Theories of Tax Competition

Abstract - *A central message of the tax competition literature is that independent governments engage in wasteful competition for scarce capital through reductions in tax rates and public expenditure levels. This paper discusses many of the contributions to this literature, ranging from early demonstrations of wasteful tax competition to more recent contributions that identify efficiency-enhancing roles for competition among governments. Such roles involve considerations not present in earlier models, including imperfectly-competitive market structures, government commitment problems, and political economy considerations.*

INTRODUCTION

The modern literature on tax competition began with an attempt to understand the potential efficiency problems associated with competition for capital by local governments. Oates (1972, p. 143) describes this problem as follows:

> "The result of tax competition may well be a tendency toward less than efficient levels of output of local services. In an attempt to keep taxes low to attract business investment, local officials may hold spending below those levels for which marginal benefits equal marginal costs, particularly for those programs that do not offer direct benefits to local business."

In other words, local officials will supplement the conventional measures of marginal costs with those costs arising from the negative impact of taxation on business investment. These additional costs might include lower wages and employment levels, capital losses on homes or other assets, and reduced tax bases. Their presence will reduce public spending and taxes to levels where the marginal benefits equal the higher marginal costs. Oates's conclusion that this behavior is inefficient rests on the idea that when all governments behave this way, none gain a competitive advantage, and consequently communities are all worse off than they would have been if local officials had simply used the conventional measures of marginal costs in their decision rules.

Since the mid-1980s, there has been an outpouring of academic research on tax competition, and this research continues unabated. Interest in this area has been stimulated by highly publicized instances where U.S. states and localities do seem to have engaged in tax competition, including the many cases where they have offered large subsidies to foreign and domestic automobile companies in an attempt to

John Douglas Wilson

Department of Economics, Michigan State University, East Lansing, MI 48824

influence plant location decisions. In addition, researchers and policymakers have found that Oates's (1972) description of tax competition can be applied more broadly to a host of important policy concerns, such as competition for investment through weaker environmental standards or reductions in welfare payments by states trying to avoid attracting poor households.

More generally, the view that intergovernmental competition is wasteful has raised fundamental questions about the appropriate roles of the central government and lower level governments. In particular, this view runs counter to the highly influential "Tiebout Hypothesis." Tiebout (1956) argues that competition for mobile households is welfare enhancing, and subsequent work has applied similar ideas to competition for mobile firms, in direct conflict with much of the tax competition literature. This conflict is reflected in the ongoing "devolution debate" over the desirability of "devolving" federal responsibilities to lower levels of government within the United States.[1]

Moreover, this conflict has surfaced in debates concerning the appropriate degree of economic integration between countries. In Europe, integration has proceeded to the point where barriers to labor and capital mobility have been officially dismantled (although cultural barriers remain). The Tiebout literature supports policies that allow free factor mobility and enable national governments to function independently in most policy areas, and the Treaty on the European Union reflects a presumption in favor of this independence. In contrast, the tax competition literature draws attention to the potentially adverse effects of this independence. Similar concerns about integration surface in Sinn's (1997) discussion of the "selection principle," which identifies a "fundamental selection bias towards [government] activities that have proved

to be unsuitable for private markets" (p. 248). Through a series of examples, Sinn essentially argues that if private markets fail to efficiently provide particular goods and services, then introducing competition among governments that seek to provide them will generate similar problems.

Given the central importance of tax competition in these ongoing policy debates, the time seems ripe to assess what we have learned from the large and growing theoretical literature on this phenomenon. This is the objective of the present paper.

The scope of my discussion is broader than Oates's (1972) original description of tax competition. Thus, I discuss models in which the governments may be interpreted as local, state, or provincial governments within a country, or as countries within the world economy. I often use the term "region" to encompass these various interpretations. A common feature of most of the models considered here is that each government independently (or "noncooperatively") chooses its tax or subsidy policies to maximize the welfare of residents within the region, and its choice affects the size of the tax bases available to other governments. These tax bases often consist of mobile capital, but I consider alternatives, such as competition for cross-border shoppers. While the main focus of my discussion is on the noncooperative choice of taxes or subsidies, I also discuss cases in which governments compete by using nontax instruments such as expenditure or regulatory policies.

My survey shows that the initial formal models of tax competition largely confirm Oates's (1972) conjecture, since they stick most closely to the situation he envisioned. Subsequent extensions of these models produce a variety of inefficiencies that differ from the original conclusion that taxes and expenditures are inefficiently low. Toward the end of the paper, I discuss recent work that identifies some

---

[1] See Tannenwald (1998) for an overview of this debate.

beneficial effects of competition among governments that seem not to have been previously recognized, in part because they represent departures from both the standard tax competition models and Tiebout models. My concluding remarks call for more work on the potentially important trade-offs between the good and bad aspects of intergovernmental competition.

This paper is organized as follows. I begin in the next section by discussing the idealized Tiebout world and how tax competition models typically depart from it. The third section then surveys a large number of models in which governments use tax policies to compete for mobile capital. Throughout this discussion, firms are assumed to be competitive, and only taxes on mobile capital are considered. The fourth section discusses several attempts to expand the basic model to include multiple tax instruments, including models where both capital and labor are mobile. In the fifth section, I change the focus to "commodity tax competition," where regions compete for cross-border shoppers, a situation that is relevant not only for regions, states, or provinces within a single country, but also for countries with few border controls, such as the European Union. The sixth section briefly discusses competition involving nontax instruments. In the seventh section, I turn to two areas of research where the concern has been that taxes are too high, not too low: competition between different levels of government ("vertical tax competition") and the use of double taxation conventions. The eighth section then discusses several lines of research that have identified some possible efficiency-enhancing roles for tax competition. The ninth section provides conclusions.

To keep this survey manageable, I restrict its focus in several respects. In keeping with common practice in the literature, I limit the discussion to full employment

models. As Huang (1992) argues, unemployment may provide an additional incentive for wasteful tax competition, since governments now benefit from the employment generated by additional capital.[2] My discussion of competition for capital is also restricted to "industrial capital," rather than "residential capital." The latter type of competition has been investigated using what Mieszkowski and Zodrow (1989) refer to as "metropolitan models." Such models contain residential housing and assume interjurisdictionally mobile residents, making them less applicable to tax competition between countries. Although I briefly discuss multinationals, interested readers should consult more specialized surveys on this topic, such as Gresik (1998) and Hines (1997, 1999). Finally, my focus on theories of tax competition precludes a detailed examination of the empirical work on its existence; see Brueckner and Saavedra (1998) for some empirical evidence and related references.

THE TIEBOUT MODEL

Tiebout's (1956) theory of local public good provision also provides a theory of efficient tax competition. In modern formulations of the theory, it is often assumed that each region's government is controlled by its landowners, who seek to maximize the after-tax value of the region's land by attracting individuals to reside on this land. To do so, the government offers public goods that are financed by local taxes. A critical assumption is that there are many "utility-taking" regions, in the sense that no single region can alter the utilities that must be offered to individuals to induce them to reside there. Thus, the model is quite similar to models of competitive markets for private goods, with land rents serving as profits and utilities serving as prices. Therefore,

---

[2] Haaparanta (1996) also examines a model with unemployment, using the common agency approach discussed below.

it is not surprising that the equilibria for such models are found to be efficient under the usual definition of efficiency: a central authority cannot feasibly reallocate goods and resources in a way that makes some individuals better off without making anyone worse off. There is tax competition here in the sense that a region's taxes must be kept low enough to induce individuals to reside in the region, given the public goods that are being provided. These taxes are collected from residents in the form of efficient "head taxes," and they are chosen so that each resident's tax payment equals the cost of providing him with the chosen levels of public goods and services. This marginal-cost-pricing rule results in efficient migration decisions.

There is now a vast literature extending these efficiency results in various directions. As originally suggested by Fischel (1975) and White (1975), the theory may be easily extended to include mobile firms. These firms are modeled in effectively the same way as mobile residents by assuming that they are in infinitely elastic supply to any given region and that the region supplies them with various "public inputs." In equilibrium, each firm is assessed a tax equal to the marginal cost of supplying it with these public inputs, and the equilibrium is efficient. See Richter and Wellisch (1996) for a detailed development of this extension. Wellisch (forthcoming) discusses this and several other extensions. Note, in particular, that the model may be extended to include not only mobile firms, but also mobility of both the labor and capital that they employ.

Wasteful tax competition involves some type of departure from the idealized settings of "Tiebout models." The main source of departure is the existence of "interregional externalities," whereby the actions that one region's government takes to increase the welfare of its own residents leads to reductions in the welfare of residents in other regions. In the tax competition literature, this externality is often described as a "fiscal externality," which occurs through the effects of one region's public policies on the government budgets in another region (Wildasin, 1989). For example, when a region lowers its tax rate on mobile capital, it gains capital at the expense of other regions, causing their tax bases to fall and, hence, their tax revenues to decline. Such externalities are often present in tax competition models because governments are assumed not to possess unlimited taxing powers. In particular, the assumption of efficient taxes on residents or firms is clearly violated in practice.[3]

Another type of externality is the "pecuniary externality" that exists when regions are large enough to affect the product or factor prices confronting other regions. I show in the "Large Regions" section that these externalities lead to inefficient policy differences across regions, causing a misallocation of factors. They do not, however, allow us to conclude that taxes and public spending are too low in some overall sense.

Other interregional externalities arise as a result of inefficiencies in private markets, coupled with the failure of governments to correct them. In particular, this study briefly addresses the issue of tax competition under imperfect competition.

Finally, regional governments may make policy choices that are not in the best interests of their residents. Such behavior may give rise to various interregional externalities. However, we cannot say a priori whether the interregional mobility of factors improves or worsens the behav-

---

[3] Hamilton (1975, 1976) argues that the zoning policies employed by local governments can turn property taxes into efficient "user fees" for local public goods, but the availability and use of efficient zoning policies is open to question. See Mieszkowski and Zodrow (1989) and Ross and Yinger (1998) for critical assessments of Hamilton's view, and see Hoyt (1991a), Krelove (1993), and Wilson (1997) for analyses of the residential property tax as an "inefficient user fee."

ior of these governments. The "Political Economy" section discusses a model in which government behavior is made more efficient by the presence of free factor mobility.

CAPITAL TAX COMPETITION

Following Oates's (1972) discussion of tax competition, it was not until the mid-1980s that economists began to build formal models based on his ideas. Two of the earliest papers were Zodrow and Mieszkowski (1986) and Wilson (1986).[4] Since the production structure in Zodrow and Mieszkowski's model is simpler than Wilson's structure, I let their model serve as the "basic tax competition model" in this survey. The model is next presented in its simplest form, and then it is extended in various directions.

Competitive Regions

Consider a system of many regions, which may be variously interpreted as cities, states, provinces, or countries. Within each region, competitive firms produce a single output, using two factors of production: mobile "capital" and an immobile factor that I will call "labor."[5] The immobile factor is inelastically supplied by the region's residents, who are themselves immobile (an assumption that I drop in the "Labor Mobility" section). These residents also own fixed endowments of capital, and the assumption of perfect capital mobility means that they are free to invest their capital anywhere.[6] Once investment and production take place, the output is sold to residents as a final consumption good, and to the government as an intermediate good, which it then trans-

forms into a public good. Income distribution issues are ignored by assuming either that each region's residents are identical or that their aggregate welfare can be depicted by the preferences of a "representative consumer." In particular, these preferences are represented by a well-behaved utility function, $U(C, G)$, where C is private consumption and G is consumption of the public good. The representative consumer finances C with the wage and capital income from her endowments of labor and capital. Summing the capital endowments across the residents in all regions gives the fixed supply of capital in the "world economy."

A critical assumption in this model is that each region's public good supply is financed by a tax on the capital employed within its borders. One simple justification for this assumption is that the government finds it administratively convenient to tax both capital and land at the same rate, as in the case of local property taxation in the United States. I later discuss a three-factor model that explicitly includes a uniform property tax on mobile capital and immobile land, and I also discuss models where governments choose among multiple tax instruments. But for the "basic model," I follow Zodrow and Mieszkowski (1986) by assuming that only capital is taxed, although each region's residents would be better off paying a head tax.

The problem confronting a region's government is to choose the unit tax rate on capital, t, to maximize the representative consumer's utility, $U(C, G)$, subject to a budget constraint requiring that tax revenue equal public good expenditures:

[1] $\quad tK(r + t) = G$

---

[4] See Beck (1983) for another early, but less general, treatment of tax competition.

[5] Zodrow and Mieszkowski (1986) interpret the immobile factor as land and assume no absentee ownership, an assumption that I address below. They also allow regions to possess market power, an extension I leave to the "Large Regions" section.

[6] The tax competition literature has devoted little attention to the intermediate case of "imperfect" capital mobility. For an exception, see Lee (1997).

where r is the after-tax return on capital, which is equated across regions by capital mobility but treated as fixed by any small region; and $K(r + t)$ is a function relating the demand for capital in the region to the cost of capital, $r + t$.[7] As more capital is invested in the region, its marginal product falls and the marginal product of labor rises. Firms invest to the point where the marginal product of capital equals $r + t$.

