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Department of Economics - #3880
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How Does a Community's Demographic Composition Alter Its Fiscal Burdens?

Thomas MaCurdy

Hoover Institution, Stanford University

Thomas Nechyba

Stanford University

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1. Introduction

With local communities providing such diverse services as education, public safety, infrastructure, and public health care, the demographic characteristics of a locality's population (e.g., age composition) surely play a fundamental role in determining both a community's fiscal needs and its fiscal capacity. Furthermore, a community's ability to efficiently fund services through the rents individuals derive from them is sharply curtailed by a variety of critical intercommunity spillovers that lead to benefits being enjoyed outside the jurisdiction of the community. These spillovers not only arise from the familiar routes associated with public goods being consumed by nonresidents, but also come into play for community investments in people who leave jurisdictions before realizing returns from such investments. The presence of these intercommunity spillovers constitutes a primary force generating what we call "fiscal burdens" which govern the fiscal federalism that relates policies of local and central governments. Throughout, we will define the fiscal burden of a local government as the excess of its expenditures valued by "outsiders" over the tax revenues it receives from them. This paper then investigates the relatively unexplored questions of the extent to which a community's age composition impacts its fiscal burden as well as of the extent to which intergovernmental transfers from central governments can and do compensate the localities for these burdens.

The analysis develops a simple theoretical model that clarifies the role of demographics and the associated spillovers in local government finance, that highlights the funding problems arising in this context, and that explores the potential remedies through central government transfers. To explore the practical applicability of this model, this study conducts an empirical analysis of county budgets in California examining the impact of a county's age composition on its local government's expenditures and revenues. This analysis sheds light on the net impact of marginal shifts in demographic compositions on county budgets and allows us to ask whether state and federal transfers compensate for these shifts. This empirical analysis, which focuses on overall flows of intergovernmental transfers and therefore

avoids the usual fungibiligy issues that arise in a narrower analysis of specific transfer and expenditure categories, suggests that the observed flows of intergovernmental transfers are broadly consistent with the predictions of our economic model.

1.1. Demographic Characteristics and Community Budgets

The simple theoretical framework presented in Section 2 incorporates the demographic composition of a community as an important element in the cost function a local government faces for providing different levels of public services. The fraction of the local population composed of school-aged children within a jurisdiction, for example, clearly has implications for the total (or per resident) cost of providing a given level of school quality to all students. In a simple world where local public spending simply represents consumption to current residents, where the taxes they pay are simply payments for benefits received, and where local governments do not attempt to strategically influence local demographic characteristics, no local fiscal burdens arise. There is thus no role for a central government, and fiscal federalism is an uninteresting issue. However, this simple world does not apply, and, instead, a variety of consequential spillovers interfere with a community's provision of many public goods and generate local fiscal burdens. In the case of public education, for example, a community is unable to fund investments in current school children if the rents from such investments cannot be taxed in the future due to the mobility of those students when they reach adulthood. It is only when various kinds of spillovers are explicitly introduced into the model that local fiscal burdens (as defined at the beginning of the paper) arise, and it is under those circumstances that central transfers to local governments emerge and improve upon decentralized outcomes. Differences in local demographic compositions combined with the existence of spillover benefits into other jurisdictions therefore generate variable fiscal burdens for different communities.

In light of this, it is perhaps surprising that there exist (to our knowledge) few prior attempts aimed at linking local fiscal burdens to local demographic characteristics, and those that do exist are generally concerned with issues quite unrelated to the issues we raise here.[1] A substantial empirical

literature arising from Bergstrom and Goodman (1973), for example, has focused on estimating demands for local public goods ranging from public education to public safety and municipal services, and in the process demographic characteristics have often been included as explanatory variables.[2] The focus of these studies, however, is the estimation of income and price elasticities, and little attention or interpretation is given to coefficients on demographic variables. This has resulted in relatively little consensus regarding the role of local demographic characteristics in determining local public good demands. More recently, Cutler, Elmendorf and Zeckhauser (1993) attempt to unravel the politics that gives rise to state and local public goods bundles, and Poterba (1997) provides evidence of political competition between generations in determining state support of public education. However, while these papers have attempted to discover something about local demand for public goods, none has taken the broader approach of linking demographic characteristics to overall fiscal burdens, nor have they asked to what extent spillovers that depend in part on demographic characteristics are internalized through present intergovernmental grants. It is in these dimensions that this paper attempts to fill a void, and it is to this end that we now turn to a brief review of the literature on fiscal federalism and intergovernmental grants.

1.2. A Brief Look at the Literature on Fiscal Federalism

The notion that intergovernmental transfers can potentially improve on purely decentralized government finance in the presence of spillovers is, of course, not new.[3] Furthermore, the idea of "spillovers" itself has evolved considerably. The earlier literature focused mainly on consumption spillovers across communities at a given time, while the more recent literatures have paid more attention to interjurisdictional tax externalities (arising from local non-benefit taxation of mobile bases)[4] and externalities arising from strategic community competition.[5] The basic underlying message from the economics literature, however, has remained relatively constant: appropriately designed central grants can, in most cases, internalize interjurisdictional externalities regardless of their source.[6] In Section 3 we attempt to capture all these types of spillovers in a simple local public finance model and demonstrate conditions under which grants by central governments originate to alleviate the fiscal burdens from

spillovers.

While the economic merits of this analysis are relatively unchallenged, some recent empirical work suggests that this model (often known as fiscal federalism) fails to provide a convincing explanation of the grant systems we observe in the US. Inman (1988) and Inman and Rubinfeld (1996), for example, suggest that a model of distributive and party politics dominates the economic model of fiscal federalism as an explanation for federal grant policy, and Hulten and Schwab (1997) similarly find federal infrastructure policy to be inconsistent with predictions from the economic framework.[7] It has thus become clear from such works that political barriers to the implementation of efficiency-enhancing central government grants may, at least in some cases, interfere with the potential economic benefit from intergovernmental fiscal interaction.[8] In light of this new conventional wisdom, our empirical findings in Section 5 that grant flows to communities in California broadly support the implications of the economic model of fiscal federalism are thus somewhat surprising.

1.3. Outline of Paper

This paper develops a conceptual model of government finance in which fiscal relationships between two levels of government emerge as the result of interjurisdictional spillovers arising from the local provision of a public good. In contrast to previous discussions of fiscal federalism, however, the local cost of providing this good is modeled as depending critically on the demographic makeup of local jurisdictions, which then causes fiscal relationships between different levels of government to depend in part on the geographic distribution of demographic groups. Section 2 assumes away all forms of interjurisdictional externalities and demonstrates that in such a world local fiscal burdens (as defined above) *do not arise*, despite the fact that differences in local demographic characteristics will certainly cause different local governments to face very different expenditures. Section 3 then introduces various types of spillovers that generate fiscal transfers from central governments. Because the size of local government expenditures and taxes depends crucially on local demographic characteristics (as illustrated in Section 2), the presence of spillovers and the resulting emergence of central government grants

implies that these transfers will also depend critically on demographic compositions. The goal of these sections is to present as succinctly as possible both the importance of local demographic characteristics in determining local public expenditures and the role of the existence of spillovers in generating fiscal interactions between different levels of government. For expositional simplicity and to highlight issues of concern, our analysis deliberately excludes political economy considerations raised elsewhere in the literature.[9] Section 4 operationalizes the relatively abstract notions discussed in Sections 2 and 3 by projecting how these factors would influence the spending and revenue patterns of local governments making up counties. Section 5 empirically tests whether the flows of grants to counties in California are broadly consistent with these predictions. Section 6 concludes the paper with a brief summary of our findings along with some final remarks and qualifications.

2. Demographic Groups, the Cost of Public Goods and Local Fiscal Burdens

We begin in Section 2.1 by introducing a precise way in which demographic groups matter in determining local public expenditures. Section 2.2 then considers an idealized setting in which the fact that different communities are composed of different demographic groups does not impose any differences in fiscal burdens on these communities. In fact, under this idealized setting, *no* community experiences *any* fiscal burdens - i.e. expenditures on public services financed locally but valued by "outsiders" - and all residents simply pay lump sum taxes related to the benefits they derive from these expenditures.

2.1. Demographic Groups and Public Good Costs

Suppose that jurisdiction i is one of many jurisdictions in a state and that the demographic makeup of the population in this jurisdiction at time t can be summarized by the vector $\mathbf{x}_t^i = (N_t^i, \mathbf{n}_t^i)$,

where N_t^i is the population size and $\mathbf{n}_t^i = \left(n_{1,t}^i, \ldots, n_{K,t}^i\right)$ represents a vector of population shares for K different types of agents. While individuals may in principle differ in many respects such as race, sex, cultural background, etc., most of our analysis will focus on age differences. In particular, we assume in our empirical work that types can be grouped into three age categories denoted J (young), M (middle-aged) and E (elderly). In the absence of demographic differences other than age, the vector $\mathbf{x}_t^i$ can therefore simply be written as $(N_t^i, J_t^i, M_t^i, E_t^i)$, where J_t^i, M_t^i, and E_t^i represent the shares of the population falling into the three age categories respectively. Throughout we will assume that each generation is of equal size at all times (and thus the total population in the economy remains constant across time), but individuals are able to choose among jurisdictions at each point in time.[10] Given this mobility assumption, the vector $\mathbf{x}_t^i$ of local population size and composition is therefore determined endogenously through the location choices of individuals, while the overall demographic characteristics of the entire population are exogenous.

Suppose a local government i in period t produces a local public good g_t^i and faces a cost function $c(\mathbf{x}_t^i, g_t^i)$.[11] Note carefully that g_t^i is an argument that enters individual utility functions and thus represents the total level and quality of a particular local public good consumed by local residents, not the expenditure required to achieve it (which is given by the cost function). For example, g_t^i may be "public safety" which is achieved through some level of spending $c(\mathbf{x}_t^i, g_t^i)$ that depends on the demographic composition of the community. Similarly, "lack of poverty" is a public good that may be achieved through welfare spending, and the levels of spending required will depend critically on local

demographics. Likewise, "quality public education" is a public good whose per capita expenditure is zero if no school aged children are present in the community. Whether we view g_t^i as a specific public good or a composite of a variety public goods produced locally, the demographic composition of the community will determine how much a given level of the good will cost (in total and per resident) for a given community, and communities with different demographic characteristics will face different expenditures for providing the same level of g.

More precisely, the size and composition of the local jurisdiction providing a public good g can enter the cost function in three distinct ways (which are outlined in Table 2.1) depending on the type of public good g represents: First, unless g is a pure public good exhibiting no rivalry within the local jurisdiction, the cost of providing a given level of g depends on the population size N_t^i in the jurisdiction. Most public expenditures by local governments are in fact devoted to goods that are at least somewhat rivalrous and thus involve some crowding through N_t^i in the cost function.[12] Second, to the extent that public expenditures other than those representing pure public goods are targeted at specific demographic groups, the share of the local population representing such groups determines the total cost of providing any particular level of the public service g. If g represents public education of a certain quality, for example, the number of children in the locality is directly related to the total level of spending required. Third, local population externalities may cause some public services to be more or less expensive than they would be in the absence of such externalities. In the case of education, for example, peer effects may cause education of a particular quality to be substantially more expensive in the presence of some demographic characteristics than in the presence of others. As already mentioned, much of our empirical discussion in this paper will focus on the second of these factors and more particularly on the impact of the age distribution.

