Intergenerational Spillovers, Decentralization and Durable Public Goods
(preliminary)

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Abstract

We consider an overlapping generations model with durable public goods and indivisible land. We show that providing public good locally, as Tiebout suggested, results in the full internalization of the intergenerational spillovers that durable public goods entail. Internalization does not take place, however, when public goods are provided by the national government. On the other hand, the beneficial effects of decentralization are mitigated when there are interjurisdictional spillovers. This paper also provides a Tiebout theorem (equilibrium exists and is first best) for a dynamic local public goods economy. These results, however, are strongly dependant on the particular way that land market is modeled, and we discus how alternative treatments of land may generate full efficency even without interjurisdictional competition.

1. Introduction

The central question we explore is how self-interested agents can be induced to invest optimally in future generations. More specifically, we investigate what sorts of institutional arrangements cause nonaltruistic agents to internalize intergenerational spillovers.

Intergenerational transfers are an extremely important and widely studied phenomenon. Pay-as-you-go social security systems and medical care for the elderly are leading examples of programs that transfer wealth from the young to the old. We also see significant transfers of wealth in the other direction as well, educational expenditures and public capital that is passed from one generation to the next, for example. We call goods that result in transfers from the young to the old, or the old to the young, *backward* and *forward intergenerational goods* (BIGs and FIGs), respectively.

If people are not very altruistic in general, one might wonder why these types of goods make up such a large fraction of national expenditure. One possible explanation in the case of BIGs is that there has come into being a social contract in which the young transfer wealth to the old expecting that their children will eventually transfer wealth to them. No young generation would be served by breaking this contract as it would lead to poverty in their own retirement. While this does not help us determine the particular level of transfer we should expect to observe, it does provide a rational foundation for this apparently altruistic behavior. Unfortunately, no similar explanation can be offered for FIGs. Once the young have received a transfer from the old it is money in the bank. If they subsequently refuse to make transfers to their children, there is no punishment available with which to threaten them. We must look to elsewhere for an explanation.

In this paper, we focus our attention on a particular type of FIG called a *durable public good* (DPG). Examples include such things as roads, public buildings, parks and R&D. An essential feature of this type of commodity is that when the current generation produces them, the next generation necessarily receives a benefit in the form of an inherited public capital stack. Clearly, unless this spillover is somehow internalized, DPGs will be systematically underprovided. Notice, however, that many DPGs are provided locally instead of by the central government. Tiebout (1956) suggested the this type of local provision might lead to interjurisdictional competition that would in turn lead to an efficient outcome. His focus (and the focus of most of the subsequent literature), however, was on static coalition formation, optimal sorting of agents by taste and overcoming free-riding though tax/public good bundles offered by competing jurisdictions. In contrast, the main question we ask is: can this argument can be extended to show that interjurisdictional competition also prevents free riding (and the consequent underprovision of public goods) *between different generations*?

To address this, we consider a very simple world with multiple jurisdictions and an overlapping generations demographic structure. To emphasize the role of intergenerational spillovers, suppose that every jurisdiction is identical and every agent has the same taste for public goods. Agents go through their life-cycle by buying a house in a particular jurisdiction when they are young, and selling it when they are old. The generation that lives in a jurisdiction in a given period has the responsibility to choose how much to invest in DPGs. We compare a centralized process in which a common level of DPGs is chosen in a national election to a decentralized process which each jurisdiction selects its own level in a local election.

What we discover is that the results are strongly dependant on the particular treatment of land and city formation. The correct formulation of the land market is not entirely obvious. In some situations, cites may be of fixed geographical size either because they are surrounded by other municipalities or are subject to land use restrictions like "greenbelt" requirements or regulations prohibiting urban sprawl. In other cases, cities may aggressively absorb surrounding municipalities or annex new developments and so be of variable geographic size. Within cities, zoning laws may allow or prohibit division of land or the building of multifamily housing on a single lot. In this paper we explore the most restrictive form of the land market possible. We assume that land is indivisible and each city is of fixed size with a fixed number of parcels of land. In on-going work, we relax this assumption and consider cities with divisible land.

We show for this case that when agents bid for houses in jurisdictions with differing levels of public goods, the effect is to fully "capitalize" the intergenerational spillover into the price. This in turn causes the present generation to internalize the spillover and invest optimally. Note that this result does not depend on the presence of an "outside offer" to pin down land prices. In contrast, the capitalization does not take place when decision making is centralized. This is because when DPGs are provided at the national level, all the jurisdictions are identical and the price of houses is not responsive to public investment. In this sense, decentralization is both necessary and sufficient to get first best outcomes in the presence of intergenerational spillovers.

To the degree that one accepts our treatment of land as corresponding to the real world, the results in this paper have a clear implication for intergenerational exchange: decentralize whenever possible. Doing so allows market forces to induce optimal behavior even for self-interested agents. The conclusion becomes less clear, however, when goods produce interjurisdictional spillovers as well as intergenerational spillovers. For example, R&D is much more in the spirt of a pure public good with widespread externalities than, say, a city street which produces localized benefits for the most part. Interjurisdictional competition is of no help in internalizing cross-boarder spillovers. Thus, there is essential institutional trade-off when dealing with intergenerational and interjurisdictional spillovers. To the extent that public goods are pure and generate interjurisdictional spillovers, they should be provided by higher level of government, and to the extent intergenerational spillovers are present, they should be provide locally. When both types of spillovers are present, it may be necessary to appeal some other institution to achieve efficiency.

We view the contribution of this paper, however, as being more on the technical side than as providing any key policy insight. Our exploration of the appropriate form of institutions is applies only to economies in which land in indivisible. This is an important benchmark case, but we would not want to represent this necessarily being the one that most closely reflects actual land markets. While we argue below that the superiority of decentralized public good provision is somewhat robust, we show in subsequent work (Conley and Rangel 2000) that this breaks down when land is treated as divisible. In this case, centralized provision does just as well. One might even choose to take this as a negative result in the sense that Tiebout's claim that decentralization is necessarily for efficient public good provision only holds in limited and possibly unrealistic circumstances when public goods are durable.

The paper proceeds as follows. In section 2, we outline the basic model. In section 3, we show that decentralized provision of DPGs leads to an first best outcome. In section 4, we show that centralized provision leads of underprovision in general. In section 5, we discussion explore the effect of interjurisdictional spillovers on these results. In section 6, we discuss some of the extensive literature on intergenerational good and local public goods in order to place these results in context. Section 7 concludes.

