Public Provision of Private Goods

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Government may provide a good that can, if legally permitted, be supplemented by private purchases. Policy is determined by majority rule. Under standard assumptions on preferences, a majority voting equilibrium exists. A regime of positive government provision with no restriction on private supplements is shown to be majority preferred to a regime of either only market provision or only government provision. Combined public and private expenditure on the good is higher under this dual-provision regime than under either of the alternatives. Under some preference configurations, the median-income voter is pivotal; under others, a voter with income below the median is pivotal.

I. Introduction

Many goods supplied or subsidized by governments may be supplemented by private-market purchases. Police protection may be augmented by private security services. Public transit riders may also use privately owned conveyances. Governmentally funded health care may be supplemented by private purchases. Public school students may enhance their education with tutoring and college preparatory

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programs. Private cartage may pick up where public refuse collection leaves off.

Normative analyses of government intervention envision a response to market imperfections arising from distinctive characteristics of a good, the technology for its production and consumption, or shortcomings in market mechanisms for its allocation. Thus externalities, excludability, scale economies, costs of coordination, and imperfect information play an important role in normative analyses.

One or more such concerns may well arise in evaluating government's role in providing the goods cited above as illustrative examples. In this paper we abstract from market imperfections in order to focus on a positive analysis of government involvement in provision of goods. Abstracting from these other issues sharpens the focus on political forces affecting government provision. However, we view our work not as supplanting analysis of the effects of market imperfections, but rather as providing a framework into which such imperfections may be introduced in developing a richer positive theory.

Several questions arise in considering government provision of goods when private provision is also feasible. Will government fund provision of the good? If yes, what level of public provision will be chosen? If some level of public provision is chosen, will restrictions be placed on private-market purchases? How will aggregate consumption of the good be affected by the presence or absence of public provision, with or without restrictions on private provision? This paper addresses these questions.

We consider an environment in which a privately produced good may be exchanged in a market without government involvement. Alternatively, the government may choose to fund some level of provision common to all. Also, when there is public provision, the government may choose either to permit or to prohibit private purchases. The choice of the form of government involvement, if any, is determined by majority rule.

Some key results are the following. With private-market supplementation permitted, preferences over government expenditure are single-peaked and majority voting equilibrium always exists. The latter dual-provision regime is majority perferred (usually strictly) to both a regime of pure market provision and one of pure government provision. The choice of government expenditure in the dual-provision regime need not be the preferred choice of the median-income household but conforms to the preference of a lower-than-median-income household in an important set of cases. Then voting equilibrium is characterized by a coalition of rich and poor that favor expenditure decreases opposing middle-income households that favor expenditure increases. For homothetic preferences, combined

public and private expenditure in the dual-provision equilibrium exceeds expenditure in the pure market equilibrium.

Choice of policy and comparisons of expenditure levels under alternative policies are a central element of the health care debate. Our analysis provides insights into the factors that cause individuals to have differing preferences over policy alternatives. In addition, our analysis provides results about the collective outcomes that emerge in equilibrium. Since the types of issues we consider are prominent in the health care debate, we refer to the good that is the subject of our analysis as health care.[1] However, the results are applicable more generally to dual-provision settings in which it is technically feasible to consume both the publicly supplied good and privately purchased supplements.

Several related lines of research are discussed next and others at appropriate points below (see also n. 1). One related research line concerns voting over provision of local public goods assuming that there is not a private alternative (Barr and Davis 1966; Bergstrom and Goodman 1973; Romer and Rosenthal 1979). A second line of work considers public provision when there are private alternatives, but it is not possible to consume both the public and the private good (Barzel 1973; Stiglitz 1974; Epple and Romano 1994; Glomm and Ravikumar, in press).[2] We show that some important results are quite different when the publicly provided good can be supplemented with private purchase. A third related line of research is concerned with the potential for redistribution via public provision and the efficiency implications of doing so (Blackorby and Donaldson 1988; Besley and Coate 1991). This work is primarily normative, whereas ours is positive.

In Section II, we present our model. Section III presents our results regarding choice of government policy. Properties of equilibrium and comparisons of expenditure levels under alternative poli-

[1] Gouveia (1993) studies the political economy of health care provision. While his paper and ours were developed independently, they are similar in spirit and some key results are analogous. Differences are that his paper provides a richer characterization of the health care environment and develops comparative static results, whereas ours focuses more generally on private provision of public goods and places more emphasis on comparison across preference configurations and policy regimes. After presenting our results, we develop the comparison between the papers more fully (n. 14).

[2] This research uses education as its archetype, its point of departure the infeasibility of full-time attendance by a student at both public and private schools. Private tutoring and other forms of private supplement of public education noted in our Introduction are ruled out by treating public and private alternatives as mutually exclusive. Here we consider the other extreme in which it is feasible to combine public and private alternatives in arbitrary amounts. Most goods probably lie somewhere between the two extremes, a generalization that might be interesting to pursue.

cies are presented in Section IV. Generalizations of the model are discussed in Section V. Conclusions are presented in Section VI.

II. The Model

There are two goods, health services and the numeraire commodity. All households are assumed to have the same strictly increasing, strictly quasi-concave, twice continuously differentiable utility function $U(h, b)$ over health services, h, and the numeraire bundle, b. We make the following assumption.

ASSUMPTION 1. h and b are normal goods.

The evidence strongly supports the presumed normality of demand for health care services (see Sec. IV). The normality assumption on b is plausible, but it is unnecessary and is made only to simplify the presentation.

Households differ in endowed income (i.e., numeraire commodity), y. The distribution of household income is denoted $f(y)$, and the population is normalized to one. We assume that $f(y)$ is continuous and that $f(y) > 0$ for all $y \in (0, \infty)$. Let aggregate income, the integral of $yf(y)$ over the support of y, be denoted $\bar{y}$, which also equals the mean income.

Health services are produced from the numeraire commodity with constant returns to scale. One unit of publicly provided health services is produced with p units of the numeraire. All consumers of publicly provided health services obtain the same level of health services. Public provision is financed by a proportional tax, t, on income. Hence, the public budget constraint is

$$t\bar{y} = p \cdot g, \tag{1}$$

where g is the publicly provided health services per capita. The level of public health expenditure is determined by majority vote.

Private health services are provided by price-taking suppliers. The cost per unit of privately provided health services is p units of the numeraire. A household can buy as much supplemental health care, s, as desired at this price. The implications of differences in productivity between public and private suppliers are considered in Section V. Policy regarding public provision of health services is determined by majority rule.

It is natural to ask why a vote is not also taken over public provision of good b. One rationale for limiting the focus to a particular good such as health care is that forces outside the model (e.g., a presidential initiative or constitutional requirement) result in placement of that good on the policy making agenda. This is in the spirit of the extensive body of research on positive models of policy in which a priori

structure is adopted to surmount the difficulties inherent in analysis of multidimensional voting problems.[3] A second rationale, developed by Meltzer and Richard (1985), is that a majority of voters may prefer in-kind transfers to cash transfers because of labor supply incentives (see Leonesio [1988] for empirical support). In Section V, we extend our model to capture this motivation for limiting attention to in-kind transfers of h.

A household's induced utility function over public tax and expenditure levels is given by

$$V(g, p, y(1 - t)) = \max_{\{s \geq 0\}} U(g + s, y(1 - t) - p \cdot s), \tag{2}$$

where s denotes private purchases. Properties of induced indifference curves in the (g, t) plane are central in demonstrating our results. In lemmas 1 and 2 below, we demonstrate that an indifference curve mapping in the (g, t) plane is as shown in figure 1. By way of preview, it is intuitive that for households consuming supplements, public provision of g is the same as an income grant of value $p \cdot g$. For households that would consume less than g if given an income grant $p \cdot g$, public provision is not equivalent to an income supplement. The "boundary" between these two groups is the set of households that would demand exactly g if given an income supplement of $p \cdot g$. Properties of this boundary locus are studied in lemma 1. Lemma 2 then shows that each indifference curve is weakly concave, linear to the left of this locus, and strictly concave to the right of this locus.