[Table 2.1 about here]

2.2. Absence of Fiscal Burdens in an Idealized Setting

Section 3 will continue by incorporating this model of demographics and public goods costs into a general framework of fiscal federalism in which different types of public goods give rise to different kinds of spillovers. Before doing so, however, we note that *in the absence of interjurisdictional spillovers*, central governments will have *no* role in alleviating fiscal burdens in such a model, either through grants or otherwise.

More precisely, suppose that many jurisdictions coexist and that individuals sort into communities based in part on their tastes for public services (as suggested by Tiebout (1956)). As we will point out more formally in Section 3, the assumption of "no interjurisdictional spillovers" in this model implies the exclusive use of benefit taxes by all local governments, the absence of any expenditure spillovers for any of the public goods and services provided by local governments, and the absence of attempts by local governments through their tax/expenditure policies to encourage or discourage any demographic group from residing within their jurisdiction. Under these conditions, individuals within jurisdictions pay benefit taxes (i.e. taxes proportional to the benefits from public services they receive), and local governments can fully use such taxes as all the benefits are strictly contained within jurisdictions.[13]

A priori, there is no reason, however, to believe that a Tiebout equilibrium of this kind will result in communities that mirror each other's demographic characteristics.[14] Given that these characteristics fundamentally determine the cost of providing particular kinds of public goods (as modeled above), this therefore implies that both total and per resident public expenditures will differ across jurisdictions *even if* all jurisdictions end up providing precisely the same level of public goods. In terms of the model introduced in Section 2.1, even if all public good levels g are the same across all jurisdictions, the expenditures incurred by these jurisdictions to produce g are given by $c(\mathbf{x},g)$ and will therefore differ assuming that $\mathbf{x}$ differs across jurisdictions. Nevertheless, in the absence of spillovers, each individual will pay only in proportion to benefits received, and no benefits will be consumed outside the jurisdiction that spends its resources on producing these benefits. Thus, despite different per resident public

expenditures resulting from differences in demographic characteristics, no community will experience any fiscal burdens.

3. Local Spillovers and the Emergence of Fiscal Burdens and Fiscal Federalism

This section now considers more precisely the strength of the assumption in Section 2 that "there exist no interjurisdictional spillovers" by describing in some detail the channels through which this assumption may be violated. In the process, the analysis presents a model of fiscal federalism and local public finance in which central governments engage in fiscal transfers, and where in the absence of such transfers, local governments would indeed experience fiscal burdens and where this generates inefficiencies that can be corrected centrally.

As suggested earlier, we remain relatively agnostic about the precise political process at work but assume only that both local and central decisions are based on an objective function that incorporates individual utility levels of residents of different types within the relevant jurisdiction. Note that we do not necessarily insist on purely benevolent government processes but only require that both local and central processes take individual utilities of different demographic types as their arguments in some particular welfare function. In the absence of some implicit constraints on the central government, however, there would be no economic justification for the existence of local jurisdictions because the center could always do at least as well as a decentralized system by simply mimicking decentralized outcomes. Thus, all our analysis implicitly assumes that central governments are constrained to providing more uniform levels of public goods across jurisdictions than these jurisdictions otherwise would, which then gives rise to an economic justification for local political jurisdictions that are, unlike the central government, able to match local public goods bundles to local tastes.[15]

The remainder of this section elaborates the precise conditions under which equilibrium fiscal transfers from the central government emerge *given that* local governments are charged with providing a

particular public good or service g. These conditions all involve interjurisdictional spillovers of some kind. Section 3.1 begins by defining and outlining interjurisdictional expenditure links that generate three different types of expenditure spillovers which lie at the core of our empirical analysis. The equilibrium properties of this model are then discussed in Section 3.2, with a particular focus given to the conditions under which central governments will provide transfers to local governments in equilibrium assuming two restrictive conditions hold : (i) all governments are constrained to use benefit taxes which implies that no additional spillovers are generated through the local tax system, and (ii) local governments are assumed to view population characteristics as exogenous when setting local public expenditure and tax policy. Finally, Section 3.3 generalizes the model by relaxing the two restrictive assumptions and providing an overall framework into which our results can be fit, and Section 3.4 concludes our theoretical exposition with some caveats.

3.1. Spillovers from the Expenditure Side

Suppose jurisdiction i is one of J different local jurisdictions, and each jurisdiction produces a single public good in each time period. Important spillovers from these local expenditures on public goods can then enter in three distinct ways: (i) across communities within the current time period; (ii) within the community but across time; and (iii) across communities and across time. In this section, we present a simple mechanism that capture these three kinds of spillover effects which we will call (i) interjurisdictional *consumption* spillovers and (ii) intra- and (iii) inter-jurisdictional *investment* spillovers respectively. These spillovers are central to our empirical analysis in that they will determine the extent to which a central government can improve on decentralized financing of public goods through intergovernmental transfers.

3.1.1 The Formal Model of Fiscal Federalism with Expenditure Spillovers

Suppose income at time t in jurisdiction i is denoted y_t^i. While this will clearly depend on the

demographic composition $\mathbf{x}_t^i$ of the community, it may also depend on past investments the jurisdiction has made (such as investments in infrastructure). Thus, current public expenditures by jurisdiction i may result in future income for residents of that jurisdiction. Similarly, investments made by communities neighboring jurisdiction i may raise income in jurisdiction i in the future. If community j invests in public education at time t, for example, and if the beneficiaries of that education migrate to community i when they reach middle age at time t+1, then community i's income in t+1 rises as a direct consequence of the investment by jurisdiction j in time t. We therefore model income in jurisdiction i at time t as a function of its demographic composition as well as past public good levels both within and outside community i; i.e.

$$y_t^i = y\left(\mathbf{x}_t^i\right) + a\left(g_{t-1}^i\right) + b\left(\sum_{j \neq i} g_{t-1}^j\right), \tag{3.1}$$

where $a(0)=ß(0)=0$, $a'>0$ and $ß'<0$, and a'' and $ß''$ depend on the type of public expenditure.[16]

Two expenditure spillovers are introduced through this community income equation. First, when $b'' \neq 0$, public good spending in jurisdiction i today leads to either higher or lower total income in that jurisdiction tomorrow.[17] We will call such effects *intrajurisdictional investment* spillovers. This kind of spillover, while it is fully contained within the community, occurs from one time period to the next and may therefore be intergenerational when viewed in the context of an overlapping generations model. Second, when $b' \neq 0$, public good spending in jurisdiction i today causes per capita income in jurisdiction j to either rise or fall tomorrow. This may occur through two distinct channels depending on the degree of interjurisdictional mobility we assume. If populations are not mobile, then investments in local roads, for instance, may cause neighboring communities to experience some spillover benefits from increased economic activity in the future. On the other hand, if populations are mobile, then greater spending on such activities as local public education in jurisdiction i may lead to greater income in jurisdiction j in the future as the beneficiaries of education in jurisdiction i move to jurisdiction j. As we will mention

shortly, such migrations are possible even in a steady state equilibrium in which only the overall demographic composition within communities remains the same but symmetric relocation of individuals for reasons other than local public goods occurs. We will refer to such effects as *interjurisdictional investment spillovers*.

Denoting private consumption in community i as q_t^i, the community then faces a budget constraint

$$q_t^i = y_t^i - c\left(x_t^i, g_t^i\right).^{18} \tag{3.2}$$

Individuals care about their private and public good consumption in each period, where type k's private good consumption $q_{k,t}^i$ is simply that type's income minus his tax payment which the local government sets (in a lump sum way, for now) at $\tau_{k,t}^i$.[19] Furthermore, the consumption value of public goods produced in jurisdiction j at time t may, for some types of public expenditures, "spill over" into the utility functions of individuals in community i. The utility of resident k in jurisdiction i at time t is then assumed to be given by the function

$$u_{k,t}^i = f\left(q_{k,t}^i, g_t^i\right) + g\left(\sum_{j \neq i} g_t^j\right), \tag{3.3}$$

where $f(0)=0$, $f'>0$, and g depends on the type of public expenditure.[20] Note that this specification of individual utilities gives rise to a third expenditure spillover through the function f; i.e. whenever $g' \neq 0$, current public good production in community j generates current consumption benefits in community i. This may occur, for example, when local governments are charged with regulating CO_2 emissions, a reduction of which would benefit neighboring jurisdictions as well. We will call such spillovers *interjurisdictional consumption* spillovers.

[Table 3.1 about here.]

3.1.2 Examples of Different Types of Local Public Goods

Table 3.1 provides some additional illustrative examples of how the first derivatives of the a,$ß$, and $?$ functions uniquely capture all relevant expenditure externalities . Local parks, for example, are unlikely to bring about any increases in future community income (thus $a_N=ß_N=0$), nor are they likely to generate consumption spillovers for residents in other communities (thus $?_N=0$). As such, expenditures on local parks represent pure consumption value for local residents, and the local government is thus able to fully finance these through local benefit taxes. Public education, on the other hand, while representing consumption for current parents, is also an investment that raises future incomes. If residents are locationally fixed, then all future income generated from this investment remains within the jurisdiction that is undertaking the investment ($a_N>0$, $ß_N=0$) and can therefore be taxed locally (so long as local governments have access to credit markets). If, on the other hand, children that benefit from the investment are able to leave the jurisdiction once they enter the labor force, the increased income will benefit a different community ($ß_N>0$), and the benefits from this investment cannot be taxed by the local jurisdiction.[21] At the same time, regardless of mobility assumptions, residents of jurisdiction i are unlikely to benefit today from current education spending in other jurisdictions ($?_N=0$). In contrast, control of carbon dioxide pollution, while it certainly has local consumption value, also directly generates consumption benefits for residents of other jurisdictions ($?_N>0$) but is unlikely to bring about substantial changes in future community incomes ($a_N=ß_N=0$) . Welfare spending intended to produce reductions in poverty may be more controversial because views differ on whether the reduction in poverty is a local or a state public good. If it is a state public good - i.e. if individuals care not only about poverty within their community - an interjurisdictional consumption externality arises ($?_N>0$). If, on the other hand, the reduction in poverty is a local public good, then benefits are fully contained within the spending jurisdiction ($?_N=0$).[22]

3.2 Steady State Equilibrium under Special Assumptions

In equilibrium, local governments are assumed to choose a public good level g and a tax system **t** (which specifies a lump sum tax payment for each demographic group k) to maximize their objective function subject to the budget constraint (3.2), subject to the actions taken by other jurisdictions, and subject to the system of transfers the central government designs. Again, while we will not specify a precise local political process that governs local public choices, we assume that the objective function of each local government takes as its arguments the utilities of the different demographic groups present in its jurisdiction. Individual agents choose locations in each time period, taking as given the public good/tax packages offered by different jurisdictions. Thus, individual actions in each period endogenously determine the demographic composition of communities. Furthermore, the central government, taking as given local objectives, employs an objective function identical to that of local governments (but considering residents of the entire state rather than any particular community) to determine a tax/grant system. A full equilibrium can therefore be defined as follows:

Definition: A *steady state equilibrium* is a set of population characteristics $\{\mathbf{x}^i\}_{i=1,\ldots,J}$, a set of local public good levels $\{g^i\}_{i=1,\ldots,J}$, a set of local tax systems $\{\mathbf{t}^i\}_{i=1,\ldots,J}$ and a state tax/transfer system such that

1. each individual in any given time period - taking as given public good/tax packages in different communities - cannot improve his utility by moving;
2. each local government - taking as given the community budget constraint, the actions of other local governments, and the central government's transfer system - has maximized its objective in determining its local public good level and its local tax system;
3. the central government - taking as given the objectives of local governments - has maximized its objective in designing its tax/grant system.