Consider now the government's optimality condition for G. To finance a unit rise in G, the government must raise t. As a result, the cost of capital rises, causing the demand for capital to change by some negative amount, ΔK. Since r is fixed from the region's viewpoint, however, the higher tax rate does not reduce the residents' capital incomes. Instead, they indirectly pay the tax through a decline in their wages. In particular, if a unit rise in G requires that t be raised by Δt to balance the budget, then wage income will fall by the resulting rise in the cost of capital, $K\Delta t$, to prevent firms from earning negative profits. Unfortunately, this tax increase must be high enough to not only pay for the "marginal resource cost" of G, denoted MC, but also to offset the negative impact of the capital outflow on tax revenue, $t\Delta K$. Thus, the resulting fall in the residents' wage income will exceed MC by the positive amount, $-t\Delta K$. At the region's optimal level of G, the sum of the residents' marginal willingness to pay for another unit of G, or "marginal benefit" of G, is equated to this wage reduction:

[2] $MB = MC - t\Delta K$

Alternatively, it is possible to use the dependence of ΔK on the elasticity of the demand for capital with respect to the cost of capital to rewrite equation 2 as follows:[8]

[3] $MB = \dfrac{MC}{1 - \tau\varepsilon}$

where ε denotes this demand elasticity (measured positively) and τ is the *ad valorem* tax rate, $\tau = t/(r + t)$.

To conclude, both of these rules demonstrate that the marginal benefit of G exceeds the marginal resource cost to compensate for the tax-induced capital outflow. In other words, we have a "modified" Samuelson rule for public good provision, since the actual Samuelson rule for efficient public good provision would require that $MB = MC$.

The tax rate t in these rules has an important interpretation. It represents the discrepancy between the social value of an additional unit of capital and the social opportunity cost of this unit, measured from the single region's viewpoint. This social value is the marginal product of capital, MP_K, which firms equate to $r + t$ when they choose their profit-maximizing investment levels. In contrast, the social opportunity cost is only r, since the tax provides revenue for the government and is therefore not a social cost. Thus, $t = MP_K - r$. It is this discrepancy between the value and opportunity cost of capital at the margin that implies that the region benefits from a capital inflow and is harmed by a capital outflow. In a more general model, we would recognize that capital investments impose various burdens on the public sector, such as the increased demands for public infrastructure and various public services. If capital were taxed to cover the marginal costs of these public goods and services, then the region would

---

[7]   For simplicity, the literature often specifies capital taxes as tax rates on each unit of capital. The distinction between unit and ad valorem taxes is irrelevant for the current model. When regions with market power are later considered, the equilibrium can depend on the form of taxation, but its qualitative properties do not change.

[8]   Using calculus notation, $\Delta K = (dK/dt)(dt/dG)$, where dt/dG is the rise in t needed to finance a unit increase in G. As noted in the text, wages fall by $K(dt/dG)$ to offset the higher capital costs, and this wage reduction is set equal to MB at the optimum. Thus, we also have $\Delta K = (dK/dt)(MB/K)$. Substituting this relation into equation 2 and rearranging gives equation 3.

be indifferent about a marginal inflow or outflow of capital, and so the terms involving t in equations 2 and 3 would disappear. But if capital is not taxed efficiently and we view the term t more generally as the difference between the social value and social opportunity cost of capital at the margin, then equations 2 and 3 remain valid. The subsequent analysis therefore can be given this more general interpretation.[9]

Having described a single region's optimal public good supply, let us now consider whether it is efficient for the system of regions as a whole. A critical insight from the tax competition literature is that a rise in one region's tax rate benefits other regions by increasing their capital supplies. Under the assumed fixity of the total capital stock, the tax-induced outflow of capital from the given region represents an inflow of capital to other regions, and the value of this inflow will depend on the tax rates being set in these regions. In particular, another region j benefits by the amount $t_j\Delta K_j$, where t_j is its tax rate and ΔK_j is the capital inflow that it experiences.[10] In other words, a rise in the given region's tax rate creates a positive externality. The region's government fails to account for such external benefits because it is concerned only with the welfare of its own residents. Consequently, it sets its tax rates and public good levels at inefficiently low levels.

The tax competition literature has focused heavily on the case where all regions are identical and therefore choose the same tax rates. This case nicely isolates inefficiencies in the overall level of public good provision from the efficiency and equity issues concerning differences in tax rates and public good levels across regions. In this case, the cost of a capital outflow from one region is exactly offset by the benefits from the accompanying capital inflows to other regions. Hence, ΔK disappears from rule 2 and we are left with the rule for effi-

cient public good provision, $MB = MC$. Starting from the equilibrium level of public good provision, where $MB > MC$, we can satisfy the efficiency condition by increasing all regions' tax rates and public good levels by identical amounts. These changes raise welfare in all regions.

Another way to satisfy the efficiency condition would be to close each region's borders to factor mobility, so that the region's firms could use only the capital supplied by its residents. In this case, the interregional externalities described above would disappear, and the capital tax would become equivalent to an efficient lump-sum tax. Thus, each government would independently choose to set its public good supply where $MB = MC$. With the borders open, however, no single government has an incentive to raise G to the point where $MB = MC$, given the costs associated with the resulting capital outflow. There must be some type of coordination among regions, suggesting a role for a central authority. This role is discussed below in the context of nonidentical regions.

Finally, two considerations may mitigate the tendency of regions to underprovide public goods. First, suppose that the model is modified to include a variable supply of capital for the system of regions as a whole, due to the savings behavior of residents. If a subset of regions increases its tax rates, then total savings may decline, dampening the amount of capital that is redirected to other regions. The interregional externalities remain, but their importance is somewhat reduced. We may conclude that allowing a variable supply of capital reduces, but does not eliminate, the tax competition problem.

Second, extending the basic model to include absentee ownership of the immobile factor, reinterpreted as "land," introduces "tax exporting" into the analysis. The capital tax is now capitalized into

---

[9] This discussion assumes an exogenous level of public infrastructure. See footnote 27 on this issue.
[10] I use subscripts to identify regions only in cases where they are needed to avoid confusion.

the return on land, passing part of its burden on to nonresidents. This form of tax exporting counteracts the effects of tax competition, thereby raising the supply of public goods.[11] As an empirical matter, it seems unlikely that households come close to owning the diversified portfolio of land needed to fully eliminate the underprovision problem in the basic tax competition model.

Corrective Policies

Regions may choose different tax rates because they possess different production technologies or their residents possess different preferences or factor endowments. If the tax rates do differ, then two types of inefficiencies exist in the economy. First, public good levels are set inefficiently, because regions fail to account for the interregional externalities discussed above. Second, capital is misallocated across regions, so that the marginal product of capital is relatively high in high-tax regions. A fully efficient allocation cannot be achieved if tax rates differ across regions, and identical tax rates are usually not consistent with efficient differences in public good levels across regions, unless a central authority also redistributes revenue across the government treasuries.

The central authority can achieve this efficient allocation by providing each region with a "corrective subsidy" on the revenue it raises, while at the same time engaging in lump-sum transfers of income between the regional governments. In symbols, a region-i government faces a grant schedule of the form

$$[4] \quad S_i = a_i + s_i(tK)$$

where the a_i's are positive or negative, reflecting the interregional transfers, and the s_i's denote the corrective subsidies. These subsidies have been suggested by Wildasin (1989) and analyzed further by DePater and Myers (1994). For a system of N regions, the a_i's and s_i's represent $2N$ variables that are chosen to satisfy the $2N$ conditions for an efficient allocation: the $N-1$ equations requiring that all regions choose the same tax rates, the N equations requiring that each region's public good level be set where $MB = MC$, and the requirement that the central authority's budget balance. In equilibrium, the corrective subsidies will generally differ across regions to induce them to choose the same tax rates. But the critical point here is that all corrective subsidies should be positive in equilbrium. Only then will regions be compensated for the positive externalities associated with increases in their tax rates.[12]

In practice, however, it is doubtful that the policy intervention described by equation 4 would be feasible, since it would require that the grant functions be tailored to the individual characteristics of regions, which might be difficult for a central authority to observe. A recent paper by Bucovetsky, Marchand, and Pestieau (1998) designs an alternative form of policy intervention that takes into account the central authority's information problem. Their model contains two types of regions, distinguished only by the residents' demands for public goods.[13] The central authority has two policy instruments: a "national capital tax," T, and a

---

[11] See Lee (1998) for a fuller treatment of the case of absentee landowners. Burbidge and Myers (1994) provide limited efficiency results for a three-factor model where capital and labor are mobile between two nonidentical regions and each individual owns equal amounts of capital, labor, and land in each region. But Bucovetsky (1995) emphasizes the inefficiencies that emerge from this setup when factor endowments are allowed to differ.

[12] By focusing solely on efficiency issues, this analysis ignores issues involving the interregional distribution of income. Given the limited policy instruments available to a central authority, it might want to deviate from an efficient allocation to reduce inequities in the income distribution.

[13] Following the basic tax competition model, Bucovetsky et al. (1998) assume many regions of each type. For the difficult problem of regulating large regions that possess informational advantages, see Dhillon, Perroni, and Scharf (forthcoming).

single grant schedule, which determines the total grant provided to a region as a function of the region's chosen tax rate. In symbols, the grant schedule may be described by a function, $S_i = f(t_i)$. The critical difference between this type of policy and the one given by equation 4 is that both types of regions must face the same function f, in contrast to the different linear functions in equation 4. Given this restriction, we should not expect the optimal grant function to induce the two types of regions to choose the same tax rates, since they would then receive the same grants, despite their preference differences.

The problem confronting the central authority is to choose T and the grant schedule to maximize the total welfare of residents, measured by summing the welfare levels of residents across all regions. Using solution techniques from principal-agent theory, Bucovetsky, Marchand, and Pestieau (1998) demonstrate that the optimal grant function induces the high-demand regions to choose a higher tax rate than low-demand regions. Thus, the capital market is necessarily distorted at the optimum as a means of inducing the different types of regions to select different grant levels. Moreover, the regions respond to the grant function by choosing inefficient public good levels. For the special case where public good demands are independent of income levels (quasi-linear preferences), Bucovetsky, Marchand, and Pestieau show that the high-demand regions underprovide the public good (i.e., $MB > MC$), but the low-demand regions are induced to overprovide the public good (i.e., $MB < MC$). This makes sense. In order to lessen the capital market distortions caused by raising the high-demand tax rate above the low-demand tax rate, the central authority accepts policies where the interregional difference between public good levels is less than it would be under an efficient allocation (where $MB = MC$ in all regions). It is striking, however, that information asymme-

tries can cause the central authority to "overcorrect" the tax competition problem by inducing some regions to go from undersupplying public goods to oversupplying them.

To advance our understanding of "optimal fiscal federalism," future research will increasingly need to take information problems into account. However, the information-based approach has two limitations. First, we do not have a good understanding of how information asymmetries occur between different levels of government, and what exact form these asymmetries take. Rather, we have vague ideas, such as the understanding that local officials know more because they are "closer to the people." Formal models that try to capture such ideas must usually assume such a simple economic environment that it seems difficult to justify why the central authority cannot easily obtain the information that is assumed absent. In Bucovetsky, Marchand, and Pestieau (1998), for example, it would seem to be a simple matter to check whether the demand for the single public good is higher in one region than in another. Future research should try to "endogenize" this lack of information, rather than simply assume it.

Second, this information approach to fiscal federalism is largely a normative exercise, in the sense that government officials at all levels of government seek only to raise the welfare of those individuals they represent. This ignores self-interested behavior and the constraints imposed by existing political institutions, both of which would be useful to model.

At the international level, there do not exist strong institutions for coordinating the activities of sovereign nations. The need to induce cooperation among such nations severely restricts the set of feasible policies. Fortunately, the tax competition literature often identifies forms of intervention that leave all regions better off, suggesting some scope for cooperation.

Large Regions

Suppose now that regions are large enough to influence the equilibrium after-tax return on mobile capital. For this large-region case, a Nash equilibrium is the accepted equilibrium concept. Specifically, the economy is in equilibrium when each region's strategy maximizes its objective function, given the strategies pursued by the other regions. The literature typically treats tax rates as the strategy variables, in which case public good levels adjust to satisfy each region's government budget constraint once all of the tax rates have been chosen. A single region chooses its tax rate, treating as fixed the tax rates chosen by other regions.[14] It then recognizes that the equilibrium after-tax return on capital depends on its chosen tax rate and that of every other region: $r = r(t_1, \ldots t_N)$, where t_i is the tax rate chosen by region i in a system of N regions. In particular, if region i raises its tax rate a unit, then its cost of capital, $r + t_i$, will rise by $1 + \Delta r$, which is less than one, because the resulting change in r, Δr, must be negative to clear the capital market. As a result, $K(r + t_i)$ is less sensitive to changes in t_i than in the case of many small regions, where r is fixed from a single region's viewpoint. An increase in one region's tax rate continues to create a positive externality through a capital outflow, but now this outflow is less severe, due to the partial capitalization of higher tax rates into the after-tax return on capital.