Let $h_d(p, I)$ denote the ordinary demand function for h of a household with income I. Define $\hat{H}(p, y(1 - t))$ implicitly by $\hat{H} = h_d(p, y(1 - t) + p\hat{H})$. We show the following lemma.

LEMMA 1. (*a*) $\hat{H}$ is increasing in $y(1 - t)$. (*b*) $s > (=) 0$ at points (g, t) such that $g < (\geq) \hat{H}(p, y(1 - t))$. (*c*) At points at which $s > (=) 0$, $g + s = (>) h_d(p, y(1 - t) + pg)$.

Proof. (*a*) Differentiate the definition of $\hat{H}$ yielding

$$\frac{\partial \hat{H}}{\partial [y(1 - t)]} = \frac{\partial h_d / dI}{1 - p(\partial h_d / dI)}.$$

By assumption 1, $\partial h_d / \partial I \in (0, 1/p)$, implying the result. (*b*) Letting $h^* = g + s$ denote total consumption of health services, we can rewrite problem (2) as

[3] Examples include the related work discussed below that restricts voting to consideration of the parameters of linear taxes, research taking congressional rules and procedures as mechanisms for overcoming voting instability (Shepsle and Weingast 1981, 1982), and research in which issues are assumed to be voted one issue at a time (Denzau and Mackay 1981; Enelow and Hinich 1983; Meltzer and Richard 1985; Epple and Kadane 1990).

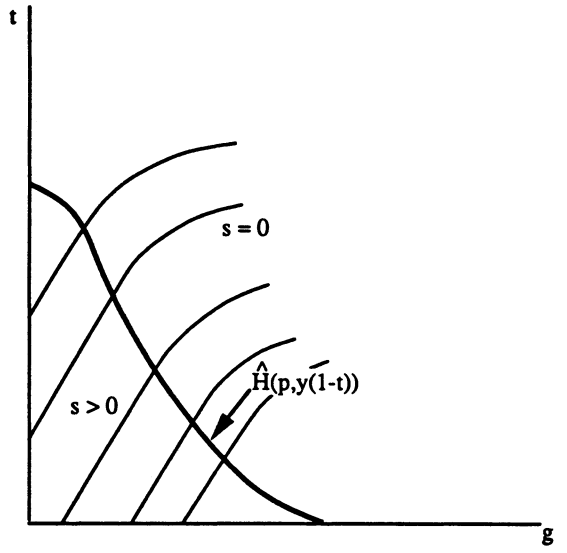

FIG. 1.—Indifference curve mapping

$$\max_{(h^* \geq g)} U(h^*, y(1 - t) + pg - ph^*).$$

Figure 2 depicts solutions in which the constraint is not binding (fig. 2*a*) and is binding (fig. 2*b*). The solid lines depict the actual budget constraint with public provision of g health services. It is clear from the figure that the optimal $s > (=) 0$ as $g < (\geq) h_d(p, y(1 - t) + pg)$. Next we note that $\hat{H}$ is the fixed point g solving $g = h_d(p, y(1 - t) + pg)$ and again use assumption 1 to establish that $g < (\geq) h_d(p, y(1 - t) + pg)$ as $g < (\geq) \hat{H}(y(1 - t))$, implying the result. (*c*) This is confirmed by inspection of figure 2*a* and *b*. Q.E.D.

Consider further the region below $\hat{H}(\cdot)$, where supplemental expenditure is positive. The following first-order condition holds:

$$U_h(g + s, y(1 - t) - p \cdot s) - pU_b(g + s, y(1 - t) - p \cdot s) = 0. \quad (3)$$

From the envelope theorem, the slope of a household's indifference curve $V(g, p, y(1 - t)) = \bar{v}$ in the region where $s > 0$ is given by

$$\left.\frac{dt}{dg}\right|_{V(\cdot)=\bar{v}} = \frac{U_h(g + s, y(1 - t) - p \cdot s)}{yU_b(g + s, y(1 - t) - p \cdot s)}. \quad (4)$$

Combining (3) and (4), we establish that the slope of a household's indifference curve in the region where $s > 0$ is given by

$$\left.\frac{dt}{dg}\right|_{V(\cdot)=\bar{v}} = \frac{p}{y}. \quad (5)$$

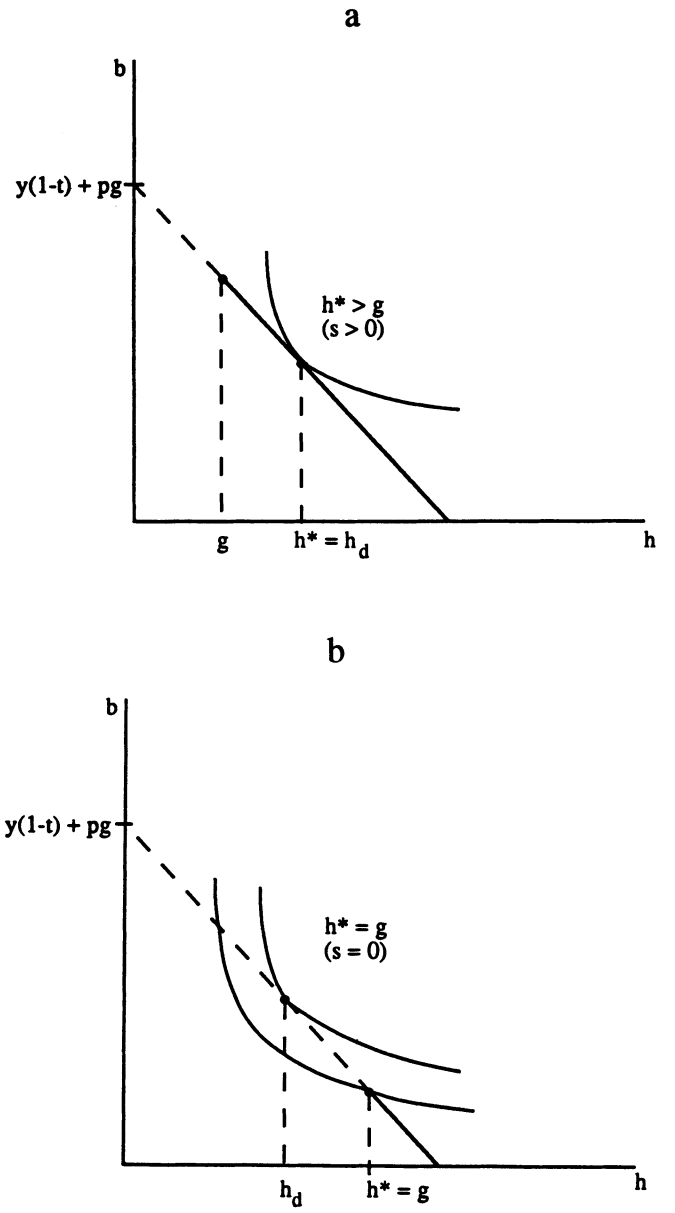

FIG. 2.—*a*, Constraint not binding: $h_d = h_d(p, y(1 - t) + pg)$. *b*, Constraint binding: $h_d = h_d(p, y(1 - t) + pg)$.

