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Working Paper

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Research Report, No. 2000-11

Provided in Cooperation with:

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Suggested Citation: Horstmann, Ignatius J.; Scharf, Kimberley A. (2000) : The new federalism: Distributional conflict, voluntarism, and segregation, Research Report, No. 2000-11, The University of Western Ontario, Department of Economics, London (Ontario)

This Version is available at:

<https://hdl.handle.net/10419/70373>

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The New Federalism: Distributional Conflict, Voluntarism, and Segregation*

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This version: March 2000

Abstract

Along with the rise in income inequality in the U.S., we have observed a simultaneous move toward fiscal devolution and increased government reliance on private provision of public goods. This paper argues that these phenomena are related. We describe a model of jurisdiction and policy formation in which the structure of government provision is endogenous and public good provision levels are determined by a political process that can exploit private motives for voluntary giving. The model predicts that an increase in income inequality leads to decentralization, with local jurisdictions becoming more income-homogeneous than the population as a whole. This reduction in local income heterogeneity, combined with a reduced tax base, results in increased reliance by government on private provision.

KEY WORDS: Fiscal Federalism, Private Provision of Public Goods, Jurisdiction Formation.

JEL CLASSIFICATION: H2, H7.

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*The first draft of this paper was prepared in March 1997. We thank Tim Besley, Craig Brett, Stephen Coate, Richard Cornes, Jim Davies, Jim Hines, Carlo Perroni, Al Slivinski, and Ron Wintrobe for comments and suggestions, as well as participants to seminars at the University of Alabama, the University of Birmingham in the UK, the Institute for Fiscal Studies, Stanford University, the University of Toronto, Warwick University, and the University of Western Ontario. Research support from the British ESRC is gratefully acknowledged.

I Introduction

During the last twenty years the distribution of income in the U.S. and other developed countries has become progressively more unequal. In the U.S., for instance, the share of aggregate income held by the lowest income quintile has decreased from 4.2 percent in 1969 to 3.6 percent in 1994. The share of income held by the highest quintile has increased by almost fifteen percent, rising from thirty-four percent in 1969 to more than forty-nine percent by 1994. The Gini index has risen over this period by seventeen percentage points to its 1994 level of 0.456. At the same time as income inequality has been rising, governments have come increasingly to rely on the private sector to provide, at least in part, services that had been previously provided exclusively by the public sector. A recent survey by the U.S. Independent Sector (1999) reports that, over the period 1987-1996, charitable contributions by U.S. households rose by 22 percent, from 87.4 billion to 106.6 billion (in constant 1992 dollars). The fraction of household income going toward charitable contributions rose over the same period from 1.9 to 2.2 percent. The two areas in which private contributions rose most rapidly were in “social and legal services” (40 percent increase) and “civic, social and fraternal organizations” (53 percent increase). Together, these two categories accounted for over 40 percent of all private contributions to non-religious organizations.¹

At first sight, these two trends seem contradictory. Because of preference revelation problems, taxes are typically based on income or some other observable indicator of ability to pay. In the presence of income heterogeneity, a progressive income tax system allows a low-income majority to pursue redistribution by raising taxes on high-income individuals and using the proceeds to provide public goods. As a consequence, increased distributional conflict resulting from increased income inequality should not produce increased reliance on private provision of public goods. It is, rather, differences in preferences for public goods that are not due to income differentials that should bring about private provision. If, for instance, a majority places a relatively low valuation on public goods and is unable to graduate taxes according to preferences, it may choose low levels of public provision and induce high-preference individuals to volunteer. That is, when the endogeneity of tax policies is accounted for, we should expect to observe increased reliance on private provision of public goods with increased heterogeneity in preferences not income.

The two trends, however, can be reconciled once it is recognized that the institutional structure within which public good provision choices are made is endogenous. Then, the increased tax burden that the rich face as income inequality increases cre-

ates incentives for them to restructure existing arrangements. Specifically, rather than having tax and spending decisions made by a centralized authority representing all income groups, the rich might prefer arrangements where fiscal choices are devolved to separate and distinct entities representing less income-heterogeneous groups. Because these entities have both a smaller tax base and represent individuals with more similar incomes, differences in preferences for public goods become more important. The result is increased reliance on private provision.²

This paper investigates the theoretical link across these trends. We present a model of endogenous jurisdiction and policy formation, in which public good provision can be supplemented by private provision. In the model, there are four types of individuals distinguished both by their income levels (high or low), and by their intensity of preferences for a single public good (weak or strong). Individuals may choose to operate public provision within a single jurisdiction, in which case all individuals obtain the same level of public consumption. Alternatively, they may arrange themselves into multiple jurisdictions, each providing a local public good, and each with a (potentially) different level of taxation and public consumption. The level of taxation in a given jurisdiction is determined by a voting process involving only the individuals in the jurisdiction. Taxes can be conditioned on income but not an individual's preference for the public good. Individuals can, however, choose to make private, voluntary contributions towards the provision of the public good in their jurisdiction. The public good is not congestible, and multiple jurisdiction formation is costly in the sense that a fixed cost of establishing a jurisdiction must be incurred for each jurisdiction created.

Within this framework we find that, if there is more than one jurisdiction, then individuals segregate either along income lines (rich versus poor) or according to their intensity of preferences for the public good (strong versus weak). The only case in which there can be both income and preference heterogeneity within a jurisdiction is the single-jurisdiction case. If the differences in income and/or preferences are not large, then, in order to exploit scale economies in public good provision, it pays all individuals to be in a single jurisdiction. If, however, these differences increase, there will be increased distributional conflict between high- and low-income individuals and high- and low-preference individuals. In this case, it may pay individuals to incur the fixed cost of jurisdiction formation to segregate with others having similar characteristics, in order to escape an adverse policy outcome in a larger jurisdiction.

Voluntary provision can occur (but need not) if either there is a single jurisdiction or multiple jurisdictions segregated along income lines. In these situations, voluntary

provision acts as a second-best means of conditioning an individual's payment for the public good on both income and preferences. As income inequality rises, both taxes on the rich and public provision rise in a single-jurisdiction arrangement. As a consequence, incentives for voluntary provision fall—the standard result. However, incentives for the rich to segregate from the poor *increase* due to the large tax burden they face in a single-jurisdiction arrangement. With income segregation, both the reduced tax base and reduced income heterogeneity can lead to an increase in private provision. Essentially, a reduced level of public consumption and reduced ability to differentiate tax payments across individuals under income segregation make the second-best instrument (private provision) relatively more attractive to policymakers. In such a scenario, increased income inequality, by leading to a less centralized provision structure, can produce an increased reliance on private provision.

The analysis in this paper draws on two separate strands of literature: that which examines non-cooperative giving behavior and that which examines the equilibrium structure of local jurisdictions. As to the former, Bergstrom, Blume and Varian (1986) and Warr (1982, 1983) are good examples of the kind of giving behavior that we model here. These models, however, assume an exogenous fiscal structure, and thus are not able to address the distributional tensions that determine the political equilibrium and form of public provision.³

The latter strand is motivated by Tiebout's (1956) hypothesis that individuals, by sorting themselves into communities with like individuals, will reveal their preferences for local public goods and so produce efficiency in local public good provision. Most models of jurisdiction formation typically assume that individuals differ only in income or preferences but not both.⁴ Exceptions are Epple and Sieg (1997), and Epple and Platt (1997), who allow both income and preferences to vary, and find sorting by income to be incomplete. These two studies, however, do not examine the relationship between distributional tension, segregation, and private provision—the focus of our analysis here. Rather, their emphasis is on capitalization of local expenditures and taxes into property values. Glomm and Lagunoff (1998) examine how individuals would sort between two jurisdictions adopting respectively private and public provision. Unlike here, however, they do not endogenize jurisdictions, nor do they consider how policy choices are made and how private provision outcomes arise.

The full details of our model and results are presented in the following sections. Section II develops a political-economy model of private and public provision choices within a jurisdiction, describing the economic environment, the tax system and the

way that public good provision is determined through the political system. Section III analyses jurisdiction formation and describes the possible jurisdictional equilibria and situations in which voluntary provision occurs. Section IV contains results on income distribution and jurisdictional equilibria. Two appendices give proofs of all results in the text.

II A Political-Economy Model of Private and Public Provision Choices

In the following, we describe a positive model of tax and public good provision choices, where both private and public provision can emerge as the outcome of a political process determining taxes and spending. We focus on an environment in which taxes are income based and in which tax expenditures for voluntary contributions are unavailable.

II.1 The Economic Environment

Consider an economy with a population comprised of N heterogeneous agents, each consuming a private consumption good, c , and a pure local public good, g . Agents are differentiated both by their labour endowment, ℓ , and by a preference parameter, θ . An agent's labour endowment is assumed to take on one of two possible values, $\underline{\ell}$ or $\bar{\ell} > \underline{\ell}$; likewise, $\theta \in \{\bar{\theta}, \underline{\theta}\}$. An agent type is a pair (ℓ, θ) , with the set of all possible types being defined as $T = \{(\bar{\ell}, \bar{\theta}), (\bar{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}), (\underline{\ell}, \underline{\theta})\}$. The distribution of agent types is given by $\pi(\ell, \theta)$, with $0 < \pi(\ell, \theta) < 1$ and $\sum_{\ell, \theta} \pi(\ell, \theta) = 1$, where $\pi(\ell, \theta)$ is the fraction of the population having labor endowment ℓ and preference parameter θ . This specification allows for the possibility of endowments and the preference parameter being correlated.

Agents group themselves into jurisdictions, with jurisdiction membership determining an agent's access to the local public good. Each agent can be a member of at most one jurisdiction. The size of the k th jurisdiction is denoted as α_k ; this value represents the total number of individuals residing in jurisdiction k :

$$\alpha_k \equiv \sum_{\ell, \theta} \beta_k(\ell, \theta) \pi(\ell, \theta) N; \quad (1)$$

where $\beta_k(\ell, \theta)$ is the fraction of individuals of type (ℓ, θ) choosing to reside in jurisdiction k . The number of individuals that are of type (ℓ, θ) and reside in jurisdiction k is defined by the variable $n_k(\ell, \theta) \equiv \beta_k(\ell, \theta) \pi(\ell, \theta) N$.