3.2.1 Population Migrations and Demographic Compositions in the Steady State Equilibrium

Given that the overall distribution of demographic groups in the state does not change between time periods, it is important to note that the population size and the population composition within communities must, in the steady state equilibrium, also remain constant across time even if individuals migrate between time periods; that is, while it is possible, for example, that individuals move between

jurisdictions in their life cycle, it has to be the case that $\mathbf{X}^i_t = \mathbf{X}^i_{t+1}$ for all t and all i in any steady state.[23]

Thus, it may be that some workers in jurisdiction i move to community j at some time t for reasons exogenous to the model a long as they are replaced by workers from outside jurisdiction i. This is, of course, true only in the steady state equilibrium, and out-of-equilibrium net migrations are certainly possible.

3.2.2 Implications of Expenditure Spillovers for Equilibrium Central Transfers

In order to focus explicitly on expenditure externalities, we will begin our analysis by assuming that, governments face two further constraints: (i) only benefit taxes can be used to raise revenues,[24] and (ii) demographic features of communities ($\mathbf{X}^i_t$) are taken as fixed when policies are determined in jurisdiction i. The first of these assumptions excludes from the analysis tax-generated interjurisdictional externalities (which we introduce in Section 3.3.1), while the second prohibits strategic tax or spending policies aimed at altering the demographic composition of the community (which is added to the model in Section 3.3.2).

A local public good g's spillover characteristics can then be fully characterized by the vector of functions (a,ß,?) associated with the type of good g represents, and the nature of this vector determines to what extent the rents generated from public expenditures can be captured locally and thus financed through benefit taxes. If local public expenditures give rise to interjurisdictional consumption externalities (?ℕ>0), for example, at least some of the rents from the jurisdiction's activity are consumed outside the jurisdiction and can therefore not be taxed under benefit taxation. This is the classic example of positive interjurisdictional spillovers (Oates (1972)). If, on the other hand, local public expenditures represent investments that generate future income, the extent to which benefit taxation can be employed to finance such expenditures depends crucially on whether the future income is realized within the local jurisdiction (aℕ>0) or outside (ßℕ>0). To the extent that such future income remains in the local

jurisdiction, current bonds can be financed through future benefit taxes from those agents whose income was affected, and no additional central government intervention is called for. But if incomes rise in jurisdiction j as a result of public investments in jurisdiction i, these rents cannot be captured through benefit taxation in jurisdiction i.

Whenever a public good g is characterized by $\beta^N>0$ and/or $\gamma^N>0$, benefit taxation at the local level is therefore not sufficient to finance levels of the good g that are optimal from the perspective of the central government. Furthermore, the central government is able to employ matching grants that cause lower level governments to internalize spillover externalities which thus improves (from the center's perspective) on the decentralized outcome. Note that the transfers themselves can be directed either at local governments directly or at residents of local jurisdictions in the form of deductions or credits for local taxes on central government tax forms.[25] The important feature of such grants to the central authority is that they change relative prices of local public goods to local governments and can thus cause local governments that maximize their own objective to implicitly take into account the spillover externalities their policies cause. Furthermore, in equilibrium the taxes collected by the central authority would in fact represent benefit taxes in that local residents would simply be paying for the benefits received from policies enacted in other jurisdictions. *In the presence of local public goods that exhibit either interjurisdictional consumption or investment spillovers ($\beta^N\neq 0$ and/or $\gamma^N\neq 0$), a central government that maximizes its objective subject to the constraints outlined above will therefore initiate a tax/transfer system.*[26] In the absence of either $\beta^N\neq 0$ and/or $\gamma^N\neq 0$, however, no such central government tax/transfer systems can improve (from the center's perspective) on decentralized outcomes.[27]

3.3 Non-Benefit Taxation and Competition for Demographic Groups

Our exclusive focus on expenditure externalities thus far is convenient given the empirical analysis we will report in Sections 4 and 5 but is made possible only because of the two special assumptions of exclusive use of benefit taxation and no strategic manipulations of demographic

characteristics by local governments. Both for the sake of completeness and in order to point out the limits of the results in this paper, we now relax each of these assumptions in turn.

3.3.1 Non-Benefit Taxation

The assumption of benefit taxation at the local level has allowed us to focus exclusively on the ability of local governments to finance public goods of different types from the rents produced from these public goods, and it has allowed central government tax/transfers to arise only when expenditure spillovers are present. As is well known, however, additional externalities from competitive interactions between local governments arise when such governments employ non-benefit taxation, and these externalities can also be addressed through higher government interventions.[28] The above discussion, therefore, implicitly assumes that the tax assignment problem has been solved and that local governments are constrained in the space of tax policies they can utilize to meet their fiscal obligations. In the absence of such constraints, local tax distortions may generate further channels through which central government transfers can improve on decentralized outcomes.

By far the most cited such externality arises from the tax competition literature which demonstrates that local non-benefit taxation of mobile tax bases causes underutilization of these bases because local governments do not consider the benefits from the movement of the tax base to other jurisdictions when setting their tax rates. The most common example of this is taxation of mobile capital.[29] The opposite effect of overutilization of tax bases, on the other hand, may arise when local governments are able to export tax burdens to other jurisdictions by using non-benefit source-based (rather than residence based) taxes on locally concentrated goods such as tourist attractions.[30] Finally, whenever local governments are charged with taxing activities that themselves have interjurisdictional spillovers, additional tax externalities arise.[31]

While we will not explicitly focus on these effects in our later analysis, we note that they are conceptually quite similar to the types of effects we have modeled. Tax competition and tax exporting can be incorporated into our model by changing the budget constraint for jurisdiction i to

$$q_t^i = y_t^i - \delta\left(c\left(x_t^i, g_t^i\right)\right) + \lambda\left(\sum_{j \neq i} c\left(x_t^j, g_t^j\right)\right). \quad (3.4)$$

Under strict benefit taxation (as in the previous section), d=1 and ?=0. In the presence of tax competition, d>1 and ?>0; i.e. if local expenditures are funded through a non-benefit tax on mobile capital, an increase in the local tax rate causes capital to leave and thus local income to decline (d>1), but if other jurisdictions also use similar taxes, capital from those jurisdictions flows to jurisdiction i thus causing local income to rise (d>0). Similarly, in the presence of tax exporting, d<1 as some of the local fiscal expenditures are shifted outside the jurisdiction while ?<0 as other jurisdictions shift their burden as well. In the absence of central government transfers, tax competition over non-benefit taxes therefore leads to under-provision of local public goods (from the central government perspective) as some of the benefits from the public good/tax system in jurisdiction i (i.e. the increase in consumption elsewhere) is ignored by that jurisdiction's local government. Tax exporting, on the other hand, leads to an over-provision of local public goods (from the center's perspective) as local jurisdictions do not take into account the cost of their public good/tax system incurred outside their jurisdiction. Finally, if local public goods are funded through taxes on activities that themselves cause consumption spillovers, then the public good/tax system causes ?N (in the utility function) to deviate from 0.[32]

This discussion suggests that, unless local public expenditures are financed through benefit taxation, local expenditure and tax programs should ideally be studied jointly. Henceforth, we will therefore sometimes speak of the local public good/tax system. Table 3.2 summarizes the tax and spending externalities that give rise to central transfers in our model.

[Table 3.2 about here.]

3.3.2 Strategic Manipulation of Local Demographic Characteristics

Our second simplifying assumption in Section 3.2 was that local governments take the vector of demographic characteristics $\mathbf{x}_t^i$ as fixed when setting tax and spending policies. While we have argued

that, in equilibrium, this vector indeed does not change across time (even if migrations take place), the equilibrium itself will differ depending on whether local governments attempt to strategically manipulate local population size or the local demographic composition. Suppose, for example, that the reduction of poverty is a local public good and that poor individuals are mobile. If local governments are assumed to take $\mathbf{X}_t^i$ as fixed when setting welfare spending, they will choose some level of transfers to the poor that maximizes their objective. When local governments perceive that a reduction in welfare spending will cause poor individuals to leave their community, however, the local government can achieve a reduction in poverty by lowering or eliminating its welfare programs. In an environment where all local governments attempt to manipulate $\mathbf{X}_t^i$ in this manner, the often hypothesized "race to the bottom" leading to equilibrium underfunding of local welfare programs (from the center's perspective) may occur. More generally, given that the cost function for public goods has $\mathbf{X}_t^i$ as one of its arguments, strategic setting of local tax/spending policies with an aim of affecting $\mathbf{X}_t^i$ may lead to either more or less funding than would occur under non-strategic setting of such policies depending on how various demographic characteristics enter the cost function. In the case of education, for example, high income jurisdictions may spend artificially large amounts on public schools in order to price low income individuals (whose peer characteristics may be lower) out of the local school system and thus control local demographic characteristics (Hoyt and Lee (1997)). As before, similar central government tax/transfer programs will therefore arise in our setting to address the implicit externalities that arise when local governments act strategically to influence local demographic variables.