2. The Model

Consider a simple finite horizon overlapping generations economy. There are two periods ($t = 1, 2$) and three generations: an old generation 0 that lives only in period 1, generation 1 that is young in period 1 and old in period 2, and generation 2 that is born in period 2 and only lives for that period. Each generation has I agents indexed by $i \in \{1, \ldots, I\}$.

There is one private and one public good in the economy. Every period the young, but not the old, receive an endowment w of the private good. This good may be consumed immediately or stored for consumption in the future. We assume a storage technology that transfers resources across periods and yields a constant rate of return $1 + r$, with $r > 0$. The public good is produced by local governments and is described in more detail below

Young agents choose to live in one of J separate jurisdictions. Each jurisdiction consists of L *identical* plots of land. Land does not depreciate with use. For simplicity, we assume that agents buy exactly one plot, and rule out additional purchases for speculative purposes. Furthermore, we assume that $I = J \times L$. As a result, the entire stock of land is sold every period from old to young. This approach to land follows Dunz (1985) and Nechyba (1996). We discuss alternative treatments might affect this in Remark 3, below.

Initially the land is owned by the old of generation 0. However, at the beginning of period 1 they sell the plots to the young of generation 1 in an interjurisdictional land market. Similarly, at the beginning of period 2 the generation 1 sells these plots to generation 2.

Each jurisdiction offers its residents a level of a durable public good which depends both on the stock inherited from the previous generation, and the level new spending on public goods. This DPG depreciates across periods and *survives* at a rate $\delta \in [0, 1]$. We denote the level of DPGs in period t and jurisdiction j[1]

$$G_t(j) = \delta G_{t-1}(j) + g_t(j) \tag{1}$$

where $g_t(j)$ denotes the amount of new public expenditures in period t, and $G_0(j)$ is given exogenously. Note that the level of DPGs depends both on the actions current residents, through $g_t(j)$, and the choices of previous residents, through $\delta G_{t-1}(j)$.

The survival rate is a good measure for the degree of intergenerational spillovers. In the extreme case of full depreciation ($\delta = 0$), no intergenerational transfers take place and the level of public services in a jurisdiction only depends on the decisions of current residents. If $\delta > 0$, on the other hand, an investment in DPGs by generation 1 generates a transfer to generation 2. This intergenerational spillover is the key distinction between DPGs and the type of public good more commonly treated in the literature. Note, however, that since the world ends in period 2, the public investment decisions of generation 2 do not generate intergenerational spillovers.

[1] In an attempt to simplify the notation, the subscript in *any* variable denotes the period.

Initially, we rule out interjurisdictional spillovers by assuming that the DPG in jurisdiction j only affects the residents of that jurisdiction. This assumption is satisfied by some goods, like local roads, but not for others, like pure R&D. Interjurisdictional spillovers will be added to the model in Section 5.

We shall assume that DPG investments are fully reversible. In other words, g can be negative, although it must satisfy $g_t(j) \geq -\delta G_{t-1}(j)$. This assumption is natural for some DPGs but not for all. A jurisdiction that inherits a large forest can always cut it down and give a transfer to its residents. Similarly, a nice city hall can always be sold to the private sector and transformed into an up scale shopping center. On the other hand, infrastructure like roads cannot easily be de-invested.

Reversibility implies that every generation chooses exactly the level of DPGs that it consumes. We wish to emphasized that while this simplifies the analysis, it does not eliminate the intergenerational spillovers. If generation 1 chooses to consume G units of DPGs, the next generation of residents starts with δG. Thus, a decision to consume a positive amount of DPGs necessarily entails a transfer to the next generation. The role that reversibility plays in the results will be discussed in more detail in Remark 1, below.

We consider an economy in which all the agents of a given generation have identical tastes. Because the generations 0 and 2, live for one period, while generation 1 lives two periods, the preferences are slightly different across generations. If we were to make this an infinite horizon model, however, all the utility functions would be like those for generation 1 agents. Formally, the preferences for generations 0, 1, and 2, respectively, are as follows:

$$U_0(c^o) = c^o,$$

$$U_1(G_1(j), c^y, c^o) = V(G_1(j)) + c^y + c^o,$$

$$U_2(G_2(j), c^y) = V(G_2(j)) + c^y,$$

where $V(.)$ is a differentiable, strictly concave, strictly increasing and $V'(0) = \infty$, and c^y and c^o denote consumption when young and old. Since preferences are linear in consumption and $r > 0$ generation 1 only consumes in old age. This is simplification is intentional since we wish to focus on intergenerational transfers stemming from DPGs. We should admit, however, that abstracting from this issue is one of the factors that allow us to get a first best outcome so easily.

Political decisions are made by majority rule. We assume that in each jurisdiction only land owners vote. We also assume that jurisdictions balance their budget every period. As a result, public policy is summarized by $g_t(j)$, which denotes the level of investment (or de-investment if $g_t(j) < 0$). All taxes are lump-sum, and thus $\frac{g_t(j)}{J}$ also denotes the tax paid by each resident. Note that given that agents consume an equal amount of land, the lump-sum tax is equivalent to a property tax.

To summarize, the timing of a period is as follows:

1. A new generation is born.
2. Each member of the new generation buys a plot in the land market.
3. Every jurisdiction holds an election, which determines the level of DPGs for the period.
4. Young agents decide how much to save, and old agents consume their savings plus the returns on the sale of their house.
5. The period ends.
6. The depreciation of DPGs takes place between periods.

We introduce a state variable that will prove useful later on. The state of the economy is given by a description of the level of DPGs in every jurisdiction at the beginning of the period. The state in period 1 is given exogenously and is equal to

$$s_1 = (\delta G_0(1), ..., \delta G_0(J)).$$

On the other hand, in period 2 there are many possible states depending on the actions of generation 1:

$$s_2(j) = \delta G_1(j) = \delta(s_1 + g_1(j)).$$

An allocation is a list (A, g, c, σ) that specifies an assignment of agents to jurisdictions, an investment plan for each jurisdiction and a consumption plan for agent. More specifically, $A_1(i)$ and $A_2(i)$ determines the location of agent i in each period, $g_1(j)$ and $g_2(j)$ denotes the level of investment in jurisdiction j for each period, $c_1^y(i)$, $c_2^y(i)$, $c_1^o(i)$ and $c_2^o(i,s)$ give the private good consumption for individual i of each generation when young or old, and σ denotes aggregate savings in period 1.