The intuition for this result is as follows. On the portion of an indifference curve where supplemental expenditure is positive, consumption of health care services, $h^* = h_d(p, y(1 - t) + pg)$, does not vary. Instead, each dollar increase in public provision is exactly offset by a dollar reduction in expenditure on supplemental services. Thus, on this portion of an indifference curve, increases in public health expenditures are equivalent to an income grant. The equation for this region of an indifference curve is given by the following condition specifying that numeraire consumption remains constant:

$$y(1 - t) - p \cdot (h^* - g) = \text{constant}.$$

The slope of such an indifference curve in the (g, t) plane is as given in equation (5).

Next, consider the portion of an indifference curve along which $s = 0$, that is, beyond the $\hat{H}(\cdot)$ locus. In this region, $V(g, p, y(1 - t)) = U(g, y(1 - t)) = \bar{v}$. Using strict quasi concavity of $U(\cdot)$, we can easily establish that the indifference curve in the (g, t) plane is concave in this region. Moreover, the slope is given by

$$\left.\frac{dt}{dg}\right|_{V(\cdot)=\bar{v}} = \frac{U_h(g, y(1 - t))}{yU_b(g, y(1 - t))}. \tag{6}$$

The two segments of the indifference curve meet on the $\hat{H}(\cdot)$ locus where $g = h^*$ and, hence, $s = 0$. Equations (4) and (6) are the same at this point, establishing that the indifference curve is differentiable at this point. Thus we have established the following lemma.

LEMMA 2. A typical indifference curve in the (g, t) plane for a household with income y is increasing, weakly concave, and differentiable and has a slope that is everywhere less than or equal to p/y.

III. Determining Government's Role

We now prove that a majority voting equilibrium exists in this dual-provision regime. This is followed by our results characterizing choice over alternative regimes. There is no loss of generality in choosing units so that the unit price of h is $p = 1$. Henceforth, we adopt this normalization and suppress p as an argument in the relevant functions.

PROPOSITION 1. When the pair (g, t) is chosen by majority rule, a voting equilibrium exists, and the point most preferred by the voter with the median most preferred level of g is chosen.

Proof. Substitute the budget constraint (1) into the induced utility

function $V(\cdot)$ to obtain induced preferences over g for a voter with income y:

$$W(g, y) = V\left(g, 1, y\left(1 - \frac{g}{\bar{y}}\right)\right). \tag{7}$$

Weak concavity of indifference curves in the (g, t) plane established in lemma 2 coupled with weak convexity of the budget constraint (1) imply that the induced preferences $W(\cdot)$ are single-peaked. Q.E.D.

Remark.—The equilibrium is generically unique.

The single-peakedness of $W(\cdot)$ is illustrated in figure 3, where the line labeled GPF is the government possibilities frontier found from (1).

COROLLARY 1. The most preferred level of government expenditure is zero (positive) for all voters with income $y > (<) \bar{y}$.

Proof. By lemma 2, the slope of an indifference curve in the (g, t) plane for a voter with $y > \bar{y}$ is everywhere less than or equal to $1/y$. By equation (1), the slope of the GPF is $1/\bar{y}$. Thus the slope of the GPF is everywhere steeper than any indifference curve of a voter with $y > \bar{y}$. Hence, such a voter's highest utility is achieved at $g = 0$. The preference for strictly positive public expenditure of households with $y < \bar{y}$ follows from an analogous argument that uses assumption 1 to rule out corner cases. Q.E.D.

COROLLARY 2. Equilibrium government provision is positive (zero) if the median income is less than (greater than) $\bar{y}$.

Proof. This follows immediately from proposition 1 and corollary 1. Q.E.D.

Remarks

1. The preference for government provision by households with income below the mean is to effect a redistribution, as in the literature on voting over linear income taxes (Romer 1975; Roberts 1977; Meltzer and Richard 1981; Snyder and Kramer 1988). The tax price of health care to households with income less than the mean is below the market price; hence they benefit from positive taxes. While the incentive to redistribute directly in the just-cited literature is limited by attendant reductions in labor supply and the tax base, the incentive here to redistribute via public supply of health care will be seen to be limited by diminishing marginal utility.

2. Corollary 2 does not, however, imply that the median-income voter is pivotal, as we show in the next section.

We have shown that a majority voting equilibrium exists for a regime in which government provision may be supplemented by private

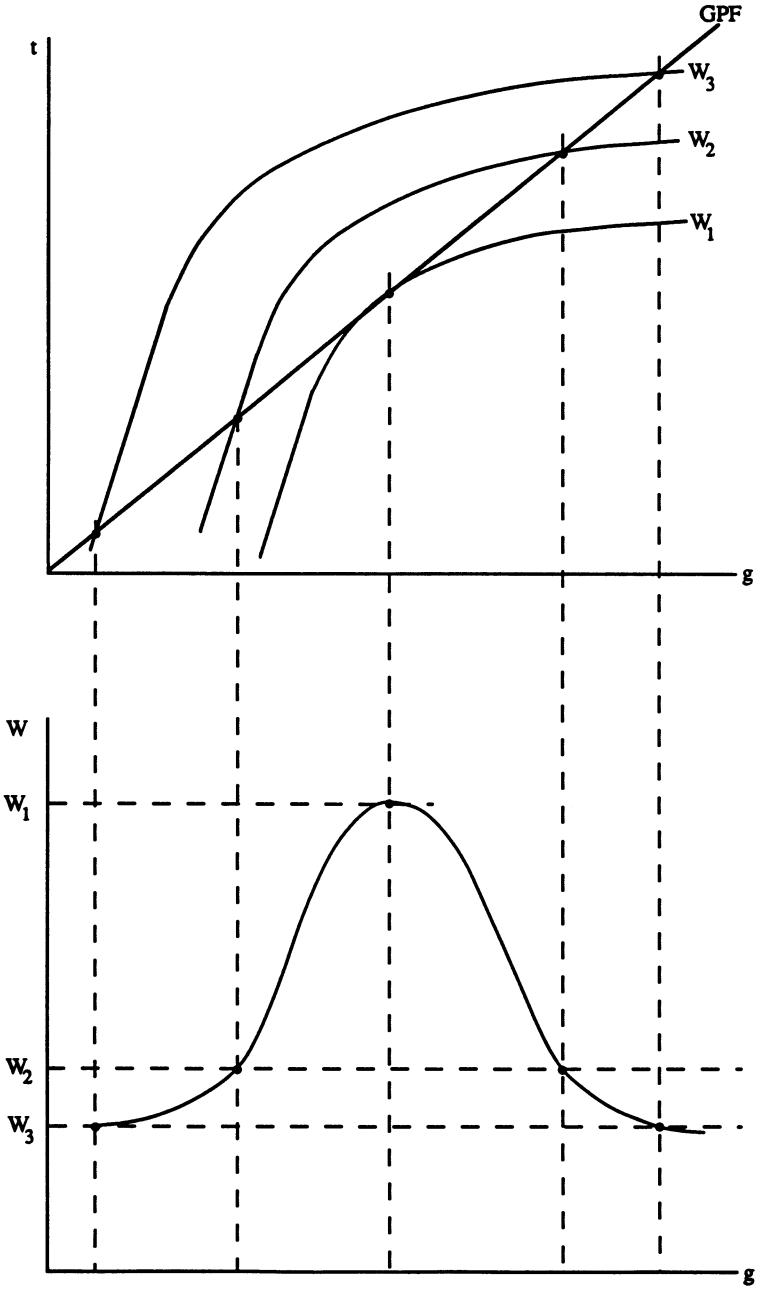

FIG. 3

market purchases. For ease of reference, we denote this as regime GM, and we let g_m be the equilibrium level of government provision under this regime. We now ask whether such a regime is preferred by a majority to the alternatives of market-only (MO) or government-only (GO) provision. Let g_o denote equilibrium government provision in the latter case.[4] We consider simultaneous voting over both regime and level of government provision, if any.

