.

**Theorem 4.** When the government is inefficient, tax evasion and private contribution to the public good can coexist. Furthermore, evasion may occur even when \( pf > 1 \).

**Proof.** Calculating the first-order conditions for maximizing expected utility and evaluating at \( M^h = X^h \) gives

\[
\frac{\partial EU}{\partial X^h} \bigg|_{X^h = M^h} = U^h_X \left[ \tau \left( pf - 1 \right) + \frac{\left[ 1 - \tau \right] \xi \left[ \left( 1 - p \right) t - \rho \tau \left( f - 1 \right) \right]}{1 + t - \xi \left( t + \tau \right)} \right].
\]  

(37)

Evaluating at \( t = 0 \)

\[
\frac{\partial EU}{\partial X^h} \bigg|_{X^h = M^h} = U^h_X \left[ \tau \left( pf - 1 \right) - \frac{\left[ 1 - \tau \right] \xi \rho \tau \left( f - 1 \right)}{1 - \xi \tau} \right].
\]  

(38)

Since this is certainly negative when \( pf < 1 \), it establishes the theorem. ■

The economic interpretation of this finding is that private contributions to the public good will be made because that is the most efficient method of provision. They will also reduce tax liability, which is a further improvement. Tax evasion will take place as another means of avoiding the inefficiency of government provision. In fact, the theorem shows it will occur even in cases where it would not be beneficial without the existence of the public good. So in this way, government inefficiency is an incitement and incentive to evade.

These observations raise the question of whether this inefficiency implies that the government should not intervene at all in the economy. It has two instruments at its disposal: the income tax to finance the public good and the commodity tax to adjust relative prices. Using the first leads to tax evasion and any revenue raised is spent inefficiently so it would seem a very poor policy tool. The second may have more success, but this is by no means certain. The earlier results show that a simpler framework can now be adopted. Since the inefficiency eliminates the
region of equivalence, income differentials are not as significant as they previously were. This allows the two incomes to be set equal without much loss of content. Having done this, the symmetry of the equilibrium can be exploited.

The analytical procedure is to assume that \( p > 0, f > 0 \) and to consider the effect upon welfare of the introduction of income and commodity taxes from an initial position with \( \tau = \iota = 0 \). Doing this gives

\[
\frac{\partial U}{\partial \tau} \bigg|_{\tau=0} = U_0 M \left[ g \left(1 - 2 \xi \right) + M \left[ 1 - 2 \xi f \right] - 4 M \xi + \frac{\partial g}{\partial \tau} \right], \tag{39}
\]

and

\[
\frac{\partial U}{\partial \xi} \bigg|_{\tau=0} = U_0 M \left[ g \left(1 - 2 \xi \right) - M \left[ 1 - 2 \xi f \right] + \frac{\partial g}{\partial \tau} \right]. \tag{40}
\]

From Eqs. (39) and (40), it cannot be concluded that the introduction of the taxes will always reduce welfare despite the previous arguments. The possibility exists that they will, but there is no stronger conclusion available. This is partly due to the fact that the comparative statistics analysis is unable to restrict the values of \( \frac{\partial g}{\partial \tau} \) and \( \frac{\partial g}{\partial \tau} \), even under the symmetry assumption. It is also partly due to the ways in which the taxes affect behavior. For example, the income tax encourages evasion and generates revenue that is spent inefficiently. Both tend to reduce welfare. But it also raises the value of the tax-deductibility of private provision that raises welfare as it offsets the basic inefficiency.

In summary, it has been shown that the introduction of taxes will induce tax evasion and lead to inefficient use of revenue by the government. Despite this, it cannot be demonstrated that they are always detrimental. Since the initial position is not Pareto optimal, the possibility remains that the taxes can raise welfare by reducing this sub-optimality despite their other negative consequences.

5. Golden glow

The golden glow model has received increasing attention since its introduction by Andreoni (1990). As noted in Section 3, the important property of this model is that a contribution to the public good generates a private utility benefit, in addition to any return derived from increased provision of the public good. This private benefit is motivated through feeling good about the act of contributing. The important property of the model is that it gives a reason for contribution even in a large population when the marginal effect of an individual contribution is negligible.

5.1. See-through

The analysis of see-through is conducted for the case of perfect political culture. The benefit of this is that the outcome is very clear and can easily be
extended to cover the cases of tax evasion and inefficient government. In contrast to the analysis of instrumental preferences, it is assumed that the government levies taxes (or subsidies) upon both the private and public good. This change is necessitated by the fact that the golden glow derived from contributions to the public good is essentially a private good in the consumer’s utility function. The argument that its price does not matter with see-through can therefore not be applied.