3.4 Summary and Additional Caveats

Before considering additional caveats, the basic conclusions thus far can be summarized as

follows within the context of our model:

> In general, local tax and expenditure policies must be viewed jointly, and unless the local public good/tax system in all communities is such that $\beta_N = \gamma_N = \gamma = 0$ and d=1, and/or if local governments attempt to strategically influence $\mathbf{x}_t^i$, our model predicts (generically) that central government transfers will arise and improve (from the central government's perspective) on decentralized financing of public goods.[33]

Some additional caveats arising from the absence of an explicit underlying political model may be in order. First, we have assumed that the public choice process within jurisdictions is able to credibly issue bonds today to finance public investments to be realized in the future. As suggested in Rangel (1998), it is not clear that such credible commitment is always possible. However, if the state government has a similar objective function to the local governments, it would be similarly unable to solve such intergenerational problems, and state grants would be unable to address this concern. Second, by assuming that the state political process mirrors that of local governments in taking into consideration the individual utilities of its residents in the same way, we argue that state transfers are capable of internalizing the externalities we point to. While this possibility certainly exists to the extent that the spillovers do not cross state boundaries, a different political model of the state public choice process might suggest that such internalization of externalities is an unlikely outcome of state transfer policies. Inman and Rubinfeld (1996), for instance, suggest that a model of distributive politics in which localities are represented by representatives in the state legislature may yield state grant systems that do not reflect the externality-internalizing structure that is in principle possible. Other concerns arising from different types of political economy models include loss of political accountability and local control when complex state grants govern local public decision-making.[34] Thus, the extent to which real world political systems can effectively utilize intergovernmental grants to remedy the types of problems arising under decentralized public finance we have outlined is an empirical issue calling for careful analysis of how state and federal grants actually operate. We now attempt such an analysis for the case of California.

4. Implications of a Community's Age Composition on Fiscal Policy

This section considers an important application of the above framework designed to explore the ways in which the age composition of a local community's population alters the intergovernmental transfers that its local government receives to fund expenditures. We assume here that the demographic composition of community i at time t is fully described by the vector $\mathbf{x}_t^i = (N_t^i, J_t^i, M_t^i, E_t^i)$ representing the size of the local population and the fraction of the population that is young, middle-aged and elderly. Further, local governments take their demographic composition as given (i.e. we assume away the externalities from strategic manipulation of local demographic characteristics discussed in Section 3.32) and spillover externalities arise solely through expenditures (i.e. ?=0 and d=1 for all public goods). Finally, public good cost functions for different types of public goods all take the form

$$c(\mathbf{x}_t^i, g) = ?_J*(N_t^i J_t^i)g + ?_M*(N_t^i M_t^i)g + ?_E*(N_t^i E_t^i)g, \qquad (4.1)$$

where $(N_t^i J_t^i)$ is the number of young, $(N_t^i M_t^i)$ is the number of middle aged and $(N_t^i E_t^i)$ is the number of elderly in the population of community i at time t, and $?_J$, $?_M$ and $?_E$ represent the relative crowding characteristics of the different age groups in the production of the local public good. For education, for example, $?_M$ and $?_E$ would equal zero while $?_J$ would be positive. Note that this cost function incorporates no fixed costs and specifies the marginal cost of extending the service g to an additional individual as constant but differing across age groups. As such, the function contains no scale effects from population growth, which implies that it could equivalently be written in per capita terms where all N_t^i arguments drop out of the right hand side of (4.1).

4.1. Age Composition Alters a Locality's Public Goods and Funding Sources

Given this set-up, public goods can differ only along two dimensions: first, their spillover functions (a,ß,?), and, second, their cost function parameters ($?_J$,$?_M$,$?_E$). Tables 4.1 and 4.2 give examples of extreme types of public goods in both these dimensions. Table 4.1 defines four stylized public goods along the spillover dimension: g_1 represents a pure local consumption good with no interregional or intergenerational spillovers; g_2 is a pure local investment good with intergenerational but no interregional spillovers; g_3 represents an investment with interjuridictional spillovers; and g_4 constitutes a good with only interjuridictional consumption spillovers. Table 4.2 categorizes public goods along the cost dimension where goods of type c_1, c_2, and c_3 are targeted solely at the young, middle-aged and elderly respectively.

[Table 4.1 about here.]

According to Section 3, our model predicts no sharing between different levels of government of goods of type g_1 and g_2 and the emergence of central government grants for the financing of public goods of type g_3 and g_4. Furthermore, a community whose public good is of spillover type g_3 and cost type c_1 will receive central government grants only proportional to the fraction of its population that is young. Thus, the level of central government funding received by a given community depends *both* on the spillover type of its public good *and* the demographic composition of its population.

While both the spillover parameters in Table 4.1 and the cost function parameters in Table 4.2 are extreme, note that any real public good is some combination of these stylized entities. For example, investment by local communities in roads typically contains some local investment value (g_2) to the extent that it is spent on local roads and some spillover investment value (g_3) to the extent that if is spent on connecting roads. On the cost side, such spending may benefit all age groups to some (although not necessarily an equal) extent. Infrastructure spending is therefore likely to be a convex combination of g_2 and g_3 on the spillover dimension (Table 4.1) and some convex combination of all three cost functions in Table 4.2. The size of the weight in these combinations given to g_3 on the spillover dimension then determines the *fraction* of total road spending by the local government that is funded through central government transfers in our model. Furthermore, the relative weight given to each of the three stylized

public goods in the cost dimension (Table 4.2) links the *total size* of local spending on a given level of infrastructure to the local demographic characteristics of the community and thus indirectly links the size of the central government infrastructure funding within the community to local demographics.

[Table 4.2 about here.]

4.2. Application to Spending in Counties

The fact that local governments supply services for residents within counties provides an interesting context for considering practical implications of our analysis. Interpreting a county as having a single local government, one can generally classify the spending by these governments into five broad categories: education, health, welfare, police/fire protection, and infrastructure. The central governments here include both the state and federal governments.

Table 4.3 categorizes each of these spending classifications in terms of the simplified spillover and cost dimensions introduced in Section 4.1 and derives in the last column the resulting predictions given by the model. Education, for example, is largely a public good of type g_3 in the spillover dimension, and its per resident costs for a community depend solely on the fraction of that community that is of school age (i.e. education is a public good of type $c_1$on the cost dimension). Our model therefore implies that much of the funding for education will come from the state level (to internalize interjurisdictional investment spillovers), and the per capita level of funding will be directly related to the fraction of the local population that is young.

[Table 4.3 about here.]

The remaining predictions in the table are similarly and straightforwardly derived from the stylized model above. Health expenditures are assumed to be somewhat more targeted to the young and the elderly (c_1,c_3), while welfare spending, given its emphasis on spending on children, is assumed to be relatively more targeted to the young (c_1). Safety (i.e. police and fire) expenditures, on the other hand, are likely to be more pronounced (for any level of public safety) the greater the fraction of M (given that most in the J generation are children under the age at which they commit crimes and given that the elderly

are statistically less likely to be involved in crime). Finally, infrastructure such as roads is likely to be used somewhat more by the working population and is therefore also assumed to be somewhat more targeted to the M generation (c_2).

On the spillover side, education is denoted largely as an interjurisdictional investment good, while we interpret health, welfare and safety as largely current local consumption goods (although spending on health and welfare in part involve investments in children that contain elements of intergenerational spillovers, and public safety may spill over into neighboring jurisdictions). Finally, infrastructure expenditure, to the extent that it mixes local projects with projects of wider regional investment potential, is denoted both a local and an interjurisdictional investment good.

5. Empirical Analysis of California Counties

To explore the empirical applicability of our model of fiscal federalism, we analyze data on 58 California counties - their expenditures, their tax and grant revenues, and the age composition of their populations - to test the predictions of the model. The spending categories analyzed correspond to those presented in Table 4.3. Our data integrates the fiscal activities of all local governments within a county, and, so, our measures of county expenditures represent totals spent on all residents within a county. Our data combine all transfers from state or federal governments to local governments in a county into a single net "intergovernmental transfer." Finally, our tax revenue variable reflects the portion of county expenditures paid for directly by local residents.

This section begins with a brief description of our data, and then presents a set of elementary empirical specifications capturing the key relationships linking expenditure categories and funding sources. After presenting our regression results, the discussion explores the implications of our results for the issues identified in our theoretical analysis.

5.1 Data Description

Data on revenues and expenditures for the 58 California counties in fiscal years 1986-1987 and 1991-1992 are drawn from the Census of Governments, a survey conducted every 5 years by the Bureau of the Census. Each observation represents the total expenditures (or revenues) in a given county, including transactions not just for the county level of government but also for all municipalities, townships, school districts, and special districts within that county. The broad expenditure categories include education (K-12 and community colleges), health (including hospitals), public welfare, and police and fire protection. The residual category is "infrastructure" which includes all expenditures not classified in the other groups. We refer to this category as "infrastructure" rather than "other expenditures" because the bulk of these expenditures are infrastructure-related. Our data also provides direct measures of intergovernmental transfers to counties (from the federal and state levels of government) and the amount of total local taxes used to fund expenditures within the county. All demographic variables are from the 1990 Census STF3A files for the California counties. The appendix attached to the end of this paper offers detailed descriptions of these data.

Table 5.1 reports descriptive statistics (the mean, minimum, maximum, and the lower, median and upper quartiles) summarizing our data, for both 1987 and 1992. The top three rows present findings for county population, total expenditures, and total revenues. The remaining rows report statistics for variables appearing in our regressions: the first group are the share variables for expenditures and revenues, the second are the corresponding per capita variables, and the last five rows are demographic variables from the 1990 Census summary tape files (STF3A). All pecuniary values are measured in 1990 dollars, using the CPI (all items) for all urban consumers in the Western region of the U.S. as the deflator. All revenue and expenditure variables, apart from the totals, are measured in $1000s. Median income is measured in $10,000s.

[Table 5.1 about here.]

5.2 Empirical Specification

The purpose of our empirical analysis is to discover the systematic relationship linking the five

expenditure categories (i.e., Education, Health, Welfare, Police and Fire Protection, and Infrastructure) to the two revenue categories (Intergovernmental Transfers and local taxes). We do this by introducing separate empirical specifications for each of these measures treated as dependent variables. Our analysis considers two forms of dependent variables: measures expressed as budget shares, and measures formed by calculating per-capita (i.e. per resident) expenditures and revenues.

We estimate models of the form

$$\mathbf{y} = \mathbf{X}\,ß + \mathbf{e}\,, \tag{5.1}$$

where **y** is a 58x1 vector of expenditure or revenue variables for the 58 California counties, **X** is a 58x5 matrix of regressors, ß is a 5x1 parameter vector, and **e** is a 58x1 vector of mean-zero disturbances. The matrix X is the same across all specifications. It includes the fraction of persons in a county aged 0 to 20 (termed here the "young proportion"), the fraction of persons in a county aged 65 or older (termed the "elderly proportion"), median income for households in the county, the fraction of households in the county living in rural (farm or nonfarm) areas, and an intercept. With the fraction of persons aged 21-64 (middle age) excluded from regression relations, coefficients on the young proportion show how much the fitted component of y in (5.1) responds to a shift in the population from the middle-age group to the young group; and coefficients on the elderly proportion reveals the effects on y of increasing the share of the population being elderly with a corresponding decline in the middle-age group. Differences in the young and elderly coefficients indicate how shifts in the population between these two groups influence fitted values of y.