Preferences for an individual of type (ℓ, θ) residing in jurisdiction k are represented by an increasing, strictly quasiconcave utility function, $u(c_k(\ell, \theta), g_k; \theta)$, with $c_k(\ell, \theta)$ representing the consumption level of the private good by an (ℓ, θ) type residing in k and g_k the level of the public good provided in k . An individual residing in k obtains no utility from public goods provided in other jurisdictions. Utility is normalized such that $u(c, g; \theta) \geq 0, \forall c, g \geq 0$. Preferences are assumed such that c and g are both essential ($u(0, g; \theta) = u(c, 0; \theta) = u(0, 0) = 0, \forall c, g, \theta; u(c, g; \theta) > 0, c, g > 0$) and normal goods. In addition, the willingness to pay for g , $w(c, g; \theta) = u_g(c, g; \theta)/u_c(c, g; \theta)$, is assumed increasing in θ . Normality of c and g implies that $w(c, g; \theta)$ is increasing in c .⁵

Output in the k th jurisdiction, Y_k , is produced from labour, which is inelastically supplied. The production technology is assumed to be linear in total labor inputs:

$$Y_k \equiv \sum_{\theta} \left(n_k(\bar{\ell}, \theta) \bar{\ell} + n_k(\underline{\ell}, \theta) \underline{\ell} \right). \quad (2)$$

Output in k is used for private consumption and for the provision of the public good.⁶ The cost, in terms of units of private consumption, of providing g_k units of the public good is given by the function $TC(g_k) = F + hg_k$. The value F may be thought of as the set-up cost of establishing a jurisdiction; both it and the marginal cost of public goods, h , are assumed independent of jurisdiction size. This specification implies that the per capita cost of providing g_k units of the public good for a community of size α_k , $(F + hg_k)/\alpha_k$, is decreasing in α_k : per capita cost is minimized at $\alpha_k = N$. This feature of the public good provision technology, along with the assumption of no congestion, means that the model is biased toward a single-jurisdiction outcome and away from segregated outcomes. As a result, if segregation arises, it is not for efficiency reasons.

II.2 The Tax System and Public Good Provision

It is assumed that the only tax instrument available to the government is an income tax. In levying income taxes, the tax authority is assumed able to observe perfectly an agent's labour endowment (level of income), ℓ , but to be unable to observe the preference parameter, θ . As a result, income taxes can be conditioned only on the value of ℓ ; that is, the value of taxes paid by type (ℓ, θ) in region k , $t_k(\ell)$, is independent of θ . It is maintained throughout that $t_k(\ell) \geq 0, \forall \ell$, so that there are no income subsidies.

The provision of the public good can be funded both by taxes and voluntary contributions. Unlike income taxes, voluntary contributions have the feature that they can vary both with ℓ and θ . This feature of voluntary contributions makes possible

a degree of discrimination in public good provision not available with the tax system alone. The level of voluntary contribution made by a type (ℓ, θ) in region k is denoted by $v_k(\ell, \theta)$. Tax levels for jurisdiction k are set (and committed to) prior to any agent decisions on voluntary contributions. Contributions are determined by agents in a non-cooperative fashion, in light of income tax levels, so as to maximize utility. The level of voluntary contributions within a jurisdiction is defined by the Nash equilibrium of the contribution game.⁷

Under this provision system (and given the structure of production), the level of private consumption for an individual of type (ℓ, θ) residing in jurisdiction k is

$$c_k(\ell, \theta) = \ell - t_k(\ell) - v_k(\ell, \theta); \quad (3)$$

and public good provision in jurisdiction k is

$$g_k = \frac{\sum_{\ell, \theta} n_k(\ell, \theta) (t_k(\ell) + v_k(\ell, \theta)) - F}{h}. \quad (4)$$

II.3 The Political Process

The level of income tax, and therefore of public provision, in jurisdiction k is determined as the outcome of a political process. Because the focus of this paper is not on the political process *per se*, the details of the political system are left intentionally vague. In particular, the voting and legislative processes are not specifically modelled. Rather, the political system is allowed to be any system whose outcome satisfies certain general properties. These properties are given below.

Property 1 Anonymity of taxes. *All agents in jurisdiction k with income ℓ pay the same tax, $t_k(\ell)$.*

Property 2 Weak tax progressivity. *In any jurisdiction, k , $t_k(\underline{\ell}) \leq t_k(\bar{\ell})$.*⁸

Property 3 Non-confiscatory taxation. *In any jurisdiction, k , tax levels must be such that $\bar{\ell} - t_k(\bar{\ell}) \geq \underline{\ell} - t_k(\underline{\ell})$.*

Property 4 Imposition of preferences. *The government of jurisdiction k is defined by one of the agent types, (ℓ, θ) , resident in k . Tax levels, $t_k(\ell)$, are chosen to maximize the utility of the governing agent type, subject to Properties 1-3 above.*

Property 5 Monotonicity of the election process. *The probability that agent type (ℓ, θ) residing in jurisdiction k forms the government is (weakly) increasing in $\beta_k(\ell, \theta)$ (the number of agents of type (ℓ, θ) in jurisdiction k) and (weakly) decreasing in $\beta_k(\ell', \theta')$ for some $(\ell', \theta') \neq (\ell, \theta)$. In addition, if a type (ℓ, θ) prefers a government formed by type (ℓ', θ') to one formed by type (ℓ'', θ'') when $\beta_k(\ell, \theta) = \hat{\beta}_k$, then an increase in $\beta_k(\ell, \theta)$ from $\hat{\beta}_k - n$ to $\hat{\beta}_k$ must (weakly) decrease the probability that type (ℓ'', θ'') is elected for any n .*

Property 6 Majority voting. *If there are only two agent types in a jurisdiction, then the majority type forms the government with probability one.*

Properties 3-6 deserve some comment. Property 3 is really a free-disposal constraint in that an agent with income $\bar{\ell}$ could always destroy some of that income, and would have an incentive to do so, were 3 violated. Property 4 would be a property of a citizen candidate voting model (see Osborne and Slivinski (1996), and Besley and Coate (1997)). It would also arise in a median voter model in which there were two or fewer types in a jurisdiction. Properties 5 and 6 also would be properties of a median voter model and a citizen-candidate model in which individuals voted sincerely.

II.4 Jurisdictional Equilibrium

The political system is organized and political outcomes realized after jurisdictions are formed. We define a jurisdictional equilibrium by the notion of a stable jurisdiction configuration. Let $U_k(\ell, \theta)$ represent the utility level of an individual of type (ℓ, θ) in jurisdiction k . Then, a jurisdiction configuration, J , is stable if it satisfies three conditions:

Condition 1 Feasibility. $U_k(\ell, \theta) > 0 \forall k, \ell, \theta$.

Condition 2 Individual rationality (Nash). *No agent can increase his utility by a unilateral move from jurisdiction J_i to J_k , $J_i, J_k \in J$.*

The third condition is a requirement that the configuration be immune to certain deviations by coalitions of agents. We impose the strong requirement of unanimity on blocking coalitions. Specifically, if \mathcal{J}^* is the set of jurisdictions that satisfy conditions 1 and 2 above and configuration $J, J' \in \mathcal{J}^*$, then J' is said to dominate J if $\tilde{U}(\ell, \theta, J) \leq \tilde{U}(\ell, \theta, J'), \forall \ell, \theta$, where $\tilde{U}(\ell, \theta, J)$ (resp. $\tilde{U}(\ell, \theta, J')$) gives the value of utility for an agent of type ℓ, θ under the jurisdiction configuration J (resp. J'). The third condition for configuration J to be stable is thus

Condition 3 Unanimity. *There exists no configuration J' that satisfies Conditions 1 and 2 and dominates J .*

Condition 2 above is a free-entry/exit condition which restricts the set of possible equilibrium configurations to the set of subgame perfect Nash equilibria for this problem. Condition 3 provides a refinement of this set. Specifically, it allows for jurisdiction configurations to be ruled out if all individuals would benefit from moving to a new configuration. At the same time, it restricts the possibilities for ruling out a given configuration by requiring that any alternative configuration must Pareto dominate it. One might interpret this unanimity requirement as a strong form of a majority voting condition for significant political or constitutional change. As a condition for a blocking coalition, it is far more restrictive than that for the core; on the other hand, existence of a stable jurisdiction configuration is not an issue here.⁹

III Analysis

Pareto efficient allocations in this economy can be characterized as follows. Since per capita costs of provision are declining everywhere in jurisdiction population size, the optimal number of jurisdictions in a centrally planned economy is equal to unity. The optimal level of public good provision in this single jurisdiction, g^* , is then characterized by two conditions: equality between the marginal cost of provision and the aggregate marginal valuation by all individuals (the Samuelson condition); and the resource constraint.¹⁰ These are respectively

$$\sum_{\ell, \theta} N\pi(\ell, \theta) \frac{u_g(c(\ell, \theta), g; \theta)}{u_c(c(\ell, \theta), g; \theta)} = h; \quad (5)$$

$$\sum_{\ell, \theta} N\pi(\ell, \theta) (\ell - c(\ell, \theta)) - hg - F = 0. \quad (6)$$

Given our assumptions about how fiscal choices are made within jurisdictions, there is no reason to expect that (5) will be met in an equilibrium outcome. Moreover, as we shall show below, the single-jurisdiction outcome need not be the only equilibrium outcome in our model, and inefficient segregation can occur as a result of distributional tensions.

In the remainder of this section, we shall characterize the properties of political/residential equilibria, starting first with an examination of the public good provision problem for arbitrary jurisdictions, and then proceeding to analyze jurisdictional equilibria. Proofs for the results in this section are contained in Appendix A.