An allocation is feasible if it assigns exactly L agents to each jurisdiction and satisfies the following two resource constraints:

$$\sum_i c_1^y(i) + \sum_i c_1^o(i) + \sum_j g_1(j) - \sigma \leq Iw$$

and, for every state s,

$$\sum_i c_2^y(i) + \sum_i c_2^o(i) + \sum_j g_2(j) \leq Iw + (1+r)\sigma.$$

We are now ready to characterize the first best level of DPGs. Since preferences are quasilinear, in any interior allocation there is a unique efficient level of DPGs for each period. As long as we stay away from corners, direct transfers between the agents do not affect optimality. Also note that *the optimal level of the DPGs in period* 2 *is independent the level in period 1.* This might be counterintuitive at first, but it is the result of our assumption of full reversibility. Under this assumption, period 2 agents can always start by de-investing the DPGs that they have inherited from the previous generation, and then choose how much to spend. Thus, reversibility implies that the optimal program is additively separable and state independent. Also note that given that agents are homogenous, there is no need for the planner to consider maximization over all possible assignments of agents to jurisdictions. All feasible assignment are equally good. If agents were heterogenous, then the more traditional concern in Tiebout economies about sorting agents optionally by tastes would come into play. We will say more about this in Remark 4, below. Given all this, the socially optimal level of DPG in period 1 is given by the solution to:

$$\sum_j \max_{G_1}[JV(G_1) + \delta G_1 - (1+r)G_1] \tag{2}$$

and the socially optimal level of DPG in period 2 is given by the solution to:

$$\sum_j \max_{G_2}[JV(G_2) - G_2]. \tag{3}$$

Equation 2 is constructed by adding the consumption value of DPG to the J agents in each jurisdiction to transfer value of the surviving public good that generation 2 thereby inherits (which is identically as good as passing on private commodity on give the assumption of reversibly) and then subtracting the opportunity cost of not investing the period 1 DPG expenditure in the storage technology instead. Similarly, equation 3 is constructed by taking the consumption benefit of public goods to agents in the period 2 jurisdictions and subtracting the opportunity cost of not consuming this DPG as private goods instead.

We denote the optimal levels of DPGs for each identical jurisdiction by $G_1^*(j)$ for period 1 and $G_2^*(j)$ for period 2. The solution to 2 and 3 are characterized by the following first order conditions.

$$JV'(G_1^*(j)) = 1 + r - \delta \tag{4}$$

and

$$JV'(G_2^*(j)) = 1, \tag{5}$$

which are the familiar Samuelson conditions modified for durability of the public good and the opportunity cost of not investing in the storage technology.

In this model agents choose where to live and then vote over how much DPG to consume. Both of these choices are affected by the price system and so it is worth spending some time discussing it. At a formal level, the price system specifies for each period, and for every possible level of public good in each jurisdiction, the cost of housing. We denote prices in each period as follows:

$$p_t(s) = (p_t(1, s), \ldots, p_t(J, s)).$$

Note an agent of generation 1 must consider prices for both periods. First, he must compare both the level of inherited DPG and the cost of buying a house under period 1 prices across jurisdictions to make optimal location decision. Second, he must consider the impact on period 2 prices (when he will try to sell his house) when choosing a level of public investment (g_1) to add to the DPG stock. In other words, an agent must anticipate the effect of public investment, both in his own community and in others, on his property values. We will see below that without further constraints, commonly held beliefs about the relationship of public good levels to property values can generate a wide variety of equilibria. One of the contributions of this paper will be to show that a simple economically motivated refinement gets rid of socially nonoptimal outcomes.

Now we turn to defining our equilibrium concept. An feasible allocation (A, g, c, σ) and a price system $(p_1(s), p_2(s)$ is a *political economic equilibrium* if they satisfy the following three conditions:

Non-Mobility Condition: Given the prices and politics, the allocation assigns every agent i, in every state and for both periods, to his favorite jurisdiction. Formally, for period 1 this means for all i where $A_1(i) = j$, and for all $\bar{j}$

$$V\left(s_1(j) + g_1(j)\right) + (1+r)\left(w - p_1(j, s_1) - \frac{1}{J}g_1\right) + p_2\left(j, \delta(s_1 + g_1(j)\right) \geq$$

$$V(s_1(\bar{j}) + g_1(\bar{j})) + (1+r)\left(w - p_1(\bar{j}, s_1) - \frac{1}{J}g_1(\bar{j})\right) + \delta(s_1 + g_1(\bar{j})),$$

and for period 2, for all i, where $A_2(i) = j$, and for all $\bar{j}$

$$V(\delta(s_1(j) + g_1(j)) + g_2(j)) + w - p_2(j, \delta(s_1 + g_1)) - \frac{1}{J}g_2(j) \geq$$

$$V(\delta(s_1(\bar{j}) + g_1(\bar{j})) + g_2(\bar{j})) + w - p_2(\bar{j}, \delta(s_1 + g_1)) - \frac{1}{J}g_2(j).$$

Political Equilibrium: Given the assignment of agents to jurisdictions and the price of housing, $g_t(j)$ arises as a political equilibrium. Given that we only treat the case of identical agents, majority rule, the Condorcet winner, and unanimity are all equivalent to allowing a representative voter in each jurisdiction chose that level of public goods investment. We discuss generalizations in Remark 4, below. Formally, we require for period 1 that for all j and for all $\bar{g}$

$$V(s_1(j)+g_1(j))+(1+r)\left(w-p_1(j,s_1)-\frac{1}{J}g_1\right)+p_2(j,\delta(s_1+g_1(j))\geq$$

$$V(s_1(j)+\bar{g})+(1+r)\left(w-p_1(j,s_1)-\frac{1}{J}\bar{g}\right)$$
$$+p_2(j,\delta(s_1(1)+g_1(1),\ldots,s_1(j)+\bar{g},\ldots,s_1(J)+g_1(J))$$

and for period 2, for all j and $\bar{j}$

$$V(\delta(s_1(j)+g_1(j))+g_2(j))+w-p_2(j,\delta(s_1+g_1))-\frac{1}{J}g_2(j)\geq$$

$$V(\delta(s_1(j)+g_1(j))+\bar{g})+w-p_2(j,\delta(s_1+g_1))-\frac{1}{J}\bar{g}.$$

Optimal Savings: Given the price of housing and taxes, every member of generation 1 saves optimally. Formally:[2]

$$c_1^y=0,$$

for all j:

$$c_2^o(s)=(1+r)\left(w-p_1(j,s_1)-\frac{1}{J}g_1(j)+p_2(j,\delta(s_1+g_1(j))\right),$$

and

$$\sigma=Iw-\sum_j(Lp_1(j,s_1)-g_1(j)).$$

3. Sunspots and Efficiency when Public Good Provision is Decentralized

In this section we will consider the decentralized voting system described above in which each jurisdiction makes an independent decision about how to invest in public goods. We begin by making a series of observations about the equilibrium.