PROPOSITION 2. Regime GM defeats regimes MO and GO.

Proof. First consider voting over regimes GM and MO. The outcome $g = 0$ could be chosen by voters under regime GM. Hence, GM with the majority-preferred public expenditure defeats MO.

Next, consider voting over regimes GM and GO. Note that every tax-expenditure combination with GO is Pareto-dominated by the *same* tax-expenditure combination with GM. Those that supplement under GM are strictly better off by revealed preference, and those that do not are no worse off.

Consider a vote comparing the majority-preferred tax-expenditure combination given GM to regime GO and *any* tax-expenditure combination. Since the GM/tax-expenditure combination is majority preferred to all other GM/tax-expenditure combinations, the Pareto-dominance result implies that it is likewise majority preferred to any GO/tax-expenditure combination. Q.E.D.

Remarks

1. The proof extends immediately to show that GM defeats a regime of government provision that is accompanied by any restrictions on private consumption when such restrictions are not dependent on public expenditures or the tax rate.

2. Our results also hold with sequential voting. Consider the subgame perfect equilibrium in which the regime is chosen first and then the level of government provision. Since (GM, g_m) defeats both (GO, g_o) and (GM, 0) (the latter equivalent to MO) in simultaneous voting, it follows immediately that (GM, g_m) is also the equilibrium in the sequential voting specification.

3. If $g_o \neq g_m$, then regime GM strictly defeats regime GO. If $g_o = g_m$, GM strictly defeats GO if indifferent voters choose their votes randomly. Hence, if indifferent voters randomly determine their votes, regime GO is an equilibrium only in the uninteresting case in

[4] That preferences are single-peaked in the GO case under the present conditions is well known. Hence, existence is not problematic. See, e.g., Romer and Rosenthal (1979, p. 566).

which no households choose private supplements, that is, when regime GM yields the same allocation as regime GO.

4. Regime MO is an equilibrium only in the case in which, under GM, a majority prefers no public provision. This case too is of little interest. From corollary 2 we know that positive provision under GM occurs for income distributions skewed the usual way.

For expositional simplicity, we have assumed that the preference function $U(\cdot)$ is common across individuals and that the income distribution is continuous and well behaved. These assumptions were not used in this section, and the results presented thus far hold under much more general conditions.

The results of this section are striking. They suggest that a regime of government-only provision or a regime of market-only provision will not survive. Under very weak conditions, a regime of government provision with private supplements defeats either. Perhaps the strongest assumption is that the government is as cost efficient as the market in providing the good. Section V discusses the limits placed on the results when government provision is less efficient.

IV. Analysis of Policy Alternatives

This section has two purposes. One is to contrast government expenditure levels and aggregate expenditures under the GM regime to those under the MO and GO regimes. The other is to illustrate GM equilibria by invoking commonly used regularity conditions on preferences.

We first compare government expenditures under the GO and GM regimes.

PROPOSITION 3. $g_o \geq g_m$.

Proof. We demonstrate that $g_o \geq g_m$ by first showing that every voter's most preferred level of government provision is at least as high under regime GO as under regime GM. It follows that the median ideal point is at least as high as well, and, with single-peakedness, the median ideal point is the voting equilibrium.

Consider first voters with $y < \bar{y}$. Using (1), substitute for g in the problem described in (2) (recall that $p = 1$). The marginal cost to a voter with income y of a unit publicly provided is $y/\bar{y}$, and this is less than the marginal cost of private provision when $y < \bar{y}$. Hence, whether or not private supplementation is permitted, a voter with income $y < \bar{y}$ will prefer the level of g that maximizes $U(g, y - (gy/\bar{y}))$. Thus the most preferred allocation for a voter with income $y < \bar{y}$ is the same under either regime GO or GM.

Next consider voters with $y > \bar{y}$. Under regime GM, all these voters prefer $g = 0$ by corollary 1. Under regime GO, these voters prefer

the level of g that maximizes $U(g, y - (gy/\bar{y}))$. Hence, under GO, assumption 1 implies that the most preferred level of government provision for a voter with $y > \bar{y}$ will be higher than under regime GM.

Combining the results above, we conclude that the most preferred level of government spending of every voter under regime GO is at least as great as under regime GM. Hence, the median ideal point under GO must be at least as high as under GM, and this implies $g_o \geq g_m$. Q.E.D.

Remark.—As with the results in Section III, the result in proposition 3 does not require a common utility function or restrictions on the properties of the distribution of income.

Proposition 3 makes clear why some voters may prefer a GO regime. A prohibition on private purchases (weakly) increases public provision. Below, we show that g_o strictly exceeds g_m in a large set of cases. Thus, in general, a subset of voters who prefer public provision higher than that provided under GM will prefer the GO regime. We know from proposition 2 that they are always a minority.

In what follows, we adopt the usual terminology of referring to the voter with the median most preferred level of government provision as the "pivotal" voter. In our model, it is not necessarily the case that the pivotal voter is the voter with median income. It is instructive to consider two alternative restrictions on preferences that permit determination of the income of the pivotal voter.

Let the slope of an indifference curve of $U(g, y(1 - t))$ in the (g, t) plane be denoted $M(g, y, t)$. Hence,

$$M(g, y, t) = \frac{U_h(g, y(1 - t))}{yU_b(g, y(1 - t))}. \tag{8}$$

It will be assumed for all y that the slope of the $U(g, y(1 - t))$ function in the (g, t) plane is monotone in y. In particular, we consider the following preference configurations.

ASSUMPTION 2*a*. $\partial M(g, y, t)/\partial y < 0$ for all y (SDI).

ASSUMPTION 2*b*. $\partial M(g, y, t)/\partial y > 0$ for all y (SRI).

For ease of reference, we adopt the mnemonics SDI (slope declining in income) and SRI (slope rising in income) to refer to these assumptions. These conditions may be interpreted graphically as follows. Refer to figure 4. (The GPF is used below and may be ignored for now.) Consider two voters y' and y'', with $y'' > y'$. The SDI assumption implies that, in the (g, t) plane, the strictly concave portion of the indifference curve of voter y'' crosses the strictly concave portion of the indifference curve of voter y' from above. The SRI assumption implies the reverse direction of crossing. Keep in mind that these slope conditions regard only the strictly concave portions of indiffer-