III.1 The Public Good Provision Problem

Within any jurisdiction, public good provision is completely characterized by the tax regime that arises out of the political equilibrium for that jurisdiction. This regime determines both the extent of tax provision of the public good as well as the equilibrium level of voluntary provision. As for the latter, given any tax system $(t_k(\underline{\ell}), t_k(\bar{\ell}))$, the symmetric Nash equilibrium level of voluntary provision by a type (ℓ, θ) in jurisdiction k , $v_k(\ell, \theta)$, is defined by the following conditions:

$$\Omega_k(\ell, \theta) \equiv u_g(c_k(\ell, \theta), g_k; \theta) / u_c(c_k(\ell, \theta), g_k; \theta) - h \leq 0; \quad (7)$$

$$v_k(\ell, \theta) \Omega_k(\ell, \theta) = 0; \quad (8)$$

where

$$c_k(\ell, \theta) = \ell - t_k(\ell) - v_k(\ell, \theta); \quad (9)$$

$$g_k = \frac{\sum_{(\ell', \theta') \in k} n_k(\ell', \theta') t_k(\ell') + v_k(\ell, \theta) + \bar{V}_k - F}{h}; \quad (10)$$

and

$$\bar{V}_k \equiv \sum_{(\ell', \theta') \neq (\ell, \theta)} n_k(\ell', \theta') v_k(\ell', \theta') + (n_k(\ell, \theta) - 1) v_k(\ell, \theta); \quad (11)$$

are respectively private consumption, public goods provision and the total of all the other individuals' voluntary contributions in jurisdiction k .

As for the tax regime, two features arise immediately from Properties 2 and 3 of the political system:

Lemma 1 *Suppose that agent type $(\underline{\ell}, \theta)$ forms the government in jurisdiction k and that the jurisdiction contains some agents of type $(\bar{\ell}, \theta')$. Then, for any θ, θ' , the tax regime involves two taxes, $t_k(\underline{\ell})$ and $t_k(\bar{\ell}) > t_k(\underline{\ell})$. In addition, for any $t_k(\underline{\ell})$, the value of $t_k(\bar{\ell})$ is determined by the condition $\bar{\ell} - t_k(\bar{\ell}) = \underline{\ell} - t_k(\underline{\ell})$.*

Lemma 2 *Consider a stable configuration, J , and jurisdiction $J_k \in J$ such that agent type $(\bar{\ell}, \theta)$ forms the government in J_k and that this jurisdiction contains some agents of type $(\underline{\ell}, \theta')$. Then, for any θ, θ' , the tax regime involves a single tax, $t_k(\underline{\ell}) = t_k(\bar{\ell}) = t_k$.*

The intuition for these two results is quite straightforward. Lemma 1 says that, if the low income type forms the government, then it will always set the tax on the high income type such that the non-confiscatory tax condition binds. To do otherwise would simply reduce, at least weakly, both the amount of public good provided in the jurisdiction and the low-income type's consumption of the private good. As a result, the low-income type's utility is reduced. Lemma 2 provides, essentially, the opposite result. If it is the high-income type that forms the government, it sets the tax for the low-income type such that the weak progressivity condition binds. Again, to do otherwise would simply result in a reduction in public good provision and so in the utility of the high-income type.

These two results prove crucial to the subsequent determination of the jurisdictional equilibrium. From Lemma 1, low-income types have an incentive to form a jurisdiction in which high income types are a significant minority. Doing so essentially allows the low-income types to confiscate the high-income types' "extra" income. This fact, however, means that high-income types have an incentive to locate together in a jurisdiction in which they form the government. As a result, jurisdictions with significant minorities of high-income types tend to be unstable. The fact that, should high-income types form the government, they can impose high taxes (Lemma 2) on any low-income types in the jurisdiction means, together with Lemma 1, that there is a strong incentive for income segregation across jurisdictions.

Another implication of the above results is that, in a jurisdiction in which a low-income type forms the government, the level of voluntary provision by a type $(\bar{\ell}, \theta')$ in k is identical to that by the type $(\underline{\ell}, \theta')$. The reason is that, from Lemma 1, the low-income type chooses a tax rate $t_k(\bar{\ell})$ such that $c_k(\bar{\ell}, \theta') = c_k(\underline{\ell}, \theta')$. Therefore, whatever level of voluntary provision is optimal for the low-income type must also be optimal for the high-income type. A second implication is that, in a jurisdiction in which the high-income type forms the government, $v_k(\bar{\ell}, \theta) \geq v_k(\underline{\ell}, \theta)$. This result follows from Lemma 2 and the normality of c and g . We can, therefore, state the following result:

Lemma 3 *In any stable jurisdiction configuration, J , and for any government of jurisdiction $J_k \in J$, $v_k(\bar{\ell}, \theta) \geq v_k(\underline{\ell}, \theta)$. If $(\underline{\ell}, \theta)$ forms the government, then, $v_k(\underline{\ell}, \theta') = v_k(\bar{\ell}, \theta')$.*

Whether voluntary contributions are positive or not depends on tax levels in a jurisdiction. Tax levels, in turn, depend upon the make-up of the jurisdiction. If there is perfect segregation, for instance, so that any jurisdiction contains only one type of

agent, then all public good provision will be through taxes. This result is standard and reflects the inefficiency of the Nash equilibrium in the contribution game.

Of more interest are the cases in which jurisdictions contain at least two types of agents. Of particular interest for our subsequent analysis are the cases in which jurisdictions segregate either along income lines or preference lines. The former is defined to occur if a jurisdiction has either agents of types $(\underline{\ell}, \underline{\theta})$ and $(\underline{\ell}, \bar{\theta})$ only or of types $(\bar{\ell}, \bar{\theta})$ and $(\bar{\ell}, \underline{\theta})$ only; the latter has either agents of types $(\underline{\ell}, \underline{\theta})$ and $(\bar{\ell}, \underline{\theta})$ only or of types $(\underline{\ell}, \bar{\theta})$ and $(\bar{\ell}, \bar{\theta})$ only. When a jurisdiction segregates along income lines, whether there is voluntary provision or not depends upon which type forms the government. If a type with preference parameter $\bar{\theta}$ forms the government, then there is no voluntary provision. More specifically, the following result must hold:

Lemma 4 *Consider a jurisdiction $J_k \in J$, J stable, composed solely of agents of types $(\ell, \bar{\theta})$ and $(\ell, \underline{\theta})$ for $\ell = \underline{\ell}$ or $\bar{\ell}$. If the government is formed by type $(\ell, \bar{\theta})$ then $v_k(\ell, \theta) = 0$, $\forall (\ell, \theta)$.*

The intuition for this result is simple. With all agents having identical income, the government sets a uniform tax rate. Were this tax rate chosen such that voluntary provision occurred, then, since the willingness-to-pay for g is increasing in θ , $v_k(\ell, \bar{\theta}) > v_k(\ell, \underline{\theta})$. Effectively, the $(\ell, \underline{\theta})$ types pay a lower tax than the $(\ell, \bar{\theta})$ types. By raising the tax rate to the point at which $v_k(\ell, \bar{\theta}) = 0$, the $(\ell, \bar{\theta})$ types make the same payment as under voluntary provision but the $(\ell, \underline{\theta})$ types' payment, and so g_k , increases.

When a jurisdiction segregates along preference lines, then, regardless of which type forms the government, there will be no voluntary provision. In the case of the $\underline{\ell}$ type forming the government, Lemma 3 implies that $v_k(\underline{\ell}, \theta) = v_k(\bar{\ell}, \theta)$. Were the common v_k positive, then the government could raise both $t_k(\bar{\ell})$ and $t_k(\underline{\ell})$ until $v_k(\underline{\ell}, \theta) = v_k(\bar{\ell}, \theta) = 0$ and not affect g_k . Therefore, there is no strict incentive for voluntary provision. When the $\bar{\ell}$ type forms the government, then, from Lemma 2, $t_k(\bar{\ell}) = t_k(\underline{\ell}) = t_k$. The same argument as in Lemma 4 applies and, again, there are no voluntary contribution. These results are summarized below.

Lemma 5 *Consider a jurisdiction $J_k \in J$, J stable, composed solely of agents of types $(\underline{\ell}, \theta)$ and $(\bar{\ell}, \theta)$ for $\theta = \underline{\theta}, \bar{\theta}$. Then, $v_k(\ell, \theta) = 0, \forall (\ell, \theta)$.*

Within the set of segregated jurisdiction configurations, the only one allowing of voluntary provision is that in which the jurisdiction is segregated along income lines

and the government is formed by the $\underline{\theta}$ type. In this situation, the inability of the government to condition taxes on θ means that pure tax provision must result in all agents contributing an identical amount. A system with voluntary provision allows the $\underline{\theta}$ type to contribute less to the public good than the $\bar{\theta}$ type. This ability of the voluntary provision scheme to condition contributions on θ makes it attractive to the $\underline{\theta}$ type. The cost is, of course, the inefficiency that results in any voluntary provision scheme.¹¹

Finally, from Property 4 above, tax levels within a jurisdiction are defined as those that maximize the utility of the type forming the government. In the cases covered by Lemmas 4 and 5, there is no voluntary provision and so the problem of defining the policymaker's preferred tax level(s) is straightforward. For those cases in which either there is income segregation and a type $(\ell, \bar{\theta})$ forms the government or there is preference segregation and some type $(\bar{\ell}, \theta)$ forms the government, the chosen tax level is independent of income and is defined by the conditions

$$u_g(\ell - t_k^*, g_k^*; \theta) / u_c(\ell - t_k^*, g_k^*; \theta) - h / \alpha_k = 0; \quad (12)$$

and

$$g_k^* = \frac{\alpha_k t_k^* - F}{h}; \quad (13)$$

where the values ℓ, θ are determined by the type that forms the government.

When a type $(\bar{\ell}, \theta)$ forms the government and there is preference segregation, then there are two taxes, $t_k(\underline{\ell})$ and $t_k(\bar{\ell}) = \bar{\ell} - \underline{\ell} + \underline{t}$. The choice of $t_k(\underline{\ell})$ is given by condition (12) above with $t_k^*(\underline{\ell}) = t_k^*$ and where g_k^* is now defined as

$$g_k^* = \frac{\alpha_k t_k^* + n_k(\bar{\ell}, \theta)(\bar{\ell} - \underline{\ell}) - F}{h}. \quad (14)$$

When type $(\ell, \underline{\theta})$ forms the government and there is income segregation, then there is a single tax, and there may or may not be voluntary provision by the $(\ell, \bar{\theta})$ type. When there is no voluntary provision, conditions (12) and (13) again define the equilibrium tax rate and public good level respectively, with $(\ell, \theta) = (\ell, \underline{\theta})$. When voluntary provision occurs in equilibrium, then the tax rate in the jurisdiction is given by the condition

$$u_g(\ell - t_k^*; \underline{\theta}) / u_c(\ell - t_k^*; \underline{\theta}) = h / \beta_k \pi(\ell, \underline{\theta}) N \quad (15)$$

and g_k^* by

$$g_k^* = \frac{t_k^* \alpha_k + n_k(\ell, \bar{\theta}) v_k(\ell, \bar{\theta}) - F}{h}. \quad (16)$$

By contrast with equation (12), only the $(\ell, \underline{\theta})$ types enter equation (15). The reason is that, for any individual making positive private contributions, an increase in tax payments due to a higher tax rate is exactly offset by reduced contributions (see Bergstrom, Blume and Varian (1986)). As a result, an increase in the tax rate only increases g_k to the extent that it increases tax collections from the $(\ell, \underline{\theta})$ types. The total contribution of any $(\ell, \bar{\theta})$ type remains unchanged.