5.3 Regression Results

For each specification of the **y** and **X** variables, we report two sets of estimates of model (5.1), least squares (LS) and least absolute deviations (LAD). We implement bootstrap procedures to compute all reported coefficient estimates and standard errors, drawing 1000 replications for each estimation. Furthermore, we report these results for different ways of measuring the **y** variables, with Section 5.31 reporting (both LS and LAD) estimates when the **y** variables are expressed as shares of total expenditures

or shares of total revenues and Section 5.3.2 reporting (again both LS and LAD) estimates when they are expressed in per capita terms. In both sections, the **y** variables are averages of the 1987 and 1992 data, expressed in 1990 dollars.[35]

5.3.1 Results for Expenditure and Revenue Shares

In Table 5.2, all of the **y** variables are measured as shares of total expenditure or shares of total revenue. The first column of this table lists the dependent variables. For example, the first row of the "Expenditure Shares" part of the table gives the results for which **y** = 0.5 (1987 Education Expenditure / 1987 Total Expenditure) + 0.5 (1992 Education Expenditure / 1992 Total Expenditure), and the first row under "Revenue Shares" gives the results for which **y** = 0.5 (1987 Intergovernmental Transfers / 1987 Total Revenue) + 0.5 (1992 Intergovernmental Transfers / 1992 Total Revenue). Two results are reported in each main row of the table. The first and uppermost result appearing in each main row is the bootstrapped least squares coefficient, with its bootstrapped standard error immediately below it in parentheses. Immediately below this standard error is another bootstrapped coefficient, but for least absolute deviations (LAD) estimation (or median regression) rather than OLS. Immediately below this coefficient is its bootstrapped standard error. For example, consider the first main row of the table, for **y** = Education Share. The average bootstrap OLS coefficient based on 1000 draws is 1.001, and its standard deviation is 0.369. The average bootstrap LAD coefficient based on 1000 draws is 0.896 and its standard deviation is 0.479. The 5 columns of the table correspond to the 5 columns (1 intercept and 4 independent variables) of X.

[Table 5.2 about here.]

The estimates of Table 5.2 indicate that increasing the proportion of young in a community raises the share of expenditures devoted to education and decreases the shares going to safety (i.e., police and fire) and infrastructure. There is slight evidence that more young also leads to higher welfare spending, but significance levels for these coefficients are very marginal. On the revenue side, more young leads to a greater proportion of local funding coming from intergovernmental transfer revenues with a

corresponding lower share paid for by a county's own taxes.

More elderly in a community increases the allocation of expenditures spent on infrastructure. While none of the elderly coefficients associated with revenues are statistically significantly different from zero, their pattern suggests that more elderly results in lower proportions of revenues coming from intergovernmental transfers and less from own taxes.

Examining differences between the young and elderly coefficients in Table 5.2, three sets of differences are statistically significantly different from zero at conventional levels of significance. Shifting population from young to old induces a greater share of spending going to education. On the revenue side, the share from intergovernmental transfers falls and the share from own taxes rises.

5.3.2 Results for Per-Capita Measures

Table 5.3 reports the second main set of results. All dependent variables here – listed in the first column – are now in per capita terms rather than shares of total expenditures or revenues. We construct y in (5.1) by averaging per capita measures in 1987 and 1992; i.e. Education Per-Capita listed in the first row is 0.5 (1987 Education Expenditures / 1987 population) + 0.5 (1992 Education Expenditures / 1992 population), with all monetary values expressed in 1990 dollars. The last set of rows in the Expenditure group of Table 5.3 gives Total Expenditures per capita, defined as 0.5 (1987 Total Expenditures / 1987 population) + 0.5 (1992 Total Expenditures / 1992 population). All other **y** variables in Table 5.3 are defined analogously.

[Table 5.3 about here.]

The results in Table 5.3 broadly confirm the conclusions reached from Table 5.2. Increasing the proportion of young in a community raises per-capita education expenditures and lowers safety and infrastructure per-capita spending. From a revenue perspective, more young leads to smaller local government tax revenue per capita.

More elderly in a community also leads to less spent on infrastructure per-capita. While only marginally significant, the elderly coefficients associated with per-capita revenues indicate that a higher

fraction of elderly leads to lower amounts of funding coming from both intergovernmental transfers and local government taxes.

The differences between the young and elderly coefficients in Table 5.3 affirm the insights revealed in Table 5.2. Shifting population from young to old provokes higher per-capita expenditures on education and greater per-capita intergovernmental transfers.

5.4 Implications of Findings

Tables 5.4 and 5.5 explore the budgetary consequences of changing the age composition of a California county's population. The tables are designed to answer the question: How does a change in the age composition of a county's population alter a local government's spending on public goods and on its sources for funding these expenditures? All information in these tables is derived from the two sets of regression results (LS and LAD) of Table 5.3 in which all dependent variables are measured per capita. Table 5.4 presents the budgetary implications calculated using the least squares coefficients of Table 5.3, and Table 5.5 gives the corresponding computations using the median coefficients.

[Table 5.4 about here.]

[Table 5.5 about here.]

The first column of each table signifies the nature of the demographic change under consideration. Thus, the first row considers the consequences of increasing the fraction of middle-aged people by decreasing the fraction of elderly people by the same magnitude, with the fraction of young people held constant. The other two rows are defined analogously. The second column of each table projects the effect of the specified demographic change on per capita expenditures, while the third column predicts the effects on per-capita revenues. The values in both columns are simply the responses implied by the point estimates reported in Table 5.3. For the last rows describing the quantities associated with shifting population from the young to the elderly group, the listed values reflect differences in the estimated young and elderly coefficients reported in Table 5.3. However, not all expenditure categories from Table 5.3 appear in the second column of Tables 5.4 and 5.5. We included

only those categories where at least one of the estimated coefficients in Tables 5.2 or 5.3 is statistically significant at the 90% confidence level for either the LS or the LAD estimates. So, if an estimated coefficient from the median regression is significant at the 0.10 level but the corresponding coefficient from least squares estimation is insignificant, then the variable is still included in the second columns of both Tables 5.4 and 5.5. In the third column, we include predicted responses of both per-capita intergovernmental transfers and local government taxes to the demographic shift under consideration.

Tables 5.4 and 5.5 largely confirm the predictions of Table 4.3. While the totals for the changes in expenditures and revenues associated with each demographic shift may appear to produce budgetary imbalance, conventional hypotheses tests indicate that total changes in expenditures and revenues are never significantly different from one another for any of the shifts considered, using either LS or LAD estimates. Inspections of the individual findings in Tables 5.4 and 5.5 reveals a variety of systematic patterns. A demographic change from young to either middle-age or elderly brings about a marginal decline in education spending and, as evidenced in the last rows of the tables, a corresponding marginal decline in intergovernmental grants. Marginal infrastructure spending rises with demographic changes toward middle-age (from either the young or the elderly), thus confirming our intuition that those of working age disproportionately crowd in the cost function for infrastructure. Furthermore, the budgetary numbers are consistent with the view that marginal spending on infrastructure is in fact shared between the central and the local governments, a finding that is again consistent with Table 4.3. In the case of marginal changes in public safety expenditures, the findings do indicate a rise expected from a demographic shift from young to middle aged, but they show no such marginal increase (as was hypothesized in Table 4.3) when the shift is from old to middle-aged. The middle rows of Table 5.4 further suggests that public safety expenditures are largely funded locally, again a prediction consistent with Table 4.3.[36]

Simplified to their essence, the findings in Tables 5.4 and 5.5 are consistent with the following view of fiscal relationships linking county governments with state/federal governments. Marginal changes in education are fully funded by intergovernmental transfers from state/federal governments. Public

safety expenditures are primarily funded by local taxes. Infrastructure expenditures are jointly funded by intergovernmental transfers and local taxes, with an even split approximating the contributions.

6. Conclusion

This paper develops a model of fiscal federalism that links levels of local government expenditures to local demographic characteristics, highlights interjurisdictional spillovers (rather than demographic differences) as the culprit that creates local fiscal burdens, and suggests a role for a central government to alleviate these burdens. The analysis focuses on three types of spillovers interfering with fully decentralized funding of public goods: inter-jurisdictional consumption spillovers (wherein benefits occur across communities within the current time period), and intra- as well as inter-jurisdictional investment spillovers (wherein benefits occur across time and within and across communities). Central governments can mitigate interjurisdictional spillovers by making transfers to local governments based on the demographic composition of each locality's population, with age being a vital distinguishing characteristic. According to our model of fiscal federalism, the fraction of local public expenditures financed through intergovernmental transfers depends on the particular combination of expenditures for public goods provided in a locality, a combination which arises because different public goods are subject to the different spillovers. Since the age composition of the population significantly alters both local tax revenues and expenditures on different types of public goods, this composition is thus predicted to change the fraction of local goods funded by central government transfers.

Using data on California counties for the years 1987 and 1992, we find intriguing evidence supporting the implications of our model. Our analysis considers levels of spending in counties on five broad expenditure categories: education, health, welfare, police/fire protection, and infrastructure. Not surprisingly, the age composition of a county's residents strongly influences its allocations across these expenditure categories. Given the differing characteristics of these goods, such shifts in allocations signify distinctive alterations in the types and sizes of spillovers encountered. In response to this, our fiscal federalism model predicts particular adjustments in intergovernmental transfers from central governments (state and federal) for each of these spending categories. Our empirical results indicate that

central governments act to fully fund marginal changes in education expenditures through intergovernmental transfers, while public safety expenditures are primarily funded by local taxes. Infrastructure expenditures are jointly funded by intergovernmental transfers and local taxes. These findings are broadly consistent with the fiscal relationships hypothesized by out model.

A few qualifications, however, are in order. While the empirical analysis suggests that gross flows in central transfers correspond qualitatively to the predictions of our simplified model and thus compensate jurisdictions for local fiscal burdens from spillovers, we can say little in regard to whether the size and nature of these flows is optimal without both gathering more information on the magnitude of expenditure and tax spillovers as well as exploring the particular incentives contained within grant programs.[37] However, we should note that the paper's emphasis on overall flows of transfers has the advantage that this approach avoids the usual fungibility issues that arise when transfer programs are analized one by one. We also emphasize briefly that, in interpreting our results, the reader should keep in mind that there is much distinction between the optimal division of government financing of public goods and the optimal degree of local control over the funds that are spent. Our suggestion throughout this paper, for example, that state financing of education may be appropriate given the potentially large interjurisdictional investment components of education funding, is a suggestion only about the funding side. Neither our theoretical model nor our empirical results shed any light on how financial resources, once transferred, should be further directed and controlled.

Appendix

Description of Data

This appendix describes the two sources of data used in our empirical analysis: data on county finances obtained from the Census of Governments; and data on demographics extracted from the 1980 US Census.

A.1 Revenue and Expenditure Data for California Counties

Our revenue and expenditure data for all California counties in fiscal years 1986-1987 and 1991-1992 are from the Census of Governments,[38] a survey conducted every 5 years by the Bureau of the Census. For each revenue and expenditure category, our data represent the sum of the totals for each local government in a given county. That is, a total for a particular county includes data not only for the county government but also for all municipalities, townships, school districts, and special districts within that county.