[2] Since utility is additive is private goods, it is always better to consume in the second period because of the storage technology. Thus, $c_1^y=0$. The remaining part says that anything that is not spent on housing or public goods production goes into saving and is then consumed in the second period.

Observation 1: *In period 2, voters choose the socially optimal levels of investment in DPG.*

Consider a typical jurisdiction j, and let the state and assignment $A_2(s)$ be given. Since the public investment is reversible, the problem facing voters is to maximize the per capita utility they receive from DPG which is given by $V(G) - \frac{1}{J}G$. Given the inherited capital stock s_2, this implies that the optimal investment choice is the following:

$$g_2(j, s_2) = \underset{g \geq -s_2(j)}{\operatorname{argmax}} \left\{ V(s_2(j) + g) - \frac{1}{J} g \right\}.$$

Obviously, the solution to this equation will satisfy the first order condition for a social optimum given in equation 3.

Observation 2: *Period* 2 *land prices must fully capitalized any differences in DPG levels left over from period 1.*

More formally, this statement means that for any state s_2, for all jurisdictions j and $\bar{j}$, and for all prices $p_2(s_2)$ that clear the land market, it must be the case that

$$p_2(s_2, j) - p_2(s_2, \bar{j}) = \frac{1}{j}(s_2(j) - s_2(\bar{j})).$$

Since all agents are identical, and the DPG inherited from the previous period is reversible, and all jurisdictions must be *ex anti* equally attractive to period 2 agents, land prices must *exactly* reflect the differences in inherited capital stock.

Notice, however, that this leaves an indeterminacy in prices. While the differences in public goods levels must be reflected in land prices, this tells us nothing about the absolute level of prices. In principle, the level could change for every possible state of the world, providing that relative prices maintain this market clearing differential. Formally, this means that land prices must take the form:

$$p_2(j, s) = \frac{1}{J} s(j) + \alpha(s),$$

All prices of this form clear the land market in period 2. The key factor here is that $\alpha(s_1)$ is a common constant added to the price of land in each jurisdiction, but which may be different of each state.

Observation 3: *Within the constraints imposed by feasibility, any level of DPGs can be supported as an equilibrium for period* 1*.*

Suppose we wanted period 1 agents to produce an arbitrary level of public good given by the state vector $\bar{s}_2$. Consider the following price vector:

$$p_2(j,s) = \begin{cases} \frac{1}{J}s(j) + K & \text{if } s = \bar{s}_2 \\ \frac{1}{J}s(j) & \text{otherwise} \end{cases}$$

where K is a very large constant. Clearly, regardless of the benefits of public good consumption or the opportunity costs of investing in public goods, if K is large enough, agents are better off following the program defined by $\bar{s}_2$ than any other possibility. They are more than compensated for their consumption losses when they sell their houses

In effect, any commonly held belief about the effect of public investment that respects the differences in the attractiveness of jurisdictions are self-fulfilling. This multiplicity is similar to the phenomena of sunspot equilibria in macroeconomics (see, for example, Cass and Shell 1983). Sunspots can arise in dynamic models with multiple stages if there are multiple equilibria in the spot markets. In this case, the equilibrium behavior on earlier stages might depend on the selection of the continuation equilibrium. In our case, the problem is that while equilibria exist, almost all them are inefficient. For example, if all agents belive that the putting a subway in every city and town, no matter how small, will result in the cost of subway construction plus $1,000,000 being added to the price of every house in the country, then all locations will choose to build the subway. In period 2, the housing markets will clear and period 2 agents will deinvest in public goods until they are at the efficient level. Thus, the price system induces agents in period 1 to overconsume public good. Of course other equilibrium price systems exist that cause period 1 agents to underconsume public goods, or consume them efficiently. The point is that there is no reason to expect the market should induce optimal investment decisions in general.

A closer look at these sunspots, however, shows that they depend of price expectations that may not be very plausible. Sunspots arise only if the choice of DPGs that a jurisdiction makes affects the price in every other jurisdiction. In our example above, it only takes the failure of one small town to build a subway to cause every house is the country to lose $1,000,000 in value. This seem highly unlikely when the number of jurisdictions is very large and each jurisdiction is a tiny part of the economy. It turns out that making the small refinement on the formation of price expectations that this observation suggests is enough to eliminate all of the implausible and inefficient equilibria. Formally, the assumption we make is the following:

> Small Jurisdiction Assumption (SJA): If two states s and $\bar{s}$ only differ in the amount of DPGs in jurisdiction j, then there exists a jurisdiction $\bar{j} \neq j$ such that $p_2(\bar{j}, s) = p_2(\bar{j}, \bar{s})$.

This is a fairly weak assumption. All it says is that if one jurisdiction changes its public good level, there is at least one other jurisdiction in which land prices are unaffected. For example, this implies that San Diego builds a new airport, the price of housing in Portland should not change, or at any rate there should be one city somewhere in the world which is not be affected.

Observation 4: *The small jurisdiction assumption eliminates sunspots.*

Consider an arbitrary equilibrium price systems that satisfies SJA. Let s_2 denote an equilibrium state supported by equilibrium prices $p_2(s)$ and consider the optimization problem facing period 1 voters in a particular jurisdiction j. Let prices in jurisdiction $\bar{j}$ be unaffected by the choices made by jurisdiction j agents. Then it is immediate that the price in jurisdiction j must differ from those in jurisdiction $\bar{j}$ by exactly the difference in public good levels. Otherwise one or the other jurisdiction would have excess demand for land. Since the price of land in jurisdiction $\bar{j}$ is fixed by assumption, prices in jurisdiction j change relative to this, but do not change the common constant $\alpha(s)$ in all land prices. More formally, under SJA, period 2 prices take the form:

$$p_2(j, s_2) = \frac{1}{J} s_2(j) + K.$$

Since in the homogeneous case, any feasible assignment of agents to jurisdictions is optimal, is easy to demonstrate our main result for this section:

Theorem 1. *In the homogeneous agent case, if prices satisfy SJA, then decentralization generates optimal investment in the DPGs regardless of the strength of the intergenerational spillovers.*

