FISCAL DECENTRALIZATION*

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1. Introduction

Both within the U.S. and in most countries around the world, fiscal decentralization seems on the rise both in the political rhetoric and in actual policy outcomes. At the same time, barriers to factor and population mobility around the world are declining. Greater decentralized government activity is therefore taking place in an economic environment characterized by increased competition for mobile resources, and government policy within this environment is increasingly cognizant of profound implications this combination of decentralization and mobility may have on political and economic outcomes. As these trends have become important over the past several decades, it is furthermore not surprising that the academic literature across several disciplines in economics has paid increasing attention to the issues that arise in this more mobile and decentralized world. This chapter attempts to summarize the progress that has been made in this literature over the past decade while simultaneously pointing out some open questions for future research.

We begin in Section 2 by providing some brief overview of stylized facts regarding fiscal decentralization around the world. Section 3 then proceeds with a discussion of the theoretical literature on fiscal decentralization and horizontal government competition.[1] The section begins with an analysis of the literature that aims to establish conditions under which Tiebout's analogy between market competition and government competition holds. The section then proceeds to a comparison of two extreme models of local government behavior – the Pigouvian welfare maximizing versus the Leviathan rent maximizing model. Neither is based on modern political economy models, but both provide insights into potential political and economic distortions that may be important under fiscal decentralization. Recent advances in the literature have, however, been focused on the more explicit modeling of political forces as well as the development of more applied and computational approaches. A discussion of these rounds out Section 3. Section 4 then considers the theoretical literature that is focused on the addition of a hierarchical dimension to decentralized government competition. Two issues are addressed: First, when considering the discrete choice of centralization versus decentralization, what are the primary forces that the recent literature has explored; and second, how do these same forces help us to evaluate the kinds and levels of hierarchical fiscal interactions. Section 5 then turns to a discussion of the empirical work on the types of theoretical issues raised in the previous two sections. This includes early work as well as innovative recent work on capitalization of

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[1] By "horizontal government competition" we mean competition between governments that are not hierarchically ordered – i.e. competition between local governments or between state governments, but not competition between local and state governments. We do not use the term horizontal in the industrial organization sense of horizontally versus vertically differentiated products.

fiscal variables into housing and land prices, studies of fiscal competition and efficiency, evaluations of the role of political institutions and the emergence of a promising line of empirically estimated structural models. Section 6 provides some concluding comments.

2. Increasing Fiscal Decentralization around the World

While fiscal and political decentralization has undoubtedly been a clear trend around the world over the past 25 years, it is not immediate how to best quantify this trend. Crude measures include official government structures (unitary versus federal) that rarely change over time and often do not give an accurate picture of actual government practices, while more continuous measures (such as the percentage of government expenditures at different government levels) may mask underlying subtleties such as the degree of control exercised by the levels of government that are officially recorded as engaging in economic activity. Nevertheless, some recent attempts to quantify worldwide trends on fiscal decentralization provide interesting insights.

Arzaghi and Henderson (2002) provide a nice synthesis of the available evidence. For a sample of 48 countries with populations in excess of 10 million in 1990, they construct a federalism index from 1960 to 1995, and they complement their analysis with a measure of the central government share in total government current consumption. Some clear trends emerge from these data. First, developed countries are generally more decentralized as measured by both the federalism index and the central government share of total government consumption. Latin American countries decentralized substantially over the period from 1980 to 1995, with the federalism index showing this block of countries as decentralized by the end of that period as the group of developed countries. Government consumption in Latin America, however, remains substantially more centralized, with developed countries spending just over 45% centrally while Latin American countries spend closer to 70% at the central level. Middle East and North African countries are by far the most centralized (with close to all government spending occurring centrally), and these countries show the least sign of decentralizing over the past several decades. All other regions exhibit substantial decreases in centralization as measured through the federalism index and at least modest decreases in centralization as measured through government spending concentration.

A more systematic analysis by Arzaghi and Henderson reveals that several economic and demographic factors seem to have large and significant impacts on the degree of centralization. In particular, per capita income, population size, and land area within a country are associated with greater decentralization, while the percent of the population that is Muslim and the degree of population centralization in the largest city in a country are associated with greater centralization. These results mirror previous cross section results by Panizza (1999) who also documents that fiscal centralization declines with greater democratization and ethnic fragmentation.

The general trend toward greater federalism and greater fiscal decentralization thus seems widespread and increasing. In light of this, a deeper understanding of the connection between federalism on the one hand and economic and political performance on the other is therefore in order. The remainder of this chapter attempts to provide a snap shot of where the increasing academic literature on these issues stands.

3. Theoretical Literature on Fiscal Decentralization

Much of the literature on horizontal government competition finds its origin in Tiebout's (1956) seminal article of almost five decades ago. Tiebout's provocative thesis draws an analogy between competitive markets for private goods on the one hand and competitive governments that provide mixes of local services at different tax rates on the other. Shopping plazas and malls, for instance, cater to different clienteles by providing different mixes of stores, products, restaurants, mall security, ambiance and prices, and competitive markets are largely thought to provide such services efficiently (subject to some caveats). Political jurisdictions, the Tiebout argument suggests, are similar in that they

also provide different types of services (schools, police services, fire protection, street lighting, etc.), and residents gain access to these services by paying for them through taxes (and possibly through property values that may capitalize these taxes and services.) Under certain loosely specified conditions, Tiebout therefore suggested that such horizontal government competition may lead to efficiency in the local public sector – with mobility of households providing the disciplining market force.

The large literature that has arisen from Tiebout's article attempts to come to terms with (1) whether and under what precise conditions the market analogy holds, and (2) ways of modeling in more realistic and policy relevant ways the basic Tiebout notion of household and factor mobility as an important force in local government competition. We proceed in this section as follows: In Section 3.1, we discuss the lessons emerging from attempts to formalize Tiebout's intuition in a general equilibrium setting. Particular attention is given in this section to the success of researchers in generalizing existence and welfare theorems in relatively abstract general equilibrium models that include clubs and local jurisdictions. Sections 3.2 and 3.3 then turn to more tractable models of local government competition in which specific objective functions are assumed for local governments. In particular, Section 3.2 uses the conceptual simplification of Pigouvian local governments of homogeneous households to illustrate the kinds of externalities that may cause decentralized competition to lead to sub-optimal outcomes. Section 3.3, on the other hand, turns to the opposite extreme by assuming Leviathan local governments. Neither of these approaches comes to terms with the underlying political forces that may be relevant in an analysis of decentralized competition since both approaches exogenously specify a local objective function. Section 3.4 therefore considers recent advances in modeling politics more explicitly within a decentralized government model. Section 3.5 then considers the role of computational models that introduce greater complexities while relying on data to restrict the relevant structural parameter space.

3.1. *From Clubs to Local Public Goods*: Horizontal Competition under Local Profit Maximizing Behavior

General equilibrium analysis of competitive markets is built on an assumption of profit maximizing behavior by firms that are small relative to the economy and can freely enter and exit. How one can extend the assumption of profit maximization and free entry by firms to an analogous assumption on decentralized governments is not immediate. Two possible ways of modeling decentralized governments as profit maximizers with potentially free entry have emerged:

(1) Models of governments as profit maximizing clubs that provide excludable public goods or services and restrict entry through prices (and possibly through more explicit exclusionary rules);
(2) Models of governments as competing land developers that provide public goods in an attempt to maximize the value of land, or alternatively, models of governments as controlled by homeowners who seek to maximize the value of their homes.

In each of these literatures, attempts are made to answer the standard general equilibrium questions related to the existence and welfare properties of equilibria. As such, they represent the purest attempts at generalizing Tiebout's intuition by identifying conditions under which the intuition holds. No claim is made in these literatures that the models are "realistic" in the sense of being immediately applicable to applied policy analysis. Rather, the aim is to understand the potential role and the limits of horizontal government competition as a disciplining market force -- much as the attempt in the Arrow-Debreu general equilibrium tradition is to arrive at an understanding of both the benefits and the limits of market competition. And, as in the Arrow-Debreu framework, the actual mechanics of the market are left relatively unspecified. However, in the case of club/developer competition, assumptions such as completeness of markets are significantly more severe than in the standard Arrow-Debreu framework – and thus leave the formalized market analogy in this section open to criticism.

3.11. Club Competition

Among the attempts to rigorously move from a standard general equilibrium framework to one that formalizes Tiebout's intuition, *club* models come closest to models of purely private good economies and thus are the farthest removed from a model of truly competing local *jurisdictions*. They deal with neither the spatial aspects of a local economy nor the important presence of land as a crowding factor nor the political forces present within local jurisdictions. Still, club theory moves the analytical framework in the direction of incorporating commonly consumed goods within clubs, introduces notions of spillovers and crowding and specifies how markets might allocate costs of commonly consumed goods while internalizing externalities associated with club memberships – all issues relevant to horizontal government competition. The literature, which finds its origins in Buchanan's (1965) original treatment of clubs, is too large to be fully explored here, which leads us to touch only on the most recent contributions as they relate to our broader aim of discussing fiscal decentralization. A fuller treatment of clubs is provided in other handbooks (most recently by Scotchmer (2002)).

Club goods are public goods in the sense that they can be simultaneously consumed by multiple agents, but they differ from pure public goods because of crowding in either production or consumption. Crowding in production occurs if the size or composition of the club membership affects the cost of providing the club good, while crowding in consumption arises from club size or composition entering directly into utility functions. Crowding can be *anonymous* if only the total club membership size enters the production or utility functions, or it can be *non-anonymous* if the composition of the club membership or the characteristics of club members enter independently. The good that is priced in general equilibrium club models, however, is not usually the club good itself but rather *membership* in the club.

It is in these kinds of models that Tiebout's notion has indeed survived many important tests in the sense that profit maximizing behavior by clubs leads to a first welfare theorem – equilibria, when they exist, are efficient. Existence itself, however, is not easy to establish primarily because of what has come to be known as an "integer problem": Unless the number of agents of each type is "just right" to fill up optimally sized clubs without unassigned agents being left behind, no equilibrium exists. The problem has been overcome most elegantly by Ellickson, Grodal, Scotchmer and Zame (1999) who treat clubs as "small" (i.e. infinitesimal) in an economy with a continuum of agents.[2] At the same time, an important underlying assumption of this approach is that markets are "complete." While similar to assumptions required in standard Arrow-Debreu models, this assumption can seem particularly severe in the context of club models as it requires a complete set of prices for clubs of all possible populations – not just of clubs that exist in equilibrium.

Nevertheless, the model is general in the sense that agents can belong to multiple clubs, crowding can be non-anonymous, and multiple private goods are traded both within and outside of clubs. Not only is existence of an equilibrium and a first welfare theorem established, but it is further shown that the core coincides with the set of competitive equilibrium allocations. The model in many ways generalizes previous results in both the club and the standard general equilibrium literatures. In a variety of other contexts, similar results on the efficiency of decentralized club economies have emerged in the past two decades. The main lesson from these models seems to be that – so long as clubs are

[2] An alternative way of overcoming the integer problem is to define the notion of an ε-equilibrium in which there is an ε-cost to setting up new clubs. This is explored in a long literature by Myrna Wooders and John Conley (see, for example, Conley and Wooders (1998)).

relatively small in a competitive economy, the set of equilibria is non-empty and coincides with the core (thus also implying that all competitive equilibria are efficient.)[3]

Tiebout's intuition has therefore been formalized in general equilibrium models of profit maximizing *club* competition, but it is not immediately evident how much relevance these results hold for questions related to horizontal *government* competition. While crowding in production and consumption are fully introduced into club models, crowding that arises from the scarcity of land is not – and it is the link of local governments to land and housing markets that seems in many ways central to horizontal government competition. Formally, as suggested by Scotchmer (forthcoming), it is possible to interpret the Ellickson et. al. (1999) club model as a local government model by interpreting one of the private goods in the model as homogeneous land. But this treats land as fully transferable between jurisdictions, implies no role for capitalization (because land, like other private goods, would command a single price regardless of where it is consumed) and loses much of what makes land unique in local public finance models. If the first step from standard general equilibrium models to Tiebout's conjecture is the introduction of clubs and club goods, the next step is then the introduction of a true model of land.

3.12. Introducing Land, Capitalization and Profit Maximizing Land Developers

Land is a peculiar type of good that is in many ways difficult to model (Berliant, 1985). While it can be introduced in a trivial manner into club good economies (as suggested above), club models do not really become models of jurisdictions (and club goods do not really represent local public goods) unless the essential features of land are indeed modeled seriously.[4] Nevertheless, we can already see in the trivial model of land within club economies the basic reasons why a general efficiency result of the type common in club models is difficult to obtain once land is introduced. Within club models (such as that of Ellickson et. al.), the efficiency result holds for trivial models of land *because land, just like bread, is transferable between clubs*. Thus, "jurisdiction boundaries" are fully endogenous and change with market conditions, and capitalization of local club goods plays no more a role in "land" markets than it does in the market for bread. This outcome of no land market capitalization turns out to be key to any full efficiency result in a local public goods economy, and any model of horizontal government competition that gives rise to equilibrium inter-jurisdictional capitalization is one in which equilibria are *not* fully efficient.