All of our revenue and expenditure data are from the Local Government Finances portion of the census, which contains information for the 3042 county, 19,221 municipal, and 16,695 township governments existing in the United States in fiscal years 1986-1987 and 1991-1992. The initial data collection phase used three methods: mail canvass, field compilation, and centralized collection from state sources. Detailed census schedules with reporting instructions were used in the mail canvass. Census examiners then reviewed these and conducted extensive correspondences, when necessary, to verify incomplete and questionable responses. In some cases, census enumerators visited local government offices to obtain this information

The field compilations had two components. Initial plans required census representatives to compile data for the largest county and municipal governments, typically those counties with populations exceeding 500,000 and municipalities with populations exceeding 300,000, by accessing records on site.

The second component of field compilation endeavored to resolve questions that arose during the survey by having the census agents review source material in the local government offices. Finally, in California a central data collection system existed for the county and municipal levels of government. When needed, the census staff obtained supplementary data from special tabulations in other state offices, printed reports, secondary sources, or supplemental mailings directly to the local governments.[39]

The revenue and expenditure data include all net receipts and expenditures for all local governments within each county (net of correcting within county intergovernmental transfers and transactions, such as recoveries of refunds), excluding debt issuance and retirement, loan and investment, agency, and private transactions. Internal transfers among the agencies of a particular government are excluded from these data. Therefore, a government's contribution to a retirement fund that it administers is not considered an expenditure, nor is the receipt of this contribution by the retirement fund considered revenue.

In our data, the relationship between the totals of revenue and expenditure for a given county do not provide a direct measure of budgetary balance. Government expenditure includes all capital outlay, including a significant fraction which is financed by borrowing, while revenue does not include receipts from borrowing. In addition, the relationship between the totals of revenue and expenditure may be distorted further by changes in cash and security holdings, and contributions to retirement systems.

Taxes and intergovernmental transfers are the two broad revenue categories that we consider. We further partition taxes into property taxes and other taxes, and intergovernmental transfers into transfers from the federal government and transfers from the state government. Our broad expenditure categories include education, health and hospitals, public welfare, police and fire protection, and infrastructure. The following is a complete list of all expenditure and revenue variables discussed in this paper, with precise definitions provided when needed:

Direct General Expenditures

Total: All expenditures of the local governments excluding utility, liquor stores, employee-retirement or other insurance-trust expenditures and any intergovernmental payments.

Education: For provision or support of schools and other educational facilities and services, including those for educational institutions beyond the high school level operated by local governments (e.g. community colleges). They cover such related services as pupil transportation, school milk and lunch programs and other cafeterias, health and recreational programs, and the like.

Health and Hospitals: Includes out-patient health services including public health administration, research and education, treatment and immunization clinics, nursing, etc.; financing, construction, and operation of nursing homes; financing, construction, acquisition, maintenance, or operation of hospital facilities; provision of hospital care; and support of public or private hospitals.

Public Welfare: Covers support of and assistance to needy persons contingent upon their needs. Includes Cash Assistance paid directly to needy persons under categorical (Old Age Assistance, Aid to Families with Dependent Children, Aid to the Blind, and Aid to the Disabled) and other welfare programs; vendor payments made directly to private purveyors for medical care, burials, and other commodities and services provided under welfare programs; welfare institutions; and any intergovernmental or other direct expenditure for welfare purposes. Pensions to former employees and other benefits not contingent on need are excluded.

Police and Fire Protection: For preservation of law and order and traffic safety. Includes police patrols and communications, crime prevention activities, detention and custody of persons awaiting trial, traffic safety, and vehicular inspection. Also covers fire fighting

organizations and auxiliary services, fire inspection and investigation, support of volunteer fire forces, and other fire prevention activities. It includes cost of fire fighting facilities, such as fire hydrants and water, furnished by other agencies of the government.

Infrastructure: This is a residual category representing expenditures that do not fall under the above four subcategories. This category covers expenditures on the general functions of government (legislative, as well as management and support); transportation (streets, highways and storm drains, street trees and landscaping, public transit, airports, ports and harbors); community development (planning, construction and engineering regulation enforcement, redevelopment, housing, employment, and community promotion); culture and leisure (parks and recreation, marina and wharfs, libraries, museums, golf courses, sports arenas and stadiums, community centers and auditoriums).[40]

General Revenue

Total: Includes all revenue except utility, liquor stores, and employee-retirement or other insurance-trust revenue. All tax revenue and all intergovernmental revenue, even if designated for employee-retirement or local utility purposes, is classified as general revenue.

Intergovernmental Transfers: Covers amounts received from the federal or state government as fiscal aid, as reimbursements for performance of general government functions and specific services for the paying government, or in lieu of taxes. It excludes amounts received from other governments for sale of property, commodities, and utility services. All intergovernmental revenue is classified as general revenue.

Total Taxes: Compulsory contributions exacted by a government for public purposes, except

employee and employer assessments for retirement and social insurance purposes, which are classified as insurance trust revenue. Total taxes include amounts received from all taxes imposed by a government.

All expenditure and revenue variables are in $1000s, with the exception of total expenditures and total revenue which are in $1,000,000s. All pecuniary variables used in this paper are measured in 1990 dollars, adjusted by the CPI (all items) for all urban consumers in the Western region of the U.S. For more detail about the above variables, consult the 1987 and 1992 *Compendiums*.

Not all geographic areas known as counties have county governments. When municipal and county governments have been consolidated, or substantially merged, the composite units are classed as municipalities for the Bureau of the Census reporting of governmental statistics. In California, the only county without a county government is the city and county of San Francisco. As defined for census statistics on governments, municipal governments are political subdivisions within which a municipal corporation has been established to provide general local government for a specific population concentration in a defined area. This includes all active governmental units officially designated as cities, boroughs, towns, and villages.

A.2 Demographic Data for California Counties

The explanatory variables in our regressions are constructed using demographic data from the 1990 Census of Population STF3A files for California counties. We consider 3 age categories: age 0 to 20, 21 to 64 and 65 and older. So, for example, the age 0 to 20 regressor is simply the fraction of people in a given county falling into this age category. The regressor called “rural” is the fraction of households in a given county which are in rural (farm or nonfarm) areas. The median income regressor is the median household income for the each county, in 10,000s of 1990 dollars.

Notes

1. A notable exception is offered by Echevarria (1995) who uses a model that is somewhat similar to ours to theoretically investigate the consequences of population growth on the relative needs of different governments in a federal systems.

2. Bergstrom and Goodman's (1973) original work focused on estimating local political equilibria and included fractions of demographic groups in the local population but neglected to take into account the now well recognized presence of Tiebout bias (Goldstein and Pauly (1981), Rubinfeld, Shapiro and Roberts (1987)). Other notable papers attempting to estimate local public good demand in various contexts include Gramlich and Rubinfeld (1982), Denzau and Grier (1984), Megdal (1984) and Bogart (1991).

3. The basic ideas have been presented in many contexts over the past three decades (see Breton (1965), Williams (1966), Pauly (1970), Bradford and Oates (1971), Wilde (1971), Oates (1972), Boskin (1973), Gramlich (1977), Inman and Rubinfeld (1979), Arnott and Grieson (1981), Gordon (1983), Inman and Rubinfeld (1996)), although empirical documentation of spillover effects remains relatively scarce (Weisbrod (1965), Greene, Neenan and Scott (1974)). Often spillovers are not, however, thought of in the way we model them. Wyckoff (1984), for example, estimates the degree of education spillover *within* communities from parents to non-parents, while we are concerned mainly with education investment spillovers across jurisdictions due to mobility considerations.

4. This idea owes much of its prominence to the "New View" of property taxation as largely a tax on all forms of capital first explored by Mieszkowsi (1972) and since elaborated by Mieszkowski and Zodrow (1989) and Zodrow and Mieszkowski (1986). A general approach to internalizing such externalities through fiscal federalism can be found in Gordon (1983) and Inman and Rubinfeld (1996). A recent caveat to this literature is offered by Lee (1998) who argues that if individuals hold diversified portfolios that include fixed factors in other

jurisdictions, then local governments will take into account the benefit to other jurisdictions when capital migrates.

5. Tax competition in a strategic setting is explored in Wilson (1986) and Wildasin (1989), and expenditure competition is most often discussed in terms of a hypothesized "race to the bottom" when community's consider the impact on local community composition when setting local welfare policy. Besharov and Zweiman (1998) further point out that strategic policy considerations also arise in regulatory rather than tax/expenditure dimensions.

6. Some special cases have been identified in which this is not the case (Krelove (1992), Myers (1994)), but these cases are of relatively narrow empirical interest given the special assumptions required (Inman and Rubinfeld (1996)).

7. Del Rossi and Inman (1994) argue that federal infrastructure investment is, in fact, in part a political payment to special interests.

8. For a more detailed illustration of some of these political barriers, see Inman and Rubinfeld (1996) and McKinnon and Nechyba (1997). It should be noted, however, that public choice economists disagree about the extent to which such political barriers are important. While Tullock (1983) emphasizes the role of imperfect information in providing politicians with the means to engage in inefficient special interest redistribution, Becker (1983) and Wittman (1989) argue that political competition ensures efficient redistribution.

9. See, for example, Inman and Rubinfeld (1996) and Weingast (1995).

10.Whenever the local age distribution is assumed to characterize demographic differences across jurisdictions, the model becomes an overlapping generation model. At time t+1, each age group advances, with the oldest exiting the model and a new young generation entering.

11. A more general version of the model might include past public good spending as one of the arguments in this cost function. This would give rise to a public investment channel separate from that described below. For expositional convenience, we forego such a generalization here.

12. See Ladd (1998) for a survey of the empirical evidence regarding the relationship between

population size and fiscal burdens of local communities.

13. Under certain additional conditions, the absence of spillovers further implies efficient provision of public goods. For an accessible elaboration of the precise conditions under which efficiency obtains, see, for example, Scotchmer (1994).

14. While such an equilibrium generally exists, it is easy to demonstrate it would not be stable.

15. This constraint is implicit, for example, in Oates' (1972) well-known "Decentralization Theorem." The idea of local matching of tastes to public goods bundles is, of course, reinforced by Tiebout's (1956) notion that individuals will tend to sort into jurisdictions according to their tastes for public goods. Other constraints on the central government that have been cited as justifications for lower level governments include the less efficient use of policy relevant local information by central governments (Hayek (1966)) and the inability of central governments to conduct policy experiments.

16. Note that for expositional convenience we are restricting investment spillovers to be the same among all jurisdictions. This could easily be remedied by specifying a β function for each jurisdiction, but the central idea would remain the same. Further, whenever we use derivative notation such as $\beta'>0$, we will implicitly be making statements about the derivative at every argument (i.e. $\beta'>0$ will be taken to mean $\beta'(x)$ for all $x>0$).

17.This may occur whether populations are mobile or not. In the absence of mobility, local public investments such as local infrastructure may directly raise future per capita incomes of those currently residing in that community. In the presence of mobility, such increases in per capita incomes would be bid away through immigration from other jurisdictions unless those jurisdictions also engaged in similar public investments. Given that in equilibrium other jurisdictions must invest sufficiently for no net migrations to take place, however, benefits from such investments would in fact remain in the locality.