Proof/

We know under SJA that the equilibrium prices must take the form:

$$p_2(j,s) = \frac{1}{J}s(j) + K_2.$$

It is easy to see that whatever the state in period 1 (recall this is data inherited from generation 0, and is not a choice variable) prices in period 1 are of the form:

$$p_1(j,s_1) = \frac{1}{J}s_1(j) + \alpha(s_1).$$

As in the argument made to support Observation 2, if the prices did not exactly reflect the differences in public goods level, agents would demand too much land is whatever jurisdiction was relatively underpriced. Since s_1 is not a variable, $\alpha(s_1)$ is in effect a constant (which we will denote K_1) . Putting this together, the decision faced by period 1 voters is there for the following:

$$\max_g V(s_1(j)+g) + (1+r)\left(w - \frac{1}{J}s_1(j) - K_1 - \frac{1}{J}g\right) + \frac{1}{J}\delta(s_1+g) + K_2.$$

This gives the following first order condition:

$$JV'(s_1(j)+g) = 1 + r - \delta,$$

which is the same as for the social optimum given in equation 2.

■

We now make a series of remarks about the how the details of the model play into this result.

Remark 1: Reversibly is not needed. A generation that inherits a large stock of DPGs needs to spend fewer resources of its own to achieve a given level of public goods.

For a generation that wants to increase the level of DPGs ($G_2(j) > s_j$), every unit received from generation 1 is worth one unit of private goods because it decreases the amount of taxes that they have to pay by exactly one unit. In this case reversibility does not bite. Reversibility is useful only because it simplifies the characterization of "out-of-equilibrium" prices. For example, consider the price of land in a jurisdiction that has a very large level of DPGs: $s(j) >> G_2^*(j)$. With reversibility, the overinvestment by generation 1 gets "capitalized" on a one-to-one basis because the excess DPG can be de-invested. Without reversibility, the excess investment gets capitalized at a positive, but lower rate. In either case, the land market generates prices that incorporate the value of DPGs for generation 2, which in turn induces generation 1 to internalize the spillover.

Remark 2: Stictly speaking, foregoing analysis is only valid for interior optima. Let us briefly consider what might happen on the boundary. Clearly, the prices in period 1 must be lower than the endowment of the generation 1 agents or else no one would be able to afford a house and markets would not clear. It is still possible that prices might be so high that generation 1 agents do not have enough private good left over to build the optimal level of DPG. In this case, the equilibrium prices will give agents an incentive to invest all of their remaining private good in public good. That is, to come as close to the optimum as is feasible. A similar argument holds for period 2. Agents will come as close to the optimal level of public investment as the land prices make feasible. Thus, while extremely high land prices may produce equilibrium that are not socially optimal, we see a continuous falling away from this optimum rather than qualitatively different results on the boundary.

4. Centralization vs. Decentralization

In this section we compare the performance of centralized and decentralized institutions in the presence of intergenerational spillovers. Previous studies of decentralization have emphasized the role of differences in the taste for public goods. In these papers, decentralization is valuable because it allows agents to sort into jurisdictions populated by agents with similar tastes. Here we provide a new case for decentralization that is based *solely* on the capitalization effect.

From a policy standpoint, the strength of this case depends on how realistic one believes the assumption of indivisible land is. It is clearly the fact that the supply for land equals the demand in our model that is producing the sunspots and therefore the strong argument in favor of decentralization. These results do suggest, however, that interjurisdictional completion may be a force to eliminate sunspots in other contexts, although we do not explore this possibility in the current paper. In any event, regardless of the view one takes of the land market, our results demonstrate that full capitalization of durable local public goods investment decisions does not depend of existence of unused agricultural land available at a fixed price, or any other outside offer.

The model of centralization is a straightforward variation of decentralization. The only difference is that the level of DPGs is chosen in a national election and is identical across jurisdictions. Let $\hat{s} \in \Re_+$ denote the state of the economy in period 2 where

$$\hat{s}_2 = \delta(\hat{s}_1 + \hat{g}_1).$$

These variables do not have a jurisdictional index because they are determined at the national level and are common across jurisdictions. To avoid confusion, we add a "hat" to all the variables in the analysis of centralization. Note that given agents have identical tastes, the level DPGs that agents would like to consume is the same as in the decentralized case and is still unanimously agreed upon. If there is any difference in the outcome of the vote, it is the because centralization has distorted the capitalization effect through the price system.

For the except for the issue of sunspots, both the equilibrium outcomes and the logic that supports them are the same under centralization and decentralization. In particular,

1. In period 2, voters choose the socially optimal levels of investment in DPG.

2. Period 2 land prices must fully capitalized any differences in DPG levels left over from period 1.
3. Within the constraints imposed by feasibility, any level of DPGs can be supported as an equilibrium for period 1.

In particular, land prices in period 2 take the same form as before:

$$\hat{p}_2(j, \hat{s}) = \frac{1}{J}\hat{s} + \alpha(\hat{s})$$

The big difference is that under centralization, the small jurisdiction assumption has no bite. The level of DPG in each jurisdiction moves together through a national election. There is no possibility of agents in single jurisdiction contemplating the effect on local land prices of increasing public good provision within their own city alone.

This implies that arbitrary sunspots can arise, and anything can be an equilibrium under centralization. This uncovers a new role for interjurisdictional competition. Not only does it play a role in solving the free riding problem within jurisdictions and inducing agents to sort efficiently by taste as Tiebout suggested, *but it also can generate efficient provision of certain types of intergenerational goods*

One may view the conclusion that centralization fails in our model as a bit too hasty. While it is true SJA does nothing to remove the inefficient sunspots, perhaps there might be another plausible refinement that would do the job. We would like to give centralization the best possible chance of succeeding, so we will propose a fairly strong refinement. Notice that sunspots can arise only if land prices depend on the national level of DPG. But why should this be so? Agents have a taste for DPG, but their taste is not based on how the DPG interacts with land. With decentralization agents bid up the price of jurisdictions with higher levels of DPG because they want *access* to those DPGs. With centralization, access is not tied to land because the DPG is provided centrally. Thus, the only economic forces behind the sunspots are self-fulfilling beliefs. Since the plots of land are identical in every jurisdiction *and* in every state, we propose that we remove the dependence of land prices on centrally provided public good. Formally:

No-Sunspot Refinement (NSR): Equilibrium prices in period 2 are given by $\hat{p}_2(j, \hat{s}) = \hat{K}_2$.

The next theorem shows that although the no-sunspot refinement gets rid of the problem of multiple equilibrium, the one that remains is not efficient.