Consider first the simpler case of identical regions. Rule 2 remains valid, recognizing that the capital outflow, ΔK, is lower than before, and rule 3 is modified to account for the capitalization effect:

$$[5] \quad MB = \frac{MC}{1 - \tau\varepsilon(1 + \Delta r)}.$$

Thus, market power is actually beneficial from the viewpoint of welfare in the entire system of regions, since it lowers the perceived marginal cost of public good provision, thereby stimulating public good provision. Hoyt (1991b) carries this idea further by showing that public good levels and tax rates rise as the number of competing regions drops. Of course, there is no longer any tax competition problem once the economy contains only one region. In this case, there are no capital outflows, and a unit rise in t_i is fully capitalized into r, so that there is no change in the cost of capital, $r + t_i$.

New considerations arise when regions differ in size. Bucovetsky (1991) and Wilson (1991) analyze "asymmetric tax competition" between a "large" region and a "small" region, as distinguished by the number of residents, each possessing the same endowments of capital and labor. Since the large region is the relatively large demander in the capital market, an increase in its tax rate depresses the after-tax return on capital, r, by a relatively large amount. Thus, the cost of capital, $r + t$, is less sensitive to tax changes in the large region than in the small region. This consideration suggests that the large region will compete less vigorously for capital through tax rate reductions and therefore end up with the higher tax rate. Bucovetsky and Wilson demonstrate that this is indeed the case.

This finding leads to interesting conclusions about the advantage of "smallness" in a tax competition model. Because the small region possesses the lower cost of capital in equilibrium, firms there employ more capital per unit of labor and therefore offer higher wage rates than in the large region. As a result, the residents of the small region can be shown to be bet-

---

[14] Wildasin (1988, 1991) analyzes the alternative formulation in which the public good levels serve as the strategy variables, with the tax rates adjusting to satisfy the government budget constraints. For a system of identical regions, this change in strategy variables reduces equilibrium public good levels further below the efficient level.

ter off than the residents of the large region. In fact, Wilson (1991) demonstrates that if the difference between regional sizes is sufficiently large, then the small region will be better off than it would be in the absence of tax competition, where the capital tax is replaced with head taxes on residents. Thus, we find that although tax competition is inefficient, it can actually benefit some regions.

This comparison between small and large regions shows that tax competition is quite different from the analysis of "tariff wars." In the latter case, it is generally believed that sufficiently large countries win tariff wars in the sense that they are better off than they would be under free trade. The basic idea is that they have more ability to manipulate the terms of trade through their use of tariffs and will therefore employ higher tariffs than small countries. Kennan and Riezman (1988) present a formal analysis of a tariff war between two countries, modeled as a Nash equilibrium in tariff rates, and they find that the larger country does "win" if the size difference is sufficiently great. The reason for this difference in results can be traced back to interregional externalities. In the case of tax competition, we have seen that one region's tax creates a positive externality through the flow of capital to other regions. Since the smaller region has the lower tax rate, it is therefore the net beneficiary of these interregional externalities. In the case of tariff wars, however, a country's tariff creates a negative externality by changing the terms of trade in an unfavorable way from the other country's viewpoint. This difference in the sign of the externalities is responsible for the different welfare results.[15]

Another interesting implication of asymmetric tax competition between two regions is that one region may choose to overprovide the public good relative to the rule for efficient provision. Differences in regional size, production technologies, or consumer preferences can be expected to cause one region to export capital to the other, and the capital-importing region has an incentive to restrict such imports, thereby driving down the required after-tax return on capital. The tax-induced change in r, again denoted $\Delta r < 0$, now enters the rule for equilibrium public good provision as follows:

$$[6] \quad MB = \frac{MC\{[1 - (\bar{k}/k)]\Delta r + 1\}}{1 - \tau\varepsilon(1 + \Delta r)}.$$

where $\bar{k}$ is the capital owned by the region's residents and k is the capital used by the region's firms, making $k - \bar{k}$ imports of capital. Comparing this rule with the rule given by equation 5 for the symmetric case, we see that the new term, $[1 - (\bar{k}/k)]\Delta r$, acts to reduce the marginal cost of the public good for capital-importing regions. In other words, such regions have an extra incentive to increase the tax rate in order to achieve desirable "terms-of-trade effects." Of course, such effects come at the expense of capital-exporting regions, which are directly harmed by the drop in r. DePater and Myers (1994) refer to these terms-of-trade effects as pecuniary externalities, in contrast to the fiscal externality associated with the capital elasticity in equation 6. It is the existence of a pecuniary externality that may lead to overprovision of the public good in capital-importing regions. On the other hand, its presence works in the opposite direction in capital-exporting regions, thereby aggravating the underprovision problem.

This overprovision possibility has implications for the optimal form of central authority intervention, an issue that DePater and Myers (1994) also address.

---

[15] In a paper that combines elements of trade and tax competition, Haufler and Wooton (1999) consider competition between two countries for a foreign-owned monopolist and conclude the large country wins the competition, because the monopolist benefits from a larger market, due to the assumed existence of transport costs.

Once again, the first-best allocation can be achieved with a subsidy function of the form given by equation 4. But now the corrective subsidy may be negative in capital-importing regions, to offset the pecuniary externality. Thus, we can no longer say that all regions engage in wasteful tax competition, in the sense that they set their tax rates inefficiently low to attract capital. On the other hand, the misallocation of capital resulting from the differing incentives faced by capital-importing and capital-exporting regions is a new and potentially important type of inefficiency.

Finally, the issue of large versus small regions raises interesting questions about the incentives that groups of regions might possess to form into coalitions (or "federations") for the purpose of competing with other regions for scarce capital. Burbidge et al. (1997) analyze this issue by combining the basic tax competition model with a model of coalition formation. If the number of regions exceeds two, then the equilibrium coalition structure can involve more than one independent coalition. Thus, the tax competition problem does not necessarily disappear when there exists endogenous coalition formation.

Trade

We have seen how different regions may choose different tax rates, creating a misallocation of capital. A natural question is whether the pattern of interregional trade in private goods is also distorted by taxation. The basic tax competition model does not address this issue, because private consumption is aggregated into a single good. Wilson (1987) considers instead a system of many regions with two private goods, one labor intensive and the other capital intensive. The implications of this change are surprising: even if there exist no innate differences between regions, such as the usual trade-creating differences in comparative advantage, different regions choose different tax rates and trade goods with each other. In fact, the low-tax regions produce only the capital-intensive good, and the high-tax regions produce only the labor-intensive good, with the share of regions producing each good determined by the requirement that demand equal supply in the goods markets. To see this, observe that if a region produced both goods, then both industries would earn zero economic profits, as required for a competitive equilibrium. But then a tiny reduction in the tax rate would lower the cost of capital and raise the wage rate so that only the capital-intensive industry could break even, thereby driving labor-intensive firms out of the region and leaving the region specialized in the capital-intensive good. The result would be a large jump in the region's capital stock, which would raise tax revenue and thereby provide residents with more public good provision. Thus, it can never be optimal for a region to produce both goods.

Stated differently, some regions choose to compete vigorously for capital, thereby ending up with capital-intensive firms and high wages, but low public good levels, whereas others forego vigorous competition and settle for labor-intensive firms and low wages, but high public good levels. Any single region is indifferent between the two tax policies, since all regions are innately identical. Since the model assumes that all individuals are identical, it is inefficient for the residents of different regions to consume different bundles of private and public goods. Thus, the analysis identifies another potential type of inefficiency in tax competition models.

MULTIPLE TAX INSTRUMENTS

There would not exist a tax competition problem if the regional governments could utilize head taxes or other forms of

lump-sum taxation, i.e., taxes that do not distort private sector behavior because they are collected in fixed amounts, independent of consumption and factor supply decisions. For example, a tax on labor income would be a lump-sum tax in the basic tax competition model, since the supply of labor is fixed. As such, it would be definitely preferred to the capital tax. The modeling practice of much of the tax competition literature is to exclude such taxes in order to analyze taxes that governments typically levy on mobile factors. The original tax competition models focused on capital taxes, because such taxes are a component of property taxes in the United States, given the common practice of not distinguishing between the values of capital and land at a given site.

One reason given for not relying heavily on lump-sum taxes is that administratively feasible forms of lump-sum taxation would not be equitable or politically feasible. For example, Margaret Thatcher's implementation of a poll tax in Great Britain is widely viewed as having helped drive her from office. If it is not possible or desirable to generate tax revenue through the use of lump-sum taxes, we are still left with the question of whether the inefficiencies from tax competition in the basic model remain if capital taxation is supplemented with other forms of taxation that distort consumer or producer decisions. This section discusses a few attempts to address this issue.

The next two subsections discuss some alternative assumptions about available taxes, using extensions of the basic tax competition model. I then amend the model in a fundamental way by allowing both labor and capital to be mobile. In both cases, I identify assumptions under which public goods are underprovided, but some of these assumptions imply that only labor is taxed, not capital. In contrast, the Samuelson rule for efficient public good provision is found to hold in a case where governments choose to tax capital. Taken together, these results demonstrate that the underprovision of public goods is not tied to the taxation of mobile capital when other tax instruments are available. In a final subsection, I discuss the "common-agency approach," which explicitly models the information problems that governments face when they design their tax policies.

Optimal Commodity Taxation

The analysis of alternative tax instruments must confront a fundamental result on optimal taxation in an open economy: if a government can satisfy its revenue requirement using a system of optimal commodity taxes, then it should not use tax instruments that distort the pattern of goods trade or factor trade with other regions. In particular, it should not use the type of "source-based" capital tax employed in the basic tax competition model, which is levied on only the capital income earned within a region's borders. Instead, it should use a "residence-based" capital tax, which is levied on each resident's worldwide capital income. This result applies to regions that are small in the sense that they cannot manipulate the terms of trade, including the required after-tax return on capital, and it also assumes the absence of untaxed profits. Gordon (1986) provides a proof within the context of a two-period model of a single region, in which residents choose how much labor to supply to competitive firms in the first period and how much to save for consumption in the second period. The residence-based tax on capital is basically a tax on the residents' income from savings, which is a tax on future consumption. By also taxing labor income, the government implements an optimal commodity tax system, leaving no room for a beneficial source-based tax.[16] Although

---

[16]   Current consumption serves the role of an untaxed numeraire commodity in this model.

Gordon assumes away income distribution problems, the desirability of commodity taxation extends to regions with heterogeneous populations.

This negative conclusion about the use of source-based capital taxation essentially extends a theorem by Diamond and Mirrlees (1971) to an open economy context. They show that the government should keep the economy on the frontier of its aggregate production possibility set if it can employ an optimal commodity tax system (where factors such as labor are among the commodities). For a small region, "international trade" in goods or factors may be viewed as another production sector, where exports are used to "produce" imports via a linear technology. Viewed this way, aggregate production efficiency requires that government policies not distort trade (Dixit and Norman, 1980). In particular, source-based capital taxes should not be employed. In the absence of income distribution problems, this particular conclusion is quite intuitive. A small region faces an infinitely elastic supply of capital at the after-tax return required by investors in the world economy. In contrast, the region's residents have savings and labor supply curves with finite elasticities. Thus, taxing the income from savings and labor minimizes the "deadweight loss," or "excess burden," from taxation.

The availability of a residence-based capital tax has important implications for tax competition. Bucovetsky and Wilson (1991) examine this issue within the context of a system of identical regions. They employ the two-period setup used by Gordon (1986) to examine a single region's tax policy, and they allow the number of regions to be either small or large. If these regions have access to both source- and residence-based capital taxes, then the equilibrium is efficient, given the available tax instruments. Thus, the tax competition problem disappears when a residence-based capital tax is available.[17]

In practice, it is quite difficult to tax capital income on a residence basis, independently of where it is owned. The administrative and tax compliance problems involved in taxing foreign-source income are much more severe than those associated with taxing domestic income.[18] As a result, researchers have investigated models where residence-based taxation is either limited or not available.[19]

Taxes on Labor and Capital

The absence of a residence-based capital tax does not justify taxing capital at source. In fact, Bucovetsky and Wilson (1991) also demonstrate that a small region should meet all of its revenue needs by taxing only labor income, although labor-leisure decisions are distorted. Again, the intuition is that capital investment is in infinitely elastic supply for a small open economy, whereas the labor supply elasticity is finite. If, instead, regions are large enough to have influence over the equilibrium after-tax return on capital, then a region's optimal tax system again includes a source-based tax on capital income.