III.2 Jurisdictional Equilibria

Depending on the characteristics and distribution of agent types in the population and the size of the jurisdiction set-up cost, F , many jurisdictional equilibria are possible. To limit the scope of these possibilities and so focus attention on the key features of the model, we impose two additional parameter restrictions. The first is a restriction on the size of F relative to ℓ :

Assumption 1 $\bar{\ell} - F < 0$; $\underline{\ell} - F/N\pi(\underline{\ell}, \theta) < 0$, $\theta = \underline{\theta}, \bar{\theta}$.

This assumption means that configurations in which either a single individual lives in a separate jurisdiction or all low-income individuals of a given preference type live in a separate jurisdiction is not feasible in the sense of covering the costs of operation. As a result, such jurisdiction configurations cannot be part of a stable configuration.

The second assumption imposes an additional restriction on agent preferences so as to structure the response of a policymaker to changes in jurisdiction size. In particular, note that an increase in jurisdiction size both lowers the relative price of the public good and expands the policymaker's consumption opportunities. Because g is assumed a normal good, an increase in jurisdiction size is guaranteed to lead to an increase in the level of the public good, policymaker fixed. Its impact on private consumption is less clear since the price effect and the income effect work in opposite directions. The assumption below restricts agent preferences to ones such that consumption also increases, at least weakly as jurisdiction size increases (again, policymaker fixed). Formally, the assumption is:

Assumption 2 *In any feasible jurisdictional configuration, the tax $t_k^*(\ell)$ set by the governing type (ℓ, θ) is weakly decreasing in α_k for any change in α_k that leaves (ℓ, θ) as the policymaker.*

From the above discussion, it should be clear that any policymaker preferences that result in the private consumption good, c , and the public good, g , being gross complements are sufficient for Assumption 2 to be satisfied.¹² Examples of such preferences are the Cobb-Douglas utility functions employed in Section IV below and CES functions with elasticity of substitution between unity and zero.

As will become apparent shortly, Assumption 2 captures for the finite numbers case the operational content of the continuum of agents assumption in other models. That is, if one thinks of the continuum as an approximation to a large but finite economy, then Assumption 2 holding in the finite economy guarantees the kind of agent sorting that occurs in the continuum economy (where an individual agent's location decision leaves the policymakers level of private consumption unchanged).

With these assumptions in place, we turn to a consideration of the stable jurisdiction configurations. The configurations provided form the set of *potential* stable configurations. Typically, not all of these configurations will be stable for a given set of parameter values. In what follows next, only equilibrium Conditions 1 and 2 (feasibility and the Nash condition) are exploited.

The first set of results narrows the collection of possible stable configurations to those that have complete segregation of agent types across jurisdictions. In particular, we show by a sequence of steps that any stable configuration must have the feature that, if an agent type resides in a given jurisdiction, then all agents of that type must reside in the same jurisdiction. An implication of this result, given Assumption 1, is that the maximum number of jurisdictions is three.

As a first step, we show that, if an agent type forms the government in a jurisdiction with probability one, then that type cannot reside in any other jurisdiction:

Lemma 6 *Consider a jurisdiction configuration J with elements $J_{k'}$, $J_{k''}$. Suppose that, with probability one, types (ℓ, θ) and (ℓ', θ') form the governments in $J_{k'}$ and $J_{k''}$ respectively. Then, $\beta_{k'}(\ell', \theta') = \beta_{k''}(\ell, \theta) = 0$ if J is stable.*

The intuition for this result is simply that, if (ℓ, θ) type agents prefer residing in j and forming the government over residing in k , then an (ℓ, θ) type agent in k must prefer a move to j over staying in k . By moving, the agent in k gets a government that chooses the policy that maximizes his utility and this utility will be at least as large as that obtained by the (ℓ, θ) types currently residing in j .

Because there is no requirement in the above lemma that $(\ell, \theta) \neq (\ell', \theta')$, it must be that, when agent types form the governments of two different jurisdictions with

probability one, different types form the government in each. The next result shows that, if in every jurisdiction some agent type forms the government with probability one and agent type (ℓ', θ') forms the government in no jurisdiction, then all agents of type (ℓ', θ') must reside in a single jurisdiction.

Lemma 7 *Suppose that the configuration J is stable and that, in each jurisdiction, some agent type forms the government with probability one. Suppose, also, that type (ℓ', θ') forms the government in no jurisdiction. Then $\beta_k(\ell', \theta') = \pi(\ell', \theta')$, for some k .*

The intuition for this result is similar to that for Lemma 6; namely, if agents of type (ℓ', θ') resided in more than one jurisdiction, then there would be an incentive for those in one of the jurisdictions to move to the other. In this case, the incentive to move is provided by the wealth effect of Assumption 2. Roughly speaking, moving increases the size of the jurisdiction, and so by Assumption 2 lowers the tax on the type forming the government. This tax reduction results in a reduction in taxes for all agents and so an increase in utility.

An apparent implication of Lemmas 6 and 7 is that, whether or not an agent type forms the government, it cannot be an equilibrium for that type to reside in more than one jurisdiction. This implication proves to be correct whether types form the government with probability equal to one or less than one. We, therefore, have

Proposition 1 *In any stable configuration and for all (ℓ, θ) , $\beta_k(\ell, \theta) > 0$ if and only if $\beta_j(\ell, \theta) = 0$, $j \neq k$.*

This proposition has several immediate implications. First, given Assumption 1, there can be at most three jurisdictions in any stable configuration; moreover, in this case, the configuration must be $J_1 = \langle (\underline{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}) \rangle$, $J_2 = (\bar{\ell}, \underline{\theta})$, $J_3 = (\bar{\ell}, \bar{\theta})$. There may also be configurations with just two jurisdictions and, of course, a single-jurisdiction configuration. The next result narrows down the number of possible two-jurisdiction configurations.

Lemma 8 *The jurisdiction configurations $J_1 = \langle (\bar{\ell}, \bar{\theta}), (\underline{\ell}, \underline{\theta}) \rangle$, $J_2 = \langle (\bar{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}) \rangle$ and $J_1 = \langle (\underline{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}), (\bar{\ell}, \bar{\theta}) \rangle$, $J_2 = \langle (\bar{\ell}, \underline{\theta}) \rangle$ are not stable configurations.*

What these configurations have in common is that they combine the type with the highest willingness to pay, $(\bar{\ell}, \bar{\theta})$, with the type with the lowest willingness to pay, $(\underline{\ell}, \underline{\theta})$.

This mismatch means that, regardless of who forms the government, some type will have an incentive to move across jurisdictions.

Lemma 8 implies that, in addition to the income and preference segregation outcomes identified previously, the only other possible two-jurisdiction configuration is that given by $J_1 = \langle (\underline{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}), (\bar{\ell}, \underline{\theta}) \rangle$, $J_2 = (\bar{\ell}, \bar{\theta})$. Both this outcome and the three-jurisdiction outcome can only arise if $\bar{\ell}$ is large and preferences heterogeneity among $\bar{\ell}$ types is sufficiently great that they prefer to live apart rather than together. If this possibility is ruled out, then we have:

Proposition 2 *The set of potential stable jurisdiction configurations is: (i) the single jurisdiction (S)— $J_1 = \langle (\bar{\ell}, \bar{\theta}), (\underline{\ell}, \underline{\theta}), (\bar{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}) \rangle$; (ii) two jurisdictions, income segregation (IS)— $J_1 = \langle (\underline{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}) \rangle$, $J_2 = \langle (\bar{\ell}, \underline{\theta}), (\bar{\ell}, \bar{\theta}) \rangle$; (iii) two jurisdictions, preference segregation (PS)— $J_1 = \langle (\underline{\ell}, \underline{\theta}), (\bar{\ell}, \underline{\theta}) \rangle$, $J_2 = \langle (\underline{\ell}, \bar{\theta}), (\bar{\ell}, \bar{\theta}) \rangle$.*

Several points are worth noting here. First, reiterating, to this point only Conditions 1 and 2 for a stable jurisdiction configuration have been exploited; that is, if only unilateral deviations by single individuals are considered, the configurations in the above proposition are the only possible equilibrium configurations. Consideration of deviations by coalitions of individuals (Condition 3 for a stable jurisdiction configuration) is only relevant for narrowing the set of jurisdictions beyond this set. Second, without Condition 3, multiple equilibrium configurations would occur. There would also be jurisdiction configurations that were Pareto dominated but nonetheless equilibrium configurations. Condition 3 rules out such a possibility and also makes prediction possible. It should be stressed, however, that Assumptions 1 and 2 are sufficient but not necessary for the above results to hold: depending on the configuration of parameters, mixed outcomes will be ruled out by weaker (albeit more complex) conditions.

Which of the jurisdictions S, IS, and PS are stable depends on the distribution of income and preferences. The conditions that must be satisfied for any of these configurations to be stable are the standard Nash equilibrium conditions along with the non-domination requirement among those configurations that are Nash equilibria. One obvious implication of these conditions is that, if any one of the jurisdiction configurations S, IS, PS is a Nash equilibrium and Pareto dominates all of the remaining elements of this class, then that configuration is the unique stable configuration (i.e., if S Pareto dominates IS and PS, and S is a Nash equilibrium, then S is the unique stable outcome). Conversely, if one of these configurations is Pareto dominated by another (and both are Nash), then the Pareto dominated configuration cannot be

stable. When configurations are not Pareto ranked, then there may still be multiple stable configurations.