This result shows up in many different and sometimes unconnected parts of the local public finance literature. For example, in response to Oates' (1969) seminal empirical paper demonstrating large capitalization of local tax and public spending levels, Edel and Sclar (1974) pointed out that the finding of capitalization – far from being evidence of Tiebout's efficiency hypotheses, was in fact evidence against Tiebout's hypothesis. More precisely, the presence of capitalization is evidence that there is an excess demand for the type of jurisdiction in which local public choices are being capitalized, which then implies that there is room for new jurisdictions to enter the market (thus driving down the capitalization in existing jursidictions). In a full Tiebout equilibrium (with free entry and exit of jurisdictions), there should in fact be no capitalization of local fiscal conditions into land values (just as is the case in club models when land is introduced in a trivial way.) While the presence of capitalization of local public finance variables into land values is therefore evidence in favor of Tiebout's notion of consumers "voting with their feet" by choosing jurisdictions in part based on local public finance factors, it is also evidence against

[3] Among the many applications of this intuition, one of the most relevant to policy debates has been the treatment of peer externalities in schools. Epple and Romano (1998) and Caucutt (2001) demonstrate that, in line with results from the club literature, private schools can internalize these externalities through differential tuition prices. Just as in the club literature, membership in private schools is the good that is priced, and mixed private schools emerge. (Nechyba (1999), on the other hand, models privates schools as exclusionary clubs that are prohibited from differential pricing which then leads to homogenous private schools.)

[4] Hochman, Pines and Thisse (1995) emphasize this point in their discussion of overlapping local jurisdictions.

Tiebout's conclusion that this consumer mobility provides a sufficiently strong disciplining force to yield a fully efficient outcome.[5]

Once clubs are tied to land (and thus become jurisdictions), the only way that the full efficiency result established in club models can then be preserved is if land is allowed to play a role similar to the role it plays when it is introduced to club models in the "trivial" manner described in the previous section. Theoretically, this can be accomplished by allowing jurisdiction boundaries to be perfectly elastic to accommodate increases or decreases in demand for a particular "jurisdiction," by permitting land within jurisdictions to be perfectly elastically supplied, or by assuming that the supply of new jurisdictions is perfectly elastic.[6] In practice, of course, none of these assumptions seem plausible in the sense of being realistic, which implies that Tiebout's full efficiency hypothesis is unlikely to hold for horizontal jurisdiction competition.

Nevertheless, the introduction of land into club models does not necessarily imply that a more constrained efficiency result cannot be obtained for models of decentralized competition among jurisdictions. One possibility that has been explored repeatedly is to model local jurisdictions as land value maximizers for some exogenously given partition of land into competing jurisdictions. This assumption may be interpreted literally as competition among profit maximizing land developers who choose the level of local public goods knowing that such goods will in fact be capitalized into land values, or it may be interpreted more loosely as a political economy model in which homeowners cause local governments to maximize property values (much as corporations may in fact maximize shareholder wealth (Fischel, 2002)). Unless the division of land into jurisdictions is optimal to begin with, Scotchmer (1994) then demonstrates that the competitive equilibrium under such maximizing local government behavior is *constrained* efficient (where the constraint is the way in which land is partitioned to begin with). The absence of inter-jurisdictional capitalization of local public finances into land values would be an "accident" in such a model – and would occur only if the number of jurisdictions were optimal and if jurisdiction boundaries happened to be optimally drawn given the particular primitives of the model. Any presence of inter-jurisdictional capitalization in the model would be evidence that efficiency gains could be achieved through either a redrawing of jurisdiction boundaries (i.e. a transfer of land) or an increase in the number of jurisdictions (i.e. free entry).[7] Tiebout's efficiency hypothesis – motivated by the introduction of market-like forces through consumer mobility, continues to apply when club models become models of jurisdiction competition through the introduction of land. But, the strength of the efficiency result is constrained by the process of jurisdiction formation[8] and, of course, by the degree to which competitive behavior is plausible[9].

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[5] It is important to note that "capitalization" here refers to *inter*-jurisdictional capitalization of public goods and services that are uniformly available within jurisdictions into all land values within a jurisdiction. There are at least two other types of *intra*-jurisdictional capitalization that are *not* inconsistent with Tiebout efficiency. First, to the extent that public goods or services are not uniformly accessible from all locations within a jurisdiction, capitalization within (rather than across) the jurisdiction would emerge. Examples include physically fixed public goods like parks or schools within a jurisdiction, or non-uniformity of goods such as air quality. Second, Hamilton (1976) demonstrates that financing of local public goods may be such that intra-jurisdictional capitalization emerges. For instance, if local public goods are financed through a property tax and housing quality varies within the jurisdiction, higher quality houses are subject to negative capitalization of the expected above average property tax burden while lower quality houses are subject to positive capitalization of the expected below average property tax burden. Hamilton demonstrates that such capitalization can be consistent with Tiebout efficiency.

[6] This point is made in various ways by Epple, Zelenitz and Visscher (1978), Epple and Zelenitz (1981) Yinger (1982), Henderson (1985) and Epple and Romer (1989). The extent to which some of the assumptions – such as elastic community boundaries – are empirically realistic is debated across these papers.

[7] In addition, the integer problem dealt with in the previous section on land-less clubs poses similar existence difficulties.

[8] An interesting application of the intuition emerging from these theoretical findings applies to models of local property taxation in the presence of residential zoning. Zoning can be viewed as a means of turning a property tax levied on both land and improvements of land (i.e. housing) as a tax akin to a tax on just land. In Hamilton (1975), jurisdictions are free to enter and exit as they provide public goods through a property tax while at the same time setting a minimum house quality level for the jurisdiction through zoning. In equilibrium, this results in house quality within jurisdictions being homogeneous which then implies that the property tax simply becomes a head tax. The tax is efficient; no capitalization emerges because of free entry of jurisdictions; and the overall outcome is efficient as households choose jurisdictions based on their willingness to pay for local public goods. In the absence of free entry of

3.2. *Government Competition under Local Pigouvian Welfare Maximization*: The Role of Inter-jurisdictional and Intra-Jurisdictional Spillovers

As we now turn away from more general attempts to formalize Tiebout's intuition and toward more specialized models, it is useful to begin with those models that abstract away from heterogeneity of households and from local political institutions. Since voter preferences do not conflict in this setting, a local social choice process is not faced with the task of aggregating preferences across voters and can thus simply be modeled as maximizing the utility of a representative resident. Thus, under the assumption of homogeneous households, we can assume a "Pigouvian" system of local governments – each seeking to maximize the local welfare of its population. This permits us to identify important economic forces that may arise under local government competition without being distracted by separate political considerations. These forces deal primarily with externalities of one type or another that may cause economic distortions. These distortions arise when local Pigouvian officials do not have access to a full set of policy instruments -- which then leads to interjurisdictional spillovers, or when local expenditures inherently produce costs or benefits for other jurisdictions.[10] These cases are treated in Sections 3.21 and 3.22. At the same time, it is worth noting that much of this discussion rests on the assumption that local public goods can be modeled as an abstract g that enters utility functions identically for all residents within the jurisdiction providing g. In Section 3.23 we then turn to a brief discussion of the potential importance of considering the micro-foundations of g in particular settings. Finally, Section 3.24 explores intergenerational (rather than inter-jurisdictional) spillovers which have been largely ignored in much of the local public finance literature until recently.

3.21. Local Tax Spillovers

Efficiency of a local tax in models of this kind has two separate dimensions: First, in the presence of substitution effects, distortions may arise as market prices are changed through local tax policy in a manner that is standard in the public finance literature; and second, inter-jurisdictional externalities may arise as local tax policy creates spillover costs or benefits for other jurisdictions. Consider, for instance, a tax on capital. In a typical public finance framework with a closed economy, such a tax would give rise to inefficiencies by creating a wedge between the price of capital paid by firms and the price received by those who provide capital – causing various substitution behaviors within the economy. In the absence of other tax instruments, Pigouvian governments that are constrained to use capital taxes would weigh the efficiency costs of raising tax revenues against the benefits of

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jurisdictions (Hamilton, 1976), on the other hand, and in the presence of zoning that leads to heterogenous but fixed housing quality within jurisdictions, the combination of property tax payments and capitalization within the jurisdiction leads to a similar head tax result and thus the conclusion that the property tax is once again an efficient tax. However, because of the inelasticities in land markets that arise in this alternate model, the overall equilibrium is not efficient unless the partition of houses into jurisdictions (as well as the number of jurisdictions) happens to be optimal.

[9] In the absence of competitive behavior, there is of course no particular reason to expect the efficiency result to survive. A recent literature on oligopolistic land developer models, however, provides important insights into the kinds of pricing policies that may emerge when perfect competition is relaxed. Henderson and Thisse (2001), for instance, present a model with endogenous formation of developments that provide public goods where pricing policies differ dramatically across developments. While developers of high income areas charge higher entry fees and per unit housing prices, developers of low income areas are predicted to subsidize housing in an attempt to keep some high income residents. Issues that arise when community formation is analyzed in an imperfectly competitive environment fall outside the scope of our review, but readers are directed to Henderson and Thisse (2001) and references therein.

[10] Similar issues arise for regulatory rather than local fiscal policies, as for example in the case of growth controls (Helsley and Strange (1995), Brueckner (1990)). In a relatively rich framework in which local Pigouvian governments provide goods, produce inputs that enhance local productivity of capital and employ environmental regulations that improve local amenities, Oates and Schwab (1988) illustrate that price taking (i.e. small) competing governments do behave efficiently in the absence of interjurisdictional spillovers of local regulations and expenditures. The topic is treated in a more game theoretic context in Wildasin (1988).

providing public goods and services with such revenues – and would set the tax on capital such that the marginal cost from such a tax equals the marginal benefit. When capital taxes are set locally in an open economy setting, however, a second inefficiency arises despite the Pigouvian nature of the government. The welfare maximizing government would realize that capital will leave the jurisdiction as a result of an increase in the local tax on capital – and it would therefore count this as one of the costs of such a tax increase. However, since the fleeing capital is then used in another jurisdiction, it creates fiscal benefits elsewhere – resulting in a positive externality not taken into account by the local welfare maximizer. As a result, the local capital tax is underutilized.[11]

Note, however, that the latter effect does not arise if, with an increase in the tax on capital, the local government provides benefits per unit of capital equal to the increase in tax revenue per unit of local capital. For instance, a local tax on capital might be used to improve local infrastructure in such a way as to make each unit of capital within the jurisdiction more productive. Under such a scenario, the increased tax on capital would cause neither intra- nor inter-jurisdictional reallocation of capital. Thus, when benefits are directly attached to local taxes, they simply become user fees for local services. It is only when taxes on capital are used to provide services for other purposes (such as, say, public schools) that the inter-jurisdictional distortion arises -- leading to underutilization of the tax. Local tax competition (resulting from local taxation of mobile factors) thus arises from inter-jurisdictional fiscal spillovers when such taxes cease to be "benefit taxes."

While, under some conditions, certain taxes like the local property tax may indeed take on the character of a benefit tax,[12] this is generally not the case. For instance, in a model of homogeneous households who each enjoy equal public goods benefits within a jurisdiction (from, say, a local school), the portion of the property tax that is levied on housing will typically generate intra- and inter-jurisdictional distortions even though the tax burden within each jurisdiction is equally disbursed.[13] While each household indeed pays taxes in proportion to the benefits they receive, marginal benefits of the local public good are not tied to marginal consumption decisions regarding housing – i.e. access to the local public school is the same regardless of how much housing a household consumes, or put still differently, marginal investments in housing capital are not made more productive by increases in local school quality. Thus, to the extent that the property tax is a tax on (housing) capital, households will economize on capital which would then flow into other uses and other jurisdictions. [14] Both forms of inefficiency are present because the tax is not truly a "benefit tax" that acts as a user fee.[15]

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[11] Similar issues of course arise for any tax on a base that is mobile. They also arise if the locally taxed activity is itself generating inter-jurisdictional spillovers; for instance, if a local Pigouvian government raises revenues by taxing industries that generate cross-border pollution, it will not take into account the positive inter-jurisdictional externality associated with marginal increases in local taxes.

[12] The most well known case of this type is explored in Hamilton (1975, 1976) where local zoning combined with the property tax is shown to result in an efficient benefit tax.

[13] The portion of the property tax that falls on land rather than improvements of land (such as housing) is the traditional public finance answer for a fully efficient tax since it acts as a lump sum tax on owners of land. A well known theorem – known as the Henry George Theorem – has developed to suggest that, in a first-best world with no distortions and with non-rival (within the jurisdiction) local public goods, 100% taxation of land rents yields the optimal level of local public goods. With ~~non-~~rivalry, additional user fees or head taxes are required (Stiglitz, 1977; Arnott, 1979; Arnott and Stiglitz, 1979). Furthermore, when multiple local public goods are provided across overlapping geographic areas, a regional government must assign property rights to particular local jurisdictions for the result to hold (Hochman, Pines and Thisse, 1995), and if non-residents own land the problem of tax exporting (mentioned in the next paragraph) may arise. For illustrative simulations regarding the potential for land taxes to raise local welfare, see Nechyba (2001).

[14] Note that this leads to a very different view of the property tax than does the model of Hamilton discussed in a previous footnote – and this difference gives rise to the well-known debate over whether the residential property tax is an efficient benefit tax or at least in part an inefficient tax on mobile capital (Mieszkowski and Zodrow, 1989; Fischel, 1992). The topic is similarly treated in Wilson (1986), Wildasin (1988, 1989).