---

[17] In contrast, Razin and Sadka (1991) and Frenkel, Razin, and Sadka (1991) suggest that tax competition is efficient even in the absence of residence-based taxation. In particular, Frenkel, Bazin, and Sadka conclude, "tax competition leads to a constrained optimum, relative to the set of tax instruments that is available" in cases where the countries "cannot effectively tax their residents on their income from capital invested in the rest of the world" (p. 206). The apparent conflict is resolved by noting that they consider only two small countries that face a fixed world interest rate determined in the rest of the world. There is no such rest of the world in Bucovetsky and Wilson (1991).

[18] See Blumenthal and Slemrod (1995) for some estimate of these costs.

[19] Gordon and MacKie-Mason (1995) and Gordon and Bovenberg (1996) provide additional explanations for why a government might desire to use source-based taxes or subsidies.

For both cases, Bucovetsky and Wilson (1991) demonstrate that regions under-provide the public good in equilibrium. But now the argument centers on a mechanism for interregional externalities that differs from the one in the basic tax competition model. Suppose that a single region raises its labor tax to finance additional public good provision. As a result, the supply of labor declines, and firms respond by reducing their demands for capital. More capital is then available to other regions, raising the marginal products of labor in these regions. The resulting increase in the wage rates in other regions encourages workers there to supply more labor, thereby partially offsetting the distortionary effect of the labor tax on labor supplies. Thus, a rise in one region's labor tax creates positive interregional externalities, but now these externalities occur through interactions between the undistorted capital market and the distorted labor markets. Their presence implies that tax rates and public good levels are set too low. In particular, everyone could be made better off if a central authority forced governments to tax wage income at a higher rate to finance greater public good provision.

The availability of multiple tax instruments introduces a second source of inefficiencies involving government behavior: the choice among tax instruments. For example, suppose that the variable supply of savings in the Bucovetsky–Wilson model is replaced by the assumption of fixed capital endowments, as in the basic model. It remains true that small regions will continue to tax only labor income, but the efficient tax policy for the system of regions now consists of taxing only capital, given its fixed supply. Thus, the decentralized choice of tax instruments gets things completely wrong from the viewpoint of efficiency. We see once again that extending the basic tax competition model in various directions can produce new types of inefficiencies.

Huber (1999) investigates tax competition in a model that essentially merges the basic tax competition model with a finite-type version of the Mirrlees (1971) model of optimal income taxation. Each of many identical regions contains two types of residents, distinguished by the type of labor they provide, "high skilled" and "low skilled." Each government uses a nonlinear tax on wage income and a source-based capital tax to finance public good provision and redistribute income. As in the Mirrlees model, a government seeks to maximize an objective function that depends on the welfare levels of all residents. But unlike the Mirrlees model, the two types of labor enter production functions as separate complementary factors. As a result, they should be viewed as separate commodities, and thus an optimal income tax system does not constitute an optimal commodity tax system, because the latter would require that the two types of labor income face different tax schedules. The absence of optimal commodity taxation creates a role for a source-based capital tax. In particular, it should now be used to distort investment decisions in a way that reduces the spread between the skilled and unskilled before-tax wage rates. Doing so partially compensates for the government's inability to apply different rate schedules to these two types of labor income. But the equilibrium capital tax may be positive or negative, depending on the way in which a rise in the capital stock affects the relative marginal products of the two types of labor.

In either case, Huber's analysis suggests that the equilibrium capital tax will be inefficiently low under reasonable conditions. To identify the interregional externality, suppose that the capital tax is increased above its equilibrium level in one region. To clear the capital market, we can expect this higher tax rate to be partially capitalized into the after-tax return on capital, i.e., the return falls by some small

amount.[20] In the empirically reasonable case where high-skilled workers own more capital than low-skilled workers, the fall in the after-tax return will create a more equal distribution of income in all regions. Thus, the capital tax continues to create a positive interregional externality, but now this externality consists of beneficial equity effects. It follows that the equilibrium tax rate on capital is inefficiently low, as in the basic tax competition model. The analysis nicely demonstrates that whether the equilibrium tax on capital is positive or negative does not tell us whether it is too low from the viewpoint of the entire system of regions.

To conclude, it appears that competition for capital can lead to inefficiently low levels of taxation even if the tax instruments available to the government extend significantly beyond a source-based capital tax. An important task for future research is to explicitly model the reasons for why particular sets of tax instruments are utilized by governments. The information and political economy approaches discussed below represent some initial efforts along this line.

Labor Mobility

Since individuals are normally free to choose where to reside within their country of citizenship, the models developed above are perhaps more suitable for tax competition between countries (except for those groups of countries with free migration, such as the European Union). However, labor mobility can be added to the basic tax competition model without changing the results, provided we continue to assume that only capital is taxed. To set the stage for the analysis of multiple tax instruments, I begin by describing two such models.

Brueckner (1999) retains the two-factor setup of the basic model but allows each individual not only to choose where to invest capital, but also to pick the community in which to work and consume. He assumes a large number of competitive "developers," who choose public good levels and tax rates on mobile capital to maximize the "profits" from community development (which equal zero in equilibrium). The public good has the properties of a private good, meaning that the per capita cost of providing a given amount to each resident is independent of the number of residents, i.e., no scale economies in public good consumption. The mobile individuals differ only in their preferences for the public good. In equilibrium, communities offer different tax rates and public good levels, and individuals sort themselves across communities according to their preferences.[21] But the capital tax continues to create a positive externality, resulting in inefficiently low tax rates and public good levels. In fact, the rules for equilibrium public good provision given by equations 2 and 3 remain unaltered. As found in the "Corrective Policies" section, however, not everyone must lose from tax competition. In the present case, individuals with relatively "low" preferences for the public good may be better off under tax competition than they would be in a fully efficient equilibrium with head taxes used to finance pub-

---

[20] Huber does not show that the after-tax return must fall in all cases. Assuming that it does fall, the assumption that the region is small implies that its residents' capital income falls by a negligible amount. But when we sum the changes in capital income across the residents in the many small regions, we obtain a non-negligible change.

[21] If the public good were pure (i.e., no congestion), then its per capita costs would fall with the number of residents, creating incentives for regions to grow in size. Employing this assumption, Perroni and Scharf (1997) analyze a model in which each region contains many types of residents and majority rule serves as the mechanism by which taxes and public good levels are chosen. They argue that increased capital mobility may make everyone better off in equilibrium, but that tax competition reduces efficiency "in less extreme scenarios."

lic good provision. Intuitively, these individuals benefit from living where capital taxes are relatively low and, therefore, capital-labor ratios are relatively high.

The model developed by Wilson (1995) yields similar conclusions in the absence of scale economies. There exists a large but fixed number of identical regions, each possessing a fixed amount of a third factor, land. Each region competes for both mobile capital and identical mobile workers, with the objective of maximizing the value of the region's land. Capital is now taxed through the use of a "property tax," levied uniformly on the values of both capital and land. Assuming this is the only tax, the rules given by equations 2 and 3 remain valid, but with the capital outflow replaced by a reduction in the per capita value of the region's capital and land, since the latter now serves as the per capita tax base. As before, a rise in the property tax shifts some of this base to other regions, creating the usual positive externalities.

If we were to add a head tax to this model while retaining the assumption of no scale economies, then the response would be exactly the same as in the basic tax competition model: governments would abandon the property tax and use only the head tax. But now the head tax would be used to efficiently control migration. In particular, each government would make each resident pay a head tax equal to the marginal cost of supplying the public good to another individual. No other taxes would be needed to balance the government budget because the absence of scale economies implies that this marginal cost equals the per capita cost of public good provision. With efficient head taxation, governments would choose the efficient level of public good provision, which satisfies the Samuelson rule.

Wilson's (1995) surprising conclusion is that this rule for efficient provision continues to hold when there exist scale economies, although the head tax no longer satisfies the marginal-cost-pricing rule. The presence of scale economies introduces a need for other taxes, since the per capita cost of public good provision then exceeds the marginal cost. Governments respond by employing the property tax and manipulating the head tax to partially compensate for the distortionary effects of the property tax. But they do not deviate from efficient public good provision. We see, then, that the taxation of mobile capital need not imply that public goods are underprovided in equilibrium.

This last conclusion becomes even more pronounced if the head tax is replaced with a labor tax that distorts labor-leisure choices. If scale economies are absent, then the results are similar to those in the Bucovetsky–Wilson (1991) model of a system of many regions: only labor is taxed but public goods are underprovided. Adding scale economies creates a role for property taxation, but the public good need no longer be underprovided. In fact, the Samuelson rule is now satisfied in the special case of a pure public good (an extreme case of scale economies).[22] Once again, we cannot identify cases of underprovision by examining whether regions choose to tax capital.

Yet another consideration is the manner in which labor is mobile. In the models discussed so far, individuals choose the region in which to reside and work. In contrast, Braid (1996) examines a model with commuting. The world economy consists of many metropolitan areas, each containing a fixed number of identical local jurisdictions with fixed residential populations. As in Wilson (1995), competi-

---

[22] In contrast to the head-tax case, however, this equilibrium is inefficient. Wilson (1995) provides conditions under which a rise in every region's public good supply beyond the equilibrium level reduces welfare if the financing comes from the labor tax, but increases welfare if the property tax is used instead (Prop. 4, p. 349). These results suggest that the primary inefficiency in this case is an inefficient tax mix, not an inefficient level of public good provision.

tive firms in each jurisdiction use immobile land and mobile capital and labor to produce output, but now labor is mobile because individuals can costlessly commute to other jurisdictions. The public good in this model is assumed to benefit residents, not commuters. To finance it, jurisdictions can employ source-based taxes on wage and capital income, and also a property tax, levied uniformly on both capital and land. Jurisdictions prefer the property tax over a tax on mobile capital alone, since the former includes the nondistortionary land tax. To compete for commuters, they employ both the property tax and the wage tax, rather than solely relying on the wage tax. Thus, Braid's model also endogenizes the taxation of property. He ties the level of taxation to the degree of competition for commuters, as indicated by the number of jurisdictions. As this number rises, the wage tax declines, the property tax rises, and the public good provision declines.[23]

Thus, Braid's work shows that competition for commuters increases the degree to which public goods are underprovided, while causing greater reliance on the property tax. In contrast, recall that Wilson (1995) finds no such positive relation between public good underprovision and reliance on the property tax. One important difference between the two models is that scale economies in public good provision are central to Wilson's results but irrelevant in Braid's model, since he assumes that only residents consume the public good, and their number is fixed in each jurisdiction. It would be interesting to see whether the two models yield more similar conclusions if commuters also benefit from a jurisdiction's public expenditures.

The Common-Agency Approach

The research strategy reported in the previous subsections involves limiting the government's power to tax in interesting ways and then investigating the resulting implications for tax competition. An alternative approach is to derive such limits as the outcome of specific aspects of the economic environment. One such aspect is incompleteness in a government's information about the firms that it is attempting to tax. For example, firms may differ in the degree to which they are interregionally mobile, but such differences may be difficult for the government to observe. In this case, the government cannot tax a firm in a way that directly depends on its unobserved mobility characteristics. Instead, the government must base its tax on observable aspects of firm behavior that may serve as signals of these characteristics, such as the firm's investment decisions. This is a principal-agent problem, with the government serving as the principal and the firm as the agent. See Osmundsen, Hagen, and Schjelderup (1998) for an example of such a model.

When two or more governments compete for a share of a mobile firm's profits, this problem becomes a common-agency problem, with the governments now serving as multiple principals. A Nash equilibrium is established when each government chooses its optimal policy, given the policy chosen by the other government. The firm's private information about its attributes allows it to earn an "information rent," adding a new dimension to the welfare analysis of tax competition. In Mezzetti (1997), for example, tax competition (i.e., his "independent contracting") raises the information rent earned by the

---

[23] This decline in public good provision also occurs when only the property tax is available. In another paper, Braid (1998) obtains a similar relation between commuting and public good provision, using a spatial model to capture the costs of commuting. In particular, public good provision falls as commuting costs fall. Braid (1997) adds absentee ownership of land to the model developed by Braid (1996) and finds that overprovision may result, but this is due to "tax exporting," which I have discussed in the "Capital Tax Competition" section.

firm relative to its level when the two principals cooperate, and the result is lower aggregate welfare for the principals. Thus, tax competition again worsens welfare, but for new reasons.

The common-agency approach seems especially useful for analyzing the taxation of multinationals. Many countries attempt to tax the income of foreign subsidiaries, suggesting a common agency problem in which the home and host countries are the principals. Bond and Gresik (1996) present an interesting model in which the home and host countries independently confront the multinational with subsidies and trade taxes. Relative to setting these policy instruments cooperatively, tax competition is shown to lower the countries' aggregate welfare and leave the multinational worse off.[24] In other words, the inefficiencies associated with tax competition turn out to be detrimental to all parties.

While there is thus some evidence that the detrimental effects of tax competition in the basic model carry over to the more complex common agency problem, much remains to be done in this exciting area of research. As increasingly complex government policies are considered, however, we are led to increasingly question the basic assumption that government officials seek to maximize welfare, rather than engage in self-interested behavior. A model that centers around such behavior is discussed in the "Political Economy" section.