IV Income Distribution and Voluntary Provision

We now turn to the question we outlined at the outset: how does an increase in income heterogeneity affect private provision? In the model, income heterogeneity can arise in the population in two ways. First, the size of the endowments of low- and high-income types can vary. This variation can be captured by $\bar{\ell} - \underline{\ell}$. Income heterogeneity can also arise because the fractions $\pi(\underline{\ell}) = \sum_{\theta} \pi(\underline{\ell}, \theta)$ and $\pi(\bar{\ell}) = \sum_{\theta} \pi(\bar{\ell}, \theta)$ respectively of low- and high-income types in the population vary.

In the data, we see increased income inequality reflected in an increased share of GDP for the highest quintile and a decreased share of GDP for the lowest quintile. We also see an increase in the Gini coefficient. The first feature of the data can be captured in the model by any changes in $\pi(\bar{\ell})$, $\bar{\ell}$ that increase $\pi(\bar{\ell})\bar{\ell}$ more than proportionately to $\pi(\underline{\ell})\underline{\ell}$. Whether or not any such change results in an increase in the Gini coefficient will depend on the value of $\pi(\bar{\ell})$ and the amounts by which $\pi(\bar{\ell})$, $\bar{\ell}$ change. For instance, an increase in $\bar{\ell}$ only is guaranteed to increase income inequality by both measures. This change is the one that we focus on the experiments below; however, the insights provided there extend to other changes that produce the pattern of GDP share changes described above.

As noted previously, voluntary provision occurs either when there is a single jurisdiction or when there are two jurisdictions segregated by income. It does not occur when there is preference segregation. To determine the impact of income inequality on voluntary provision, therefore, it is necessary first to determine how inequality affects the set of stable jurisdiction configurations. Then, one can analyze how inequality affects voluntarism within a given stable configuration.

One can show, under fairly general conditions, that the single-jurisdiction outcome will be a Nash equilibrium for any income and preference distribution. In particular, it can be shown that (proofs of the results are contained in Appendix B)

Proposition 3 *If $N(\pi(\bar{\ell})\bar{\ell} + \pi(\underline{\ell})\underline{\ell}) > F$, then the jurisdiction configuration S is always a Nash equilibrium configuration.*

The condition in the above statement guarantees that the single jurisdiction is feasible; Assumption 1 guarantees that an individual cannot operate a jurisdiction privately.

Given the assumption that g is essential, together these conditions are sufficient to guarantee that an individual is always better off being in the single jurisdiction than operating privately. As a result, the single-jurisdiction configuration is always a Nash equilibrium (satisfies Condition 2 for a stable configuration).

Since a single-jurisdiction arrangement is also necessary for efficiency in the provision of public goods, it will be undominated (satisfies Condition 3): as long as the type who is the policymaker for this configuration is chosen with probability one, it is guaranteed to be worse off under any of the other possible configurations. We, therefore, have, as a corollary to the above proposition,

Corollary 1 *If the policymaker for the single jurisdiction is determined by a non-stochastic political process and $t^*(\underline{\ell}) < \underline{\ell}$, then the configuration S is stable.*

Note that the condition $t^*(\underline{\ell}) < \underline{\ell}$ is guaranteed to be satisfied as long as a low-income type is the policymaker. One would expect this outcome to occur if $\pi(\underline{\ell}) > \pi(\bar{\ell})$. Since the situation in which the single jurisdiction has a low-income type policymaker is the relevant one for our analysis, we will maintain this assumption in the discussion that follows.

Consider, then, any set of parameters for which this condition is satisfied. From the above, the single-jurisdiction configuration is always stable and so it is possible to analyze how income inequality affects voluntary provision in this type of outcome. Two aspects of public good provision in this situation are particularly relevant. First, from Lemma 1, $t(\bar{\ell})$ is set such that $\underline{\ell} - t(\underline{\ell}) = \bar{\ell} - t(\bar{\ell})$: a high-income individual has the same after-tax income as a low-income individual. The fact that high-income types are heavily taxed (their after-tax income is no greater than $\underline{\ell}$) means that, unless there is significant preference heterogeneity, voluntarism will not occur in the single jurisdiction regardless of income inequality. Second, as either $\bar{\ell}$ or $\pi(\bar{\ell})$ increase, g increases (from Assumption 2) and so the incentive for voluntary provision decreases (cf. eqs. (7) and (10)). Essentially, when there is a low-income policymaker, high taxes on rich individuals make the tax system a sufficient means of public good provision when there are enough rich types. As a consequence, if voluntary provision occurs at all in the single-jurisdiction outcome, it is more likely to do so when income inequality is low rather than high, i.e., *increased income inequality is not a source of increased voluntary provision within a single-jurisdiction configuration.*

These points can be illustrated within a simple parameterized version of the model where individuals have preferences of the form $u(c, g; \theta) = c^{1/(1+\theta)} g^{\theta/(1+\theta)}$, parameters take on the values

$\pi(\underline{\ell}, \underline{\theta})$	$\pi(\underline{\ell}, \bar{\theta})$	$\pi(\bar{\ell}, \underline{\theta})$	$\pi(\bar{\ell}, \bar{\theta})$	N	F	h
.35	.28	.22	.15	8	3	1

and the political process consists of pairwise majority ballots between candidates of each type, with all types represented in a jurisdictions always standing as candidates, and all individuals voting sincerely.¹³ To establish a point of reference, we make $\underline{\ell} = 1$, $\bar{\theta} = 3$ in all scenarios, and vary $\bar{\ell}$ and $\underline{\theta}$. Suppose, first, that $\bar{\ell} = \underline{\ell} = 1$, and $\bar{\theta} = 3$, $\underline{\theta} = 1$. In this situation, the policymaker is a low-preference type individual and the political outcome is

$t(\underline{\ell}) = t(\bar{\ell})$	g	$v(\underline{\ell}, \underline{\theta}) = v(\bar{\ell}, \underline{\theta}) = v(\underline{\ell}, \bar{\theta}) = v(\bar{\ell}, \bar{\theta})$
.69	2.54	0

S outcome: $\bar{\ell} = \underline{\ell} = 1, \bar{\theta} = 3, \underline{\theta} = 1$

with utilities $U(\underline{\ell}, \underline{\theta}) = U(\bar{\ell}, \underline{\theta}) = 1.50$ and $U(\underline{\ell}, \bar{\theta}) = U(\bar{\ell}, \bar{\theta}) = 0.89$. Note that, even with $\bar{\theta}/\underline{\theta} = 3$, no voluntary provision occurs in this case.

An increase in the endowment of the high-income type to $\bar{\ell} = 3.2$ makes the $(\underline{\ell}, \underline{\theta})$ type the elected policymaker. The political outcome becomes

$t(\underline{\ell})$	$t(\bar{\ell})$	g	$v(\underline{\ell}, \underline{\theta}) = v(\bar{\ell}, \underline{\theta}) = v(\underline{\ell}, \bar{\theta}) = v(\bar{\ell}, \bar{\theta})$
.21	2.41	6.28	0

S outcome: $\bar{\ell} = 3.2, \underline{\ell} = 1, \bar{\theta} = 3, \underline{\theta} = 1$

with utilities $U(\underline{\ell}, \underline{\theta}) = U(\bar{\ell}, \underline{\theta}) = 2.22$ and $U(\underline{\ell}, \bar{\theta}) = U(\bar{\ell}, \bar{\theta}) = 3.74$. The response of the low-income, low-preference policymaker to the increase in $\bar{\ell}$ is to impose higher taxes on the high-income types and to almost triple the level of public provision. As a consequence of these choices, voluntary provision remains zero.

By way of contrast, suppose that $\bar{\ell} = \underline{\ell} = 1$ and $\bar{\theta} = 3$, $\underline{\theta} = .1$. This case again results in the $(\underline{\ell}, \underline{\theta})$ type being policymaker, but now, because of the large degree of preference heterogeneity, voluntary provision arises in the single-jurisdiction outcome. The political outcome is

$t(\underline{\ell}) = t(\bar{\ell})$	g	$v(\underline{\ell}, \underline{\theta}) = v(\bar{\ell}, \underline{\theta})$	$v(\underline{\ell}, \bar{\theta}) = v(\bar{\ell}, \bar{\theta})$
0.1	.23	0	.83

S outcome: $\bar{\ell} = \underline{\ell} = 1, \bar{\theta} = 3, \underline{\theta} = .1$

with utilities $U(\underline{\ell}, \underline{\theta}) = U(\bar{\ell}, \underline{\theta}) = .8$ and $U(\underline{\ell}, \bar{\theta}) = U(\bar{\ell}, \bar{\theta}) = .23$. However, when $\bar{\ell}$ is increased to $\bar{\ell} = 3.2$ the $(\underline{\ell}, \underline{\theta})$ policymaker collects sufficient tax revenues from high-income types that voluntary provision is no longer observed. The political outcome is

$t(\underline{\ell})$	$t(\bar{\ell})$	g	$v(\underline{\ell}, \underline{\theta}) = v(\bar{\ell}, \underline{\theta}) = v(\underline{\ell}, \bar{\theta}) = v(\bar{\ell}, \bar{\theta})$
0	2.2	4.57	0

S outcome: $\bar{\ell} = 3.2, \underline{\ell} = 1, \bar{\theta} = 3, \underline{\theta} = .1$

yielding utilities of $U(\underline{\ell}, \underline{\theta}) = U(\bar{\ell}, \underline{\theta}) = 1.15$ and $U(\underline{\ell}, \bar{\theta}) = U(\bar{\ell}, \bar{\theta}) = 3.12$. As argued above, income inequality dampens the incentives for voluntary provision rather than enhancing them.