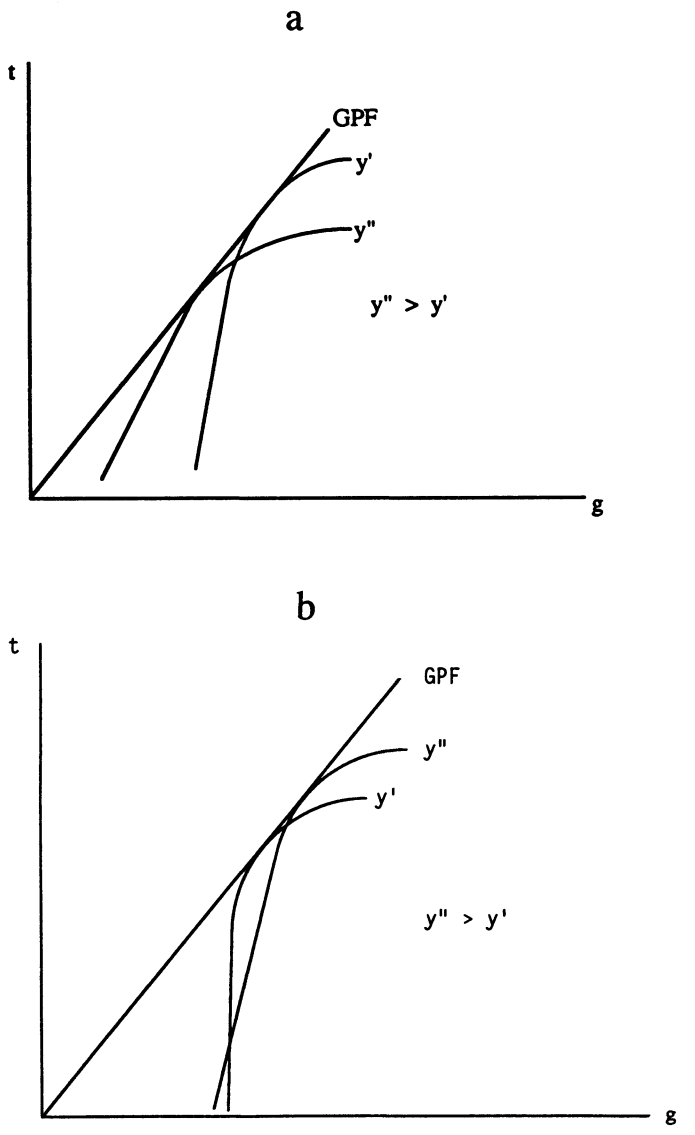

FIG. 4.—*a*, SDI. *b*, SRI

ence curves, that is, portions where $s = 0$. The case in which *s*lope is *u*nchanging in *i*ncome will be denoted SUI.

Whether SDI or SRI is the more appropriate assumption depends on the relative magnitudes of the price and income elasticities of the (implicit) demand for good h. The marginal willingness to pay for public provision rises with income since h is a normal good, but this

is countered by the increased tax price. Kenny (1978) has shown that SRI results if the income elasticity of demand exceeds the (absolute value of the) price elasticity, and SDI holds in the reverse case.[5] The evidence strongly supports an assumption of SRI for health services (see Keeler et al. 1988; Phelps 1992, chaps. 5, 17). Likewise, Bergstrom and Goodman's (1973) classic study of demand for publicly provided goods supports an assumption of SRI for police protection, public parks and recreation, and general (noneducation) municipal expenditures.[6] On the other hand, for public transportation, an assumption of SDI may be more appropriate.

We henceforth focus on the empirically interesting case in which median income is less than mean income.

ASSUMPTION 3. Mean income exceeds median income.

For voters with income less than the mean, the linear portion of an indifference curve has a slope in the (g, t) plane of $1/y$ that is greater than the slope $1/\bar{y}$ of the budget constraint. Hence, the most preferred allocation of each such voter must be a point of tangency between the strictly concave portion of an indifference curve and the budget constraint. This fact will be useful for the results that follow.

The next two propositions characterize the two types of equilibria that assumption 2 permits in a GM regime.

PROPOSITION 4. In a GM regime, the voter with median income is pivotal when SDI holds.

Proof. Consider voters with income $y' < \bar{y}$ and $y'' < \bar{y}$ where $y'' > y'$. The SDI assumption implies that the most preferred level of expenditure for y'' is less than the most preferred level of expenditure for y' (see fig. 4*a*). Since all voters with $y > \bar{y}$ prefer zero government expenditure, it follows that the most preferred levels of expenditure are weakly decreasing in income for all y. Hence, the voter with median income has the median most preferred level of expenditure. Q.E.D.

The result in proposition 4 is related to the results obtained in models of voting over linear tax schedules (Romer 1975; Roberts 1977; Meltzer and Richard 1981; Snyder and Kramer 1988). In those models, the incentive for redistribution declines as income rises, and, as noted above, households with greater than mean income prefer no redistribution. The outcome is the tax rate that maximizes the

[5] We adapt Kenny's analysis to our specific problem in an appendix (available on request).

[6] Our results below actually indicate that adjustments to the estimation procedure of Bergstrom and Goodman are warranted. They assumed that the median-income voter was pivotal, whereas we show that a lower-income voter is pivotal in the case of SRI. It would be interesting to reestimate their model to see whether this is of much consequence to the estimates.

median-income voter's utility taking account of the benefits of the net tax transfer and the costs of distorted labor supply choices induced by the tax. In proposition 4, the benefits to the median-income household come in the form of a reduced price per unit of the good provided publicly, and the costs come in the form of an inefficient allocation between the two goods the household consumes (see fig. 2*b*). When SRI holds, the results are qualitatively different, as the next proposition demonstrates.

PROPOSITION 5. When SRI holds, voter y_l is pivotal in a GM regime, with y_l defined by

$$\int_{y_l}^{\bar{y}} f(y)\,dy = .5. \tag{9}$$

Proof. Consider voters with income $y' < \bar{y}$ and $y'' < \bar{y}$ where $y'' > y'$. The SRI assumption implies that the most preferred level of expenditure for y'' is greater than the most preferred level of expenditure for y' (see fig. 4*b*). Thus, for all voters with $y < \bar{y}$, the most preferred levels of expenditure are weakly increasing in income. All voters with $y > \bar{y}$ prefer zero government expenditure. It follows that the median most preferred level of expenditure is that of a voter with income level y_l such that voters with incomes less than y_l plus voters with incomes greater than $\bar{y}$ constitute half the population. This value of y_l is given in equation (9). Q.E.D.

Remarks

1. Propositions 4 and 5 can be interpreted as follows. The pivotal voter's optimization problem can be written

$$\max_{\{g,s\}} U\left(g + s, y - \frac{gy}{\bar{y}} - s\right).$$

Consider the incentives of a household with income below the mean. The price of government provision of h equals $y/\bar{y}$, which is less than the price in the private market. The proportional tax system subsidizes such a household's consumption.[7] The household's preference is to choose $s = 0$ and satisfy its demand for h via government provision at the subsidized price. In doing so, the relatively poor household indirectly effects a favorable wealth redistribution.

Now consider the identity of the pivotal voter. All those with $y > \bar{y}$ face a price of government provision that is above the private-market price and prefer $g = 0$ (corollary 1). Under assumption 3, however,

[7] Similar arguments apply to many tax systems, including some regressive ones, as discussed in Sec. V.

the majority prefer $g > 0$ (corollary 2). For the latter set of households, the most preferred level of g declines with income in the case of SDI. Then the most preferred level of g declines with income for the whole population, and the median-income voter is pivotal.

In the case of SRI, although the majority subset of households prefer positive g, their most preferred choices increase with income. The median-preference household must then have an income at the fiftieth percentile below the mean to have equal-sized groups that prefer lower and higher levels of provision.

2. The latter type of voting equilibrium has much intuitive appeal for services such as health. When a private alternative is available, high-income households prefer low public expenditure because private-market purchases cost them less per unit than public provision. Low-income households prefer low public expenditures because they are less willing to substitute health expenditures for other goods than higher-income households. Middle-income households are more willing than low-income households to substitute health expenditures for other expenditures, and they find public provision to be less costly than private provision. Hence, a coalition of middle-income households prefers higher public expenditure at the margin, whereas a coalition of high- and low-income households prefers a reduction. In this "ends-against-the-middle" equilibrium, these two coalitions are equal in size and balance each other in voting. The result suggests that all households with income below the mean prefer *some* positive level of public provision, but the highest level of public provision will be desired by households with incomes near, but below, the mean.

3. The ends-against-the-middle equilibrium is reminiscent of Director's law of redistribution. Public redistribution occurs from the rich *and* poor to the middle class according to the law (see Stigler 1970). Our model provides theoretical support and conditions for this phenomenon.