18. As we point out in Section 3.31, this specification of the community budget implicitly assumes away tax externalities and thus assumes the exclusive use of benefit taxation.

19. We will place restrictions on this tax function which maps individuals into tax payments shortly.

20. As for the case of investment spillovers, we are restricting consumption spillovers to be the same among all jurisdictions which could again be remedied by specifying a *?* function for each jurisdiction. Furthermore, additional notation could be used to allow the *?* function to differ across types of agents, but this yields no additional insights for the present purposes.

21. This assumes that parental utility functions do not fully take into account the future gains in their children's income - i.e. parents cannot be modeled as infinitely lived individuals - and, to the extent that they do, they do not control the local political process. As modeled, education brings some current consumption value to parents and non-parents, but this consumption value is not modeled as necessarily relating to the future income of children.

22. An additional issue arises in the case of welfare when the reduction in poverty is viewed as a local public good and when the poor are mobile. In particular, a jurisdiction might reduce welfare benefits in an attempt to cause the poor to migrate out of the community (thus leading to the often cited "race to the bottom"). This case is excluded here because we assume that the local public choice process takes demographic characteristics as fixed, an assumption that will be relaxed in Section 3.32.

23. Technically, some other types of equilibria in which population characteristics rotate between jurisdictions are also plausible but are of little empirical interest. We will therefore restrict ourselves to steady state equilibria in which such rotations do not occur.

24. This is a restriction that is implicitly already assumed in the community budget constraint we have specified (see equation (3.2)) and goes beyond lump sum taxation in that it requires taxes to be both lump sum *and* in some sense proportional to the benefits received by a particular agent. The extent to which local governments employ benefit taxes is the subject of much academic controversy. Hamilton (1975, 1976) and Fischel (1992), for instance, argue that residential property taxes approximate local benefit taxes, while Mieszkowski (1972), Zodrow and

Mieszkowski (1986) and Mieszkowski and Zodrow (1989) argue that such taxes are borne to a large extent by all forms of capital and thus do not represent benefit taxes. As we will point out in Section 3.31, additional tax externalities arise when local governments do not use benefit taxes to fund expenditures.

25. For a detailed analysis of the equivalence between these schemes, see Nechyba (1996). It should be noted, however, that much of the literature on intergovernmental grants has been devoted to the empirical documentation of quite different local public finance responses depending on whether the grant is given to local governments or local voters. This effect has become known as the "flypaper effect" and has been discussed in detail by, among others, Gramlich (1977), Romer and Rosenthal (1980), Wyckoff (1991) and Hines and Thaler (1996).

26. In most cases, such central government grants would in fact cause a pareto improvement from the local governments' perspective and could therefore be viewed as a collusive agreement between local governments in which the center acts as an enforcer. For a formal example in which federal grants emerge as a result of such collusion, see Nechyba (1997).

27.While the public finance literature therefore recommends matching grants for the internalization of externalities, other problems may arise from such grants. For our purposes, we are concerned about the local fiscal burden which could also be addressed, though perhaps not as easily, through block grants.

28. See Starrett (1980), Gordon (1983), Inman and Rubinfeld (1996) and McKinnon and Nechyba (1997) for more detailed discussion of these tax induced externalities than we are able to offer here.

29. For a more detailed analysis of tax competition for capital, see Mieszkowski (1972), Wilson (1986), Zodrow and Mieszkowski (1986), Wildasin (1989), Gordon (1992).

30. Consumption taxes can be exported whenever a good is scarce outside a jurisdiction (as, for example, Disney World) and consumers are thus forced to purchase that good in a particular location. Exporting of factor taxes, on the other hand, can occur whenever a factor is relatively

immobile (like land) and is used in the production of an export commodity. Given the relatively high mobility of most factors (in particular, labor and capital - see Grieson (1980), Feldstein and Vaillant (1994), Papke (1991)), lower tier governments are limited in their ability to export taxes on these factors. Similar types of issues arise when localities tax exports that are produced by non-competitive industries. See also McLure (1967), Arnott and Grieson (1981), McLure and Mieszkowski (1983) and Mintz and Tulkens (1996) for various applications, and see Pindyck (1978) and Kolstad & Wolak (1983, 1985) for empirical illustrations.

31. In particular, taxes on activities with locally concentrated benefits but geographically diffuse costs (high smoke stack industries) will tend to be underutilized while taxes on activities with locally concentrated costs but geographically diffuse benefits (landfills) well tend to be overutilized. The former is often referred to as a "Beggar Thy Neighbor" distortion (and often lead to inefficient negative taxes (Oates and Schwab (1988)), while the latter is sometimes referred to as a NIMBY ("Not In My Backyard") policy (Gordon (1983), Inman and Rubinfeld (1996), Nechyba and McKinnon (1997)).

32. For example, if jurisdiction i raises taxes from high smoke stack industries in community i, $\partial N > 0$ as such a tax causes lower pollution outside jurisdiction i and thus generates a positive consumption externality. Similarly, if the jurisdiction i raises tax revenues from local landfills, $\partial N < 0$ because the local jurisdiction does not take into account the positive benefits to residents outside jurisdiction i from having the landfill in jurisdiction i.

33.This statement includes the word "generically" because there exist circumstances when the conditions in the first part of the statement are violated thus giving rise to the presence of interjurisdictional externalities, but where the existing spillovers exactly offset one another. For example, one could have positive spillovers (consumption externalities) on the expenditure side that are exactly offset by negative spillovers (tax exporting) on the tax side. Such events of course do not occur generically.

34. See McKinnon and Nechyba (1997) for a review of some of these political economy

arguments. A further issue raised in McKinnon and Nechyba involves concerns over monetary policy and a softening of local budget constraints, concerns that arise only in regard to federal transfers and do not arise in state and local fiscal interactions. Given that we focus in later sections on counties within California and the state of California, there is no need here to raise such issues.

35. We combine years simply to summarize our empirical findings more succinctly. We obtain similar estimates for all specifications if we use only one year of data, or if we implement a seemingly unrelated framework that combines years.

36. This conclusion, while somewhat tentative, can be reached as follows. From the top row of Table 5.4 we can infer that slightly more than half of marginal infrastructure expenditures are covered by the state, and from the last row we can infer that roughly all of the marginal education expenditures are funded by the state. When focusing on the middle row, we can therefore infer that state grants fall by roughly $2,100 due to less education spending and rise by roughly $2,500 due to higher infrastructure spending. The changes in education and infrastructure spending alone therefore account for a $400 increase in intergovernmental grants as a shift from young to middle age occurs, which is precisely the predicted increase in state funding. Thus, we conclude that the increase in funding for safety is paid for locally. Similar calculations from Table 5.5, however, are not as conclusive.

37. More precisely, much of the literature on fiscal federalism has focused on issues of optimal grant design, with price and income effects, fungibility and various principle agent problems arising as concerns. Clearly, a simple look at gross flows of government resources across broad spending categories is not sufficient to come to a conclusion about issues of this kind.

38. U.S. Bureau of the Census. 1987 Census of Governments. Volume 4-Government Finances, Number 5-Compendium of Government Finances, and the corresponding volume for 1992. Hereafter, we refer to these simply as *Compendiums*.

39. For more detail on data collection procedures and methodology, consult the introductory

chapters of the *Compendiums*.

40. For more details on the categories of expenditure and revenue in the California cities and counties, see *Financial Transactions Concerning the Cities of California: Annual Report 1991-1992*. Office of the Controller, and the corresponding volume for counties.

Table 2.1

Impact of Demographic Characteristics on Cost Function

Nature of the Public Expenditure (g)	**Relevant Demographic Characteristics**	**Examples**	
Rivalry of g (i.e. degree of population crowding)	population size	total cost of local fireworks is independent of population size (pure public good), while cost of local crime prevention rises with population size (public service).	
Degree of Targeting to Population Segments	size of targeted groups (age distribution)	Young:	Welfare, Child Nutrition, Education, Head Start, Tuition Subsidies
		Middle-aged	Some Welfare Programs, Job Training, Unemployment Insurance
		Elderly	Social Security, Health Care (Hospitals, Medicare), Retirement Benefits
Population Externalities	Family Characteristics Culture/Gender Socioeconomic Status	Education: Peer effects in classrooms Crime Prevention: Male/Female	

Table 3.1

Public Expenditure	α_N	β_N	γ_N
Local Park, Local Library	0	0	0
Police/Fire Protection	0	0	0
Education without mobility	+	0	0
Local Road	+	0	0
Education with mobility	(+)	+	0
Pollution Control of CO_2 Emissions	0	0	+
Road connecting communities	+	+	0
Welfare/Health	0	0	(+)

Table 3.2

Expenditure Externalities	Consumption	?N…0
	Investment	ßN…0
Non-Benefit Taxation Externalities	Tax Competition	d>1, ?>0
	Tax Exporting	d<1, ?<0
	Taxation of Spillover Activities	?N…0

Table 4.1

Spillover Parameters for Four Stylized Public Good Types

Public Good Type	Spillover Parameters					Example
	*a*N	ßN	?N	d	?	
g_1 - pure local consumption	0	0	0	1	0	local park
g_2 - pure local investment	+	0	0	1	0	local infrastructure
g_3 - interjurisdictional investment spillover	0	+	0	1	0	education
g_4 - interjurisdictional consumption spillover	0	0	+	1	0	pollution control

Table 4.2

Cost Function Parameters for Three Stylized Public Good Types

Cost Function Type	Cost Parameters			Example
	$?_J$	$?_M$	$?_E$	
c_1 - targeted to the young	+	0	0	education
c_2 - targeted to the middle-aged	0	+	0	job training
c_3 - targeted to the elderly	0	0	+	community nursing home

Table 4.3

California County Spending Categories as

Convex Combinations of Stylized Public Goods*

Spending Category	**Spillover Dimension** *	**Cost Dimension**	**Implication from Model**
Education	(g_1), g_3	c_1	central grants targeted at communities with large J
Health	g_1, (g_3)	c_1, (c_2) c_3	local funding, limited central grants
Welfare	g_1, (g_3), (g_4)**	c_1, (c_2), (c_3)	mainly local funding if local public good; some central funding targeted somewhat to J otherwise
Police/Fire Protection	g_1 , (g_4)	(c_1), c_2, (c_3)	some central funding, somewhat targeted to communities with M
Infrastructure	g_1,g_2 , g_3	(c_1), c_2, (c_3)	split between local and central funding, somewhat targeted to communities with large M

* In this column we enclose an item in parenthesis to designate that it is of secondary importance as a component in the expenditure category under considerations, and thus receives relatively smaller weights in the perceived combination of stylized goods making up this category.