COMMODITY TAX COMPETITION

In addition to the literature on competition for scarce capital, a literature on "commodity tax competition" has also been developed. Mintz and Tulkens (1986) introduce a model where this form of competition occurs between two regions that are linked by cross-border shopping. Each region contains a fixed number of identical residents, whose utility depends positively on the consumption of a private good and a public good, and negatively on the supply of labor. Public good expenditures are financed by a tax on private good consumption, levied on an origin basis, and Mintz and Tulkens examine the Nash equilibrium in these tax rates. The use of origin-based taxes means that each region's government collects a uniform tax on only the output of domestic firms, regardless of where this output is ultimately consumed. As a result, the region's residents can escape the tax by incurring the transport costs necessary to cross the border and purchase the private good in the other region. In contrast, a destination-based commodity tax would enable a region to collect a tax on all of its residents' private good consumption. This could be done through the use of border adjustments, under which the tax is collected from domestic firms, but a tax rebate is given for exports of these goods and a tax is collected on imports. (Imports and exports take place through cross-border shopping in the Mintz–Tulkens setup.) In this case, a region's residents would not escape their government's tax by crossing the border. But border adjustments are administratively difficult to enforce, and in some areas, they have been effectively eliminated, most notably in the European Community. See Lockwood (1993) for a detailed comparison of commodity tax competition under the destination and origin principles.

In contrast to the models of competition for capital, Mintz and Tulkens (1986) and de Crombrugghe and Tulkens (1990) describe cases where the equilibrium is fully efficient. However, these cases occur when transport costs are so high that no cross-border shopping occurs, either in equilibrium or in response to small tax

---

[24] See also Bond and Gresik (1998), who examine the case where the two governments are asymmetrically informed about the firm's production costs.

changes.[25] In such cases, there are none of the interregional externalities described previously. It seems difficult, however, to describe these cases as "tax competition," because the governments are not really competing over a tax base.

Instead, tax competition in these models is associated with tax rate differences that are sufficiently large to overcome transport costs, so that the low-tax region "exports" the good to cross-border shoppers from the high-tax region. In this case, a rise in the high-tax region's tax rate raises the amount of shopping done by its residents in the low-tax region, thereby increasing the latter's tax base. This tax base change is called the "public consumption effect." As in the basic tax competition model, it represents a positive externality, implying that the high-tax region's tax rate is inefficiently low. In particular, Mintz and Tulkens (1986) show that if a central authority were to force the two regions to change their tax rates in directions that made both of them better off, then any such tax changes would involve a rise in the high-tax region's tax rate.

But would this efficiency-improving tax change also involve a rise in the low-tax region's tax rate? The recent work by Haufler (1998) concludes "not necessarily." When the low-tax region increases its tax rate, it not only creates the public consumption effect mentioned above, but also a "private consumption effect," consisting of the welfare loss that cross-border shoppers experience from the increased price of the private consumption good. As a result of these conflicting effects, it is pos-sible for the rise in the low-tax region's tax rate to harm residents of the high-tax region, i.e., create a negative externality. Hence, it is not possible to show that both regions set their tax rates "too low" in equilibrium.

To conclude, the pattern of interregional externalities is more complex than in the basic tax competition model, producing less clear-cut results. It is interesting to note, however, that the literatures on capital tax competition and commodity tax competition do seem to obtain similar results concerning the advantage of smallness. See, in particular, Kanbur and Keen's (1993) analysis of a spatial model of cross-border shopping.[26]

OTHER FORMS OF COMPETITION

There are many ways in which governments can compete for mobile factors or shoppers other than through the use of taxes or subsidies. One possibility is to compete through the use of public inputs that improve the productivity of capital. Keen and Marchand (1997) argue, for example, that the equilibrium pattern of expenditures is inefficiently weighted toward too much public input provision and too little public good provision, since the latter benefits residents but does not attract capital.[27] There is also a literature suggesting that regions compete too aggressively for mobile firms through the use of inefficiently lax environmental policies, creating a "race to the bottom." Wilson (1996a) reviews this literature and concludes that the possibility of a "race" depends critically on assumptions about

---

[25] See Mintz and Tulkens (Prop. 9b) and also de Crombrugghe and Tulkens (Prop. 2).

[26] A limitation of this model is that governments care only about maximizing tax revenue. Trandel (1994) and Haufler (1996) analyze spatial models with less extreme objective functions, but they do not directly address the welfare comparisons in Kanbur and Keen (1993). See also Braid (1993). Unlike the other spatial models, he allows lump-sum taxation in addition to commodity taxes.

[27] Noiset (1995) and Bayindir-Upmann (1998) obtain less clear-cut results, and Sinn (1997) claims that "public infrastructure," modeled as reducing the "cost" of investment in a region, is efficiently provided. But neither paper also models the endogenous provision of public goods. If they did, then public expenditures would be inefficiently weighted away from public good provision and toward public inputs or infrastructure

the available tax and subsidy instruments.[28] As mentioned in the Introduction, policymakers have also expressed concern about the possibility of a "race to the bottom" in welfare benefits, brought on by the mobility of welfare recipients.

Other government regulatory programs can be subject to wasteful competition between governments. See, for example, Sinn's (1997) demonstration that independent governments choose inefficiently low product quality standards, given that their products are interregionally traded. In addition, he discusses the failure of independent governments to provide adequate amounts of social insurance in the presence of factor mobility.[29]

The degree to which existing tax laws are enforced may also serve as a strategy variable. Cremer and Gahvari (1996) consider two countries that compete with each other for cross-border shoppers, using both tax rates and tax audit probabilities as strategic variables. In this case, any coordination between the two countries in the setting of tax rates will be offset to some extent by competition for shoppers through reductions in the audit probabilities.

In some cases, governments may design nontax policies that will commit them to change the degree to which they compete in taxes with other governments. See, for example, Jensen and Toma's (1991) analysis of the use of national debt as a strategic variable in a tax competition model. By committing to debt now, a government can signal to other governments that it will have to impose higher taxes on capital in the future. If these other governments respond by raising their own capital taxes in the future, then the first government will have benefited from this reduction in competition for capital.

These various examples illustrate the multifaceted nature of competition among governments, which is likely to create difficulties for the design of cooperative agreements to reduce the wasteful aspects of this competition. It may be possible to coordinate one policy variable, but doing so may simply cause governments to compete more vigorously by means of another policy variable.

THE POSSIBILITY OF EXCESSIVE TAXATION

The general thrust of much of the tax competition literature is that tax competition leads to inefficiently low taxes. In contrast, two types of tax competition have been found to produce inefficiently high taxes: vertical tax competition and tax competition with double taxation conventions. By examining recent work, however, I find that this conclusion may be too hasty.

Vertical Tax Competition

The types of tax competition discussed to this point can be characterized as "horizontal tax competition," in the sense that the governments doing the competing are all at the same level. There also exists a literature on "vertical tax competition" between different levels of government, such as the federal government and state governments within the United States. The basic problem is that each level of government imposes a tax on the same tax base. Whereas one state's tax increases the tax base available to another state under horizontal competition, now the tax imposed by one level of government diminishes the size of the tax base available to the other level of government. In the case of capital taxation, for example, a rise in

---

[28] For formal models of a race, see Kim and Wilson (1997), Markusen, Morey, and Olewiler (1996), Oates and Schwab (1988), and Rauscher (1995).

[29] On the other hand, the existence of factor mobility may alter voters' preferences and make them elect governments with more liberal views about redistributive policies. See Persson and Tabellini (1992).

the federal government's tax rate reduces national savings, thereby lowering the amount of capital available to each state government. A rise in a single state's tax rate has a similar, but smaller, effect, reducing the tax base available to the federal government.

Since tax increases now create negative externalities, rather than positive externalities, we might expect conclusions from the basic tax competition model to be reversed: taxes are now set too high. This conclusion is too hasty, however, because other aspects of the political-economic environment must be specified. First, there is the issue of what objective function is employed by the federal government. A benevolent federal government desires to maximize some measure of the aggregate welfare of all residents, whereas a benevolent state government is concerned with maximizing the welfare of the state's own residents. Unlike horizontal tax competition, then, the objectives of the federal government and state governments overlap to some extent, reducing conflict. If the federal government pursues objectives that are independent of resident welfare, then we might want to look not only at ways to facilitate more efficient interactions between the federal government and state governments, but also at ways to improve the internal functioning of the federal government.

The other issue to consider is the timing of the actions undertaken by the federal and state governments. The "Corrective Policies" section discusses optimal fiscal federalism under the standard assumption that the federal government "moves" first, committing itself to a set of policies that state governments then treat as fixed when choosing their own policies. In contrast, the models of horizontal tax competition assume that all governments choose their policies simultaneously. In some cases, institutional features argue for the higher-level government having the first-mover advantage; see Hoyt and Jensen (1996). But this is not the only reasonable assumption. The sequential move models described in the "Corrective Policies" section simplify matters by assuming that each government chooses its policies only once. In a more complicated setting, state governments might both react to the past decisions of the federal government and also make new decisions that influence the federal government's future behavior. Models with simultaneous moves sweep all such complications away by putting the state and federal governments on an equal footing in terms of the timing of their moves.

Clearly, the best case for efficiency will occur when the federal government is benevolent and is able to move first, so that it can influence the behavior of the state governments. Boadway, Marchand, and Vigneault (1998) consider this case in a model where the federal government and identical state governments utilize an income tax that redistributes income among a diverse set of residents. They distinguish between cases where migration is possible or impossible, with the former case allowing horizontal tax competition to exist. For both cases, the equilibrium is efficient, given the available policy instruments. In other words, the federal government could do no better if it directly controlled the states' policy instruments. This outcome can be readily understood. An individual state engages in vertical tax competition by not accounting for the negative effects of its tax on the federal budget. But the federal government has sufficient tax tools and foresight to undo any inefficiencies in state government behavior. In other words, vertical tax competition seems to be happening at the state level but not the federal level, because the federal government "sees through" the state budget constraints when it makes its own policy choices. The result is an efficient equilibrium.

If the federal and state governments set their policies simultaneously, then the

federal government can no longer alter state policy choices by changing its own policies. An efficient equilibrium is unachievable in most cases, but a benevolent federal government can still manipulate its policy instruments to at least partially offset inefficiencies at the state level. See Hoyt (1996) for a recent analysis of this case.[30]

Keen and Kotsogiannis (1996) provide a good example of the inefficiencies that can result when governments are no longer benevolent.[31] In their model, the federal and state governments care only about maximizing tax revenue. Although there exists both horizontal tax competition between states and vertical tax competition between the federal government and states, the vertical tax competition problem dominates in the case where all governments move simultaneously. The equilibrium tax rates are found to be too high, even relative to those that maximize tax revenue.

To conclude, vertical tax competition seems to be a more slippery concept than horizontal tax competition. It seems most likely to create inefficiencies in models where the federal government is unable to optimally influence the choice of policy instruments by local governments, due to commitment problems, information problems, or objectives other than welfare maximization. Future work should seek to develop more realistic political processes within and between the different levels of government.

Double Taxation Conventions

An important issue in the taxation of multinationals is the use of double taxation conventions. Given that a home country attempts to tax foreign-source income,

we have a situation where a firm's income is being taxed by two different countries, home and host. As a result, double taxation is viewed as a potential problem, and three methods have been used to alleviate the problem. First, the home government can provide a tax credit for taxes paid to the host government. Second, it can allow foreign investors to deduct these taxes from their taxable income. Finally, it can exempt foreign-source income from taxation. Of these three methods, the deduction method is the least commonly used.

The formal analysis of how independent governments choose their tax policies under these methods begins with Bond and Samuelson (1989). They use a two-country model in which a capital-exporting (home) country and capital-importing (host) country use their tax rates on foreign-source income as strategy variables. The surprising result is that if the home country provides tax credits, then the Nash equilibrium involves taxes so high that all international capital flows cease. In striking contrast to the basic tax competition model, the problem here is not that taxes are too low, but rather that they are too high. The basic intuition is that the host country always has an incentive to raise its tax rate at least to the level levied by the home country, since the latter's government treasury effectively pays the tax by providing tax credits to foreign investors. But as long as capital exports occur, the home country should keep its tax rate on foreign-source income above the host country's rate, since doing so allows it to exercise its market power on the world capital market, i.e., to drive up the equilibrium after-tax return on capital by reducing incentives to invest abroad. As a result, capital tax rates are so high in equilibrium that all capital exports

---

[30] Hoyt (1996) also shows that a uniform matching grant can be used to ensure that the combined policies of the two levels of government are efficient, given the restrictions on the tax instruments. This result is limited to the case where the "localities" controlled by lower-level governments are identical. For other recent work on the use of intergovernmental grants to offset fiscal externalities, see Boadway and Keen (1996) and Dahlby (1996).