4. The two varieties of equilibria illustrate when g_m equals or exceeds g_o (proposition 3). The median-income household is pivotal under SDI in both the GM and GO regimes. Since it chooses zero supplement in the GM regime, $g_m = g_o$. The pivotal voter's income is below the median under SRI in a GM regime, implying $g_m < g_o$.

5. Provision of health services is Pareto inefficient in both types of equilibria. Zero supplement is chosen by the pivotal voter and other households, including all those with incomes below the pivotal voter (by lemma 1). It is apparent from figure 2*b* that the marginal rate of substitution of income for health services is below the marginal rate of transformation for these households. Reductions in the level of provision could yield Pareto improvements. Our interpretation of this is moderated by the point made in the Introduction that public

provision may be motivated by some market imperfection. *If* public provision is purely a consequence of the redistributive motive, then equilibrium provision is inefficient.

We now turn to a comparison of total consumption of good h, both public and private, under the three regimes we consider in this paper. For this comparison, we make the following assumption.

ASSUMPTION 4. Preferences are homothetic.

The next proposition is concerned with total consumption of good h under a GM regime. To prove it, we employ the following lemma.

LEMMA 3. Along the GPF, for any t, an income $\hat{y}(t)$ exists such that households with $y > (\leq)\ \hat{y}(t)$ would choose a positive (zero) supplement.

Proof. The function $\hat{H}(\hat{y}(1 - t)) = g(t)$ defines $\hat{y}(t)$ at point $(g(t), t)$ on the GPF. The claims then follow from lemma 1. Q.E.D.

PROPOSITION 6. Aggregate consumption under regime GM is strictly increasing in the level of government provision, and hence, aggregate consumption is higher under regime GM than under regime MO.

Proof. Let H_{GM} be aggregate consumption under regime GM. We show that H_{GM} is an increasing function of t along the GPF, $g(t)$. From lemmas 1 and 3,

$$H_{GM}(t) = F(\hat{y}(t))g(t) + \int_{\hat{y}(t)}^{\infty} h_d(y(1 - t) + g(t))f(y)dy. \tag{10}$$

Differentiating, we get

$$\begin{aligned} H'_{GM} &= F(\hat{y})g' - \int_{\hat{y}}^{\infty} h'_d(y - g')f(y)dy \\ &= F(\hat{y})g' - k\int_{\hat{y}}^{\infty} (y - g')f(y)dy, \end{aligned} \tag{11}$$

where we use $h_d(\hat{y}(1 - t) + g) = g$ by lemma 1 and $h'_d = k$, a positive constant less than one, by assumptions 4 and 1. Add and subtract $k\int_0^{\infty} h'_d(y - g')f(y)dy$ and substitute $g' = \bar{y}$, yielding

$$\begin{aligned} H'_{GM} &= F(\hat{y})\bar{y} + k\int_0^{\hat{y}} (y - \bar{y})f(y)dy - k\int_0^{\infty} (y - \bar{y})f(y)dy \\ &= (1 - k)\bar{y}F(\hat{y}) + k\int_0^{\hat{y}} yf(y)dy. \end{aligned} \tag{12}$$

It is clear that $H'_{GM} > 0$ for all $t > 0$, implying the result. Q.E.D.

Remarks

1. A heuristic development clarifies the trade-off from increased public expenditure and the reason why aggregate expenditure rises. A

marginal increase in the tax rate increases public expenditure by $\bar{y}$. Those households with incomes greater than $\hat{y}$, which supplement public provision, will, however, reduce their supplements. The reduction equals the demand (h_d) change resulting from the change in effective income, $y(1 - t) + g(t)$, further reduced by the demand that is satisfied by the increased public provision. Specifically, a household with income $y > \hat{y}$ changes its supplement by $k[g'(t) - y] - g'(t) = -[ky + (1 - k)\bar{y}]$. Hence, the aggregate change equals

$$\bar{y} - \int_{\hat{y}}^{\infty} [ky + (1 - k)\bar{y}]f(y)\,dy,$$

which is easily confirmed to equal (12). Because the reduction in the supplement is a convex combination of own income and the mean income, it would offset the increased public expenditure only if every household were to supplement. Households that choose zero supplement exist no matter how low t is since some have incomes arbitrarily close to zero, so H_{GM} is strictly increasing in t.[8]

2. Our model's prediction that majority choice of public provision (and regime) leads to an increased aggregate provision is not too surprising but is potentially quite important. It would be an oversimplification and would be premature to claim that this will be the consequence of the current political debate about health services. However, we do believe that the force we have described may play a role: The motive for redistribution tends to lead to increased expenditures on the good. This is a strong prediction of the model.

PROPOSITION 7. (*a*) Ordering of preferences across individuals implies ordering of aggregate expenditure across regimes MO and GO:

$$\left(\frac{\partial M(g,y,t)}{\partial y} \begin{array}{l} > 0 \text{ (SRI)} \\ = 0 \text{ (SUI)} \\ < 0 \text{ (SDI)} \end{array}\right) \Rightarrow \left(H_{MO} \begin{array}{c} > \\ = \\ < \end{array} H_{GO}\right).$$

(*b*) Under any of these three preference configurations, aggregate expenditure under GM exceeds aggregate expenditure under GO.

Proof. The price per unit publicly provided for a voter with income $\bar{y}$ is the same as the market price under MO. Thus, under regime

[8] If the poorest household has income bounded above zero, then H_{GM} is constant until $g(t)$ is high enough that this household stops supplementing. Increased public expenditure completely "crowds out" private expenditure in this range. This is similar to the neutrality result in the literature on public/private provision of public goods (Sugden 1982; Warr 1983; Roberts 1984; Bergstrom, Blume, and Varian 1986; Bernheim 1986; Steinberg 1987; Andreoni 1988; Fries, Golding, and Romano 1991). Note, too, that increased public provision is always associated with some crowding out of private consumption, as in the latter literature.

GO, voter $\bar{y}$ prefers a public provision level of $k \cdot \bar{y}$, regardless of the ordering of preferences with income.

Consider first the case in which slope is unchanging in income (SUI). This condition implies that if, under GO, a given voter's indifference curve is tangent to the public budget constraint at some (g, t), then all voters' indifference curves are tangent at that point. Thus, when preferences satisfy SUI, all voters have the same most preferred government provision level as voter $\bar{y}$, and aggregate expenditure is $k \cdot \bar{y}$ under both regimes GO and MO.

By assumption 3, median income is less than mean income. When preferences satisfy SRI, a voter with median income prefers less public expenditure in regime GO than the voter with mean income. Since the voter with mean income prefers $k \cdot \bar{y}$, it follows that aggregate expenditure is higher under MO than under GO when preferences satisfy SRI. When SDI prevails, the voter with median income prefers greater expenditure than the voter with mean income, and aggregate expenditure is higher under GO than under MO. Thus part *a* is proved.

Proposition 6 and part *a* above imply that aggregate expenditure is higher with regime GM than with either regime MO or GO when preferences satisfy SRI. Under SDI or SUI, the voter with median income is pivotal in both regimes GM and GO. Hence, the level of public provision is the same in both (see remark 4 following proposition 5). Since private purchases supplement government purchases in regime GM, it follows that aggregate expenditure is higher under regime GM than under regime GO. This proves part *b*. Q.E.D.

Let H_{MO}, H_{GM}, and H_{GO} denote aggregate consumption under regimes MO, GM, and GO, respectively. Then we may summarize the results of propositions 6 and 7 as follows:

Preference Ordering	Expenditure Ranking
SRI	$H_{GM} > H_{MO} > H_{GO}$
SUI	$H_{GM} > H_{MO} = H_{GO}$
SDI	$H_{GM} > H_{GO} > H_{MO}$

Note that while aggregate expenditures are the same under SUI in regimes MO and GO, the distribution of utilities under these two regimes is very different.