On the basis of the above analysis, one is led to conclude that, if increased income inequality is to lead to increased reliance on voluntary provision, the reason must lie in changes that increased inequality produce in the jurisdictional outcome. To address this issue, we need to determine the conditions under which income segregation can also be (or not be) a stable configuration.¹⁴ To this end, let $\mathcal{T}_k(\vec{n}_k)$ give the political outcome (a vector of tax rates) for jurisdiction k with type distribution given by the vector $\vec{n}_k = [n_k(\underline{\ell}, \underline{\theta}), n_k(\underline{\ell}, \bar{\theta}), n_k(\bar{\ell}, \underline{\theta}), n_k(\bar{\ell}, \bar{\theta})]$ (where $n_k(\ell, \theta)$ is as defined in II.1). Also let \vec{n}_k^i be the vector created adding $\frac{1}{N} \cdot \vec{e}^i$ (where \vec{e}^i is the i th unit vector) to \vec{n}_k and giving the type distribution if a single type i agent moves to jurisdiction k . Finally, let $\hat{U}_k(\vec{n}_k; \ell, \theta)$ give the utility obtained by a type (ℓ, θ) residing in jurisdiction k with type distribution \vec{n}_k and political outcome $\mathcal{T}_k(\vec{n}_k)$. Then, for IS to be a stable configuration, the necessary conditions are (the Nash equilibrium conditions):

$$\begin{aligned}
\hat{U}_1(\vec{n}_1; \underline{\ell}, \underline{\theta}) &\geq \hat{U}_2(\vec{n}_2^1; \underline{\ell}, \underline{\theta}); \\
\hat{U}_1(\vec{n}_1; \underline{\ell}, \bar{\theta}) &\geq \hat{U}_2(\vec{n}_2^2; \underline{\ell}, \bar{\theta}); \\
\hat{U}_2(\vec{n}_2; \bar{\ell}, \underline{\theta}) &\geq \hat{U}_1(\vec{n}_1^3; \bar{\ell}, \underline{\theta}); \\
\hat{U}_2(\vec{n}_2; \bar{\ell}, \bar{\theta}) &\geq \hat{U}_1(\vec{n}_1^4; \bar{\ell}, \bar{\theta});
\end{aligned} \tag{17}$$

with $\vec{n}_1 = [\pi(\underline{\ell}, \underline{\theta}), \pi(\underline{\ell}, \bar{\theta}), 0, 0]$ and $\vec{n}_2 = [0, 0, \pi(\bar{\ell}, \underline{\theta}), \pi(\bar{\ell}, \bar{\theta})]$. If the conditions (17) are satisfied and there exists at least one type for which $\hat{U}_k(\vec{n}_k; \ell, \theta) > \hat{U}_{k'}(\vec{n}_{k'}; \ell, \theta)$, where

k' gives the jurisdiction in which type (ℓ, θ) would reside under an alternative Nash equilibrium configuration, then the configuration IS is a stable configuration.

Consider, now, the political outcome for an arbitrary jurisdiction configuration when $\bar{\ell} = \underline{\ell}$. In this case, a policymaker's preferred tax (given either by equations (12) and (13) or equations (15) and (16)) depends only on θ and the size of the jurisdiction, α_k (alternatively, the number of $\underline{\theta}$ types in the jurisdiction). As a result, if two individuals with the same θ live in different jurisdictions, both cannot find it optimal to continue residing in their jurisdiction rather than moving to the other's. That is, it must be that, if some type θ resides in jurisdiction 1 and jurisdiction 2, then either $\hat{U}_1(\vec{n}_1; \ell, \theta) - \hat{U}_2(\vec{n}_2^i; \ell, \theta) < 0$ or $\hat{U}_2(\vec{n}_2; \ell, \theta) - \hat{U}_1(\vec{n}_1^i; \ell, \theta) < 0$. Since the functions $\hat{U}_j(\cdot)$ are continuous in ℓ , these inequalities imply one of the conditions in (17) above must be violated for sufficiently small levels of income inequality. We therefore have the following result:

Proposition 4 *There exists an $\varepsilon > 0$ such that, for all $\bar{\ell}, \underline{\ell}$ with $0 < \bar{\ell} - \underline{\ell} < \varepsilon$, the jurisdiction configuration IS is not stable.*

A similar results holds when $\pi(\underline{\ell})$ or $\pi(\bar{\ell})$ are sufficiently small.¹⁵ In this case, income segregation fails to be a stable configuration because, with $\pi(\underline{\ell})(\pi(\bar{\ell}))$ small, the low-income (high-income) jurisdiction cannot meet the fixed costs of operation. Thus, we have:

Proposition 5 *There exist $\varepsilon > 0$ such that, for all $\pi(\bar{\ell}) < \varepsilon$ (or $\pi(\underline{\ell}) < \varepsilon$), IS is not a stable jurisdiction configuration.*

What these results establish is that, without significant income inequality, the IS configuration cannot be stable. As an example, in the case above with $\bar{\theta} = 3$, $\underline{\theta} = 1$, even if we raise $\bar{\ell}$ to 1.5, S remains the only stable configuration. Basically, the IS configuration can only arise when there are sufficient numbers of high-income types with sufficiently high incomes (relative to the low-income types) that they can both afford to segregate and find the high taxes in a single jurisdiction sufficiently burdensome that they have an incentive to do so. Because of this fact, voluntary provision within an income-segregated configuration can only be observed when there is sufficient income inequality.

In contrast to the single-jurisdiction case—where increased Income inequality tended to dampen the incentives for voluntary provision—if increased inequality leads to income segregation being stable, the incentives for voluntary provision are enhanced. For the $\bar{\ell}$ types, after-tax income typically rises with income segregation; moreover, because there are fewer members of the jurisdiction and the fixed cost F must still be incurred, the level of public good provision tends to fall. Both of these features enhance the incentive for the $(\bar{\ell}, \bar{\theta})$ type to engage in voluntary provision if this type is not the policymaker. For the $\underline{\ell}$, the decline in g due to smaller numbers in the jurisdiction has a similar effect, which, however, is dampened by the fact that $t(\underline{\ell})$ typically rises.

To illustrate these differences between the income-segregated case and the single-jurisdiction case, we return to the example above. Recall that, in the case of $\bar{\theta} = 3$, $\underline{\theta} = 1$, voluntary provision in the single-jurisdiction outcome is always zero. If $\bar{\ell}$ is raised to 3.2 (with $\underline{\ell}$ held constant at 1), S continues to be stable and there remains no voluntary provision; however, IS is now also stable. In each jurisdiction the $\underline{\theta}$ type is the policymaker and the political outcomes yield (jurisdiction 1 is the high-income jurisdiction)

$t_1(\bar{\ell})$	$t_2(\underline{\ell})$	g_1	g_2	$v_1(\bar{\ell}, \underline{\theta})$	$v_1(\bar{\ell}, \bar{\theta})$	$v_2(\underline{\ell}, \underline{\theta})$	$v_2(\underline{\ell}, \bar{\theta})$
1.41	.72	2.86	.49	0	0.83	0	.11

IS outcome: $\bar{\ell} = 3.2, \underline{\ell} = 1, \bar{\theta} = 3, \underline{\theta} = 1$

with utilities $U(\underline{\ell}, \underline{\theta}) = .37, U(\bar{\ell}, \underline{\theta}) = 2.26, U(\underline{\ell}, \bar{\theta}) = .37, U(\bar{\ell}, \bar{\theta}) = 2.17$. In this configuration, the $(\bar{\ell}, \underline{\theta})$ type's utility increases relative to S (making IS stable). Also, there is positive voluntary provision in both jurisdictions by the $\bar{\theta}$ type. Thus, *by inducing income segregation, increased income inequality can lead to increased private provision.*

We note finally that increased income inequality may also induce increased private provision if it causes the preference segregated outcome to become unstable. From Lemma 5, no private provision occurs with preference segregation; therefore, an increase in income inequality that induces a switch to a non-segregated outcome can give rise to private provision. In this case, increases in income inequality and private provision are accompanied by greater centralization rather than less; moreover, additional increases in income inequality will lead to reduced private provision unless there is a switch to an income-segregated configuration. Both of these features make such a scenario a less obvious candidate for describing recent trends. Nevertheless, it still illustrates

the point that increased income inequality, combined with changes in the structure of public provision, can induce increased private provision.

V Concluding Remarks

This paper has provided a model of endogenous jurisdiction formation in a setting in which taxes are set by a political process and voluntary provision of a local public good is possible. In spite of being biased toward a single-jurisdiction outcome, the model generates both jurisdictional segregation of the population and increased use of voluntary provision as income inequality increases. Increased income heterogeneity can lead individuals to sort themselves along income lines, forming communities where individuals have similar income levels but different intensities of preferences for public goods. This sorting can in turn result in fiscal choices that induce private provision. Both of these outcomes are consistent with recent trends in North America and Europe.

Our analysis has focused on how the distribution of income and preferences can affect private provision via segregation outcomes. The reverse linkage could also be of interest. In other words, what role does voluntarism play in jurisdiction formation? One could examine how the set of stable configurations would change if voluntary provision were infeasible. In particular, does voluntarism lead to increased community cohesion, as often claimed, or may it lead to increased segregation? Except in the cases of the IS and S configurations having a $\underline{\theta}$ -type policymaker, the equilibrium utility levels of the agents will be unchanged by a ban on voluntarism (or any other policy promoting or discouraging voluntary provision). In these two cases, and in certain out-of-equilibrium configurations, agent utilities may be affected. For the policymaker, utility weakly decreases when private provision is infeasible; for a $\bar{\theta}$ type (the type that potentially engages in voluntary provision), utility may increase or decrease. The net effect of voluntary provision on jurisdiction formation is, as a consequence, not immediately obvious. In the example described at the end of the previous section, with $\bar{\ell} = 3.2$, $\underline{\ell} = 1$, $\bar{\theta} = 3$, $\underline{\theta} = 1$, when voluntary contributions are infeasible, income segregation ceases to be a stable configuration. Thus, in this example, voluntarism can actually encourage segregation; which goes counter to often-heard arguments that voluntarism should be promoted as a means of community building.

Our analysis could also be extended in several other directions. First, the choice of other tax variables may be included into the analysis; in particular, tax incentives

to voluntary giving could be used by a low-preference majority to encourage voluntary behaviour, resulting in policy outcomes that are relatively more unfavourable to high-preference individuals (Scharf, 1999); this, in turn, may affect segregation incentives. It may also be important to account for heterogeneity in preferences over the composition of public consumption. When such heterogeneity exists, a majority can dictate not only the level of taxation, but also how the revenues from taxes are spent. Voluntary contributions give volunteers full control over the use of funds, an advantage which could make a private provision outcome relatively more attractive to volunteers. Finally, it may be important to consider agglomeration motives other than scale economies in public good provision, such as technological complementarities in production (Bénabou, 1996).