Under the see-through assumption, the derivations used in Section 4 show that total supply of the public good will again be given by Eq. (13). The equilibrium of the private provision game is given by a demand for the private good of the form \( x^h = x^h(q_s, q_G) \). The important aspect of the golden glow is that, in contrast to the model without this, noncontribution to the public good will not necessarily arise when income differentials increase. The reason for this is that the golden glow is essentially a private good and which a consumer may not wish to see become zero. Although contributions could be zero under other assumptions, it will be assumed for the present that they are not. A formal justification for this position would be to assume that the utility function satisfies the Inada conditions.

With quantity golden glow and see-through, social welfare can be written as

\[
W = \sum_{h=1}^{H} U(q_s, q_G) \sum_{j=1}^{H} \left[ M^j - x^j(q_s, q_G) \right] \frac{M^h - q_s x^h(q_s, q_G)}{q_G},
\]

(41)

The nature of the policy resulting from the maximization of Eq. (41) can be derived by considering the effect of a variation in the price of the public good upon social welfare. Differentiating Eq. (41) and employing the envelope theorem,

\[
\frac{\partial W}{\partial q_G} = - \sum_{h=1}^{H} U_g(h) \sum_{h' \neq h} \frac{\partial x^{h'}}{\partial q_G} - \sum_{h=1}^{H} U_g(h) \frac{M^h - q_s x^h}{q_G} < 0,
\]

(42)

if \((\partial x^{h'})/(\partial q_G) > 0\). Consequently, a reduction in the consumer price of the public good always raises welfare.

The mechanism that is operating here is that a subsidy to the public good allows private contributions to be increased. This generates more of a golden glow. The resulting reduction in revenue for the government implies that it makes a smaller contribution to the public good. However, total supply of the public good actually rises since consumption of the private good falls. This result is a variant on that found in Andreoni (1990).

To incorporate the above reasoning into an optimal policy, account must be taken of the fact that the government’s budget must be balanced. Clearly, since more government supply has no direct effect on welfare but only an indirect cost via the higher taxes needed to finance it, there should be no government supply of
the public good. So, with quantity golden glow and see-through, all public goods should be privately provided. The intuition behind this conclusion is that private provision generates both a private and public return whereas public provision does not provide the private return. It is therefore always best to use the tax system to encourage private provision rather than to fund public provision. Despite the efficiency of the government, these arguments show that it should not be involved in the provision of public goods.

To illustrate the nature of optimal pricing, assume that there are two consumers with identical incomes. In this case the optimal prices satisfy

$$q_s - q_G = \frac{U_s q_s}{U_g}.$$  \hspace{1cm} (43)$$

Using the first-order condition for consumer choice, $U_s - U_G - \left[\frac{q_s}{q_G}\right]U_g = 0$, Eq. (43) becomes

$$U_s - U_G - 2U_g = 0,$$ \hspace{1cm} (44)$$

which is the optimality condition for this economy. Therefore, if there are no income differentials, the commodity taxes can achieve efficiency even if there is a golden glow from contributions.

The implications of these results for the case of tax evasion and government inefficiency are easily found. It has already been concluded that there should be no government provision since this merely reduces private provision and lessens the golden glow. This argument can only hold even more strongly when there is inefficiency in government provision. Similarly, the revenue from an income tax would be used to subsidize private provision rather than to finance public. Hence it can only be of value if the extra subsidy provides more than offsets its direct loss of welfare and the added inefficiency of tax evasion. If all consumers had equal incomes, then it can only reduce welfare. For it to have any beneficial effect there must be significant income differentials and even then it can only raise the welfare of the low-income consumers.

5.2. Non-see-through

With non-see-through the consumers take as given the aggregate quantity of public good. Any private contribution they make has a negligible effect upon this, so it is made only for the return it provides in the form of the golden glow. This has the consequence that the aggregate quantity is independent of whether tax evasion is successful or not, which reduces the analysis to just two states of the world. The analysis is further simplified by assuming that the golden glow part of utility is separable from the consumption component.
Under these conditions, the first-order condition for the choice of $X$ is given by
\[
\frac{\partial EU}{\partial X} = -[1 - p]U_x + p[f - 1]U_x = 0. \tag{45}
\]
Evaluating $\frac{\partial EU}{\partial X}$ at $X = M$ shows that the standard condition for evasion, $pf < 1$, is satisfied in this model. The equivalent conditions for the choice of private contribution is
\[
\frac{\partial EU}{\partial g} = U_g - \left[1 - \tau\right] \frac{q_g}{q_s} pf U_x = 0. \tag{46}
\]
These necessary conditions can be used to address the question of how the level of evasion and the amount of private provision are affected by the prices $q_s$ and $q_g$. This will give an insight into the constraints that are faced by any policy attempting to correct for the inefficiencies in this economy.