It is instructive to interpret the results in part *a* of proposition 7 in terms of the demand for good *h*. Consider government provision under a GO regime. As in the case of a GM regime, the price per unit of g to a voter with income y is $y/\bar{y}$. Voter y's most preferred allocation is simply that voter's demand function evaluated at income y and price $y/\bar{y}$.

Suppose that preferences are Cobb-Douglas: $U(h, b) = h^k b^{1-k}$. It is easily shown that Cobb-Douglas preferences satisfy SUI. With Cobb-Douglas preferences, the price and income elasticities of demand for health are -1 and $+1$, respectively. The demand function of voter y is $k(y/\bar{y})^{-1}y = k \cdot \bar{y}$. Thus there is unanimity in the choice of public health expenditures: all voters want level $k \cdot \bar{y}$.

Now suppose that the preference function is such that the demand function for health has price elasticity η. The demand for health by voter y under regime GO is then $k(y/\bar{y})^{-\eta} \cdot y$. If voter $\bar{y}$ were pivotal, then demand would be $k \cdot \bar{y}$, and aggregate consumption would again be the same under GO as under GM. Since the pivotal voter has income $y < \bar{y}$, it follows that aggregate consumption under regime GO exceeds $k \cdot \bar{y}$ if $\eta > 1$ (SDI) and is less than $k \cdot \bar{y}$ if $\eta < 1$ (SRI).

V. Generalizations of the Model

Key results of our model are existence of voting equilibrium in a GM regime (proposition 1), majority preference for the GM regime over GO and MO regimes (proposition 2), characterizations of GM equilibrium choice of public expenditure for two frequently adopted preference configurations (propositions 4 and 5), and higher aggregate expenditure in a GM equilibrium than in a market equilibrium (proposition 6). Here we discuss several generalizations of the model with an eye toward the latter results.[9] These results are quite robust, but we also emphasize when and how they vary. Findings reported here that are more subtle are proved in an appendix (available on request). A few generalizations of the model that we have not pursued are also noted. For clarity, each generalization of the model is considered separately.

One direction of generalization examines alternative tax systems. The results require little modification for single-parameter tax systems that are linear in the tax parameter, t. Consider tax systems of the form $T(y, t) = a(y)t$, where T is household y's tax bill, $t \in [0, t_{\max}]$, and $a'(y) \in [0, 1/t_{\max}]$, the latter so the marginal tax rate is always nonnegative but below one. This tax system is more general than it may seem. It admits progressive and regressive taxes and, of course, subsumes the proportional-tax case.[10] The structural properties of the model are largely unaffected: Figure 1 continues to de-

[9] We restrict attention to what we feel are the more important results primarily out of concern for space. An appendix, available on request, provides additional analyses.

[10] For $y \in [0, y_{\max}]$, $T = ty^2$, with $t \in [0, 1/2y_{\max}]$, is an example of a progressive tax system; $T = ty[1 - (y/2y_{\max})]$, with $t \in [0, 1]$, is an example of a regressive tax system.

scribe a household's preferences, the GPF remains linear, and preferences are single-peaked.

The results above all generalize with one significant difference. Recall the significance of the mean-income household under proportional taxation. The household whose tax bill equals the average tax bill plays an important role in any case. Those households with income above (below) this threshold income prefer zero (a positive) tax in a GM regime. Consequently, public expenditure is positive in a GM regime if and only if the median income is below this threshold. In addition, in the ends-against-the-middle equilibrium of proposition 5, this threshold income provides the upper bound of the coalition that prefers tax increases. The difference in the generalized model is that this threshold income need not equal the mean. It is above (below) the mean under progressive (regressive) taxation for marginal tax rates that are monotonic (see the examples in n. 10).[11] Loosely, the reason is that the relative tax burden rises more rapidly with income under progressive taxation than under proportional taxation, and the reverse for regressive taxation. The set of income distributions having a GM equilibrium with positive public expenditure is then larger under progressive taxation and smaller under regressive taxation. Our proportional-tax model probably predicts dual-provision systems more frequently than occurs in reality, and the prevalence of progressive taxation further exaggerates this prediction. Results discussed next may explain this anomaly.

A simpler, but potentially important, generalization allows the public marginal rate of transformation to differ from that in the private market. Suppose that public provision comes at a higher cost than in the market.[12] Preference mappings are unaffected by this change in the model. The GPF simply becomes steeper! Three differences emerge with regard to the main results. The income of the just-discussed critical household drops below the mean (under proportional taxation). A household's tax bill must now be discretely below the average tax bill for it to benefit from relatively costly public provision. This tightens the condition for public provision, predicting it

[11] A simple nonlinear tax system we have analyzed presumes zero marginal tax up to an income y_1 and then a constant marginal tax beyond, with voting over the magnitude of the positive marginal tax. Our results are easily extended if y_1 is below the median. The set of income distributions having positive g is relatively large since the tax system is progressive. The equilibrium voting coalitions that characterize the case of SRI are interesting. A coalition made up of upper-middle-income households and the untaxed (incomes below y_1) that prefer tax increases balances an equal-sized coalition of lower-middle-income and wealthy households that favor lower taxes.

[12] Public choice may also be relatively inefficient in selecting product characteristics most appealing to consumers, reducing support for public provision. We thank an anonymous referee for raising this interesting issue.

less frequently. A second and obvious normative difference is the inefficiency of public provision when positive public expenditure characterizes equilibrium. Third, related to the latter, is a variation of proposition 6. Although, a fortiori, aggregate expenditure on the good rises with the tax rate, the aggregate *quantity* of provision need not.

Another generalization relaxes the monotonicity assumption, SRI or SDI. The GM equilibrium exists without such monotonicity conditions. We used these restrictions to characterize coalitions supporting voting equilibrium in a GM regime, demonstrating the possibility of a coalition consisting of two unconnected income ranges in the case of SRI. The effect of relaxing monotonicity would be to allow equilibrium with coalitions consisting of more than two unconnected income ranges in some cases. In any equilibrium, however, the top income segment will always favor tax decreases under the normality assumption (assumption 1).

As in other models of voting over tax structure, generalizations such as tax systems nonlinear in the tax parameter or systems with multiple tax parameters may result in non-single-peaked preferences and accompanying potential problems of the existence of equilibrium. Generalizations such as increasing marginal cost of provision of the good would sometimes do the same. We have not pursued such generalizations.

A generalization that induces non-single-peaked preferences that we have analyzed presumes that the joint consumption of the public and private alternatives is infeasible for technical or institutional reasons. Education is a prime example. It is well known that voting equilibrium may fail to exist here (Stiglitz 1974). In Epple and Romano (1994), we show that condition SDI implies existence with the median-income household pivotal, and equilibrium, when it exists, is of the ends-against-the-middle variety under condition SRI (see also Barzel 1973; Glomm and Ravikumar, in press). We did not consider comparisons to other possible regimes. Since the Pareto-dominance argument in the proof of proposition 2 continues to apply, equilibrium when one exists favors permitting households to choose either public or private consumption relative to either a GO or MO regime.[13] Proposition 6 does not, however, extend to this case. As the tax rate rises, the total expenditure on the good of those that switch from private to public consumption declines, permitting aggregate expenditure to decline.[14]

[13] We show that the median income below the mean income is sufficient for any GM equilibrium to have positive public expenditure in Epple and Romano (1994).