[31] See also Keen's (1998) review of the literature on "vertical tax externalities."

cease. In contrast, capital flows do occur under tax deductions. Thus, we are left with the empirical puzzle of why credits are so prevalent in the world economy.

Subsequent research has attempted to reconcile theory with practice. Davies and Gresik (1998) allow foreign subsidiaries to finance their investments by borrowing additional capital from the host country's domestically owned firms, subject to collateral requirements. This additional source of investment funds dramatically changes the effects of tax credits. In particular, the countries no longer set their tax rates so high that all capital flows are eliminated. Thus, the use of credits is no longer as bad as suggested by Bond and Samuelson (1989). This outcome does not fully explain the use of credits, however, since Davies and Gresik still find that the home country weakly prefers deductions to credits.

Whereas Bond and Samuelson (1989) allow the home country to tax at different rates the income its residents earn at home and abroad, Janeba (1995) considers the case where no such discrimination is permitted. A surprising implication of this assumption is that the home country sets its tax rate equal to zero under both the tax credit and exemption methods. The basic idea is that a positive tax rate would increase capital exports, creating undesirable terms-of-trade effects. But Janeba also finds that each country's equilibrium level of national income is independent of which method is used (credits, deductions, or exemptions). Thus, his model provides a solution to the empirical puzzle raised by Bond and Samuelson. Under all methods, however, the equilibrium tax rates continue to be inefficiently set. The problem is not that tax rates are too low, as in the basic tax competition model, but that the relative rates induce the home country to export too little capital.

In a recent paper, Davies (1998) considers two-way capital flows, where each country exports capital to the other country. Again, nondiscriminatory tax policies are assumed, and there always exist positive capital flows in equilibrium, regardless of which double taxation convention is employed. However, the choice among them is no longer a matter of indifference. Davies endogenizes this choice by allowing each country to independently choose which method to employ, prior to the choice of tax rates. His results provide some indication that deductions will be the preferred method. In particular, they are always used in the special case where the two countries have identical characteristics. While this conclusion once again seems at odds with the popularity of tax credits, further results demonstrate the desirability of cooperative agreements that eliminate the use of deductions. Perhaps the most striking conclusion is that in the case of identical countries, eliminating the use of deductions results in a fully efficient equilibrium. Although inefficiencies reappear in the asymmetric case, this limited efficiency result offers an intriguing contrast to the inefficiencies found in the basic tax competition model.

To conclude, while Bond and Samuelson's (1989) conclusion that tax credits eliminate all capital flows remains a striking result, subsequent research has generated less extreme results, ranging all the way to the efficiency results obtained by Davies (1998). In all cases reviewed here, two-country models are employed, implying that terms-of-trade effects are central to the analysis. As seen in the "Large Regions" section, extending the basic tax competition model to the case of asymmetric tax competition between large countries is itself enough to significantly change the welfare implications. Thus, there is perhaps not as much inconsistency between the two types of models as might appear.

EFFICIENCY-ENHANCING COMPETITION

Whereas the Tiebout model produces a form of "efficient tax competition," we

have seen that departures from the idealized setting of this model can produce various forms of wasteful tax competition. Recently, researchers have turned their attention to the possibility that such departures may also create an efficiency-enhancing role for competition involving tax or nontax policy instruments. This section describes some work in this direction.

Bidding for Firms

The discussion so far has assumed that capital investments may be made in small increments. In many cases, however, investments come only in large increments, i.e., they are lumpy. Regions then find themselves competing for these lumps, often taking the form of large firms. Competition for automobile plants is one example. It is often assumed that regions are able to target subsidies and other tax breaks to these mobile firms, rather than altering the entire tax system. This competition may be referred to as "bidding for firms." In this case, the effect of tax competition on the public goods provided to residents is no longer a central issue. But we can still ask whether the subsidies or tax breaks provided to firms are efficient in the sense that they lead to efficient firm location decisions while not creating any unnecessary costs for the system of regions as a whole. Additional efficiency issues arise in cases where firms receive the benefits of public services and infrastructure.

Two well-known papers produce models in which the bidding for a large firm enhances efficiency. In Black and Hoyt (1989), two regions compete for a large firm because its presence attracts more residents, which lowers the average cost of providing a public good to existing residents. The Tiebout assumption of efficient head taxes is absent from this model. In particular, each resident pays a tax equal to the per capita cost of public good provision, which is below the marginal cost. Nevertheless, bidding for firms never reduces the social efficiency of firm location, and in some cases, this bidding causes firms to locate more efficiently. Black and Hoyt conjecture, however, that the use of public services to compete for firms will not produce an efficient outcome. They also demonstrate that firm location decisions are inefficient in cases where the firm possesses private information about how its production costs differ between the two regions, which it is unable to reveal to the two regional governments.[32]

The dynamic model developed by King, McAfee, and Welling (1993) also departs from the Tiebout world by introducing uncertainties about firm productivity. In particular, the social value of a firm is given by the "surplus" that it generates by producing in a region, but this surplus is uncertain to both the firm and regional governments prior to actual production. Two regions compete for the firm over two periods. After choosing a location in the first period, the firm is free to relocate (at a cost) in the second period. The firm's location in each period is determined by an auction mechanism, and this location is found to be efficient. The second part of the paper allows each region to invest in "infrastructure." Before the auction takes place, the two regions play a Nash game in investment levels, under which each region sets its investment level optimally, given the level chosen by the other region. The authors demonstrate that only an asymmetric Nash equilibrium exists, where the equilibrium investment levels differ. In the first period, the firm locates where investment is highest. However, the losing region may choose a positive (but lower) investment level, because this raises the probability that the firm will switch locations in the second period. This possibility of relocation implies that the

---

[32] Martin (1997) focuses on the problems associated with bidding for firms that possess private information.

losing region's investment is not socially wasteful. In fact, the authors show that the equilibrium is efficient.

Both of these models follow the previous literature by assuming that each government is concerned with the welfare of its own citizens. In contrast, Biglaiser and Mezzetti (1997) investigate a model in which attracting mobile firms provides a state governor with the opportunity to engage in activities that imperfectly signal his "ability" to voters. When two or more governors with re-election concerns compete for firms, the resulting location of the firm will not necessarily be efficient. However, such inefficiencies are not a problem associated with large projects or firms per se, but rather with the imperfect political institutions.

It is also important to recognize that interregional externalities may play an important efficiency-reducing role, even in cases where subsidies can be targeted to individual firms. But now such externalities can easily work in favor of too little competition for firms. For example, if one state in the United States attracts a foreign firm, then all states may benefit in the form of lower prices, due to reduced transport costs. This example has similarities to the pecuniary externalities discussed in the context of large regions in the "Large Regions" section: by "importing" the firm, a region creates desirable price effects for other regions.[33] But such price effects can work the other way. If all states in the United States are competing for a foreign firm that faces limited opportunities for locating its plant outside the country, then they will possess market power that can be exercised by competing less vigorously. Competition for foreign firms

through the provision of subsidies may be better than no subsidies, but the equilibrium levels of these subsidies are not likely to be optimal from the nation's viewpoint.

Imperfect Competition

If firms are large, then the issue of imperfect competition becomes potentially important. The international trade literature on "strategic trade policy" has already exhaustively explored the effects of imperfect competition on a country's optimal trade policies. In particular, this literature has justified the use of output subsidies to encourage the country's firms to compete more aggressively on world markets, thereby increasing profits at the expense of foreign firms. Janeba (1998a) combines these strategic trade motives with a model of tax competition. He first follows the strategic trade literature by specifying a model with two countries, each containing a single firm that sells output in a third market. In this case, the two governments compete by offering subsidies to their firms. But then Janeba allows each firm to be mobile between the two countries, meaning that it locates where its after-tax profits are highest. The governments now recognize that their subsidies will affect not only firm output decisions, but also location decisions. In particular, each government may seek to attract the other country's firm and thereby capture some of its profits through taxation. Janeba assumes that the tax system must be nondiscriminatory, meaning that a country imposes the same tax rate on the outputs of all firms that operate within its borders, whether domestic or foreign.[34]

---

[33] Rauscher (1995) identifies this type of externality as a possible reason for why regions might not seek to attract a polluting firm, even though it is desirable to do so (a phenomenon called "not in my backyard").

[34] Although countries do typically discriminate to some extent, they are restricted in this practice by the nondiscrimination rules established by international agreements such as GATT or the laws of the European Union. Janeba and Peters (1999) focus on the different implications of nondiscriminatory taxes and taxes that discriminate between domestic and foreign firms operating within a country, but they abstract from market structure issues by assuming that each country has access to an "immobile tax base" and competes for a "mobile tax base."

Janeba's (1998a) surprising conclusion is that competition for mobile firms causes the countries to compete their tax rates down to zero. No country offers a tax rate below zero, because it would then attract both of the firms but be hurt by the transfer of subsidy revenue to the foreign firm. Janeba is also able to generalize the zero-tax result to include cases where the firms' outputs are sold to the consumers in one of the two countries, rather than in a third country. In these cases, the country containing these consumers cares about consumers' surplus, along with tax revenue and its firm's profits. In neither case is the equilibrium fully efficient, since the inefficiencies associated with imperfect competition are still present. But tax competition does improve welfare.

Thus, imperfect competition seems to dramatically alter the welfare implications of tax competition.[35] Recall, however, that regions would choose zero taxes on mobile capital in the basic tax competition model if they had access to head taxes. Capital taxes are avoided because each region faces an infinitely elastic supply of capital. Similarly, each country's production capacity is infinitely elastic in Janeba's model; it will lose all of its capacity if its tax rate is increased slightly above the other country's rate. But the two models differ in how governments behave when the borders are closed. The equilibrium is fully efficient in the basic model, whereas wasteful subsidies emerge when there is imperfect competition. Thus, tax competition is able to play an efficiency-enhancing role under imperfect competition, but not in the competitive environment of the basic model.

This comparison suggests the basic tax competition model could be accused of "stacking the deck" against the possible welfare-improving effects of tax competition by failing to recognize possible sources of inefficiency that might exist in the absence of capital mobility. In the "Political Economy" section, inefficiencies from the functioning of the political process are considered.

Commitment Problems

The basic tax competition model assumes that governments commit to a tax system, and then capital owners choose where to invest their capital. In practice, commitment issues arise because firms or capital become partially immobile once location decisions are made. One way to deal with this problem is to commit to initial subsidies or "tax holidays" for new firms, thereby shortening the period of time in which commitment is required. But such policies have the disadvantage of increasing firm turnover. In other words, some fraction of firms may choose to leave a region after the initial tax break has expired, perhaps seeking tax breaks in other regions. Wilson (1996b) models the use of initial subsidies to attract new firms, finding that excessive firm turnover is indeed the equilibrium outcome. Bond (1981) finds empirical evidence of the problem.

Janeba (1998b) demonstrates that tax competition may actually help solve commitment problems. He investigates a one-firm, two-region model in which decisions are made in three stages. First, the firm undertakes a single project consisting of investment in "capacity" in each country. Oil pipelines are a possible example. Second, each government chooses the rate at which to tax the project output within its borders. Finally, the firm chooses its outputs.[36] A commitment problem arises here

---

[35] Note also the importance of the nondiscrimination assumption. If discrimination in taxes were possible, then the two governments would continue to provide wasteful subsidies to their own firms.

[36] In contrast, Kehoe (1989) considers a two-country model in which savings, but not the location of investment, is chosen prior to tax rate decisions. If the two countries collude in setting their tax policies, then they tax away savings, since it is fixed at the time taxes are chosen. As a result, nobody chooses to save. Tax competition is preferred, because governments forgo capital taxation in an effort to attract investment.

because the governments are able to choose tax rates after the firm has fixed its capacity levels. If there were a single government, then it would have an incentive to tax all profits away. The firm would recognize this incentive at the time of its initial investment decision and choose not to invest in capacity. When there are two governments, they will "compete" in tax rates if the firm has excess capacity and is therefore able to reallocate output between the two regions in response to differences in the tax rates.[37] Provided investment costs are sufficiently low, the firm then chooses to undertake the project by investing in excess capacity as a means of creating tax competition. To conclude, commitment problems provide another possible role for tax competition as an efficiency-enhancing activity.

Political Economy

A common assumption in the literature reviewed so far is that each regional government seeks to act in the best interests of some set of residents or factor owners. Indeed, the basic tax competition model and many of its extensions assume away differences between residents, so that there is no conflict about which residents' preferences are given the most weight. In the basic model, the only potential source of inefficiency is tax competition, making it relatively easy for this competition to turn out to be a bad thing. A rather different perspective is taken by the public choice literature. Brennan and Buchanan (1980) argue that tax competition improves welfare, because the size of government would be excessive in the absence of this competition. Rauscher (1996, 1998) and Edwards and Keen (1996) examine this view formally in various "Leviathan models," where governments are concerned in part with maximizing the size of the public sector. Their conclusions about the welfare implications of tax competition are mixed, but all three papers assume that governments retain some degree of "benevolence," perhaps caused by re-election concerns that are not formally modeled.