Theorem 2. *In the homogeneous agent case, if prices satisfy SR then centralization generates underinvestment in the DPGs which increases as the strength of the intergenerational spillovers increases.*

Proof/

We know under NSR that the equilibrium prices must take the form:

$$p_2(j, s) = K_2.$$

Similarly, since the level of DPG is also identical in all jurisdictions in the first period, the only market clearing prices for period 1 are constant:

$$p_1(j, s_1) = K_1.$$

Putting this together, the decision faced by period 1 voters is there for the following:

$$\max_g V(s_1(j) + g) + (1 + r)\left(w - K_1 - \frac{1}{J}g\right) + K_2.$$

This gives the following first order condition:

$$JV'(s_1(j) + g) = 1 + r$$

This is different from the first order condition given for the social optimum (equation 2):

$$JV'(s_1(j) + g) = 1 + r - \delta.$$

Thus, under centralization, the intergenerational spillover is ignored by period one agents since the price system gives them no incentive to take it into account. As a result, DPG goods are underprovided and this underprovision is worse the larger is δ.

■

Remark 3: A key assumption in our model is that jurisdictions contain a fixed number of houses. Taking the more typical approach of allowing cities to annex elastically supplied farmland, weakens, but does not eviscerate the case for decentralization made in this paper. In particular, the presence of these outside offers is not necessarily enough to pin down the price of land in the real world. The argument is the following. One of the big controversies currently raging relates to urban sprawl and the wisdom of charging impact fees to developers. It costs cities money to provide infrastructure to newly annexed subdivisions, and the feeling is that current city residents should not bear these costs. In addition to the infrastructure cost of turning farm land into urban land, there is also the private cost of constructing a new housing. Of course, it also costs something reverse the process and convert urban land back to farm usage. This creates a band of possible equilibrium prices in which cities stay the same size. Above this band, rural land is annexed and new houses and infrastructure are built. Below this band, houses are torn down and new farm land is produced. Within this band the price indeterminacy we discover in our model persists. In other words, for the possibly of annexations to pin down the price of housing it must either be the case that one can costly convert land between farm and urban usages, or cities must be growing. The latter situation would cause housing prices set by the cost of new construction at the upper end of the price band we described. If instead we fix the geographical size of cities (perhaps because they are surrounded by other jurisdictions), there is yet another possibility that may allow us to argue in favor of centralization: we can allow is allow land to be divisible. Zoning or the already built housing stock may limit divisibly in real life, but if we take the modeling position that land is fully divisible, centralization works just as well as decentralization to force full capitalization of DPG investments. In effect, land competes with itself even within a single jurisdictions and so decentralization is unnecessary. See Conley and Rangel (2000) for this result and also for a more detailed exploration of the land tax.

Remark 4: The assumption of homogeneous tastes can be relaxed. The case we build for decentralization is based purely on the capitalization effect. If we added heterogenous agents, the model would be come more complicated, but the results would not necessarily change. Consider a simple example. Suppose we take the standard approach that agents can be ordered in their degree of preference for public goods. For example, suppose that for period 1 agents, the utility function became:

$$U_1^i(G_1(j), c^y, c^o) = \theta(i)V(G_1(j)) + c^y + c^o,$$

where $\theta(i) > \theta(\bar{i})$ if $i > \bar{i}$. Obviously, θ is a measure of the strength of an agent's preference for public good. Since this generates disagreement about the optimal level of DPG, the pollical equilibrium now becomes nontrivial. We shall assume that the investment in public goods is determined by the median voter. There is only one possible equilibria in the decentralized case. Agents sort themselves according to tastes in a stratified way with the agents who like public goods the least together in one jurisdiction, agents with the next lowest taste for public goods together in the next and so on. To see why this is so, consider any other distribution of agents. Since we assume that no two voters are identical, regardless of what the median voter in each jurisdiction chooses as the DPG level, the levels will all be different and so it possible to order the jurisdictions from least to most public good. It is then clear that the no-mobility condition could not be satisfied regardless of prices. Since agents are not stratified by taste, there must be at least one pair of agents who are inverted (a lower taste voter in a jurisdiction with more public good than a higher taste voter). But the higher taste vote would be willing to pay more than the lower taste voter to own the land in the high public good jurisdiction. Thus, this inversion could not persist regardless of prices. Also note that this equilibrium approximately maximizes the sum of agents' utilities. Of course in general the median and the mean voter may be different and agent's tastes may not symmetrically distributed around the median voter's. It therefore might be possible to improve on the median voter's choice on in terms of per capita utility. However, this improvement would be smaller the more jurisdictions existed. As the economy gets larger, each jurisdiction has to cover a smaller segment of tastes. In the limit, each jurisdiction approaches being internally homogenous and therefore maximizing per capita utility. We conclude that under decentralization, we continue to get approximate internalization of the intergenerational spillover. On the other hand, we run into exactly the same problems under centralization as we did in the homogenous case. The global median voter chooses the common level of DPG for the whole society, and this is not capitalized into land prices and does not yield approximate efficiency regardless of the size of the economy. We should also note that if we allow for more complicated forms of heterogeneity we might run into the existence problems that are familiar in the Tiebout literature.

5. Capitalization vs. interjurisdictional spillovers

The results in the last two sections suggest that any public good that generates intergenerational spillovers should be transferred to the local level. Consider, however, public goods like research and development or interstate highway systems. Such goods generate significant intergenerational spillovers, but they also produce spillovers across jurisdictional boundaries. In this section we study how the introduction of interjurisdictional spillovers affects the case for decentralization. We show that there is an inescapable trade-off between interjurisdictional and intergenerational spillovers.

To see this, consider the following extension of the homogeneous model of decentralization studied above. The only difference is that now we allow the production of DPG in one jurisdiction to affect the utility of residents in the rest of the economy. In particular, suppose that the preferences for public goods of the members of generation t that live in jurisdiction j are given by

$$V\left(G_t(j) + \gamma \sum_{k \neq j} G_t(k)\right).$$

The parameter $\gamma \geq 0$ measures the strength of the interjurisdictional spillover. If $\gamma = 0$ there are no spillovers across jurisdictions and the model reduces to the previous case.

Note that an increase in $G_1(j)$ increases the amount of DPG consumed by *every* member of generation 1, but it does not increase the amount of DPG passed on to other jurisdictions In other words, the interjurisdictional spillover does not have an intergenerational component.