[15] An extensive literature that focuses on the details of tax competition externalities has emerged. Mieszkowski and Zodrow (1986) focus on an analysis of the property tax as a tax on local capital in a competitive general equilibrium world, while others model tax competition in more strategic settings (Wildasin, 1988, 1991), Hoyt (1991a)). While these papers typically assume local governments face a very constrained set of tax instruments, a number of papers have also investigated the endogenous choice of local tax

While tax competition in models of competing governments with homogeneous households thus typically leads to inefficiently low taxation due to positive fiscal externalities that are not taken into account by local Pigouvian governments, there are also instances when the inter-jurisdictional fiscal externalities are negative leading to over-use of local taxes. [16] Examples include the collection of sales taxes from tourists from outside the jurisdiction,[17] or the taxation of a locally fixed industry that exports (and thus passes on a portion of its tax burden to non-residents).[18] In such cases, the local Pigouvian welfare maximizer would overutilize the particular tax to the extent to which she does not take into account the negative fiscal externality imposed on non-residents. The ability to export taxes through such methods is, however, limited by the mobility of tax bases. Excessive local sales taxes may divert consumption to other jurisdictions and locally taxed industries may move – both leading to the more traditional tax competition and thus under-utilization of the tax (as discussed above). Thus, for decentralized governments to successfully raise revenue from nonresidents, they must have some form of "market power" – whether in the form of a fixed factor (that makes it difficult for an industry to move) used in the production of exported goods or in the form of locally concentrated industries with market power (e.g. Disney World in Orlando which makes possible taxation of tourists).[19]

A final way to export local taxes involves the use of taxes that are deductible from tax obligations toward a higher level of government (such as, in the U.S., local property taxes on federal income tax forms). Such taxes are explicitly passed on in part to non-residents of the local jurisdiction which then provides direct incentives for greater local use of such tax bases by local Pigouvian welfare maximizers.

3.22. Local Expenditure Spillovers

The basic results relating to the over- or under-use of particular taxes under decentralized government competition then relate directly to whether – in a model of local welfare maximization and homogeneous households, one would expect over- or under-provision of public goods. Clearly, if a single local tax instruments on a mobile tax base is considered (and in the absence of a mechanism for this tax base to serve as a benefit tax), the fiscal externality under tax competition would lead to under-provision of local public goods (Mieszkowski and Zodrow, 1986, 1989; Wilson, 1986).[20] Similarly, tax exporting – to the extent that it results in an inefficiently high use of a tax used to finance local public goods, would lead to over-provision of those goods in a local welfare maximizing framework. In addition, interjurisdictional spillovers of local public goods may lead to inefficiently low spending within decentralized jurisdictions for similar and well-understood reasons. If local public goods have positive spillovers (such as local road infrastructure or certain forms of environmental protection, for instance), Pigouvian local welfare maximizers will not take the benefits that are external to their jurisdiction into account when setting local public good spending levels.[21]

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instruments (Bucovetsky and Wilson (1991), Hoyt (1991b), Krelove (1993), Henderson (1994, 1995), Wilson (1995, 1997), Nechyba (1997a)).

[16] In fact, Myers (1990), Krelove (1992), Wellisch (1996) investigate explicitly the potential for a decentralized solution to mobility-induced tax competition externalities through the setting of local taxes that induce tax exporting.

[17] For a recent synthesis of theoretical findings regarding commodity tax competition, see Lockwood (2001).

[18] Wellisch (1999) generalizes these into two categories: (1) source-based taxation of local rents that are partly owned by non-residents, and (2) origin-based consumption taxes that increase consumer prices paid by non-residents.

[19] Again, the inefficiency from local governments taking such "market power" into consideration when setting tax rates arises only to the extent that these taxes are not simultaneously accompanied on the margin by benefits for the taxed bases. For instance, local infrastructure investment may well benefit the owners of a fixed local resource, or taxation in the form of a sales tax of tourists in Orlando may well pay in part for public services valued by these tourists during their stay.

[20] At the same time, it can be shown that competition among decentralized governments may also lead to greater public spending in order to attract the mobile resource if such spending raises the productivity of the mobile resource (Wilson, 2000).

[21] A related issue emerges when local governments set regulations for industries with increasing returns to scale (who may respond by "exporting" the regulatory standard to other jurisdictions) (Besharov and Zweiman (2002)).

3.23. Spillovers and the Micro-Foundations of Local Public Goods

While much of the literature on horizontal government competition treats local public goods as uniformly consumed by all residents of a community without the possibility of private substitutes, recent investigations of particular types of local public goods and services have begun to focus on additional spillover and externality effects that emerge when the micro-foundations of local public goods are modeled more carefully. This is likely to be a fruitful avenue for future research. Two particular strains of this emerging literature relate to the modeling of the local provision of public safety and public education. While this literature is not always framed in the Pigouvian government context explored in this section, the externalities and spillovers it points to would very much be present within a Pigouvian model.

In the case of crime, for instance, Helsley and Strange (1999) explore the recent phenomenon of privately gated communities within local jurisdictions. Such communities also compete horizontally, but whether their gating expenditures are strategic complements or substitutes depends on the underlying model of crime. Furthermore, gating in one community may have externalities on others to the extent that it diverts crime to other areas.[22] In the case of schooling, a number of micro models (Epple and Romano (1998), Nechyba (1999), Caucutt (2001), McMillan (2001)) suggest important roles for peer effects and parental monitoring within schools. Such elements in the local public good production function can introduce important externalities within jurisdictions that are typically not modeled in the Pigouvian literature explored above.[23] In addition, private actions within the local public economy become important in these models of crime and schooling. In the case of crime, gated communities represent a kind of private government approach that either competes with or complements local public efforts to control crime. Here the nature of the private activity is again very much linked to residential location (in or outside the gated community). In the case of schooling, on the other hand, private substitutes provide a loosening of the tie between residential location and schooling. We will say more about this as it relates to schooling in the context of our discussion of applied computational models in Section 3.5. Finally, in most of our discussion of local public goods we have not considered transportation costs to places in which public goods and services can be consumed (such as public schools, parks, etc.). Examples of work that explores such issues includes Starrett (1988) and Hochman, Pines and Thisse (1995).

3.24. Capitalization and the Internalizing Spillovers across Generations

Much of the literature on both the economic and political effects of decentralized government competition is focused around static models of local public goods and taxes in which local government budgets balance. Often, however, decentralized governments set policies that directly affect future generations, such as local debt policies, investments in local infrastructure or the creation of durable public amenities such as environmental quality. Some recent research has therefore focused on the question of whether horizontal government competition – through capitalization of long run policies into land values – can effectively constrain fiscal exploitation of future generations.

The idea that local debt policies may have no impact on local wealth because of capitalization of future tax obligations into current land prices was first suggested by Oates (1969) and Daly (1969). Conley (2001) investigates this more formally by introducing an overlapping generations structure into a local public goods model in which current

[22] Helsley and Strange (2000) also investigate strategic issues emerging from private governments.
[23] DeBartolome (1990) similarly stresses the role of peer externalities in local public goods economies.

generations choose how much to invest in local durable public goods. Intergenerational spillovers are then capitalized into land values under local provision, and this induces current generations (who buy and sell land at different stages in their life cycle) to internalize such spillovers. (This is in sharp contrast to inter-jurisdictional spillovers which are not capitalized.) Conley and Rangel (2001) identify more specifically under what conditions similar internalization of intergenerational spillovers can be achieved without decentralized competition by simply tying public spending to land taxation.[24] While fiscal intergenerational spillovers (such as debt finance) could indeed be internalized simply through the use of land taxation, direct intergenerational spillovers (such as environmental degradation) require decentralized government competition in order for capitalization effects to cause current generations to internalize intergenerational externalities.[25]

3.3. Government Competition under Revenue Maximizing Governments: Local Governments as Leviathan Rent Seekers

While political forces have most often been incorporated into models of decentralized government competition through some form of majority rule voting (as discussed in the next section), Brennan and Buchanan (1980) suggest a very different approach to modeling such governments – an approach that is in some ways the polar opposite to the Pigouvian approach discussed in Section 3.2. In particular, Brennan and Buchanan view politicians as pure rent-seekers who provide public goods only to the extent that it enables them to gather more rents for themselves[26] – unlike citizen candidates (discussed in the next section) who care about local public goods and seek to implement their own preferences over public good and tax combinations. While tax competition as discussed for Pigouvian governments in Section 3.2 suggests local taxes will tend to be too low because of the presence of positive fiscal externalities, local taxes are predicted to be too high under Leviathan governments when local political establishments are insufficiently restrained by either political or inter-governmental competition. As a result, advocates of this "Leviathan" model of local government suggest that the more important effect of decentralized government competition is the disciplining force on local politicians that such competition introduces when tax bases are mobile, not the fiscal externalities that arise under a Pigouvian model.

This intuition is treated formally by Epple and Zelenitz (1981) and links closely to the literature on club and jurisdiction competition discussed in Section 3.1. In order to focus solely on the question of whether intergovernmental competition can indeed fully restrain rent-seeking by local governments, the parsimonious model of Epple and Zelenitz assumes that all households are homogeneous and that local governments tax land/housing for the sole purpose of accruing rents. Local governments then find themselves in a game in which they set local tax rates knowing what other local governments are doing, with a symmetric equilibrium in which all tax rates are equal emerging as the outcome of the game. Even as the number of jurisdictions in the model goes to infinity (thus yielding "perfect" competition), rent-seeking politicians will levy positive tax rates so long as land/housing is not in some way perfectly elastically supplied. Rents go to zero only when the elasticity of supply of land/housing within a jurisdiction goes to infinity.[27] Thus, the Brennan and Buchanan mechanism of restraining local government rents through decentralized competition can succeed fully only if the locally taxed good is fully mobile – either directly or

[24] Earlier, Buiter (1989) and Bailey (1993) had suggested the Tiebout competition was in fact not necessary for the Oates-Daly result because of arbitrage behavior on the part of investors.
[25] Rangel (2002) focuses further on the constitutional choice of tax bases in an environment without decentralized competition – again demonstrating the importance of linking intergenerational spillovers to asset values through such instruments as land taxes. The possibility that capitalization may internalize intergenerational spillovers is independently explored in Wellisch (2000).
[26] Typically this assumption is equated to the assumption that all governments are revenue maximizers.
[27] While Epple and Zelenitz analyze the impact of changing the number of communities in their model, the model itself assumes a fixed number of communities. Henderson (1985) analyzes the same question in a framework where the number and sizes of communities are endogenous – i.e. where new communities can form and existing community boundaries can shift. These assumptions in essence bring back the perfect elasticity conditions under which inter-jurisdictional capitalization – and with it the possibility of political rents – is bid away under Tiebout competition.

through the possibility of community formation and shifting of community boundaries (Henderson, 1985).

Note that neither the Pigovian nor the Leviathan model contains any real underlying model of a local political process by which governments or government policies arise – in each case, local governments are simply in place, and a particular objective function is specified for them. Furthermore, Pigouvian and Leviathan governments represent merely extreme ends of a continuum of possible objective functions that place different weights on local social welfare and narrow government rents. This recognition has led to some recent attempts to merge the two models in order to investigate the consequences of decentralized government competition when local government institutions contain a mixture of Pigouvian and Leviathan sentiments (Rauscher, 1998; Edwards and Keen, 1996). Again, no particular political process is specified in such models, but local governments are simply assumed to exogenously care both about local social welfare and about narrow government rents. Results from such models regarding the desirability of government competition become predictably more murky, with fiscal externalities and political rent seeking pointing in opposite directions within the same model. Under certain conditions, tax competition may provide just the right amount of downward pressure on local tax rates that would otherwise be too high because of rent seeking by local governments.

A second approach to achieving a more balanced model that contains both Leviathan and Pigouvian elements is to introduce a political process under which voters provide an endogenous disciplining force on Leviathan politicians within political jurisdictions. This will be treated in the next section (specifically in subsection 3.43) as we consider the merging of political competition ("voting with ballots") into models of decentralized government competition ("voting with feet").

3.4. *Voting with Feet and Ballots*: Adding Politics to Tiebout

In both the Pigovian and the Leviathan model of local government, our discussion has thus far focused only on the impact of one type of competition: the horizontal competition between governments. This competitive force can give rise to fiscal externalities (Pigouvian model) or act as a disciplining force on rent seeking politicians (Leviathan model). While this is clearly the distinguishing characteristic of attempts to study decentralized rather than centralized governments, a second and potentially equally important disciplining force arises from the internal political competition that shapes local governments. We therefore turn in this section to the progress that has been made in recent years as researchers introduce politics into the competitive Tiebout framework. In most cases, this involves the introduction of some form of voting by residents within political jurisdictions. Voting can take place directly over policy alternative (Section 3.41) or indirectly through representatives (Section 3.42). Particular issues may arise if voters have less information than politicians (Section3.43), or if local political processes are influenced not merely by ballots but also by other local efforts such as lobbying (Section 3.44).

3.41. Single Dimensional Policy Decisions: Median Voter Models

Perhaps the most commonly employed political model in studying local governments is the simple median voter model. Of course this model becomes meaningful only when some voter heterogeneity (and thus voter conflict) is introduced. (In the absence of such heterogeneity, voters would in fact unanimously agree to behave the same way as the local welfare maximizing government discussed in the previous Section.) With voter heterogeneity, it is well known since at least Black (1948) that – when voting occurs over a single-dimensional issue space -- a sufficient condition for a decisive median voter to emerge under majority rule voting is given by the assumption of single-peaked preferences. Single-peakedness thus guarantees a voting equilibrium. Equally well known are the existence problems that arise when policy spaces become multi-dimensional or when preferences over single-dimensional issue spaces are multi-peaked (Plott, 1969; McKelvey,

1976). Similarly, when private alternatives to the public good or service are available (such as, for example, private schools), voter preferences necessarily become multi-peaked (Stiglitz, 1974). Furthermore, "partial equilibrium" single-peakedness may disappear when aggregate responses are taken into account by voters (such as when voting outcomes have implications for location choice in local public finance models).[28] These insights have thus placed natural limits on the extent to which median voter models can be usefully employed to study decentralized governments, but they have also resulted in important new insights on the existence of voting equilibria under more general conditions and in the development of new models that take these limitations into account.