It is difficult to ascertain empirically whether the welfare-improving or welfare-worsening view of tax competition is more accurate, since both views seem to predict that an increase in the number of competing governments should reduce the total size of government. Moreover, the empirical tests of the Leviathan model conducted by Oates (1985, 1989) and others have encountered difficulties in even confirming that there is a relation between aggregate government size and the decentralization of fiscal decisions among independent governments, let alone identifying the welfare implications of such a relation.[38] It therefore appears useful to explore alternative models of government decision making that do not necessarily create this relation.

Wilson and Gordon (1998) depart from the assumption in Leviathan models that a single monolithic entity exercises control over the entire range of tax and public expenditure instruments. Their model recognizes that some policy instruments might be more accurately modeled as effectively under the control of electorates or their representatives, whereas others are largely delegated to self-interested government officials, leaving the electorate with only rudimentary methods of control. In particular, government officials are assumed to choose public expenditure

---

[37] The concept of excess capacity is well-defined here, because the model assumes that the demand for the firm's output is completely inelastic at prices below the consumers' reservation level.

[38] After reviewing his and other work, Oates (1989) concludes, "The empirical literature on fiscal centralization and government size thus contains a number of puzzles and inconsistent findings" (p. 582). More recently, Anderson and Van den Berg (1998) find no evidence of a relation between fiscal decentralization and government size.

policies but not tax rates, which are chosen to maximize welfare. In another paper, Gordon and Wilson (1998) argue at length that this asymmetric treatment of tax and expenditure policies appears to be a good description of the situation of most government bureaucrats. For example, while legislatures have substantial control over the choice of tax rates, they cannot deal adequately with the innumerable specific expenditure and regulatory decisions that affect the tax base, and they must therefore delegate these decisions to others. Moreover, the electorate can monitor easily what happens to tax rates but has a harder time monitoring the quality of the many different expenditure decisions.

Following Niskanen (1971) and the subsequent Leviathan models, Wilson and Gordon (1998) assume that government officials benefit personally from the budget they control and, as a result, face incentives to pursue activities that increase the size of the budget. A positive connection between the tax base and public good levels is modeled by assuming a system of many identical regions, each consisting of a fixed amount of land, and allowing labor to be perfectly mobile across these regions. Each region employs a linear income tax, consisting of a head tax or subsidy and a uniform tax rate on all labor and land income earned within the region's borders. Given this tax system, the government officials in each region engage in "expenditure competition" by increasing their provision of public goods to attract more labor, thereby expanding the tax base.

To isolate the efficiency-enhancing effects of expenditure competition, Wilson and Gordon (1998) compare the equilibrium in this "open economy" with the equilibrium in a "closed economy," in which the lack of interregional factor mobility means that all factor supplies are fixed. In particular, each resident possesses fixed endowments of land and la-

bor, and thus there are no opportunities for residents to confront public officials with a tax base that can be expanded through additional public good provision. Rather, other incentive devices must be relied upon. The model assumes that officials can be replaced with a probability that is related to their job performance, and that the effective penalty from being replaced can be directly controlled through the choice of the officials' salaries.

By creating expenditure competition, opening the economy increases the "efficiency" with which government officials utilize tax revenues; there is less "waste" in government. Consequently, expenditure competition improves welfare in all regions. But regions also engage in a form of tax competition similar to what occurs in the basic tax competition, causing tax rates to be too low. In the present case, each region fails to design its tax system to fully exploit the potential incentive effects created by labor mobility. Higher tax rates would strengthen the connection between the level of tax revenue and public good provision, thereby providing greater incentives for public officials to increase public good supplies. But the regions compete for mobile labor through reductions in tax rates. If they were to all raise their tax rates simultaneously, then the incentive would be strengthened without any outflows of labor.

Despite the efficiency losses from tax competition, welfare in the open economy exceeds welfare in the closed economy because of the existence of expenditure competition. The potential tax incentives associated with mobile labor may not be fully exploited, but at least such incentives are present, in contrast to their complete absence in the closed economy.

By reducing waste in government, opening the economy may reduce the effective "price" of the public good enough to induce residents to provide the public sector with more tax revenue than

is available in the closed economy. Thus, opening the economy may raise or lower the total "size" of government, although welfare unambiguously rises. This conclusion is consistent with the empirical ambiguities identified by Oates (1985, 1989) and others.

Although Wilson and Gordon (1998) do not model capital mobility, it is likely to play a similar efficiency-enhancing role. In this case, government officials will engage in expenditure competition by increasing those public inputs that enhance the productivity of capital. But it is also possible that this competition for capital might inefficiently distort the pattern of public expenditures away from expenditures on public goods or inputs that do not enhance capital productivity, an outcome similar to the Keen–Marchand (1997) finding mentioned above.

CONCLUDING REMARKS

The intellectual history of tax competition seems to have taken a normal route, going from simple models yielding straightforward results to more complicated and less clear-cut conclusions. The original insight that tax competition can lead to inefficiently low taxes and public good levels has been shown to hold in more general settings than originally investigated. However, the literature has also identified circumstances under which other inefficiencies occur, and it has also investigated competition involving a variety of nontax instruments. Competition among governments is now seen as a less straightforward phenomenon than perhaps originally envisioned. In fact, recent work has begun to examine models in which this competition has beneficial aspects.

The literature has also begun to investigate models in which political processes involving self-interested government officials take center stage. Here, intergovernmental competition for mobile factors has been shown to play a beneficial role. Briefly stated, this competition may induce government officials to reduce waste in government. This possibility brings us back to the contrast between Tiebout models and tax competition models made in my introductory remarks. Tiebout models are motivated by the view that competition among independent governments is similar to competition in the private sector and therefore has desirable efficiency properties. In contrast, tax competition models often take the view that intergovernmental competition departs from the assumptions of the standard competitive model in ways that negate its efficiency properties. This paper has stressed the role of interregional externalities in this regard. As mentioned in the Introduction, Sinn (1997) stresses the nature of the goods and services provided by governments: since they tend to be those goods and services for which competitive markets do not perform well, reintroducing competition among governments in their provision is likely to reintroduce market failures. The political approach to modeling intergovernmental competition takes a middle ground. On the one hand, it follows the Tiebout approach by recognizing that this competition introduces efficiency-enhancing incentives similar to the profit motives facing competitive firms. On the other hand, it departs from Tiebout models by recognizing that such incentives operate in an environment characterized by market failures that make a fully efficient equilibrium unattainable. As such, competition among governments has both good and bad aspects, the importance of which vary across the attributes of the goods and services that the governments provide. This assessment suggests a role for intervention by a central authority, but both political considerations and information problems should be carefully addressed.

References

Anderson, John E., and Hendrik Van den Berg. "Fiscal Decentralization and Government Size: An International Test for Leviathan Accounting for Unmeasured Economic Activity." *International Tax and Public Finance* 5 (1998): 171–86.

Bayindir-Upmann, Thorsten. "Two Games of Interjurisdictional Competition When Local Governments Provide Industrial Public Goods." *International Tax and Public Finance* 5 (1998): 471–87.

Beck, John H. "Tax Competition, Uniform Assessment, and the Benefit Principle. *Journal of Urban Economics* 13 (1983): 127–46.

Biglaiser, Gary, and Claudio Mezzetti. "Politicians' Decision Making with Re-Election Concerns." *Journal of Public Economics* 66 (1997): 425–47.

Black, Dan A., and William H. Hoyt. "Bidding for Firms." *American Economic Review* 79 (1989): 1249–56.

Blumenthal, Marsha, and Joel B. Slemrod. "The Compliance Cost of Taxing Foreign-Source Income: Its Magnitude, Determinants, and Policy Implications." *International Tax and Public Finance* 2 (1995): 37–54.

Boadway, Robin, and Michael Keen. "Efficiency and the Optimal Direction of Federal-State Transfers." *International Tax and Public Finance* 3 (1996): 137–55.

Boadway, Robin, Maurice Marchand, and Marianne Vigneault. "The Consequences of Overlapping Tax Bases for Redistribution and Public Spending in a Federation." *Journal of Public Economics* 68 (1998): 453–78.

Bond, Eric W. "Tax Holidays and Industry Behavior." *Review of Economics and Statistics* 63 (1981): 88–95.

Bond, Eric W., and Thomas A. Gresik. "Regulation of Multinational Firms with Two Active Governments: A Common Agency Approach." *Journal of Public Economics* 59 No. 1 (January, 1996): 33–53.

Bond, Eric W., and Thomas A Gresik. "Incentive Compatible Information Transfer Between Asymmetrically Informed Principals." Department of Economics, Pennsylvania State University. Mimeo, 1998.

Bond, Eric W., and Larry Samuelson. "Strategic Behavior and the Rules for International Taxation of Capital." *Economic Journal* 99 (1989): 1099–1111.

Braid, Ralph M. "Spatial Competition Between Jurisdictions Which Tax Perfectly Competitive Retail (or Production) Centers." *Journal of Urban Economics* 34 (1993): 75–95.

Braid, Ralph M. "Symmetric Tax Competition with Multiple Jurisdictions in Each Metropolitan Area." *American Economic Review* 86 No. 5 (December 1996): 1279–90.

Braid, Ralph. M. "Property Taxes, Wage Taxes, and Tax Exporting with Multiple Jurisdictions in Each Metropolitan Area." Department of Economics, Wayne State University. Mimeo, 1997.

Braid, Ralph M. "A Spatial Model of Tax Competition with Multiple Tax Instruments." Department of Economics, Wayne State University. Mimeo, 1998.

Brennan, Geoffrey, and James Buchanan. *The Power to Tax: Analytical Foundations of a Fiscal Constitution*. New York: Cambridge University Press, 1980.

Brueckner, Jan K.
  "Tiebout/Tax-Competition Models." Working Paper No. 69. Champaign: The Institute of Government and Public Affairs, University of Illinois at Urbana–Champaign, 1999.
Brueckner, Jan K., and Luz A. Saavedra.
  "Do Local Governments Engage in Strategic Tax Competition." Department of Economics, University of Illinois at Urbana–Champaign. Mimeo, 1998.
Bucovetsky, Sam.
  "Asymmetric Tax Competition." *Journal of Urban Economics* 30 (1991): 67–181.
Bucovetsky, Sam.
  "Rent Seeking and Tax Competition," *Journal of Public Economics* 58 (1995): 337–63.
Bucovetsky, Sam, and John D. Wilson.
  "Tax Competition with Two Tax Instruments" *Regional Science and Urban Economics* 21 (1991): 333–50.
Bucovetsky, Sam, Maurice Marchand, and Pierre Pestieau.
  "Tax Competition and Revelation of Preferences for Public Expenditure." *Journal of Urban Economics* 44 (1998): 367–90.
Burbidge, John B., and Gordon M. Myers.
  "Population Mobility and Capital Competition." *Regional Science and Urban Economics* 24 (1994): 441–59.
Burbidge, John B., James A. DePater, Gordon M. Myers, and Abhijit Sengupta.
  "A Coalition-Formation Approach to Equilibrium Federations and Trading Blocs." *American Economic Review* 87 (1997): 940–56.
Cremer, Helmuth, and Firouz Gahvari.
  "Tax Evasion, Tax Policy and Economic Integration." Department of Economics, University of Illinois at Urbana–Champaign. Mimeo, 1996.
Dahlby, Bev.
  "Fiscal Externalities and the Design of Government Grants." *International Tax and Public Finance* 3 (1996): 397–412.
Davies, Ronald B.
  "The OECD Model Tax Treaty: Tax Competition and Two-Way Capital Flows." Department of Economics, Pennsylvania State University. Mimeo, 1998.

Davies, Ronald B., and Thomas A. Gresik.
  "Tax Competition and Foreign Debt." Working Paper No. 4-98-1. University Park: Department of Economics, Pennsylvania State University, 1998.
de Crombrugghe, Alain, and Henry Tulkens.
  "On Pareto Improving Commodity Tax Changes Under Fiscal Competiton." *Journal of Public Economics* 41 (1990): 335–50.
DePater, James A., and Gordon M. Myers.
  "Strategic Capital Tax Competition: A Pecuniary Externality and a Corrective Device." *Journal of Urban Economics* 36 (1994): 66–78.
Dhillon, Amitra, Carlo Perroni, and Kimberley Scharf.
  "Implementing Tax Coordination." *Journal of Public Economics* (forthcoming).
Diamond, Peter A., and James Mirrlees.
  "Optimal Taxation and Public Production." *American Economic Review* 61 (1971): 8–27 and 261–78.
Dixit, Avinash, and Victor Norman.
  Theory of International Trade. London: Cambridge University Press, 1980.
Edwards, Jeremy, and Michael Keen.
  "Tax Competition and Leviathan." *European Economic Review* 40 (1996): 113–34.
Fischel, William A.
  "Fiscal and Environmental Considerations in the Location of Firms in Suburban Communities." In *Fiscal Zoning and Land Use Controls*, edited by Edwin Mills and Wallace Oates, 119–74. Lexington, MA: D.C. Heath, 1975.
Frenkel, Jacob A., Assaf Razin, and Efraim Sadka.
  International Taxation in an Integrated World. Cambridge, MA: MIT Press, 1991.
Gordon, Roger H.
  "Taxation of Investment and Savings in the World Economy." *American Economic Review* 76 (1986): 1086–1102.
Gordon, Roger H., and Jeffrey K. MacKie-Mason.
  "Why is There Corporate Taxation in a Small Open Economy? The Role of Transfer Pricing and Income Shifting." In *The Effects of Taxation on Multinational Corporations*, edited by M. Feldstein, J. Hines, Jr., and R. Hubbard. Chicago: University of Chicago Press, 1995.