A straightforward modification of (2) and (3) shows that the efficient level of DPGs at any interior allocation is given by:

$$JV'((\gamma(J-1)+1)G_1^*) = \frac{1+r-\delta}{(\gamma(J-1)+1)}, \tag{6}$$

for period 1, and

$$JV'((\gamma(J-1)+1)G_2^*) = \frac{1}{(\gamma(J-1)+1)} \tag{7}$$

for period 2.

Now consider the problem facing voters in period 2. In choosing a level of public good, agents in a particular jurisdiction take the public goods levels of other jurisdictions (and the consequent spillovers) as given. Thus, given state s_2 and aggregate public good level in other jurisdictions given by $\mathbf{G}_2^{-\bar{j}} \equiv \sum_{j \neq \bar{j}} G_2(j)$, agents in jurisdiction $\bar{j}$ choose to a level of investment in DPG as follows: in public goods by

$$g_2(\bar{j}, s) = \underset{g \geq -s(\bar{j})}{\operatorname{argmax}} \left\{ V\left(s(\bar{j}) + g + \gamma \mathbf{G}_2^{-\bar{j}} \right) + \frac{1}{J} g \right\}.$$

For simplicity we focus on the symmetric Nash equilibrium characterized by the following first order condition:

$$JV'((\gamma(J-1)+1)G_2) = 1. \tag{8}$$

A comparison of (7) and (8) shows that there is underprovision of the DPGs when $\gamma > 0$. This is not surprising given that politics of period 2 amount to a standard free-riding game.

Now consider the land market is period 2. A simple repetition of the arguments in Section 3, including the use of the small jurisdiction assumption, shows that land prices are given by

$$p_t(j, s) = \frac{1}{J} s_t(j) + K_t,$$

where K_t is a constant common across jurisdictions. Not that only the DPG passed between generations within the jurisdiction are capitalized. This is because this is the only thing that makes jurisdictions more or less attractive to the next generation. The DPG that spills over is enjoyed by all jurisdictions in common.

The next step is to look at the politics in period 1. Given the land prices in period 2, the median voter in jurisdiction 1 solves

$$g_1(\bar{j}, s) = \underset{g \geq -s_1(\bar{j})}{\text{argmax}} \left\{ V\left(s_1(\bar{j}) + g + \gamma \mathbf{G}_1^{-\bar{j}} \right) + \right.$$

$$\left. (1+r)\left(w - \frac{1}{j} s_1(\bar{j}) - K_1 - \frac{1}{J} g \right) + \frac{1}{J} \delta (s_1(\bar{j}) + g) + K_2 \right\},$$

Again, considering only the symmetric Nash equilibrium we get the following first order condition:

$$JV'((\gamma(J-1)+1)G_1) = 1 + r - \delta. \tag{9}$$

And again, a comparison of (6) and (9) shows that there is underprovision of the DPGs when $\gamma > 0$.

Now compare this outcome with results of a centralized provision mechanism. By repeating the arguments given in section 4 and applying the no-sunspot refinement, we conclude that land prices are following:

$$p_t(j, s_t) = K_t$$

The major difference is that the optimization problems for voters in the first and second periods now involve them simultaneously choosing the public goods level in all jurisdictions. That is, the voter choose public investments as follows:

$$\hat{g}_1(\bar{j}, \hat{s}) = \underset{g \geq -\hat{s}_1(\bar{j})}{\text{argmax}} \left\{ V\left((\hat{s} + g)(1 + \gamma(J-1)) \right) + \right.$$

$$(1+r)\left(w - K_1 - \frac{1}{J}g\right) + K_2\Bigg\},$$

$$\hat{g}_2(\bar{j}, \hat{s}) = \underset{g \geq -\hat{s}(\bar{j})}{\operatorname{argmax}} \left\{ V\left((\hat{s}+g)(1+\gamma(J-1))\right) + \frac{1}{J}g \right\}.$$

This gives the following first order conditions:

$$JV'((\gamma(J-1)+1)\hat{G}_1^*) = \frac{1+r}{(\gamma(J-1)+1)}, \quad (10)$$

for period 1, and

$$JV'((\gamma(J-1)+1)\hat{G}_2^*) = \frac{1}{(\gamma(J-1)+1)} \quad (11)$$

for period 2.

Notice the following: under centralization, period 2 public level is chosen optimally. There is no intergenerational spillover, and the interjurisdictional spillover has been fully internalized. On the other hand, to the degree that their is an intergenerational spillover, period 1 public good is underprovided. The interjurisdictional spillover, is internalized in the first period, and as δ approaches zero, centralization is approaches full efficency.

We can conclude that the best place to assign responsibility for provision of any given public good depends on the interplay of three forces: intergenerational spillovers, sorting effects, and interjurisdictional spillovers. The first two forces favor decentralization, the last one centralization. DPGs with strong intergenerational spillovers, strong congestion effects, and small interjurisdictional spillovers should be dealt with at the local level. Examples of this type of DPGs are local parks and public lands, local infrastructure, and local environmental issues. By contrast, DPGs with no congestion effects, very strong interjurisdictional spillovers, and relatively weaker intergenerational externalities should be dealt with at higher levels of government. Examples of this are R&D and interstate highways.

An implication of this analysis is that a DPG should move to a higher level of government only if there are significant interjurisdictional spillovers or important scale effects. The trade-off between interjurisdictional and intergenerational spillovers is inescapable and a move to a higher level of government necessarily entails a loss in the intergenerational dimension. As a result, a DPG that generates strong externalities across counties, but not across states, should be dealt with at the state and not at the national level. In other words, a DPG never should move beyond the level of government in which the most important interjurisdictional spillovers are internalized.

6. Literature review

This paper attempts to tie together the literature on intergenerational goods and Tiebout economies. In general, intergenerational goods have been treated as private goods that are voluntary transfered either forward or backward across generations in the context of a dynamic and unified (that is single jurisdictional) economy. The central question of this literature is if present generations are selfish, why should they make such transfers? See, among others, Boldrin and Montes (1998), Kotlikoff, Persson, and Svensson (1988), and Rangel (1998). There are policy implications for a wide range of issues including social security, education spending, global warming, research and development to name only a few.

It may be possible to induce self-interested agents to provide Backward intergenerational goods through a game in which all generations play the trigger strategy that they transfer goods to the currently old, only if the currently old made similar transfers when they were young. As long as the these intergenerational transfers grow at least as fast as the interest rate, the agents are best served by not defecting from this strategy. See Rangel (1998) for details. Forward intergenerational goods can also be sustained in equilibrium, but only if they are linked to the provision of BIGs. The problem is that both optimal an nonoptimal levels of BIGs and FIGs can be supported in this games. Thus, although we can get selfish generations to make transfers under centralization, we can't assure optimal outcomes. We should note, however, that none of these outcomes are sustainable in an economy with bounded endowments like the one described in this paper.