A number of alternatives to the single-peakedness assumption have been advanced, each allowing for a wider set of circumstances under which majority rule voting results in a voting equilibrium, at least as long as the policy space remains single-dimensional. Roberts (1977) introduced a condition, termed hierarchical adherence, to study voting over income tax schedules. Drawing on Robert's result, Epple and Romer (1991) used single-crossing to characterize voting equilibrium within communities. An elegant unification is provided by ~~These have been elegantly unified by~~ Smart and Gans (1996) who define an ordinal notion of single-crossing preference profiles. With social alternatives denoted by x (ordered along a single dimension such as the unit interval), and with individuals denoted by i, the preference profile for a population satisfies single-crossing if and only if individuals can be ordered such that, for all $x<x'$, if x' is preferred by i to x, x' is also preferred to x by any $i'>i$.[29] This property can often arise quite naturally in voting models with single-dimensional issue spaces, although there exist examples in which the property cannot be invoked (Bearse, Glomm and Janeba, 2001).

A version of this condition has been used in one form or another in an important class of models that includes voters who are mobile between competing political jurisdictions. For instance, in an analysis of decentralized governments providing local redistribution, Epple and Romer (1991) analyze voter behavior in an environment where voters explicitly take into account the consequences of voting outcomes on location choices. In other models of local government competition (where voter foresight is less central to the question that is analyzed), other versions of single crossing conditions that imply greater voter myopia have also been used extensively.[30] In most of these approaches, the assumption of certain types of homogeneous preferences combined with heterogeneous income yields the natural ordering (i.e. by income) required for the preferences over the public good (or the local tax rate) to satisfy the required single crossing property.[31] A different class of multi-community models (discussed further in Section 3.4) continues to use single-peakedness rather than single crossing by assuming an even more severe form of voter myopia (Dunz, 1985; Nechyba, 1997b).

Single crossing conditions have also been usefully employed to address the existence of voting equilibria in the presence of private alternatives to the local public service. Epple and Romano (1996) focus particularly on the case of education where it is natural to assume that a child is placed in either a public or a private school. Preferences over public school spending (or the tax rate funding public schools) then naturally have multiple peaks (with one peak at zero). In the context of a single community, Epple and Romano show that specialized conditions previously employed by others are in fact special cases of a broader single crossing condition, and they demonstrate the intuitive result that majority rule voting can lead to a coalition of the "ends against the middle" – with high income private school

[28] Economic examples of this appear in Gans and Smart (1996).
[29] This single crossing condition can be defined in both weak and strong terms depending on whether the latter preference is required to be strict.
[30] Examples of such models include Westhoff (1977), Epple, Filimon and Romer (1993) and Fernandez and Rogerson (1996).
[31] However, as demonstrated in Epple, Filimon and Romer (1993), assumptions on preferences required for single crossing to hold and a multi-community equilibrium to exist can be quite severe when property taxes and housing are introduced into the model. This is discussed further below when we treat the introduction of housing into multi-community models.

attendees and low income public school attendees both preferring lower taxes than middle income public school attendees. A similar result arises in a multi-community context in Nechyba (1999) where voters are assumed to vote on public school spending conditional on their choice of where to send their child to school (thus recovering single peakedness.)[32]

3.42. Multi-Dimensional Policy Decisions: Structure Induced Equilibria and Citizen Candidates

Attempts to overcome the restriction of a single dimensional issue space within a competing government setting have thus far been relatively limited. Ultimately, some additional structure needs to be imposed on the political process if voting behavior over multiple issues becomes important to the analysis. Nechyba (1997b) offers a model in which voting occurs over both local and federal levels of public good provision and uses a structure induced equilibrium concept (Shepsle, 1979). The general approach in such structure-induced equilibria is to take multi-dimensional issue spaces and specify political structures (such as multiple levels of government or multiple single-issue committees within one government) that force voting to take place over a singe dimension at a time. A similar approach could in principle be applied to studying multiple locally provided public goods, each voted on in separate elections or referenda. This approach seems particularly applicable to situations where single-issue governments are the focus of analysis, but the imposition of the single-issue voting structure in the study of multi-dimensional decentralized political choices may be too severe in other cases. For this reason, alternatives to a median voter model are likely to play an important role in analyzing research questions that emphasize the multiple functions performed by competing decentralized governments.

One interesting structure that can be placed on majority rule voting processes focuses on voting over candidates – known as the "citizen candidates" (Osborne and Slivinski, 1996; Besley and Coate, 1997) rather than direct voting over policy issues. It assumes that each citizen can choose to stand for office, and that elections occur over the set of declared candidates (whose preferences and policy making abilities may differ in a variety of ways). The winner of such elections then determines policy. Although the model is stark in assuming that a single elected representative ultimately makes all political choices, it does provide an elegant way out of the single-dimensional policy space to which median voter models are typically restricted and offers a promising tool for analyzing research questions for which a multi-dimensional issue space is critical. However, while the model has been applied to the political economy analyses of a number of topics in public economics, its application in studying competing decentralized governments remains relatively sparse.[33] This offers a potentially fruitful avenue for research.

3.43. Voter Information and Agency Problems: Yardstick Competition

In all of the approaches to modeling decentralized governments discussed thus far we have implicitly assumed that voters have complete information about the political choices they face. One strand of the literature, however, has pointed out that it is likely that such information is in fact asymmetrically distributed between politicians and voters, with voters often finding it difficult to evaluate political performance. Besley and Case (1995a), using a model known as "yardstick competition" (Shleifer, 1985), have applied this intuition to the study of the behavior of competing governments. Yardstick competition models assume that, in the absence of full information, voters use outcomes in neighboring jurisdictions as information to evaluate the performance of their own local government. Just as in the case of a standard tax competition framework in which politicians take into account what

[32] Hoyt and Lee (1998) use a similar assumption in a single community model.
[33] Besley and Coate (1999) represent one exception as they focus on issues related to fiscal federalism. Their analysis is discussed below in Section 4.

happens in neighboring jurisdictions to avoid excessive outflows of local tax bases, politicians under yardstick competition also look toward their neighbors. Here, however, the concern is not over the mobility of tax bases but rather over the signal that local political choices which diverge from neighboring choices sends to voters when politicians are up for re-election. Two predictions emerge from this framework: First, if local taxes rise disproportionately (relative to neighboring districts), voters interpret this as a signal that local politicians are either ineffective or are engaged in excessive rent seeking. Second, local tax rates under yardstick competition mimic tax rates in neighboring jurisdictions.[34]

An interesting recent advance in this literature returns to the debate over the benefits of intergovernmental competition between those advocating a model of local governments as Pigouvian welfare maximizers and those that view local governments as Leviathan rent (or revenue) maximizers. Specifically, Besley and Smart (2002) consider an asymmetric information model of local politics in which voters do not know prior to a politician taking office whether that politician has Pigouvian or Leviathan inclinations. Rather than achieving a "mix" of Leviathan and Pigouvian models by varying the weights placed on social welfare and government rents *within an exogenous political establishment* (as in the models discussed in Section 3.3), this approach moves between the polar extremes by setting the fraction of politicians that are of one kind or another. Yardstick competition then allows voters to more easily identify local Leviathan politicians.[35]

3.44. Incorporating Preference Intensities: Lobbying through Menu Auctions

When preference intensities beyond voting become of economic concern, the common-agency or "menu auction" model of Bernheim and Whinston (1986) has become "something of a workhorse model of lobbying" (Persson and Tabellini, 2000) in political economy approaches to public finance issues.[36] The model differs from traditional public finance models in that it does not assume an objective function for the government (whether Pigouvian, Leviathan or something in between), and it differs from traditional political economy models in that it specifies neither a simple voting rule on policy issues (such as the median voter rule) nor a democratic political institution (such as the citizen candidate or other structure induced political models of legislatures).[37] Rather, the model allows agents to make credible, decision-contingent promises of side payments (bribes) to a government decision maker who chooses public good and tax levels in order to maximize his own welfare. Equilibrium policy choices in an interesting subset of equilibria (those involving truth telling) are known to be efficient in this framework. Besharov (2002) introduces this framework into the local public finance literature by assuming homogenous jurisdictions with a representative government decision maker in each jurisdiction. Thus, the exogenously specified objective function of the Pigouvian or Leviathan local governments are replaced by endogenous policy choices arising from local decision makers who are influenced by side payments. The framework then permits an analysis of the role of influence costs in determining the optimal assignment of tax and spending authority to central and decentralized governments, and it permits an analysis of the desirability of constitutional constraints on central governments in the presence of influence costs.[38]

[34] Besley and Case (1995) find empirical evidence for both these predictions, as do others (Revelli, 2002).
[35] However, this may cause the equilibrium to become a separating rather than a pooling equilibrium – making it less likely that Leviathan politicians mimic Pigouvian politicians when in office. In an environment where most politicians are Pigouvian, a Leviathan politician is more likely to be detected and will thus more likely choose to "get what he can" while in office. On the other hand, in an environment where most politicians are Leviathans, detection is less likely thus causing Leviathan incumbents to seek to remain in office. This leads to interesting and somewhat counterintuitive results.
[36] Grossman and Helpman (1994) first applied the model to political lobbying to study trade policy.
[37] Recent papers have, however, introduced the approach into standard political economy models; for example, Persson (1998) introduces the menu auction model into a legislative bargaining model, and Besley and Coate (2001) combine it with the citizen candidate model.
[38] Results from this analysis provide an endogenous justification for an often assumed uniformity constraint on the central government. See section 4.1 for more details.

3.5. *Toward Computational Models for Policy Analysis*: Competing Local Governments with Heterogeneous Households

A number of attempts have been made to move the theoretical literature explored thus far toward structural models that can be informed by data and used for general equilibrium policy simulations. The purpose behind these attempts has been to move the literature toward greater policy relevance by permitting more applied models that incorporate greater complexity. Given our emphasis on the importance of linking local government models to land and housing markets, we will restrict ourselves in this discussion to those computational models that explicitly include land and/or housing.[39] Sections 3.51 and 3.52 discuss two different approached to introducing housing into local public goods models and relate these to the underlying existence problems as well as the challenges of matching empirically observed house quality distributions. Sections 3.53 and 3.54 then illustrate the potential usefulness of computational models of this kind by providing a discussion of two applications of the models to policy issues (local redistribution and the decentralized provision of public schooling).

3.51. Modeling Land and Housing

Models that permit policy analysis through computer simulations and that explicitly introduce a housing/land market generally fall into two categories. One approach is to model housing as being supplied exogenously within each jurisdiction along an upward-sloping supply schedule, with rents typically accruing to absentee landlords and households choosing their most preferred level (given the supply schedule) at their location.[40] The second approach models housing as exogenously fixed in each jurisdiction, with each house/land combination owned by a household within the model. The nature of the housing good thus differs between these two approaches, as does the nature of ownership of houses and land.

Early attempts to include housing and land in models aimed at policy analysis were plagued by existence problems that explain why the literature developed as it has. Rose-Ackerman (1979) demonstrated that a model with a continuous housing good, local property taxation and voting generally suffers from the lack of general existence of stable equilibria. Non-convexities in budget sets arise when property taxation over a continuous housing good is used as the local policy tool under majority rule, and this technical difficulty can be overcome in one of three ways: (i) through the use of a policy instrument other than property taxation (such as income or wealth taxation) (Konishi, 1996); (ii) through the use of fairly specific functional form assumptions (Epple, Filimon and Romer, 1993);[41] or (iii) through the introduction of discrete housing that is exogenously fixed (Dunz, 1985; Nechyba, 1997b).[42] Given the importance of property taxation in local government competition in the U.S., the assumption of income rather than property taxation may be problematic.[43] As a result, the literature has used the second and third way of resolving the existence problem depending on the types of policy questions that are analyzed.

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[39] As a result, we are foregoing a detailed discussion of important simulation literatures the consider government competition in the absence of land markets (as, for example, Fernandez and Rogerson, 1999).

[40] Some versions of this approach have extended the analysis to include homeowners (Epple and Romer, 1991), Epple and Platt, 1998).

[41] Epple, Filimon and Romer (1993) assume single crossing of indirect indifference curves in the house price/tax space. While examples of combinations of utility and production functions that satisfy this certainly exist and have been employed with great success in applied analysis, some common examples of functional forms do not satisfy this condition (Konishi, 1996).

[42] This approach, while placing severe exogenous restrictions on housing at each location, does not require the introduction of specific functional form assumptions to achieve general existence of equilibria. Konishi (1996) and Nechyba (1997b) give a more detailed discussion of the existence problems under local property taxation.