Gordon, Roger H., and A. Lans Bovenberg. "Why is Capital so Immobile Internationally? Possible Explanations and Implications for Capital Income Taxation." *American Economic Review* 86 (1996): 1057–75.

Gordon, Roger H., and John D. Wilson. "Tax Structure and Government Behavior: A Principal-Agent Model of Government." Department of Economics, Michigan State University. Mimeo, 1998.

Gresik, Thomas. "The Taxing Task of Taxing Transnationals." Department of Economics, Pennsylvania State University. Mimeo, 1998.

Haaparanta, Pertti. "Competition for Foreign Direct Investments." *Journal of Public Economics* 63 (1996): 141–53.

Hamilton, Bruce W. "Zoning and Property Taxation in a System of Local Governments." *Urban Studies* 12 (1975): 205–11.

Hamilton, Bruce W. "Capitalization of Intrajurisdictional Differences in Local Tax Prices." *American Economic Review* 66 (1976): 743–53.

Haufler, Andreas. "Tax Coordination with Different Preferences for Public Goods: Conflict or Harmony of Interest?" *International Tax and Public Finance* 3 (1996): 5–28.

Haufler, Andreas. "Asymmetric Commodity Tax Competition—Comment on de Crombrugghe and Tulkens. *Journal of Public Economics* 67 (1998): 135–44.

Haufler, Andreas, and Ian Wooton. "Country Size and Tax Competition for Foreign Direct Investment." *Journal of Public Economics* 71 (1999): 121–39.

Hines, James R., Jr. "Tax Policy and the Activities of Multinational Corporations." In Fiscal Policy: Lessons from Economic Research, edited by Alan J. Auerbach, 401–45. Cambridge, MA: MIT Press, 1997.

Hines, James R., Jr. "Lessons from Behavioral Responses to International Taxation." *National Tax Journal* 52 No. 2 (June, 1999): 305–22.

Hoyt, William H. "Competitive Jurisdictions, Congestion, and the Henry George Theorem: When Should Property Be Taxed Instead of Land?" *Regional Science and Urban Economics* 21 (1991a): 351–70.

Hoyt, William H. "Property Taxation, Nash Equilibrium, and Market Power." *Journal of Urban Economics* 34 (1991b): 123–31.

Hoyt, William H. "Tax Policy Coordination and Optimal Taxation in a System of Hierarchical Governments." Department of Economics, University of Kentucky. Mimeo, 1996.

Hoyt, William H., and Richard A. Jensen, "Precommitment in a System of Hierarchical Governments." *Regional Science and Urban Economics* 26 (1996): 481–504.

Huang, Yophy. *Tax Competition with Involuntary Unemployment*. Ph.D. diss. Bloomington: Indiana University, 1992.

Huber, Bernd. "Tax Competition and Tax Coordination in an Optimum Income Tax Model." *Journal of Public Economics* 71 (1999): 441–58.

Janeba, Eckhard. "Corporate Income Tax Competition, Double Taxation Treaties, and Foreign Direct Investment." *Journal of Public Economics* 56 (1995): 311–26.

Janeba, Eckhard. "Tax Competition in Imperfectly Competitive Markets." *Journal of International Economics* 44 (1998a): 135–53.

Janeba, Eckhard. "Tax Competition When Governments Lack Commitment: Excess Capacity as a Countervailing Threat." Department of Economics, Indiana University. Mimeo, 1998b.

Janeba, Eckhard, and Wolfgang Peters. "Tax Evasion, Tax Competition and the Gains from Nondiscrimination: The Case of Interest Taxation in Europe." *Economic Journal* 109 (1999): 93–101.

Jensen, Richard, and Eugenia F. Toma. "Debt in a Model of Tax Competition." *Regional Science and Urban Economics* 21 (1991): 371–92.

Kanbur, Ravi, and Michael Keen.
"Jeux Sans Frontieres: Tax Competition and Tax Coordination When Countries Differ in Size." *American Economic Review* 83 (1993): 877–92.

Keen, Michael.
"Vertical Tax Externalities in the Theory of Fiscal Federalism." *International Monetary Fund Staff Papers* 45 (1998): 454–84.

Keen, Michael, and Christos Kotsogiannis.
"Federalism and Tax Competition," Department of Economics, University of Essex. Mimeo, 1996.

Keen, Michael, and Maurice Marchand.
"Fiscal Competition and the Pattern of Public Spending." *Journal of Public Economics* 66 (1997): 33–53.

Kehoe, Patrick J.
"Policy Cooperation Among Benevolent Governments May Be Undesirable." *Review of Economic Studies* 56 (1989): 289–96.

Kennan, John, and Raymond Riezman.
"Do Big Countries Win Tariff Wars?" *International Economic Review* 29 (1988): 81–5.

Kim, Jinyoung, and John D. Wilson.
"Racing to the Bottom with Multiple Tax Instruments." *Japan and the World Economy* 9 (1997): 537–51.

King, Ian, R. Preston McAfee, and Linda Welling.
"Industrial Blackmail: Dynamic Tax Competition and Public Investment." *Canadian Journal of Economics* 26 (1993): 590–608.

Krelove, Russell.
"The Persistence and Inefficiency of Property Tax Finance of Local Public Expenditures." *Journal of Public Economics* 51 (1993): 415–35.

Lee, Kangoh.
"Tax Competition with Imperfectly Mobile Capital." *Journal of Urban Economics* 42 (1997): 222–42.

Lee, Kangoh.
"Factor Ownership and Governmental Strategic Interaction: An Efficient Nash Equilibrium." Department of Economics, Towson University. Mimeo, 1998.

Lockwood, Ben.
"Commodity Tax Competition Under Destination and Origin Principles." *Journal of Public Economics* 52 (1993): 141–62.

Markusen, James R., Edward R. Morey, and Nancy Olewiler.
"Competition in Regional Environmental Policies When Plant Locations Are Endogenous." *Journal of Public Economics* 56 (1996): 55–77.

Martin, Laurent.
"Bidding for Firms: An Asymmetric Auction Model of Interjurisdictional Competition." Department of Economics, University of Maryland. Mimeo, 1997.

Mezzetti, Claudio.
"Common Agency with Horizontally Differentiated Principals." *Rand Journal of Economics* 28 (1997): 323–45.

Mieszkowski, Peter, and George Zodrow.
"Taxation in the Tiebout Model." *Journal of Economic Literature* 27 (1989): 1089–1146.

Mintz, Jack, and Henry Tulkens.
"Commodity Tax Competition Between Member States of a Federation: Equilibrium and Efficiency." *Journal of Public Economics* 29 (1986): 133–72.

Mirrlees, James A.
"An Exploration in the Theory of Optimum Income Taxation." *Review of Economic Studies* 38 (1971): 175–208.

Niskanen, William A., Jr.
Bureaucracy and Representative Government. Chicago: Aldine, 1971.

Noiset, Luc.
"Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods: Comment." *Journal of Urban Economics* 38 (1995): 312–16.

Oates, Wallace E.
Fiscal Federalism. New York: Harcourt Brace Jovanovich, 1972.

Oates, Wallace E.
"Searching for Leviathan: An Empirical Analysis." *American Economic Review* 75 (1985): 748–57.

Oates, Wallace E.
"Searching for Leviathan: A Reply and Some Further Reflections." *American Economic Review* 79 (1989): 578–83.

Oates, Wallace E., and Robert M. Schwab.
"Economic Competition Among Jurisdictions: Efficiency Enhancing or Distortion Inducing?" *Journal of Public Economics* 35 (1988): 333–54.

Osmundsen, Petter, Káre P. Hagen, and Guttorm Schjelderup.
"Internationally Mobile Firms and Tax Policy." *Journal of International Economics* 45 (1998): 97–113.

Perroni, Carlo, and Kimberley A. Scharf.
"Tiebout with Politics: Capital Tax Competition and Constitutional Choices." Working Paper No. 1997–05. Copenhagen: Economic Policy Research Unit, Copenhagen Business School, 1997.

Persson, Torsten, and Guido Tabellini.
"The Politics of 1992: Fiscal Policy and European Integration." *Review of Economic Studies* 59 (1992): 689–701.

Rauscher, Michael.
"Environmental Regulation and the Location of Polluting Industries." *International Tax and Public Finance* 2 (1995): 229–44.

Rauscher, Michael.
"Interjurisdictional Competition and the Efficiency of the Pubic Sector: The Triumph of the Market over the State?" Working Paper 732. Kiel: Institute of World Economics, 1996.

Rauscher, Michael.
"Leviathan and Competition Among Jurisdictions: The Case of Benefit Taxation." *Journal of Urban Econonomics* 44 (1998): 59–67.

Razin, Assaf, and Efraim Sadka.
"International Tax Competition and Gains from Tax Harmonization." *Economics Letters* 37 (1991): 69–76.

Richter, Wolfram F., and Dietmar Wellisch.
"The Provision of Local Public Goods and Factors in the Presence of Firm and Household Mobility." *Journal of Public Economics* 60 (1996): 73–93.

Ross, Stephen, and John Yinger.
"Sorting and Voting: A Review of the Literature on Urban Public Finance." Center for Policy Research, The Maxwell School, Syracuse University. Mimeo, 1998.

Sinn, Hans-Werner.
"The Selection Principle and Market Failure in Systems Competition." *Journal of Public Economics* 66 (1997): 247–74.

Tannenwald, Robert.
"Devolution: The New Federalism—An Overview." *New England Economic Review* (1998): 1–12.

Tiebout, Charles M.
"A Pure Theory of Local Expenditures." *Journal of Political Economy* 64 (1956): 416–24.

Trandel, Gregory A.
"Interstate Commodity Tax Differentials and the Distribution of Residents." *Journal of Public Economics* 53 (1994): 435–57.

Wellisch, Dietmar.
The Theory of Public Finance in a Federal State. New York: Cambridge University Press (forthcoming).

White, Michelle J.
"Firm Location in a Zoned Metropolitan Area." In *Fiscal Zoning and Land Use Controls*, edited by Edwin Mills and Wallace E. Oates. Lexington, MA: D.C. Heath, 1975.

Wildasin, David E.
"Nash Equilibria in Models of Fiscal Competition." *Journal of Public Economics* (1988).

Wildasin, David E.
"Interjurisdictional Capital Mobility: Fiscal Externality and a Corrective Subsidy." *Journal of Urban Economics* 25 (1989): 193–212.

Wildasin, David E.
"Some Rudimentary Duopolity Theory." *Regional Science and Urban Economics* 21 (1991): 393–421.

Wilson, John D.
"A Theory of Interregional Tax Competition." *Journal of Urban Economics* 19 (1986): 296–315.

Wilson, John D.
"Trade, Capital Mobility, and Tax Competition." *Journal of Political Economy* 95 (1987): 835–56.

Wilson, John D.
"Tax Competition with Interregional Differences in Factor Endowments." *Regional Science and Urban Economics* 21 (1991): 423–52.

Wilson, John D.
  "Mobile Labor, Multiple Tax Instruments, and Tax Competition." *Journal of Urban Economics* 38 (1995): 333–56.

Wilson, John D.
  "Capital Mobility and Environmental Standards: Is There a Theoretical Basis for a Race to the Bottom?" In *Harmonization and Fair Trade*, Vol. 1, edited by Jagdish Bhagwati and Robert Hudec, 395–427. Cambridge, MA: MIT Press, 1996a.

Wilson, John D.
  "The Tax Treatment of Imperfectly Mobile Firms: Rent-Seeking, Rent-Protection, and Rent-Destruction." In *The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati*, edited by Robert C. Feenstra, Gene M. Grossman, and Douglas A. Irwin, 225–44. Cambridge, MA: MIT Press, 1996b.

Wilson, John D.
  "Property Taxation, Congestion, and Local Public Goods." *Journal of Public Economics* 64 (1997): 202–17.

Wilson, John D., and Roger H. Gordon.
  "Expenditure Competition." Department of Economics, Michigan State University. Mimeo, 1998.

Zodrow, George R., and Peter Mieszkowski.
  "Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods." *Journal of Urban Economics* 19 (1986): 356–70.