** Depends on whether reductions in poverty are local or state public goods

Table 5.1
Summary Statistics [1]

Variable	Mean		Minimum		Lower Quartile		Median		Upper Quartile		Maximum	
County Expenditure and Revenue Variables												
Year	**1987**	**1992**	**1987**	**1992**	**1987**	**1992**	**1987**	**1992**	**1987**	**1992**	**1987**	**1992**
Population (in thousands)	465.2	513.1	1.3	1.1	31.8	36.7	120.1	133.5	432.7	480.6	8295.9	8863.2
Total Expenditure (in millions)	1.124	1.389	0.007	0.007	0.078	0.099	0.272	0.333	1.114	1.428	20.798	24.304
Total Revenue (in millions)	1.182	1.427	0.006	0.008	0.078	0.096	0.291	0.338	1.129	1.387	21.363	26.227
Education Share	0.383	0.383	0.198	0.199	0.339	0.344	0.381	0.381	0.426	0.429	0.565	0.563
Health Share	0.101	0.114	0.017	0.022	0.045	0.058	0.095	0.094	0.146	0.162	0.283	0.335
Welfare Share	0.110	0.113	0.036	0.047	0.079	0.083	0.104	0.104	0.139	0.141	0.217	0.204
Police and Fire Share	0.073	0.072	0.032	0.031	0.059	0.059	0.071	0.067	0.086	0.085	0.124	0.141
Infrastructure Share	0.333	0.318	0.177	0.169	0.277	0.266	0.340	0.313	0.371	0.363	0.581	0.478
Intergovernmental Transfers Share	0.502	0.479	0.307	0.257	0.418	0.404	0.496	0.487	0.570	0.551	0.732	0.686
Taxes Share	0.498	0.521	0.268	0.314	0.430	0.449	0.504	0.513	0.582	0.596	0.693	0.743
Education Per-Capita (in $1,000s)	0.944	1.076	0.573	0.646	0.820	0.886	0.904	1.025	1.057	1.258	1.799	2.144
Health Per-Capita (in $1,000s)	0.254	0.333	0.041	0.057	0.114	0.150	0.233	0.265	0.357	0.432	0.927	1.293
Welfare Per-Capita (in $1,000s)	0.270	0.316	0.108	0.119	0.198	0.234	0.270	0.310	0.320	0.394	0.480	0.600
Police and Fire Per-Capita (in $1,000s)	0.182	0.204	0.078	0.095	0.136	0.148	0.172	0.189	0.208	0.228	0.476	0.800
Infrastructure Per-Capita (in $1,000s)	0.845	0.908	0.414	0.463	0.662	0.702	0.773	0.849	0.873	1.017	2.936	2.986
Total Expenditure Per- Capita (in $1,000s)	2.493	2.838	1.822	2.128	2.164	2.395	2.377	2.680	2.645	2.962	5.051	6.493
Taxes Per-Capita (in $1,000s)	1.298	1.485	0.723	0.783	1.076	1.214	1.259	1.419	1.472	1.593	2.729	3.161
Intergov Transfers Per-Capita (in $1,000s)	1.303	1.371	0.651	0.657	1.065	1.073	1.281	1.330	1.444	1.544	3.091	3.665
Demographic Variables												
Year	**1990**		**1990**		**1990**		**1990**		**1990**		**1990**	
Fraction of Households in Rural Areas	0.365		0.000		0.109		0.296		0.632		1.000	

Median Household Income (in $10,000s)	3.056	2.049	2.457	2.875	3.505	4.854
Fraction of Population Ages 0-20	0.304	0.194	0.283	0.298	0.330	0.393
Fraction of Population Ages 21-64	0.568	0.506	0.543	0.563	0.590	0.661
Fraction of Population Age 65 and Up	0.128	0.061	0.102	0.122	0.149	0.264

[1] All monetary values in expressed in 1990 dollars, deflated by the CPI for all urban consumers (Western region of the country).

Table 5.2

Effects of Population Age Composition on Expenditure/Revenue Shares for California Counties

(top results = least squares; lower results = least absolute deviations; standard errors in parentheses) [1]

Budget Measure	Proportion in Age Group		Median Income ($10,000s)	Rural	Intercept
	20 and Below	65 and Above			
Expenditure Shares					
Education Share	1.001** (0.369)	0.493 (0.535)	0.003 (0.017)	0.049 (0.052)	-0.009 (0.209)
	0.896** (0.479)	0.688 (0.647)	0.005 (0.024)	0.036 (0.060)	-0.006 (0.276)
Health Share	0.062 (0.334)	0.553* (0.405)	0.009 (0.019)	0.011 (0.048)	-0.014 (0.186)
	-0.027 (0.569)	0.510 (0.541)	0.008 (0.032)	-0.012 (0.070)	0.025 (0.311)
Welfare Share	0.183* (0.161)	0.005 (0.206)	-0.041** (0.008)	-0.061** (0.017)	0.202** (0.090)
	0.211* (0.164)	0.001 (0.230)	-0.041** (0.008)	-0.061** (0.024)	0.195** (0.086)
Police and Fire Share	-0.253** (0.094)	-0.131 (0.147)	0.007** (0.004)	-0.025** (0.013)	0.153** (0.053)
	-0.179* (0.119)	-0.031 (0.180)	0.009** (0.005)	-0.030** (0.014)	0.111** (0.066)
Infrastructure Share	-1.021** (0.321)	-0.967** (0.449)	0.020* (0.013)	0.026 (0.042)	0.688** (0.173)
	-1.223** (0.382)	-1.024** (0.536)	0.015 (0.016)	-0.004 (0.049)	.778** (0.198)
Revenue Shares					
Intergovernmental Transfer Share	0.663** (0.389)	-0.139 (0.646)	-0.085** (0.021)	-0.018 (0.048)	0.571** (0.239)
	0.541 (0.553)	-0.290 (0.825)	-0.091** (0.031)	-0.051 (0.067)	0.662** (0.331)
Taxes Share	-0.696** (0.397)	0.126 (0.636)	0.083** (0.020)	0.014 (0.047)	0.448** (0.240)
	-0.571 (0.529)	0.271 (0.817)	0.089** (0.029)	0.048 (0.066)	0.356 (0.317)

[1] All estimates and standard errors reported in this table are computed using bootstrap procedures (with 1000 sample draws). A "*" superscript after an estimate indicates the value is statistically significantly different from zero at a 75% confidence level, and a "**" superscript indicates significance at a 90% confidence level.

Table 5.3

Effects of Population Age Composition on Per-Capita Expenditures and Revenues for California Counties

(top results = least squares; lower results = least absolute deviations; standard errors in parentheses) [1]

Per-Capita Measure	Proportion in Age Group		Median Income ($10,000s)	Rural	Intercept
	20 and Below	65 and Above			
Expenditure Per-Capita					
Education Per-Capita	2.143** (0.921)	0.052 (2.018)	-0.046 (0.052)	0.352** (0.131)	0.360 (0.629)
	1.813** (0.980)	-0.884 (1.700)	-0.056 (0.052)	0.325** (0.161)	0.613 (0.583)
Health Per-Capita	-0.155 (1.130)	1.052 (1.264)	-0.016 (0.061)	0.037 (0.142)	0.241 (0.618)
	-0.235 (1.889)	0.514 (1.627)	0.013 (0.104)	0.047 (0.208)	0.208 (1.042)
Welfare Per-Capita	0.312 (0.467)	-0.467 (0.649)	-0.116** (0.021)	-0.094** (0.056)	0.646** (0.261)
	0.107 (0.713)	-0.647 (0.947)	-0.122** (0.030)	-0.093* (0.078)	0.742** (0.388)
Police and Fire Per-Capita	-1.157** (0.577)	-1.214 (1.095)	-0.004 (0.019)	0.015 (0.085)	.705** (0.341)
	-0.746* (0.479)	-0.529 (0.721)	-0.0002 (0.017)	-0.082* (0.057)	0.505** (0.273)
Infrastructure Per-Capita	-4.864** (2.408)	-6.152* (4.339)	-0.047 (0.086)	0.409* (0.350)	3.129** (1.413)
	-3.651* (2.316)	-4.103* (3.493)	-0.029 (0.093)	0.074 (0.248)	2.514** (1.360)
Total Per-Capita	-3.846 (4.117)	-7.156 (7.176)	-0.230* (0.163)	0.757* (0.577)	5.162** (2.427)
	-0.226 (5.693)	-5.503 (7.624)	-0.163 (0.252)	0.440 (0.501)	3.689 (3.334)
Revenue Per-Capita					
Intergovernmental Transfer Per-Capita	-0.418 (2.068)	-3.343 (4.161)	-0.326** (0.095)	0.328 (0.318)	2.761** (1.314)
	0.107 (2.225)	-4.427* (2.897)	-0.351** (0.104)	0.039 (0.234)	2.872** (1.331)
Taxes Per-Capita	-5.353** (2.912)	-4.804* (4.124)	0.019 (0.120)	0.335 (0.340)	3.443** (1.631)
	-2.682 (4.918)	-2.402 (6.323)	0.125 (0.195)	0.314 (0.410)	1.976 (2.771)

[1] All estimates and standard errors reported in this table are computed using bootstrap procedures (with 1000 sample draws). A "*" superscript after an estimate indicates the value is statistically significantly different from zero at a 75% confidence level, and a "**" superscript indicates significance at a 90% confidence level.

Table 5.4

Budgetary Consequences of Changing the Age Composition of a County's Population in California

(Calculations Based on Least Squares Estimates)

Shift in Age Composition Population	Effects on Expenditures			Effects on Revenues		
Old => Middle-Age	Infrastructure	+	$6152	IG Transfers	+	$3343
				Own Taxes	+	$4804
	Total	+	$6152	Total	+	$8147
Young => Middle-Age	Education	-	$2143	IG Transfers	+	$ 418
	Safety	+	$1157	Own Taxes	+	$5353
	Infrastructure	+	$4864			
	Total	+	$3878	Total	+	$5771
Young => Old	Education	-	$2138	IG Transfers	-	$2925
				Own Taxes	+	$ 549
	Total	-	$2138	Total	-	$2376

Table 5.5

Budgetary Consequences of Changing the Age Composition of a County's Population in California

(Calculations Based on Least Absolute Deviation Estimates)

Shift in Age Composition Population	Effects on Expenditures			Effects on Revenues		
Old => Middle-Age	**Infrastructure**	**+**	**$4103**	**IG Transfers**	**+**	**$4427**
				Own Taxes	**+**	**$2402**
	Total	**+**	**$4103**	**Total**	**+**	**$6829**
Young => Middle-Age	**Education**	**-**	**$1813**	**IG Transfers**	**-**	**$ 107**
	Safety	**+**	**$ 746**	**Own Taxes**	**+**	**$2682**
	Infrastructure	**+**	**$3651**			
	Total	**+**	**$2584**	**Total**	**+**	**$2575**
Young => Old	**Education**	**-**	**$2694**	**IG Transfers**	**-**	**$4534**
				Own Taxes	**+**	**$ 280**
	Total	**-**	**$2694**	**Total**	**-**	**$4254**

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