[43] While locally raised revenues in the US are derived from a number of sources (with property taxes constituting approximately 35%), virtually all locally raised revenues for public schools in the US come from property taxes. Since schooling is the most important

Both approaches have advantages and disadvantages, and each leaves room for further technical advances to produce an overall more satisfying model. The first approach models housing as a homogeneous good that can vary in quantity at each location as underlying economic conditions change. In some ways, one could argue that this incorporates a "long-run" view of housing, and models of this type can be useful in conducting policy simulations in which housing potentially increases *and decreases* at each location. At the same time, the model is somewhat artificial in a static context given that it implicitly assumes that housing at a given location can instantaneously be converted into private goods. The second approach – first introduced by Dunz (1985) and later refined by Nechyba (1997b), on the other hand, treats housing quality at each location as exogenous and not malleable (but allows housing quality to vary across different locations within each jurisdiction). This prevents an artificial instantaneous conversion of housing to private goods but it also artificially restricts households from investing in housing at a particular location to increase size or quality. As such, it represents a more "short-run" view of housing, or alternatively a model of housing in which zoning regulations bind. Neither approach therefore accomplishes what in some sense would be ideal – a model of land and housing such that housing can be improved in the short run through investments while potentially declining in quality in the long run through depreciation (i.e. a lack of adequate investment to maintain quality). Such an approach would require a multi-period dynamic model that so far remains absent from the literature but ultimately is necessary to truly address some dynamic questions of adjustments to policy changes.

3.52. Avoiding "Musical Chairs" while Replicating Real World Heterogeneity

One of the important stylized features of housing markets in the U.S. is that, while jurisdictions can generally be ranked in terms of *average* housing quality levels, there is much overlap in the distribution of housing quality (and income) across local jurisdictions. This empirical reality is not easily replicated as an equilibrium outcome in policy models with free mobility, and this difficulty further highlights some of the existence problem inherent in multi-community models.[44] In particular, with local public goods funded through local (typically proportional) taxation, jurisdictions with high income households face the threat of low income households choosing to move into the jurisdiction and free-riding on the contributions to the public good made by the wealthy. This can potentially lead to a non-existence result due to the "musical chairs" phenomenon of the poor "chasing" the rich who then relocate only to be chased again.[45] The solution to the existence problem lies in finding a way to allow rich districts to provide high levels of public goods without providing incentives that generate an excessive inflow of low-income free riders. Each of the two ways of modeling housing/land (discussed above in Section 3.51) provides a different means to overcome this existence problem while simultaneously employing data to generate the empirically observed levels of heterogeneity in housing quality and income within and across jurisdictions.

In Epple, Filimon and Romer's (1993) model of a continuous homogeneous housing good, preferences are structured in such a way as to cause the combination of housing prices and tax obligations in rich districts to be unattractive to low income households despite the fact that rich districts provide higher levels of local public goods. If preferences are identical

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locally provided service for which household mobility matters empirically, we focus on property taxation as the most relevant local tax to model in applied contexts. Local income taxes, on the other hand, are exceedingly rare.

[44] In more abstract models, the introduction of non-anonymous crowding can generate this mixing of income types within clubs or jurisdictions and can be interpreted as a recognition of the fact that complementarities between different types may result in within-jurisdiction heterogeneity. For instance, with jurisdictions defined over large enough geographic regions, each jurisdiction is likely to require the presence of different professions (doctors, teachers, etc.).

[45] Kessler and Hansen (2001) demonstrate such a non-existence result in a model that does not have constraints imposed by a land market.

across households, this leads to an equilibrium in which households fully segregate based on income.[46] The "musical chairs" existence problem can thus be overcome in the continuous housing model by placing restrictions on preferences, but income heterogeneity alone does not allow the model to replicate the overlap in housing quality and income distributions across jurisdictions observed in the data. Thus, additional preference heterogeneity must be introduced such that preferences over housing varies sufficiently to produce two-dimensional stratification of household types – with some poor households who value housing relatively less being willing to consume a small amount of housing in rich districts in order to take advantage of the higher local public good.[47]

The Dunz/Nechyba framework of discrete and exogenously fixed housing, on the other hand, overcomes the "musical chairs" existence problem directly by fixing the housing stock in each jurisdiction and permitting capitalization to support an equilibrium. The exogenous housing stock can be interpreted as resulting from zoning or from an exogenous historical process.[48] Jurisdictions that have a relatively high housing quality will tend to produce higher levels of public goods (often with lower property tax rates), but low income housing is exogenously limited within such jurisdictions – thus preventing an excessive inflow of low income households seeking to free ride. No preference heterogeneity is thus required – equilibrium prices of low quality houses in richer districts are sufficiently high relative to prices for similar houses in poorer districts to support the equilibrium presence of low-income households with identical preferences in jurisdictions that produce very different levels of public goods.[49] The process of matching the empirical distribution of house prices is also relatively straightforward and simply requires the appropriate setting of house quality distributions within each jurisdiction of the model.[50] The strong exogeneity of housing stocks also permits the introduction of various kinds of inter- and intra-jurisdictional spillovers.

3.53. Application 1: Local Redistribution

Conventional wisdom in the public finance literature has long held that redistribution is best conducted by national governments because of the constraints faced by decentralized jurisdictions subject to mobility of households. In fact, in a full Tiebout model in which jurisdictions can freely enter, local redistribution cannot emerge. However, realistic models of decentralized tax competition must incorporate the empirical reality that the number of jurisdictions is indeed limited, and this constraint makes it at least conceptually feasible that local governments could engage in limited amounts of income redistribution. It is difficult, however, to get a sense of how much such redistribution might in fact be possible when the number of local jurisdictions is limited. Epple and Romer (1991) therefore investigate this question in the context of a model with continuous housing supply with identical household preferences (but different incomes), while Epple and Platt (1998) extend the analysis to include heterogeneous preferences (and thus incomplete stratification of income across jurisdictions). The models are calibrated to incorporate important features of U.S. data, and simulations are conducted under different assumptions of relative jurisdiction sizes and alternative assumptions regarding the fraction of homeowners as opposed to renters.

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[46] Put differently, with households ordered from lowest to highest on the unit interval, jurisdictions would consist of continuous intervals of the unit interval.

[47] Epple and Platt (1998) first introduce this two-dimensional stratification in a model of local income redistribution that extends Epple and Romer (1991). Later, Epple and Sieg (1999) and Epple, Romer and Sieg (2001) estimate models with two-dimensional stratification. These models are discussed in more detail in Section 6.

[48] In the literature on zoning, residential exclusionary zoning has in fact been introduced as one method to stop free-riders from living in communities that use proportional property taxes (Hamilton, 1975). Fernandez and Rogerson (1997) treat zoning explicitly in a two community model in which zoning regulations emerge endogenously.

[49] If housing is relatively similar in all jurisdictions, multiple equilibria may arise in this model, but Nechyba (1997) conjectures that this multiplicity disappears as the interjurisdictional variance in housing stocks increases.

[50] A simple calibration method was first outlined in Nechyba (1997a) and extended in subsequent work.

The computational method employed in these exercises then gives rise to some surprising results. First, in economies with predominantly renters, decentralized competition among local governments whose sole aim is to redistribute income under local majority rule can indeed provide substantial levels of redistribution. This feasible level of redistribution declines significantly, however, the more homeowners (as opposed to renters) participate in the political process. Homeowner preferences over levels of local redistribution differ because homeowners take into account the capital losses they will incur as local redistribution is capitalized into local house prices. While the direction of these results emerges in a purely theoretical context, the empirically relevant magnitudes emerge only under computable versions of the model as the model is matched to important features of the data. The results refine the conventional wisdom that local redistribution is severely limited: the more binding force seems to arise from internal political competition (as homeowners seek to protect their property values through local political institutions) – and not as much from economic competition between decentralized governments that bid away any residents in a race to the bottom. At the same time, important differences between models that set jurisdictions sizes differently emerge, with more local redistribution arising in larger jurisdictions.

3.54. Application 2: Decentralized Provision of Public and Private Schooling

At least in the U.S., public schools are closely linked to local jurisdictions in the sense that admission to local public schools is based on the residential location of the household. Such residentially based admissions policies have long been recognized to create an important link between housing markets and the distribution of school quality across districts.[51] Housing markets in fact provide an important equilibrium force in that, when jurisdiction numbers are limited, they capitalize public school quality and local tax levels in such a way as to support an equilibrium in which large inter-jurisdictional quality differences within the public school system can be sustained as an equilibrium outcome under full mobility of households.[52] These quality differences can be the outcome of per pupil spending differences, non-pecuniary input quality differences (such as peer quality or parental involvement) or a combination of the two (Nechyba, 1999). To the extent that this link between public schools and Tiebout forces is important, a full treatment of school policy is difficult to divorce from the general equilibrium in which policies are likely to unfold.[53]

Peer effects as a component of school quality are introduced into a model of local jurisdictions by deBartolome (1990). He studies the efficiency implications of decentralized finance in the presence of peer effects, emphasizing the tradeoffs between efficiencies from varying expenditures across households and inefficiencies from stratification of peer groups. Benabou (1993, 1996) studies human capital accumulation in a general equilibrium framework in which education is locally provided and peer effects are present. Benabou demonstrates that decentralized provision of education may result in efficiency losses. This occurs if stratification of families by human capital across communities results in adverse effects on education in the low human capital community that are greater than the gains in the high human capital community. He also emphasizes that such stratification may persist despite equalization of expenditures. Durlauf (1996) studies the dynamics of income inequality when education depends on both expenditures and human capital of neighborhood residents. He establishes conditions under which stratification of families across neighborhoods can lead to persistent income inequality. In the above models, the efficiency and distributional implications of stratification depend on the way in which the

[51] This link has repeatedly been demonstrated indirectly in capitalization studies from Oates (1969) through Black (1999) and in other empirical work discussed in Section …

[52] Such interjurisdictional variances in school quality can of course also emerge in models that do not include land but yield segregation of income due to restrictions on preferences (Fernandez and Rogerson, 1999, 1998, 1997, 1996).

[53] Some similar issues arise in the treatment of crime where "peer effects", spillovers and private alternatives (i.e. gated communities) are potentially important (Helsley and Strange, 1999) – as discussed in Section 3.23.

benefits of peer effects vary across students with differing backgrounds. These models emphasize the importance of empirical work that might provide further evidence on the differential effects of peers on individuals.

The link between school policy, peer effects and Tiebout forces has been explored in a series of papers employing the Dunz/Nechyba model of discrete heterogeneous housing.[54] As in the case of local income redistribution (discussed above in Section 3.53), the theoretical direction of introducing various components of the model are relatively clear, but empirically relevant magnitudes emerge only with computational analysis from calibrated (or estimated) models. In terms of insights into the nature of decentralized competition (as opposed to the introduction of multi-level government policies discussed in Section 4), the most striking result concerns the interaction of private and public schools in ~~generating~~ limiting segregation across different school districts. Versions of the model in which private school markets are not permitted result in rather extreme levels of income segregation as equilibrium housing values for the similar quality houses are significantly higher in high-income districts. The bundling of public schools to residential locations therefore introduces a larger segregating force into the model. At the same time, when private school markets are introduced, public school quality is no longer as fully capitalized into housing prices because private schools offer alternative opportunities (divorced from residential location) to households seeking high quality schools. Thus, private school markets introduce a desegregating force into a residentially based public school system. Most surprisingly, perhaps, income segregation is lowest when public and private schools exist side-by-side. To the extent that housing remains bundled for households that choose public schools, house values continue to partially capitalize public school quality – thus providing incentives to relatively high income households who tend to choose private schools to reside in jurisdictions with depressed housing values – i.e. poor jurisdictions with bad public schools. The capitalization of public schools into housing values – itself a segregating force – thus produces desegregation as it causes high income households to live in poorer districts than they would if local public choices did not distort housing prices.[55]

Epple and Romano (forthcoming) study neighborhood schools and school choice in a model in which students differ by ability and households differ by income. Their model predicts that schools of differing quality will arise within a district (i.e., with uniform expenditure per student) that has a neighborhood school system, as well as across districts. Within districts, quality differences reflect variation in peer quality across neighborhoods and are sustained by differentials in housing prices across neighborhoods. Stratification arises due to a positive income elasticity of demand for education quality coupled with either a positive correlation of student capability and household income or with demand for educational quality rising with student capability. They also contrast outcomes in a neighborhood school system to those in a private school system with universal or flat-rate vouchers. The latter exhibits greater stratification by ability and less stratification by income than does a neighborhood public school system.[56]

4. Adding a Hierarchical Dimension to Decentralized Government Competition

[54] These include Nechyba (2000, 2002, 2003, forthcoming (a-c)).

[55] This has particular implications for the introduction of private school vouchers that unbundle the residential location and schooling choices of additional households who would otherwise choose public schools (disproportionately in better school districts) (Nechyba, 1999, 2000, forthcoming(a,c); Ferreyra, 2002a,b). General equilibrium implications for central government policy toward local public schools are explored more in Section 4.

[56] Predictions of this theoretical framework are tested in Epple, Figlio, and Romano (forthcoming). Equilibrium in a system of private schools with flat-rate vouchers is studied in Epple and Romano (1998). Alternative voucher systems are analyzed in Epple and Romano (2002). And an overview of what has been and can be learned from computational approaches in education is given in Nechyba (2003b).

Many of the concerns regarding inefficient or inequitable distribution of resources that emerge from the theoretical investigation of horizontal competition motivate the interest in structuring hierarchical government interactions to improve on purely decentralized outcomes. With the theoretical literature on decentralized competition as a backdrop, we therefore now turn to the introduction of a hierarchical dimension to the models discussed thus far. Within a fuller model that includes a central government in addition to competing decentralized governments, questions regarding the appropriate level of centralization as well as the appropriate tools to be used by central governments emerge. Models that investigate such questions typically contain both centralizing and decentralizing forces that must be traded off against one another. In some contexts, the discrete choice between central and decentralized provision of public goods is investigated, while other models investigate the degree of optimal central government intervention into decentralized government choices. We treat the first set of questions regarding a discrete choice between centralization and decentralization in Section 4.1 and then turn to questions of fiscal interactions between central and decentralized governments in Section 4.2.