**Theorem 5.** If $\frac{\partial}{\partial x}(U_{x}/U_x) < 0$, then $\frac{\partial X}{\partial q_s} \geq 0$, and if in addition, $q_s + (\frac{U_{x,s} x_s}{U_x}) > 0$ then $\frac{\partial X}{\partial q_s} \geq 0$.

The important observation to make here is that an increase in either price discourages evasion because the incentive for evading is reduced. The consequence of this is that it reduces the incentive for policy to subsidize the cost of contributing to the public good (observe that in Eq. (43) the optimal price for the public good is less than that for the private good). However, it must still remain the case that the government should not supply the public good but should act only to provide incentives for individuals to do so for themselves.

How these features interact in the determination of the optimal taxes can be investigated using the following simple example. Let the utility function be given by
\[
U = \log x + \log g + \log G. \tag{47}
\]
With these preferences, the optimal value of $X$ and $g$ are
\[
X = \frac{M}{2} \left[ pf - 1 + 2\tau f - \tau \left[1 + pf\right]\right], \quad G = \frac{M}{2q_s}. \tag{48}
\]
Using the fact that the government must earn zero revenue, and solving the optimization of welfare gives
\[
q_s = \frac{3}{2[f - 1][1 + \tau]}, \tag{49}
\]
and
\[
q_s = \frac{3f[1 - \tau][1 + p[ pf - 2]]}{[f - 1]^2[1 + \tau]}. \tag{50}
\]
From Eqs. (49) and (50), it can be seen that an increase in $f$ or $p$ reduces the price of the public good relative to that of the private good. This shows that as tax evasion is reduced (since both also increase $X$), more subsidization of private contributions becomes possible. Conversely, an increase in $\tau$ raises the relative price, because this gives an increased incentive to contribute via tax deductibility.

6. Conclusions

The paper has revealed a number of sides to the implications of political culture for the provision of public goods. The nonconcavity that arises from noncontribution certainly complicates the analysis and generates some difficult trade-offs for the government. A policy designed to raise the level of provision may be harmful to the lower-income consumers through the taxes required to finance it. This represents the inequity/efficiency trade-off involved in this model in its starkest form. Government provision will also encourage tax evasion, as this is the best response of the low-income.

The most significant finding of the paper is the extent to which the claim that public goods should be entirely provided by the government is rejected. The golden glow model generates an extreme version of this result but the tendency is there in the instrumental preference model especially when government inefficiency is incorporated. Even though these results cannot be taken as definitive, they do provide sufficient evidence to justify further reassessment of the role of government provision versus the provision of incentives to private provision and the interpretation of motives for tax evasion.

From the modeling perspective, choices have to made about the representation of preferences and the information the consumers have about the government. Rather than being inconsequential these choices have a significant impact on the nature of optimal policy. The choices made here reflect what are seen as the most internally consistent possibilities. Results to date cast some doubt on the instrumental preference model in large populations but do offer support in small (see Murdoch and Sandler, 1997).

In addition to these features, the analysis has also assumed that the government was concerned with the maximization of welfare. This assumption is commonly adopted to develop characterizations of optimal policies but is less acceptable in a positive analysis. One obvious alternative is to consider the consequences of vote-maximizing behavior by the government. In this case much of the analysis already developed can be easily applied. A vote-maximizing government will aim to cater for the preferences of the median voter. Assume the median voter is not in the lowest-income group. Now reconsider the proof of Theorem 1. In the equivalence region policy will still have no effect and will not alter the number of votes obtained. Raising the tax rate just past the point where the lowest-income consumer ceases contributing will raise the welfare of the median voter (remember
the symmetry between contributors), so the same incentives exist to crowd out. In fact, the tax rate will be raised in order that consumers are pushed into noncontribution up to the point where the median voters’ utility is maximized. Consequently, although the precise outcome will differ from that under a benevolent government, the essential points about crowding out and the response of the low-income consumers will still apply.

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