[14] As we noted in n. 1, Gouveia (1993) independently addresses several of the same

Above we defended our analysis of voting over public provision of a consumption good and not over income redistribution by appeal to agenda control. A final generalization serves to demonstrate that, in the presence of labor supply incentives, the in-kind transfer policy that we have considered may be majority preferred to a cash transfer policy. Note first that in the absence of labor supply incentives, a cash transfer policy would be majority preferred to the GM policy that we have characterized. The proof follows the logic of proposition 2.[15]

Now consider the following extension of our model, which borrows heavily from Meltzer and Richard (1985). Individuals get utility from health services, h, and the numeraire commodity, b, and they get disutility from labor, l: $U = U(h, b, l)$. Technology requires that an individual supply either one unit of labor (e.g., a standard workday) or zero (drop out of the labor force).[16] Individuals differ in skill level, x, which has continuous distribution with support $[0, x_{\max}]$. An individual who works earns income $y = w \cdot x$, where w is the wage per skill unit of labor.

Tax revenue is allocated to an in-kind grant of g_h per individual or a numeraire (income) transfer of g_b per individual. Individuals allocate a numeraire grant optimally and, as above, can supplement consumption of any in-kind grant but cannot exchange the in-kind grant for the numeraire commodity. Preferences are such that indi-

issues in his study of the political economy of health care, and we can now briefly compare results of the two papers using our notation for ease of exposition. Results on single-peakedness and the existence of voting equilibrium are analogous in the two papers. Gouveia then shows that regime GM defeats regimes GO and MO when voting occurs (implicitly) first over regime and then over level of provision. Our proposition 2 shows that the result also holds with simultaneous voting over regime and provision level. In addition, in Sec. V, we show that the results apply to environments in which the publicly and privately provided goods are not perfect substitutes. In other respects, the papers address different but complementary issues. We develop comparisons of expenditure levels under alternative policy regimes (propositions 3 and 6) and preference configurations (proposition 7), whereas Gouveia studies comparative static implications for the dual-provision case.

[15] Those supplementing under a GM regime are indifferent between the in-kind transfer and the cash transfer, and those not supplementing strictly prefer the cash transfer. Hence, for a given tax rate and expenditure level, the cash transfer Pareto-dominates the in-kind transfer. This coupled with the observation that the majority-preferred cash transfer policy defeats any other cash transfer policy implies that the majority-preferred cash transfer policy defeats the in-kind policy. This implication is very much in line with Friedman's (1962) argument for cash transfers rather than in-kind transfers.

[16] Assuming discrete labor supply alternatives greatly simplifies the analysis to follow and permits us to easily highlight key restrictions on preferences that give rise to a political preference for in-kind rather than cash redistribution. It would be of interest to explore the issues in the preceding sections of the paper assuming continuous variation in labor supply, but the attendant nonlinearity of the GPF introduces a great deal of complexity into the analysis.

viduals always prefer consumption of all goods: "man cannot live by health care alone."

ASSUMPTION 5. For any $g_h > 0$ and for all x,

$$U(g_h, 0, 0) < \max_{\{s \geq 0\}} U(g_h + s, wx - s, 1).$$

ASSUMPTION 6. For any $g_b > 0$, there is some $\hat{x}(g_b) > 0$ such that, for all $x < \hat{x}(g_b)$,

$$\max_{\{h\}} U(h, g_b - h, 0) > \max_{\{h\}} U(h, g_b + wx - h, 1).$$

Condition 5 states that no amount of good h will induce any individual to drop out of the labor force and entirely forgo consumption of the numeraire. Condition 6 states that there is always a set of individuals with sufficiently low skill that a positive transfer of the numeraire will induce them to drop out of the labor force, allocate their income grant optimally, and consume maximum leisure.

In the absence of transfers of the numeraire, all individuals choose to work. Hence, with this preference structure, all results in the preceding sections continue to hold. We now consider whether a cash transfer program would be chosen in preference to the GM in-kind program. Let (g_h, g_b, t) denote a policy triplet. Let $(g_h^*, 0, t^*)$ be the GM equilibrium. We now develop a sufficient condition such that, at tax rate t^*, there is no alternative grant policy $(\hat{g}_h, \hat{g}_b, t^*)$ that is majority preferred.

The sufficient condition for the GM allocation $(g_h^*, 0, t^*)$ to defeat $(\hat{g}_h, \hat{g}_b, t^*)$ is that the voter of median skill in the GM allocation purchases supplemental care. This condition is likely to be met in the "usual" case in which preferences satisfy SRI. As proposition 5 shows, the GM allocation in this case maximizes the utility of a voter with income y_l that is often well below median income. For example, for a lognormal income distribution with mean \$36,520 and median \$28,906 (1991 *Statistical Abstract of the United States,* tables 722, 724) and a constant elasticity of substitution utility function with expenditure share on h equal to .15 and price elasticity for h equal to $-.19$ (in market equilibrium),[17] y_l = \$13,515 and t^* = .078, and the median-income voter supplements the in-kind transfer for any $t < \hat{t}$ = .124.[18]

[17] The utility function is $U = [(10h)^{-4} + b^{-4} + (k - l)^{-4}]^{-4}$, for any $k > 1$, and the market price of h is normalized to one. The income elasticity equals one, of course, since these preferences are homothetic. The calculations of t^* and $\hat{t}$ are available from us.

[18] Tax $\hat{t}$ is the one for which the $\hat{H}(\cdot)$ locus for the median-income (or median-skill) individual crosses the GPF.

Is there any reason to believe that t^* will be the *equilibrium* choice of tax rate? If the tax rate is first chosen by majority rule followed by the balanced-budget mix (g_h, g_b),[19] then t^* defeats tax rates in its vicinity. Such tax rates continue to induce a choice of $g_b = 0$ in the second stage of voting, implying that the results of our GM model can be applied. In fact, for all $t < \hat{t}$ (see n. 18), $g_b = 0$ is the majority choice in the second stage. Hence, for $t^* < \hat{t}$, t^* is always a "local" equilibrium and is the global equilibrium over $t \in [0, \hat{t}]$. We have shown that equilibrium always exists in the second stage for $t > \hat{t}$ as well (details available on request). Although confirmation would require computational analysis, a continuity argument suggests that t^* will be the equilibrium choice in a broad range of cases.[20] The existence problem (see n. 19) reemerges, however, if voters select simultaneously from a vector of multiple in-kind tranfers and a cash transfer, so the argument relies on some exogenous limits on the political process.

VI. Conclusion

Our results are striking. Using only standard regularity conditions on preferences, we show that a majority voting equilibrium exists. A regime of government provision that permits privately purchased supplements is majority preferred to either a market-only or a government-only regime. We also present results ordering the level of government provision and the level of total consumption of the good under these three regimes. While the GM regime will generally not have the highest level of public provision, our results suggest that combined public and private consumption will be higher in this regime.

The model can be generalized in several ways, including consideration of progressive and regressive tax systems, differences in costs between public and private providers, and goods for which it is infeasible to jointly consume the public and private alternatives. We have outlined key implications of these generalizations.

We also show that the median voter (i.e., the voter whose most preferred level of public provision is chosen under majority rule) need not be the voter with median income. Indeed, by employing a frequently used and intuitively appealing single-crossing condition

[19] Simultaneous voting over t and the mix of transfers will not have an equilibrium generically (Plott 1967).

[20] While g_b will rise above zero for $t > \hat{t}$, the continuity argument demonstrates that a strict (and substantial) majority will prefer t^* over t greater than but near $\hat{t}$, provided that $\hat{t}$ and t^* are substantially different.

on preferences, we show that the voting equilibrium may be one in which a middle-income group preferring higher government provision is counterbalanced by a coalition of low-income voters preferring low government provision and high-income voters preferring no government provision. This intuitively appealing outcome is of interest in its own right as a compelling illustration of the danger of assuming the median voter to be the voter with median income.

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