Notes

¹During this period, non-government organizations have also emerged to play important roles in areas ranging from food banks, to community services such as parks, recreation facilities and local environmental clean-up. Known in the U.S. as the “privatization of America,” this shift to private provision has been endorsed by leading politicians: in a speech to the community of Monrovia, California, President Clinton stated that “...we try to set rules within which our people can work together, in which the free market can work, in which people’s creativity can work, in which communities can solve their own problems.”

²It is interesting to note that a trend toward increased transfer of fiscal responsibilities from federal to state governments and from these governments to local ones has paralleled the other two trends during the 1980s and 1990s. Dubbed the “devolution revolution,” this trend has seen responsibility for programs such as welfare, public education and health care have, to varying degrees, been passed from higher to lower levels of government. In the U.S., for instance, President Clinton signed the “Personal Responsibility and Work Opportunity Act of 1996” (PRWORA), transferring responsibility for some income support and social services from Washington to state and local governments and the private sector. In Canada, the federal government now allows each province to decide how federal transfers will be allocated between health and public education. In Ontario, responsibility for social programs has been passed from the provincial to local government.

³ In fact, Bergstrom, Blume and Varian point out that “It would be nice to have an explanation not only of what happens to private contributions when the government increases its contribution of a public good, but also of what causes the government to do so,”—a reflection shared by Weisbrod (1988) (pp. 160-161). One thing we do in this paper is provide an explanation for the response of fiscal choices to voluntary activities. With an endogenous tax system, we find no longer valid Bergstrom, Blume and Varian’s claim that “if an economy evolves to a more equal distribution of income, we can expect the amount of public goods that would be provided voluntarily to diminish.”

⁴ One strand of literature in this area looks at the effect of “voting with one’s feet” on the capitalization of property taxes and local public services into property values. See, for example, Oates (1969); Hamilton (1976a, 1976b); Epple, Zelenitz and Visscher (1978); Epple and Sieg (1997); Brueckner, (1979, 1982); and Hoyt and Rosenthal (1997). Goodspeed (1989, 1995), focuses on local income taxation. A separate strand of literature looks at conditions under which Tiebout style sorting leads to efficient and stable outcomes (Westhoff, 1977; Wooders, 1980; Bucovetsky, 1981; Epple, Filimon and Romer, 1984; Epple and Romer, 1991; Epple and Platt, 1996). A few recent papers have analyzed jurisdiction formation in a political-economy context, in the presence of preference or income heterogeneity and interjurisdictional factor mobility (Bolton and Roland, 1996, 1997; Alesina and Spolaore, 1997).

⁵ Note that, in the following, we shall assume that the tax system is always such that $c(\ell, \theta)$ is increasing in ℓ . These assumptions together imply that $w(c(\ell, \theta), g; \theta)$ satisfies the usual single-crossing property in ℓ and θ .

⁶ This production structure is equivalent to the assumption that each agent in jurisdiction k uses some fraction of her endowment for provision of g_k and consumes the remaining fraction.

⁷ For more details on this process, see Bergstrom, Blume and Varian (1987). Note, however, that, in order to account for the observed volume of charitable contributions in large-numbers economies, it is necessary to invoke altruistic motives (see, e.g., Bernheim (1986) or Ireland (1990)). This can be modelled, for example, by including a “warm-glow” effect accruing to contributors (Andreoni, 1990). Nevertheless, all of the results obtained in our analysis also go through with a linear specification of warm-glow effects, with $u(c + \gamma z, g; \theta)$, where $0 < \gamma < 1$ and z represents an individual’s total contributions (voluntary and involuntary) to the public good.

⁸ This restriction is weaker than the usual tax progressivity restriction with proportional income taxes; here the restriction could be satisfied by a proportional tax system even though tax rates are not increasing with income.

⁹ An implication of Condition 3 is that the single-jurisdiction configuration has strong stability properties that bias the results away from segregation.

¹⁰ Note that, in a planning solution, taxes and contributions are equivalent instruments.

¹¹ One could undertake similar analyses for jurisdiction configurations other than the types discussed here. For expositional reasons, and because the segregated configurations are the ones that prove relevant ultimately, we have focussed only on these ones here.

¹² The assumption of gross complementarity is sufficient but not necessary. Because of the existence of a set-up cost, an increase in the size of the jurisdiction also has a pure income effect component (in addition to that created by the implicit reduction in the price of g). As a result, Assumption 2 can be satisfied even if the substitution effect is somewhat larger than the income effect (from the price reduction).

¹³ The small value of N in the examples is chosen to ensure that positive voluntary contributions can occur in the absence of warm-glow effects (see Footnote 7). Although deviations in locational choices continue to be defined in terms of entities of unit mass, our parameterization implies that there will be non-integer numbers of individuals of each type. This is

clearly an abstraction but it is not problematic from a theoretical point of view, and does not affect our analysis and results.

¹⁴ Recall that the configuration S is invariably stable and so the issue is one of whether or not IS is also stable.

¹⁵ The reader should not conclude from this fact that reductions in $\pi(\bar{\ell})$, for instance, can only lead to the IS configuration being no longer stable. As will be seen below, it is possible to construct examples in which a reduction in $\pi(\bar{\ell})$ actually results in IS being a Nash equilibrium when it was not so for larger values of $\pi(\bar{\ell})$.

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Appendix A

Proof of Lemma 1: Suppose not, so that $c_k(\bar{\ell}, \theta') > c_k(\underline{\ell}, \theta')$. Then, there are two possibilities: (i) $v_k(\ell, \theta) = 0, \forall(\ell, \theta)$; or (ii) $v_k(\ell, \theta) > 0$ for some (ℓ, θ) . In the former case, equations (7)-(11) imply that an increase in $t_k(\bar{\ell})$ strictly raises g_k while leaving $c_k(\underline{\ell}, \theta)$ unchanged. As a result, the utility of type $(\underline{\ell}, \theta)$ increases.

For case (ii), let Δt be the increase in $t_k(\bar{\ell})$ needed to make $u(c_k(\bar{\ell}, \theta'), g_k; \theta') = u(c_k(\underline{\ell}, \theta'), g_k; \theta')$. If $v_k(\bar{\ell}, \theta) > \Delta t$ for both $(\bar{\theta})$ and $(\underline{\theta})$, then from equations (7)-(11), an increase in $t_k(\bar{\ell})$ has no effect on g_k or on consumption of the low-income type policymaker. The policymaker, therefore, weakly prefers the tax increase. If $v_k(\bar{\ell}, \theta) < \Delta t$ for some θ , then the increase in $t_k(\bar{\ell})$ increases that type's contribution to g_k . While other types' contributions may be lower, equations (7)-(11) and the normality of c and g imply that they cannot be so low as to reduce g_k . As a result, g_k increases with the increase in $t_k(\bar{\ell})$; private consumption for the policymaker is weakly increasing and so utility of the policy maker strictly increases. \square

Proof of Lemma 2: The proof here is essentially the same as for Lemma 1, where now the $(\bar{\ell}, \theta)$ type gains by raising the tax from $t_k(\underline{\ell}) < t_k(\bar{\ell})$ to $t_k(\underline{\ell}) = t_k(\bar{\ell})$. \square

Proof of Lemma 3: Suppose a type $(\bar{\ell}, \theta')$ forms the government. From Lemma 2, $t_k(\bar{\ell}) = t_k(\underline{\ell})$, implying that $\bar{\ell} - t_k(\bar{\ell}) > \underline{\ell} - t_k(\underline{\ell})$. The assumption that c_k and g_k are normal goods then implies that $v_k(\bar{\ell}, \theta) \geq v_k(\underline{\ell}, \theta)$ for any given θ , with strict inequality if $v_k(\bar{\ell}, \theta) > 0$. If the type $(\underline{\ell}, \theta')$ forms the government, then from Lemma 1, $\bar{\ell} - t_k(\bar{\ell}) = \underline{\ell} - t_k(\underline{\ell})$. Equations (7)-(11) then imply that $v_k(\bar{\ell}, \theta) = v_k(\underline{\ell}, \theta)$. \square

Proof of Lemma 4: Because all agents have the same income, there is a single tax, $t_k(\ell) \equiv t_k$. Suppose, by way of contradiction, that $t_k = t'$ is set such that $v_k(\ell, \theta) > 0$ for some (ℓ, θ) . The level of public good provision in this case is

$$g'_k = \frac{n_k(\ell, \bar{\theta})v_k(\ell, \bar{\theta}) + n_k(\ell, \underline{\theta})v_k(\ell, \underline{\theta}) + \alpha_k t' - F}{h}.$$

Now suppose that the type forming the government is $(\ell, \bar{\theta})$. From (7)-(11), this type could achieve the same level of public good provision with a tax $t_k = \hat{t}$ defined by $g'_k = (\alpha \hat{t} - F)/h$. Since the willingness-to-pay for g is increasing in θ , $v_k(\ell, \bar{\theta}) > v_k(\ell, \underline{\theta})$, implying that $\hat{t} < t' + v_k(\ell, \bar{\theta})$. Thus, the type $(\ell, \bar{\theta})$ can achieve the same level of public good provision but a higher level of private consumption with \hat{t} than with t' . As a result, this type will always choose \hat{t} rather than t' . \square

Proof of Lemma 5: Suppose, first, that the type $(\bar{\ell}, \theta)$ forms the government. Then, from Lemma 2, $t_k(\bar{\ell}) = t_k(\underline{\ell}) = t_k$, while, from Lemma 3, $v_k(\bar{\ell}, \theta) \geq v_k(\underline{\ell}, \theta)$ with strict inequality if $v_k(\bar{\ell}, \theta) > 0$. Thus, the same argument as in the proof of Lemma 4 applies and t_k must be such that $v_k(\bar{\ell}, \theta) = 0$. If the type $(\underline{\ell}, \theta)$ forms the government, then from Lemma 3, with $t_k(\bar{\ell}) = t_k(\underline{\ell}) = t_k$ we have $v_k(\bar{\ell}, \theta) = v_k(\underline{\ell}, \theta)$. This implies, however, that a t_k such that $v_k(\bar{\ell}, \theta) = v_k(\underline{\ell}, \theta) = 0$ is weakly preferred to one for which $v_k(\bar{\ell}, \theta) = v_k(\underline{\ell}, \theta) > 0$. \square

Proof of Lemma 6: Suppose, by way of contradiction, that $\beta_j(\ell', \theta') > 0$. Then, since a type (ℓ', θ') in j could move to k and be the type that forms the government in k with probability 1 (from Property 5), it must be that, in the candidate equilibrium configuration, $u_j(\ell', \theta') > u_k(\ell', \theta')$. This inequality follows from that fact that the movement of (ℓ', θ') from j to k increases g_k , tax levels constant, and so must increase the utility of a (ℓ', θ') type in k . Note, also, that Assumption 2 implies that a movement of a type (ℓ', θ') from k to j must reduce the tax level $t_j^*(\ell)$ but increase g_j^* as long as type (ℓ, θ) forms the government in j . Finally, from Lemmas 1 and 2, this tax reduction must result in a reduction in $t_j(\ell')$ also.