4.1 *Central or Local Provision*: Updating the "Decentralization Theorem"

Oates (1972) framed the trade-off between centralization and decentralization as a trade-off between efficient internalization of interjurisdictional spillovers through centralization and efficient matching of local policies to local tastes through decentralization. Thus, fewer inter-jurisdictional spillovers[57] and greater variance in tastes should lead to greater decentralization, an insight that has come to be known as the "Decentralization Theorem" (Oates, 1972).[58] Note that this framing of the issue essentially takes a Pigouvian view of governments as maximizing welfare of its citizens, introduces Tiebout's notion of the local tailoring of public services to local tastes, and constrains the central government to providing a uniform level of public goods under centralized provision. While providing the primary starting point for analyzing federalism in economic models for several decades, the framework does not, however, incorporate the insights from much of the literature on decentralized government competition discussed thus far, and it imposes an artificial uniformity constraint on central government tax and spending policies in order to generate the tradeoff that underlies the Decentralization Theorem.

The modern literature on decentralized government competition casts new light on the decentralization debate in several ways: First, the introduction of politics eliminates the need for the exogenous uniformity constraint (or alternatively provides an endogenous rationale for it) (Section 4.11); in fact, political forces may indeed be central to the question left unaddressed by the Decentralization Theorem, although other possibilities have been informally discussed in the literature (Section 4.12). Second, when production functions for local public goods or services include non-pecuniary inputs that vary with local characteristics, fundamental concerns regarding "categorical equity" in the provision of certain goods (Feldstein, 1975) may be difficult to fully address through centralization (Section 4.13).

4.11. The Decentralization Theorem, Politics and the "Local Office Test"

[57] In our discussion of Pigouvian local welfare maximizers in Section 3.2, we identified a number of such spillovers (on both the tax and spending sides) that may arise from decentralized government competition. These include the under-use of mobile tax bases under tax competition, the over-use (through tax exporting) of certain types of tax bases that involve local market power, and the under-provision of public goods with positive spillover benefits into other jurisdictions. In models with heterogeneous agents, additional mobility induced externalities may arise when local governments can "solve" local problems by providing incentives for "problem households" to move to other jurisdictions. One common example of this involves local provision of anti-poverty programs and the frequently raised fear that such programs will result in a "race to the bottom." (The subtle question for a local Pigouvian welfare maximizer in this case is to determine which population mix to consider when maximizing welfare – some initially given mix or the equilibrium mix that emerges from decentralized competition. For the case of redistribution under majority rule, our discussion in Section 3.52 suggests the possibility of similar under-provision of local redistribution.)

[58] Brueckner (2001) provides a recent formalization of this tradeoff in terms of the issues raised in Section 3. Specifically, he models tax competition and preference heterogeneity, with the former introducing the inter-jurisdictional externality that suggests centralization may be optimal and the latter introducing the Tiebout benefit of decentralizing to permit preference sorting.

The "Decentralization Theorem" asserts that centralization should take place only once the cost of centralization (uniformity of public goods) is outweighed by the benefits (internalization of spillovers). As suggested above, however, the theorem rests on the artificial assumption that centralized governments must tax and spend uniformly across decentralized political units. When this restriction is relaxed, it no longer becomes immediate why Pigouvian central governments could not simply set up "local offices" and mimic decentralized public goods provision to the extent that it is optimal to do so.[59] Thus, unless another opposing force is added to the Oates model, centralization is always optimal because at worst the central government can simply mimic what local governments would have done. One possible modification involves a modification of the Pigouvian nature of governments in the Oates model – either through the addition of Leviathan elements or through the explicit introduction of a political model. However, the introduction of a Leviathan element through a change in the objective function of governments away from welfare maximization and toward rent seeking (as in models discussed in Section 3.3) simply replaces one exogenously imposed decentralizing force in the Oates model with another. Instead, the most recent literature has introduced explicit political models that give rise to an endogenous decentralizing force or an endogenous reason for the existence of uniformity rules.

More precisely, Besley and Coate (1999) employ the citizen candidate famework (see Section 3.42) to model both local and central government provision of public goods and services without assuming constraints on the ability by central governments to vary spending across decentralized political units. They demonstrate that a tradeoff between centralization and decentralization re-emerges because of the role that politics plays in the model – with decentralization emerging as optimal if spillovers are sufficiently small and centralization, despite political distortions, becoming optimal as spillovers get large. In a somewhat different context, Lockwood (2002) employs a structure induced political equilibrium model and thus also appeals to political forces as endogenously generating this type of a tradeoff. Besharov (2002), on the other hand, employs a menu auction/political influence model to demonstrate that Oates' exogenous uniformity constraint on central governments might in fact have an endogenous justification after all -- a justification that again arises from an underlying political story.[60] Here, centralization gives rise to greater opportunities for agents to engage in lobbying, and unless economic spillovers are sufficiently high, influence costs reduce welfare under centralization. Thus, whether politics itself generates the cost of centralization (Besley and Coate, 1999; Lockwood, 2002), or whether politics gives rise to constitutionally imposed uniformity constraints (Besharov, 2002), the recent literature has focused on the introduction of political or influence models as a way of generalizing Oates' decentralization theorem when central government uniformity constraints are not exogenously imposed. In each case, decentralization becomes less attractive as interjurisdictional spillovers increase, and inefficiencies in political systems provide a decentralizing force.

4.12. Other Ways to Pass the "Local Office Test"

Attempts to challenge exogenously imposed restrictions that yield the tradeoffs underlying the Decentralization Theorem are relatively recent and almost solely focused on applying the political models we discussed above. More informally, however, the literature has hinted at other possible decentralizing forces that may take the place of Oates' uniformity constraint. One frequently mentioned force involves the ease with which local information can be processed by local political institutions as opposed to centralized bureaucracies

[59] This question bears close resemblance to Coase's (1937) question regarding firms: Why can all economic activity not simply be conducted by a single firm? And it relates closely to the modern literature on the theory of the firm (Williamson, 2002).

[60] Oates in fact seems to suggest that there are endogenous reasons for why central governments are indeed constrained (either by "typical political pressures" or "perhaps even constitutional constraints" (Oates, 1999)) to provide more uniform levels of public services at more uniform tax rates.

(Oates, 1999). A second involves potential gains from decentralized policy experiments in an environment characterized by uncertainty over the consequences of alternative policy proposals.[61] Neither of these has, to our knowledge, been modeled formally in a way that gives rise to endogenous advantages from decentralization. Given the similarity of the basic question to questions analyzed in the more developed modern theory of the firm (Williamson, 2002), it is likely that future research could fruitfully draw from this related literature.

4.13. "Categorical Equity" Gains and the Limits of Centralization

While our focus in the discussion of decentralized government competition has been primarily on efficiency considerations, a second important and policy-relevant set of considerations that naturally arise in Tiebout models with heterogeneous agents involves concerns about inter-jurisdictional equity. Even in the ideal scenario when decentralized government competition leads to efficient (or constrained efficient) outcomes, the models clearly predict that outcomes in different jurisdictions will differ. This, in fact, was Tiebout's point: competition between local governments will lead to different mixes of tax and spending patterns and thus provide a menu of choices for heterogeneous households to choose among. In fact, if central government redistribution programs have generated an "equitable" distribution of household income, one might not be any more concerned about differences in local public good levels between rich and poor districts than one is concerned about the different quality of cars consumed by higher and lower income households.

However, for certain types of local public goods and services (such as education and public safety), additional "categorical equity" concerns may arise. If this notion of equity demands equal levels of provision (or equal access to similar local public goods or services or a lack of relation between consumption levels and ability to pay),[62] the Tiebout mechanism is not particularly effective at guaranteeing such equality even if the overall income distribution is optimal in some sense. And it is on such equity grounds that central government production of some goods (or central government involvement in the production of such goods when locally produced) is frequently justified. To the extent that the production function for publicly provided goods takes only financial resources as inputs, and to the extent to which there are no alternative private markets for the provision of such goods, central government equalization of inputs can fully address such categorical equity concerns. Beyond such a simplified model of public good production, however, the general equilibrium forces that give rise to categorical inequities may continue to operate under centralization and may thus place limits on the central government's ability to fully eliminate such inequities.

This has been extensively treated in the case of public education. Ladd (1976) discusses the importance of considering both fiscal capacity (i.e. the local tax base, including industrial and commercial property) and fiscal need in determining optimal state involvement in education finance. Central government equalization of financial school inputs can indeed overcome differences in local school spending that would arise due to differences in local fiscal capacities, but fiscal needs in schools frequented by predominantly poor students is

[61] Both of these are discussed informally in McKinnon and Nechyba (1997). Strumpf (2002) points out that it is far from obvious that policy innovation will necessarily be greater under decentralization given that an "information externality" would clearly suggest suboptimal experimentation. Neither, however, is it obvious that central governments – constrained by constitutional or political considerations, can engage in the level of optimal experimentation arising in a Pigouvian setting.

[62] The notion of categorical equity differs from typical public finance notions of equity and has a longer tradition in legal analysis. It differs from equity notions that guide our thinking about such features of economies as income distributions by placing particular emphasis on "equity" of certain types of consumption. Feldstein (1975) explains it as a principle that "singles out particular categories of services such as education and health care which are deemed to be 'fundamental interests' and asserts that individuals' consumption of these services should not be allowed to differ substantially or, alternatively, that such differences should not bear a strong relation to the individuals' ability to pay." Feldstein termed the latter version of the categorical equity notion "wealth neutrality." Arrow (1971), on the other hand, takes a utilitarian approach and arrives at conditions under which notions of categorical equity emerge as socially optimal.

likely to be substantially higher than in schools with predominantly wealthy students because non-pecuniary inputs into school production (such as peer effects, parental involvement, teacher quality, etc.) are likely to be correlated with incomes of parents. Thus, within a model of decentralized (residentially based) school districts, inter-jurisdictional differences in school quality can emerge not only (or not even primarily) because of spending differences but rather because of accompanying differences in these non-pecuniary inputs when such inputs play an important part in the school production function. In a model of inequality in a general equilibrium model of capital accumulation with peer effects, Benabou (1996) also emphasizes that stratification may persist despite equalization of expenditures, and he demonstrates that stratification increases persistence of inequality.

Nechyba (2003a, 2002, forthcoming(b)) models peer influences and inputs explicitly within the Dunz/Nechyba computational model described in Section 3.54 and calibrates school production functions to place weights on pecuniary and non-pecuniary inputs so as to replicated private school attendance rates and public school spending levels (resulting from majority rule). Simulations comparing full centralization (and equalization) of public school spending to full decentralization by competing governments suggest that categorical inequities – while improving under centralization, continue to be substantial because of some of the very same general equilibrium forces that give rise to such inequities under decentralization.[63] Notions of categorical equity thus introduce a centralizing force, but even centralization may not be sufficiently strong to fully implement such equity notions in the presence of complexities such as non-pecuniary inputs into local public good production.[64] Epple and Romano (forthcoming) likewise study centralization of school finance in a model in which students vary in ability and households vary in income. While centralization of school finance decreases dispersion of school qualities in their framework, stratification across schools persists due to peer effects--stratification that is little affected by the centralization of school finance.

4.2. *Fiscal Federalism*: Hierarchical Fiscal Interactions between Governments

Ultimately, fiscal decentralization is rarely as extreme as suggested in Section 4.1 where the choice was treated as if full centralization and full decentralization were the only alternatives. Rather, different government services are often provided and financed through a complex set of intergovernmental fiscal institutions, including central government grants accompanied by central government constraints specifying what can and cannot be done by local governments under a given grant system. The justification for such hierarchical fiscal relationships – known as fiscal federalism – lies in attempts to combine the benefits of decentralization with the benefits of centralization. Much of the theory emanates from the literature on fiscal distortions that may arise from decentralized government competition even when local governments are Pigouvian in nature (Section 3.2) and from the desire of policymakers to achieve greater categorical equity with respect to goods like health care, education and crime control. Oates (1972) outlined the basics of the theory by modeling local jurisdictions as single consumers that maximize utility subject to a budget constraint, and he focused on the ways in which different types of intergovernmental grants (such as matching and block grants) alter local incentives through changing local budget constraints. What type of fiscal central government intervention is optimal depends on a variety of factors including the type of problem that motivates the subsidy (Section 4.21), the relative levels of information available to central and local government policy makers (Section 4.22), the degree to which political distortions might govern hierarchical relationships (Section 4.23) and the extent to which local budget constraints "soften" as a result of hierarchical fiscal interactions with national governments.

[63] These results are in stark contrast to the predictions from models that do not include a housing or land market and that model school production as purely a function of pecuniary inputs (xxx).

[64] Similar results of course apply to other types of publicly provided goods or services. Public safety, for instance, is clearly a function of not only pecuniary government inputs into law enforcement but also involves the characteristics of neighborhood populations – or neighborhood effects.

4.21. The Theory of Intergovernmental Grants under Pigouvian Governments with Full Information

In the Oates Decentralization framework of Section 4.1, supplementing local provision of public goods with appropriately set central government matching grants causes local Pigouvian governments to internalize spillover externalities – thus maintaining the match between tastes and local public goods achieved through decentralized local policy setting while avoiding the inefficiencies from inter-jurisdictional spillovers. The central government grants can be viewed as the solution to a Prisoners' Dilemma faced by the Pigouvian local governments in the presence of inter-jurisdictional spillovers. Each would be willing to enter an agreement to take into account the benefits and costs of his own actions on other jurisdictions, but such an agreement contains all the usual incentives for each player to deviate. One way to view fiscal federalism in this context is thus to view the central government as the enforcer to the agreement – and the hierarchical fiscal institutions as the enforcement mechanism that induces each Pigouvian local government to in fact abide by the agreement to consider costs and benefits outside the local jurisdictions.[65] Central government grants can similarly be used to address categorical equity concerns across jurisdictions.