In the presence of intergenerational spillovers, the move to a decentralized system can be interpreted as a way of "completing markets." If present residents could sign binding contracts with future generations, they would have an incentive to internalize the spillover. For example, the contract could specify that present voters would receive a transfer tomorrow that is proportional to the amount of DPGs that they bequeath to the next generation. This would give them an incentive to internalize the spillovers. Decentralization "completes markets" in this model in the sense that it generates transfers that look like the contingent contracts that generations would sign.

Turning now to Tiebout (1956), his main argument was that interjurisdictional competition should lead to efficient provision of public goods. In the early literature especially, the focus was on static coalition formation in economies without land. See, for example Buchanan (1965), Pauly (1970), McGuire (1974), Berglas (1976), Wooders (1978), and Bewley (1981) or Conley and Wooders (1998) for a recent survey. Other work has added either divisible land (Rose-Ackerman 1979 and Epple *et al.* 1984, for example) or indivisible land (Dunz 1985 and Nechyba 1996, for example) to the model. See Konishi (1996) for an excellent discussion of this literature and additional results.

A common element in all the literature above the models us that they are static. The conclusion in general is that under some conditions, interjurisdictional competition is sufficient to cause agents to internalized spillovers between agents within the same jurisdiction concerning contributions to local public good provision. In contrast, our focus is on dynamic economies and concerns whether or not interjurisdictional competition working through the mechanism of capitalization is sufficient to cause intergenerational spillovers to be internalized.

From an empirical standpoint, there is a great deal of evidence that capitalization of some type is an important phenomenon. Such studies go back at least as far as the famous paper of Oates (1969) who confirms that both property taxes and spending get capitalized into property values. The correct econometric treatment of this question is quite subtle, however. For example, it is unclear if spending is strongly correlated to public goods quality (especially school quality), and thus, what exactly should be capitalized. See Hanushek (1986), for example, and Hayes and Taylor (1998) and Black (1998) for recent work which attempts to address this problem. How to test for capitalization in a steady state is especially troublesome and we will not attempt to deal with this issue here. We refer the reader to Epple *et al* (1978) Yinger (1982, 1995) Brueckner (1982), and Starrett (1997) for enlightening discussions on this topic.

In addition to the papers above, there is a small theoretical literature of capitalization in a static economy. Notable contributions include Wildasin (1979), Stiglitz (1983), Brueckner and Wingler (1984) de Bartolome (1990), Weaton (1993) and more recently Wildasin and Wilson (1998). For the most part, this work considers the optimality of equilibrium local public good and tax levels and the response of property values in specific economic contexts. For example, Brueckner and Wingler are concerned about public goods as intermediate inputs, de Bartolome is interested in how peer groups affect the value of school districts, Weaton considers zoning, and Wildasin looks at how capitalization affects the possibility of risk pooling. These are interesting and useful papers, but it is difficult to extrapolate the results to dynamic economies in which public goods are durable.

Unfortunately, the theoretical literature on dynamic Tiebout economies with DPGs is similarly small. The earliest paper of which we are aware is Kotlikoff and Rosenthal (1993) who consider a two period model with two localities and discover that one should not expect competition to generate efficient provision of such goods.[3] Other papers consider these questions in the context of an overlapping generations model. For example, Wildasin and Wilson (1996) consider a such an economy with imperfectly mobile agents but with local public goods that are not durable. They discover that the capitalization mechanism may not induce efficient provision of local public goods. Similarly Sprunger and Wilson (1998) consider how the desire of governments to exploit

[3] It is also worth calling the reader's attention to the literature of dynamic Tiebout models without DPGs or capitalization. See especially Kotlikoff and Raffelhueschen (1991), Glom and Lagunoff (1998), Benabou (1996), and Brueckner (1997).

imperfectly mobile households may be expressed when public goods choices are made a period before the goods are consumed. These goods fully depreciate the period they are produced, however, so may have more of a flavor of a standard intergenerational good than of a DPG.

7. Conclusions

Our main conclusion is that in this capitalization is indeed an effective mechanism to cause agents to internalize intergenerational spillovers. This is limited by the degree to which there are more general spillovers across jurisdictions. At a more formal level, what this paper does is provide a Tiebout theorem for a simple economy when local public goods are durable and land is indivisible. That is, we show that a Tiebout equilibria exist and that a first welfare theorem holds. This is in sharp contrast to most of the literature in which equilibria exist or are efficient, but typically not both (see Conley and Konishi 1999 for further discussion). We believe that this is important because there are many papers which study models with distortions (for example, uncertainties, incomplete information, and market power). Unless we have a baseline case of a competitive economy for which a first welfare theorem applies, however, it is hard to know if the inefficiencies in these models come from the distortions in question or are a result of the underlying economic structure. This paper also suggests that interjurisdictional competition is sufficient to generate full capitalization even in the absence of outside offers. In Conley and Rangel (2000) we take up the question of whether it is also necessary and find that the answer depends on the treatment of the land market.

If takes view, perhaps because of real world frictions, that jurisdictions of fixed size and indivisible land are not an unreasonable approximation to reality, this paper shows that there is an essential trade off between intergenerational spillovers which can often be internalized by competing jurisdictions through capitalization, and interjurisdictional spillovers which may be internalized when agents vote centrally over public goods levels. This suggests that:

a. **Durable local public goods** should be provided by jurisdictions. Examples include roads and local infrastructure. This is because of heterogenous tastes and intergenerational spillovers.

b. **Nondurable local public goods** should be provided by jurisdictions. Examples include police and fire protection, local services and fireworks displays). This because of heterogeneous tastes only.

c. **nondurable purely public goods** should be provided nationally. This also includes private goods and public services with widespread externalities. Examples include medical care, poverty relief, and research relating to immediate problems like what should this year's cold shot contain. This is because of interjurisdictional spillovers only.

d. **durable purely public goods** can not be provided well anywhere. As above this include nonpublic goods with widespread externalities. Examples include defense, education, environmental protection, abatement of global warming and most types of pure research. This is because of the conflict between internalizing intergenerational and interjurisdictional spillovers. It is interesting to note that issues relating to these types of goods consistently poll as of most concern to voters. It may be that there is a kind of continuing crisis surrounding these goods because of the failure of any institution to provide them efficiently.

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