Now, consider a movement of a type (ℓ', θ') from k to j . If the movement causes the (ℓ', θ') type to form the government, then the argument that established that $U_j(\ell', \theta') > U_k(\ell', \theta')$ implies that the move increases the utility of the moving type.

If the type (ℓ, θ) continues to form the government after the move, then, it must be that the new tax regime in j involves lower taxes and higher levels of the public good. If either $v_j(\ell', \theta') = 0$ or $v_j(\ell', \theta') > 0$ both prior to and after the move then the move must increase the utility of any (ℓ', θ') type in j . In the former case, $c_j(\ell', \theta')$ increases (at least weakly) while $g_j(\ell', \theta')$ increases strictly (Assumption 2). In the latter case, both $c_j(\ell', \theta')$ and $g_j(\ell', \theta')$ are strictly increasing (Assumption 2 and equations (7)-(11)).

The remaining possibility is $v_j(\ell', \theta') = 0$ prior to the move and $v_j(\ell', \theta') > 0$ after. Let $t_j^0(\ell', \theta')$ be the smallest tax such that $v_j(\ell', \theta') = 0$. Then, from equations (7)-(11),

$u(\ell' - t_j^*, g_j^*; \theta') = u(\ell' - t_j^0, g_j^*; \theta') > U_j(\ell', \theta')$, the utility of a type (ℓ', θ') in the initial configuration. The last inequality follows by the same argument as the previous two cases. Thus, again, the move increases the utility of any (ℓ', θ') in j .

Finally, as $U_j(\ell', \theta') > U_k(\ell', \theta')$ initially, the movement generates higher utility for a (ℓ', θ') type initially in k if either it forms the government or (ℓ, θ) forms the government. If any other type forms the government, then, from Property 5, utility must be at least as large as if (ℓ, θ) forms the government. Thus, there can be no equilibrium configuration in which $\beta_j(\ell', \theta') > 0$. \square

Proof of Lemma 7: Suppose not and that $\beta_j(\ell', \theta'), \beta_k(\ell', \theta') > 0$. Then, the same argument as in the proof of Lemma 6 implies that a movement of (ℓ', θ') from j to k must increase the utility of the (ℓ', θ') types in k . Therefore, for this configuration to be an equilibrium, it must be that $U_j(\ell', \theta') > U_k(\ell', \theta')$. Similarly a movement of (ℓ', θ') from k to j must increase the utility of these types in j , implying that $U_k(\ell', \theta') > U_j(\ell', \theta')$. Both inequalities cannot hold simultaneously, implying that one of $\beta_j(\ell', \theta'), \beta_k(\ell', \theta')$ must be zero. \square

Proof of Proposition 1: Lemmas 6 and 7 prove the result for cases in which some type forms the government with probability one. For the other cases, Lemmas 6 and 7 also apply since these lemmas show that, if $\beta_j(\ell, \theta), \beta_k(\ell, \theta) > 0$, then a movement by (ℓ, θ) from j to k increases utility for this type whether or not it forms the government. Condition 5 then guarantees that the probability weights attached to more favorable governments increase, thereby implying that expected utility increases. \square

Proof of Lemma 8: Suppose to the contrary that the configuration $J_1 = \langle (\bar{\ell}, \bar{\theta}), (\underline{\ell}, \underline{\theta}) \rangle$, $J_2 = \langle (\bar{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}) \rangle$ is an equilibrium. Using the same arguments as before, for this to be the case it must be that $U_1(\underline{\ell}, \underline{\theta}) > U_2(\underline{\ell}, \underline{\theta})$ and that $U_2(\bar{\ell}, \underline{\theta}) > U_1(\bar{\ell}, \underline{\theta})$. Now suppose that type $(\underline{\ell}, \bar{\theta})$ forms the government in jurisdiction 2. Then, from Lemma 1, $U_2(\bar{\ell}, \underline{\theta}) = U_2(\underline{\ell}, \underline{\theta}) < U_1(\underline{\ell}, \underline{\theta}) \leq U_1(\bar{\ell}, \underline{\theta})$, contradicting the fact that the configuration is an equilibrium. The same argument applies to the case in which type $(\underline{\ell}, \underline{\theta})$ forms the government in jurisdiction 1. Therefore, there can be no such equilibrium with a low-income type forming the government.

Suppose next that the high-income type forms the government in both. For this to be an equilibrium, it must be that $U_1(\underline{\ell}, \underline{\theta}) > U_2(\underline{\ell}, \underline{\theta})$, $U_1(\bar{\ell}, \bar{\theta}) > U_2(\bar{\ell}, \bar{\theta})$ and $U_2(\underline{\ell}, \bar{\theta}) > U_1(\underline{\ell}, \bar{\theta})$. These three inequalities cannot be satisfied simultaneously given the assumption that willingness to pay for the public good is increasing in ℓ and θ .

The configuration $J_1 = \langle (\underline{\ell}, \underline{\theta}), (\underline{\ell}, \bar{\theta}), (\bar{\ell}, \bar{\theta}) \rangle$, $J_2 = \langle (\bar{\ell}, \underline{\theta}) \rangle$ can be ruled out by an analogous line of reasoning. \square

Appendix B

Before proving the results on stable configurations, we must first define the notions

of location strategies and voluntary provision strategies for agents and a location-contribution game. To proceed, let $\mathcal{J} = \{J_1, J_2, \dots, J_K\}$, $K \geq N$ define the set of potential jurisdictions. A location strategy for agent i of type (ℓ, θ) , $\lambda_i(\ell, \theta)$, is a selection from \mathcal{J} with $\lambda_i(k; \ell, \theta)$ denoting the probability that agent i of type (ℓ, θ) locates in jurisdiction J_k . A voluntary provision strategy for agent i of type (ℓ, θ) residing in jurisdiction J_k is a function $\nu_i(\vec{n}_k; \ell, \theta) \in [0, \ell - t_k(\ell)]$ giving the level of voluntary contribution of agent i of type (ℓ, θ) in any jurisdiction k with type distribution \vec{n}_k and political outcome $\mathcal{T}_k(\vec{n}_k)$. The location-contribution game involves the N agents simultaneously choosing location strategies λ_i and voluntary contribution strategies ν_i . A strategy $2N$ -tuple $(\lambda^*, \nu^*) = ((\lambda_1^*, \nu_1^*), (\lambda_2^*, \nu_2^*), \dots, (\lambda_N^*, \nu_N^*))$ satisfies Condition 2 for a stable configuration if it is a sub-game perfect Nash equilibrium strategy $2N$ -tuple for the contribution game and is such that $\nu_i(\vec{n}_k; \ell, \theta) = \nu_j(\vec{n}_k; \ell', \theta')$, $j \neq i$, $\forall k$, $\ell = \ell'$, $\theta = \theta'$.

Proof of Proposition 3: Since $u(c, g; \theta) \geq 0$, $\forall g > 0$ the utility for an individual under S is non-negative. Given $F > \bar{\ell}$, a deviating individual obtains utility of $u(c, 0; \theta) = 0$. As a result, no individual can be better off by deviating from S. \square

Proof of Corollary to Proposition 3: Given $N(\pi(\bar{\ell})\bar{\ell} + \pi(\underline{\ell})\underline{\ell}) > F$, if $t(\underline{\ell}) < \underline{\ell}$, then $c, g > 0$, implying that $u(c(\ell, \theta), g; \theta) > 0$, $\forall \ell, \theta$. Thus, S is feasible. Finally, from (14), the size of g (and so the policymaker's utility) is increasing in the number of individuals in the jurisdiction. Since S maximizes the number of individuals in the jurisdiction, the policymaker's utility under S is larger than under any other Nash equilibrium configuration. If the policymaker is chosen in a non-stochastic fashion, then any other configuration must yield less utility for the policymaker than does S. As a result, S is undominated and so stable. \square

Proof of Propositions 4 and 5: Suppose that $\underline{\ell} = \bar{\ell}$. In this case, there are only two types of individuals. By arguments analogous to those used previously (see Appendix A), the only configurations that can be Nash are those that have all individuals of the same type living in the same jurisdiction. As a result, if individuals of some type θ' live in both jurisdictions 1 and 2, it must be that either the condition $\hat{U}_1(\vec{n}_1; \ell, \theta') - \hat{U}_2(\vec{n}_2; \ell, \theta') > 0$ or $\hat{U}_2(\vec{n}_2; \ell, \theta') - \hat{U}_1(\vec{n}_1; \ell, \theta') > 0$ for (17) is violated. Without loss of generality, assume that $\hat{U}_1(\vec{n}_1; \ell, \theta') - \hat{U}_2(\vec{n}_2; \ell, \theta') < 0$. Finally, consider increasing income for the θ' type in jurisdiction 1 to $\ell' > \ell$. Since utilities are continuous functions of ℓ and $\hat{U}_1(\vec{n}_1; \ell, \theta') - \hat{U}_2(\vec{n}_2; \ell, \theta') < 0$ it must be that $\hat{U}_1(\vec{n}_1; \ell', \theta') - \hat{U}_2(\vec{n}_2; \ell', \theta') < 0$ for ℓ' sufficiently close to ℓ . This fact means that, for $0 < \ell' - \ell < \varepsilon$, for some ε , the conditions (17) are violated and so IS is not a Nash equilibrium configuration. \square