In comparing equally funded matching and block grants, the theory predicts greater local response to matching grants given the presence of substitution (price) effects in addition to income effects present in block grants. Furthermore, it predicts (under certain conditions) the same effects regardless of whether grants are given directly to local governments or indirectly to local residents through policies such as allowing local taxes to be deductible from federal tax obligations.[66] The frequent observation that the latter prediction does not seem to hold has led to a large literature (that is beyond the scope of this chapter) on what has come to be known as the "flypaper effect" – i.e. the empirical observation that where federal subsidies go (local governments versus local residents) matters to outcomes.[67] And even in the absence of inter-jurisdictional spillovers and in the presence of Pigouvian governments, central government coordination can improve on decentralized outcomes when local public goods and services (such as education, crime control, public infrastructure, etc.) are provided by *overlapping* local jurisdictions (Hochman, Pines and Thisse, 1995).

A number of different fiscal mechanisms have been proposed for the correction of different types of efficiency or equity concerns arising from decentralized provision. As suggested already, Pigouvian matching grants can control for inter-jurisdictional tax[68] and expenditure spillovers by causing local governments to fully internalize inter-jurisdictional externalities (Wellisch, 1999). Block grants, on the other hand, may be appropriate when central governments seek to insure a minimal level of spending on particular public goods or services for categorical equity reasons (Nechyba, 1996). In the funding of public education, the concept of wealth neutrality (Feldstein, 1975)[69] provides a stronger notion of categorical equity and results in a system of jurisdiction specific matching grants. Under special circumstances, such wealth neutrality may results from a matching grant system in which

[65] One portion of the literature has investigated endogenously generated transfers in decentralized systems (Myers, 1990; Krelove, 1992; Wellisch, 1996; Silva, 1997). Interregional transfers can emerge endogenously through tax exporting or through more explicit transfers to control migration. Under certain conditions, these papers demonstrate that such endogenously generated transfers are efficient.

[66] Under the current US tax code, for instance, local property taxes are deductible from federal income taxes while local sales taxes are not. Of course, subsidizing local expenditures through such a mechanism does not permit for targeted subsidies to particular categories of local spending.

[67] Theories that have attempted to explain the flypaper effect have relied on political, institutional and behavioral explanations. A recent summary and evaluation of much of this literature is provided by Hines and Thaler (1995).

[68] Wildasin (1989) and DePater and Myers (1994) analyze this for the case of capital tax competition in different settings.

[69] Wealth neutrality arises when local expenditures on a particular public good or service are not correlated with local wealth.

central government subsidies are structured so as to insure that each locality would raise the same revenue if it set the same local tax rate, but generally such a system would result in an inverse correlation of public spending and local wealth because of strong substitutions (price) effects (Feldstein, 1975, Nechyba, 1996).[70] Each of these proposals implicitly assumes that full centralization of the public service is not optimal because of the presence of at least one of the decentralizing forces discussed in Section 4.1.

4.22. Information Asymmetries in Hierarchical Fiscal Relationships

Although the assumption that local officials have more of the relevant information than central government officials (see Section 4.12) represents one of the arguments in favor of fiscal decentralization, this informational asymmetry is not incorporated into many of the treatments of hierarchical government interactions. In recent years, however, the principal-agent nature of the fiscal relationship between different levels of government has become an item of greater research interest (Wellisch, 2000), and a serious treatment of moral hazard and adverse selection issues in the area of intergovernmental grants is likely to emerge along the lines of similar treatments in industrial organization (Laffont and Tirole, 1993).

4.23. Political Distortions and Imperfect Voter Information

In 4.21, we described hierarchical fiscal interactions arising as a solution to a prisoners' dilemma faced by local jurisdictions that do not take into account the impact of their policies on other jurisdictions. In the presence of purely Pigouvian policy makers, such a solution to the prisoners' dilemma (through policies such as intergovernmental grants) can be strictly welfare enhancing. As policy makers are viewed through a more Leviathan lens, however, such coordination can become more pernicious as it could be used to protect local governments from healthy competition in much the same way as enforceable cartel agreements protect firms from such competition. Furthermore, the complexity of hierarchical fiscal relationships may obscure the connection between revenues and expenditures in the eyes of voters who may then find it more difficult to hold local governments accountable. Finally, questions have been raised as to whether it is a politically stable equilibrium to have a system in which revenues are raised at one level of government but autonomously spent at another.

In the most extreme Leviathan model, local rent-seeking politicians (in a model like Epple and Zelenitz's (1981) described in Section 3.3) would indeed find it in their interest to use central government coordination to reduce competition and thus raise political rents. But even in less extreme models, central government coordination policies may arise for reasons having much little to do with welfare-enhancing policy coordination. Nechyba (1997a), for instance, central government grants allow local residents to switch from property to income taxes even though the exclusive use of property taxes is a dominant strategy in the absence of central government coordination. If the ratio of income to property wealth is skewed to the left (with a majority of residents in each community having relatively less income than property compared to the community average), majorities would prefer such a switch in tax bases even though there is no reason to suspect an increase in general welfare from this change.[71] And, when the central government

[70] One concern raised in regard to matching grants based on local wealth arises from the general equilibrium prediction that such grants will lead to capitalization effects that "undo" the grants by raising property values (and thus local wealth) in poor districts and lowering values in rich districts (Inman and Rubinfeld, 1979). In a setting in which housing quality is realistically calibrated, however, this general equilibrium effect seems to be relatively small (Nechyba, 1996).

[71] In fact, for communities in New Jersey, the ratio of income to property wealth is skewed in exactly this way – giving rise to the prediction that voters would prefer proportional income to proportional property taxes (Nechyba, 1994). Other explanations for the desire to limit local property taxes abound – see for example Vigdor (2001) and references therein.

legislative process is modeled, political decisions are focused on funding (through grants) projects with concentrated local benefits (also termed "pork barrel projects) that may or may not be efficient.[72]

To the extent that fiscal government institutions rely on voters to hold even partially Leviathan politicians accountable, simplicity and transparency of the system is typically discussed as a virtue (Boskin, 1996; Aaron and Gale, 1996). More formally, such transparency would certainly be necessary in a yardstick competition model (see Section 3.43) where the activities in neighboring jurisdictions are used as a yardstick to judge the effectiveness of local politicians because voters do not have enough information to judge such effectiveness more directly. In a model that explicitly introduces lobbying and influence costs (as in Section 3.44), one can explicitly derive the result that politics requires constraints on hierarchical interactions – constraints that would not be optimal in a Pigouvian world (Besharov, 2002).

Finally, the literature has not yet resolved under what conditions a permanent division between provision of services (at the local level) and financing of those services (partially at the central government level) is a stable political equilibrium. Nechyba and McKinnon (1997) suggest anecdotally that, under certain assumptions, it may not be a stable equilibrium given that voters may have difficulty holding either level of government accountable, and that either central governments will impose constraints on the spending of centrally raised revenues that will in effect remove any benefits from local provision, or central governments will relinquish the funding of services over which they have little control. A formal treatment of this topic may be the subject of fruitful future research.

4.24. Intergovernmental Grants, "Soft Budgets" and Future Generations

The danger of "soft" budget constraints in generating excessive debt under fiscal decentralization has been emphasized in the debate on the difference between competition between nation states (whose budgets are "soft" due to their ability to print currency) and sub-national governments (whose budget constraints are "hard"). This literature emphasizes the role of political constraints that credibly combine monetary centralization with fiscal decentralization to generate hard budget constraints for those political units that compete.[73] Thus, decentralized governments are forced to make economic tradeoffs within their jurisdictions without being able to rely on passing costs to future generations or to others taxed by the central government. Qian and Roland (1998) set up a formal framework and apply this to an analysis of economic transition in China, and Weingast (1995) argues that such considerations were important in the development of England and the U.S. in the 18th and 19th centuries.[74] A fuller and more formal treatment which identifies more precisely the conditions under which central government access to monetary policy softens local budgets and leads to exploitation of future generations remains for future research.

5. Empirical Research

[72] Inman and Rubinfeld (1996) exposit a simple model of distributive politics of this kind. Inman (1988) argues that federal grants to U.S. states cannot be explained on either equity or efficiency grounds but can be explained as resulting from such a system of distributive politics.

[73] McKinnon (1997) and McKinnon and Nechyba (1997) provide some informal discussion of the possibility that even local budgets can become "soft" if excessively linked to central governments through intergovernmental grants. Motivated by the observation that a wave of local defaults preceded imposition of local debt limits in the U.S., Epple and Spatt (1986) develop a model in which state restrictions on local debt "harden" budget constraints by ensuring political support in state legislatures for measures that require localities to repay their debt obligations.

[74] For a more detailed review of this literature on "market preserving federalism," see also Oates (1999).

In this section, we discuss innovative empirical contributions within roughly the last decade. Research in the past decade has increasingly turned to empirical analysis seeking to take more explicit account of the interdependence among jurisdictions that arises from interjurisdictional mobility of households. This emphasis is reflected in work on yardstick competition, tests for fiscal interdependence, estimation of structural equilibrium models, and testing of effects of jurisdictional competition on public sector efficiency. A significant body of empirical research has also emerged investigating the effects of vertical interdependence among state and local governments as reflected, for example, in tax and expenditure limitations. Recent work has also continued an important agenda item from prior research—empirical analysis of the collective choice processes within jurisdictions. A growing body of theoretical work has focused on intra-jurisdictional choice, and empirical work has begun to follow suit. Portrayal of empirical research on the above topics is the task of this section.

5.1. Capitalization

Research on capitalization among local jurisdictions has been motivated from the outset (Oates, 1969) by an interest in testing for effects of interdependence among jurisdictions. In this respect, research on capitalization is an important precursor of current research on jurisdictional interdependence. Research on capitalization continues. Past work focused largely on testing for capitalization of fiscal differences across jurisdictions into property values. An innovative application by Black (1999) investigates capitalization within jurisdictions. In particular, she investigates the extent to which differences in school quality across neighborhood schools within a district are capitalized. A further novelty of her approach is using data for houses located near the boundaries delineating neighborhood school attendance zones. Neighborhood characteristics other than schools will tend to be similar for houses near each other across such boundaries, thus limiting the potential for confounding school differences with other neighborhood differences. There is much interest in learning whether differences in public service quality are capitalized when there are neither differences in per student expenditures nor tax rates. Black finds evidence of substantial housing price variation associated with differences in measures of school quality. Her findings lend support to models discussed in Section 3.54 that predict that housing price differentials will support stratification across locations even when there are no differences in expenditure levels—models that also imply that expenditure equalization across communities may have little effect in reducing stratification by income and other demographic variables.

5.2. Jurisdictional Fiscal Inderdependence, Competition and Efficiency

To economists, and probably to most everyone else, it is natural to think that competition among jurisdictions should stimulate providers to function more efficiently. This might occur, for example, by limiting the discretion of providers or special interests to pursue objectives that are not congruent with the interests of jurisdiction residents (Brennan and Buchanan, 1980; Epple and Zelenitz, 1981; Courant, Gramlich and Rubinfeld, 1979). Tests of this hypothesis by Oates (1985) led to a substantial body of empirical research investigating whether fiscal decentralization affects public sector expenditures. Responding to research stimulated by his contribution, Oates (1989) provides an illuminating assessment of the approaches and findings from the series of papers that followed his initial contribution. His bottom line: The evidence supports the conclusion that increased competition via an increase in the number of general-purpose governments serving an area tends to restrict government spending while an increase in the number of special-district governments (e.g., water authorities) tends to increase spending, perhaps due to loss of scale economies. This conclusion highlights an issue that appears to warrant greater theoretical attention, namely research focused on better understanding the complexity of overlapping local governmental units that provide goods and services by some combination of taxation, fees, and intergovernmental revenues.

The work stimulated by Oates addresses the issue of whether spending falls with increased competition, but does not address the issue of whether resources are used more efficiently as competition increases. For many locally provided government services, measures of output are difficult to obtain. However, for education, standardized test scores and post-school earnings

provide outcome measures that are comparable across school districts. In an influential contribution, Hoxby (2000) studies the effects of school district competition on educational outcomes as well as expenditures. Since the number of school districts is potentially endogenous, Hoxby introduces a further innovation by use of natural impediments to travel (e.g., rivers) as instruments for number of districts. She finds that greater competition among school districts has a significant effect both in improving educational outcomes and in reducing expenditures per student. While the both effects are of moderate size, her work suggests that decentralization not only constrains expenditures but also promote more productive use of resources.

In Section 3.43, we discussed research on voter information and agency problems, noting that decentralization may potentially improve governmental efficiency by providing alternatives that residents may observe in assessing how efficiently their government is functioning. In an admirable blend of theory and empirical research, Besley and Case (1995a) develop and test a model of yardstick competition. Their theoretical framework introduces imperfect information on the part of voters, presuming that incumbents know more about short-run changes in fundamentals than do voters. Electoral officials (governors) vary in competence. Voters face the task of deciding how much of a change in their state's taxes is due to a change in fundamentals and how much is due to the competence of their elected governor. Voters use outcomes in other states to obtain an assessment of the relative performance of their state government; other jurisdictions thus serving as a "yardstick." Their empirical evidence, based on jointly analyzing state taxes and gubernatorial election outcomes for U.S. states, supports the prediction that yardstick competition does indeed affect political outcomes state tax setting This paper is one of the few to model formally the role of informational asymmetries between voters and providers and among fewer still in testing the predictions of such a model. Their paper thus serves as a yardstick for judging future contributions in this realm.

A substantial body of research has emerged, investigating interdependence among jurisdictions in tax and expenditure decisions. Among the first is the work of Case, Hines, and Rosen (1993). They develop and test a model in which a state's expenditures may generate spillovers to neighboring states. An innovation in their approach is allowing for spatially correlated shocks as well as spillovers. Using data for a panel of states, they find evidence of strikingly large impacts; a dollar increase in spending by a state leads to an increase of seventy cents in neighboring states. Further evidence of interdependence of state fiscal policies is provided by Figlio, Kolpin and Reid (1999). They test for interdependence in setting of state welfare benefit levels. They find that states not only respond to changes in benefits by neighbors, but also that the response is asymmetric. A state tends to respond more strongly to a drop in benefits in a neighbor state than to an increase. They find, as did Case, Hines, and Rosen, that the effects arising from interdependence across states are large. Brueckner and Saavedra (2001) present a model to test whether there is strategic tax competition among local governments. Following the tax competition literature, their model takes populations as fixed and capital as mobile. Using data for localities in the Boston SMSA, they find that tax reaction functions slope upward, implying tax interdependence among local jurisdictions.

Spillovers and strategic interactions among jurisdictions will tend to lead to allocative inefficiencies. Impacts of the magnitude estimated in Case, Hines, and Rosen (1993) would seem to suggest that the inefficiencies may be very large indeed. We thus need to learn more about the nature and equilibrium consequences of the interdependences pointed to in these empirical analyses. Does greater decentralization improve efficiency via increased competition (Hoxby) and improved voter information (Besley and Case), or are such gains offset by ~~adverse offsetting effects due to~~ externalities or to inefficiencies associated with mobility of resources that localities seek to tax?

5.3. Politics, Institutions and Fiscal Outcomes

While the evidence points to interdependence in fiscal policies, institutions also have been found to be important. The work of Romer and Rosenthal (1978, 1979) provides compelling evidence on

this score with respect to local government referenda and agenda setting. Recent work has contributed to the agenda of studying state and local government institutions. Besley and Case (1995b) investigate whether gubernatorial term limits affect taxes and spending. As in their work on yardstick competition, competence of governors varies and must be inferred by voters from observed outcomes. In the model, performance of first-term governors affects their re-election prospects. Outcomes depend both on competence and effort, implying that, ceteris paribus, governors in their last term will perform less well than governors eligible for re-election. They find that changes in both tax and expenditure outcomes are consistent with the model's predictions.

Bohn and Inman (1995) study the effect of balanced-budget rules on state deficits using a 22-year panel for the states. They find that balanced-budget rules limiting end-of-year deficits do indeed limit deficits. Dye and McGuire (1995) find that state rules limiting local taxes retard growth in local government spending. Poterba and Rueben (1995) study the effects of local property tax limits in public employee wages, finding that more stringent property tax limits are associated with lower growth in public employee wages. Poterba (1994) studies how state institutions and politics affect state responses to the severe fiscal shocks of the late 1980's and early 1990's. He studies the effects of state constitutional restrictions on deficits and on permissible tax rates. He also investigates how adjustment to fiscal shocks is affected by party control, focusing, in particular, on whether a state has divided government and on the timing of elections. He finds that expenditure adjustments to shocks are more rapid where balanced-budget rules are stringent, and that tax increases in response to adverse shocks are smaller where tax-limitation rules are more stringent. He also finds that that single-party control increases the speed of response to fiscal shocks, and that tax increases and spending cuts are smaller in election years. The former result is consistent with findings of Alt and Lowry (1994) that states with divided government are more likely to run deficits.

As Poterba (1996) notes, the above findings with respect to budgetary institutions may be a manifestation of effects that persist even if they are not congruent with voter preferences. Alternatively, the institutions may evolve to reflect voter preferences. This is clearly a central issue in assessing the desirability of these rules and a key agenda item for future research. An important step toward addressing endogeneity of tax limitation rules is taken by Figlio (1997). He tests the effects of tax limits while allowing for potential endogeneity of the limits. He finds that correcting for potential endogeneity increases the magnitude of estimated effects of the limits. His findings are also of substantive policy interest; his results imply that tax limits are associated with higher student-teacher ratios, lower starting salaries for teachers, and lower student performance.

Adoption of limits often appears puzzling. Why would voters support restrictions at the state or national level that limit policy options available to voters at the local level? Vigdor (2001) presents an intriguing new perspective on this question, providing a rationale for voters to support state tax limitations that affect local jurisdictions other than the one in which they reside. Why? A voter might prefer another jurisdiction more than her own if the taxes in that other jurisdiction were reduced. Voting on a referendum to support a state-imposed tax limit on local taxes provides a vehicle to act on this preference. Vigdor presents empirical evidence supporting this prediction for Proposition 2 ½ in Massachusetts.

The question raised by Poterba, do institutional constraints reflect voter preferences, suggests research on conditions under which policies, such as mandates by a higher to a lower-level government, will be immune to change once adopted. Calabrese (1999, 2001) provides an illuminating analysis in this respect. Prior to 1842, states determined whether their representatives to the U.S. House of Representatives were elected in single-member or multi-member districts. In 1842, the federal government adopted legislation mandating single-member districts. Why? Calabrese develops a model and empirical evidence demonstrating that the party opposite the president is advantaged by multi-member-district elections. Thus, when the same party controls the presidency and both houses, as in 1842, there is an incentive to mandate election of representatives by single-member districts. Since it is in the interest of the president to oppose a

return to multi-member districts, the single-district mandate can be overridden only in the unlikely event that the party opposite the president controls two-thirds of both houses. The federal mandate adopted in 1842 endures to the present. This case illustrates that institutional change can be, essentially, irreversible. It would be of interest to investigate whether there are other institutional constraints governing state and local governments that have a similar enduring quality.

Another route by which policy is established is in the courts. For the past three decades, dating from the US Supreme Court refusal to enter the fray, state courts have been the battleground for efforts to impose greater equality in education spending. Not surprisingly, there has been a great deal of variation in state court decisions. This variation provides the foundation for analyses by, Murray, Evans, and Schwab (1988) testing the effects of court-mandated equalizations. They find that court mandates have, in fact, resulted in more equal spending within states. The bulk of variation in per pupil spending is now due to interstate rather than intra-state variation.

5.4. Structural Estimation of Locational Equilibrium Models

With the exception of research on tax capitalization, most empirical work prior to the past decade took limited account of the interdependence among jurisdictions. Interjurisdictional mobility had, however, been emphasized by Goldstein and Pauly (1981) as a potential source of bias in estimating demand functions for local public goods. An innovative approach for taking account of this potential source of bias in work with micro data was provided by Rubinfeld, Shapiro, and Roberts (1987).

As we detail in Section 3, much work has been devoted to developing theoretical models to characterize equilibrium among local jurisdictions. This work in turn has stimulated efforts to estimate "structural econometric" counterparts to these equilibrium models. Three general approaches have emerged. One is due to Epple and Sieg (1999) who estimate a model that follows on the work of Ellickson (1971), Westhoff (1977), Epple, Filimon and Romer (1984, 1993) and Epple and Platt (1999). They implement a two-stage approach, using data from the Boston SMSA. Their first stage entails choosing parameters of the model to fit the observed income distributions in each of the 92 communities in the SMSA. The second stage entails estimating the remaining parameters of the model by exploiting the necessary conditions for locational equilibrium implied by the theoretical model. A striking finding of their analysis is that a relatively parsimonious parameterization of their equilibrium model fits the 92 community income distributions in the Boston SMSA quite well. They also find that the preference parameters estimated with their approach imply the single-crossing conditions embodied in the underlying theoretical framework. Sieg, Smith, Banzhof, and Walsh (2003) extend and apply this approach to study the benefits of air pollution abatement in the Los Angeles metropolitan area. They find that the estimated benefits of pollution abatement using a framework that allows for equilibrium adjustments to air quality changes are quite different from those obtained with approaches that neglect such adjustments.

A second approach to structural econometric modeling is developed by Bayer, McMillan and Rueben (2002). Their point of departure is the discrete-choice framework of Berry, Levinsohn, and Pakes (1995), in which choice-specific unobservables are present. Their model, in the spirit of Dunz (1985) and Nechyba (1997b), takes the stock of housing in the metropolitan area as given and studies the housing choices of individuals with varying demographic characteristics. A virtue of their approach is that it is possible to allow for a relatively large set of observable characteristics of individuals. Individuals' choices of locations depend on the physical characteristics of the houses and locations as well as the demographic characteristics of the neighbors at each location. They take household employment locations as given. They estimate their model using Census micro data for the Los Angeles metropolitan area. They can then explore via simulations how changes in the distribution of characteristics of the population would affect the equilibrium allocation of population across the set of houses in the metropolitan area. As an application of their framework, they investigate the extent to which racial segregation would change if income distributions of the different races were more to become more similar. They find that this would result in increased racial segregation; members of a race could then more readily

find neighborhoods with members of their own race who have similar social-economic characteristics. While they model neighborhood demographic composition as endogenous, their approach takes local government tax and expenditure policies to be exogenous. For their application to the Los Angeles basin this is a reasonable approximation given the constraints now imposed on local governments in California.

A third approach is due to Ferrerya (2002a, 2002b) who estimates an extension of the model of Nechyba (2000). Motivated by the prominent role that religious schools play in the debate on vouchers, Ferrerya introduces religious preferences into Nechyba's model. She then estimates the parameters of the model using maximum likelihood, solving for equilibrium at each evaluation of the likelihood function. Her work thus innovates both by introduction of religious preferences and by embedding the solution for equilibrium in the estimation of the parameters of the model. Her work permits policy analyses comparing equilibrium with a voucher that permits users to attend religious private schools to a voucher that can only be used at non-sectarian private schools.

5.5. Collective Choice and Local Fiscal Institutions

Because of their number and heterogeneity, local jurisdictions have provided a valuable base of data to test models of collective choice. At least since the work of Barr and Davis (1966), local jurisdictions have been used for such tests. New work in this domain has emerged during the last decade.

Understanding political participation has long been one of the major challenges in research on political economy. Two papers in the last decade have tested theories of participation exploiting state and local government data. Shachar and Nalebuff (1999) propose a model in which leaders influence election outcomes via the effort they exert in getting followers to vote. Thus leaders rather than individual voters make strategic decisions that influence votes, their decisions being with regard to the amount of effort to exert in a particular contest. Structural estimates of the parameters of the model are then obtained using data for U.S. presidential elections, with state party leaders modeled as choosing the effort level to exert in getting out the vote. Coate and Conlin (2001) develop still another model of turnout in which voters are members of one of two competing groups, those favoring and those opposing a referendum proposal. Their model is one in which a voter's decision about participation is based on the tradeoff between the individualized cost of voting on the one hand and benefits realized from "doing one's part." They use data from Texas liquor referenda to estimate the model. The parameter estimates prove to be of reasonable magnitude, and the model outperforms two alternatives that they consider. Thus far, models of voting over local tax and expenditure decisions have typically assumed full turnout, despite the observed abysmally low turnout in many local elections. The preceding papers point to potential directions for introducing turnout in such models.

Epple, Romer, and Sieg (2001) test majority rule in the context of an equilibrium model of local jurisdictions. Using data for the 92 municipalities in the Boston SMSA, they test whether public good levels are consistent with the predictions of majority rule. The results reject the myopic voting model, which has been almost universally used in modeling voting over local government tax and expenditure decisions. Their evidence suggests that more sophisticated utility-taking models may better explain the data. Given the central role that voting plays in most equilibrium models of local jurisdictions, these results point to the need for additional work in developing an empirically valid characterization of voter behavior in local elections.

6. Conclusions

Given the increasing trend toward fiscal decentralization and greater factor mobility, it is not surprising that substantial attention has been devoted to these topics by academic economists over the past decade. Several important themes for future research arise from our discussion in this chapter: First, while simple versions of more general models have clarified many analytic issues,

policy tradeoffs are ultimately made in complicated settings rich with institutional detail. As a result, while theoretical questions remain, the search for a greater connection between theoretical models and data has taken on particular importance. Complex general equilibrium models of fiscal decentralization ultimately become most useful (while retaining the rich set of tradeoffs inherent in the economic environments of interest) when underlying parameters are determined by the data. Both calibration and structural estimation techniques are advancing this portion of the literature.

Second, the last decade has seen an increasing emphasis of political forces in debates over fiscal decentralization. Not only does such decentralization carry with it potential economic benefits and costs, but political decisions are likely to be fundamentally different in a decentralized environment. Important further work on political institutions under fiscal decentralization is needed and, on a more abstract level, includes a push toward a better understanding of how entire political systems compete under decentralization.[75]

Finally, as decentralization has been studied in multiple contexts, it has become increasingly clear that the micro-foundations of local goods and services need further theoretical and empirical investigations. Many such goods (such as crime prevention and schooling) depend fundamentally on peer and neighborhood effects, and predictions can change fundamentally as such effects are introduced into the analysis. Similarly, locally provided goods may have private alternatives that can alter predictions when included explicitly in the analysis, and commuting costs may play important roles within urban and regional settings.

[75] This is labeled "Systems Competition" in one recent contribution to the literature (Sinn, 2003).

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