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Tax Assignment and Recent Technological Advances

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Tax Assignment and Recent Technological Advances

William F. Fox[1] and George R. Zodrow[2]

December 2024

Abstract

This paper begins with a summary of the general consensus among public sector economists regarding subnational tax assignment. We then examine how technological advances in a rapidly evolving and increasingly digital economy are altering the capacity of subnational governments to effectively impose some of their traditional broad-based taxes and discuss some major structural reforms that might facilitate continuing to raise revenues using these tax instruments. These economic changes are more likely to affect larger cities and more developed countries than lower-income cities and countries that often rely on simpler revenue structures. Nevertheless, the impacts of these technological changes will be felt across the world over time, and national and subnational governments in lower-income countries will eventually experience the same issues with their tax instruments as more developed jurisdictions. In any case, these economic changes will require many difficult policy decisions both within individual governments and in governmental interactions to yield workable subnational tax structures, given the increasingly digital nature of economic activity and the impacts of ever-changing technologies. Moreover, the accelerating pace of change creates pressures on governments to adapt more quickly than in the past – a potentially difficult task, given that history indicates that revenue sources are typically changed very infrequently.

Keywords: decentralization, intergovernmental revenue, tax assignment

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I. Introduction and Overview

The determination of the allocation of tax instruments across national and subnational governments – the "tax assignment" problem – is one of the long-standing issues in public economics. Musgrave (1983), McLure (1998, 2001), and Bird and Slack (2000) provided the key early analyses, while more recently our conference honoree, Jorge Martinez-Vazquez (2008, 2015), contributed two insightful studies that comprehensively explored many aspects of tax assignment.[1] Our goal in this paper is to build on these important contributions, primarily by investigating how their analyses and policy prescriptions might be modified by the rapid evolution of technology including the increasing digitization of the U.S. and the restof-the-world economies over the past several decades.

Subnational government finance must be evaluated in the context of a country's overall government expenditure and revenue structure. A commonly used conceptual approach is to begin by determining the overall level of public services that government should provide and then allocating these service functions across national, state/provincial, and local governments. Musgrave (1959) summarized the three main functions of government as achieving an efficient allocation of resources, providing macroeconomic stabilization, and ensuring a socially acceptable distribution of income. He argued that national and subnational governments should share responsibilities for achieving allocative efficiency, with the allocation of services depending primarily on the geographical scope of the public service being provided, while macroeconomic stabilization and income redistribution should be primarily central government functions.[2]

Musgrave's tripartite classification of governmental public service responsibilities has largely stood the test of time. Subnational governments, especially in largely open economies, are unlikely to be effective in implementing stabilization policies as macroeconomic conditions are determined primarily at the national and international levels. In particular, it is clear that subnational governments can have only minimal if any effects on interest rates. Moreover, much of the benefits of any subnational government stabilization policies, such as attempts to stimulate employment or aggregate demand, are likely to be captured by non-residents so that

[1] See also Oates (1972), Boadway (1997), Norregaard (1997), Bahl and Bird (2008, 2018), Martinez-Vazquez, Noiset, and Rider (2010), and Bahl and Cyan (2011).

[2] Agrawal, Brueckner, and Brulhart (2024) provide an extensive review of fiscal federalism.

such efforts are not likely to be deemed desirable by resident voters. Similarly, geographical mobility of residents limits the effectiveness of attempts at subnational income redistribution, as redistributive taxes may drive higher-income taxpayers out of a taxing jurisdiction while generous redistributive benefits may attract lower-income recipients, with both phenomena exacerbating the difficulties associated with reducing inequality at the subnational level.

This broad assignment of the stabilization and redistribution functions to the central government is still generally accepted by both economists and policymakers, and we accordingly focus on allocative issues in this paper. However, it is important to note that in practice some degree of both stabilization policy and income redistribution takes place at the subnational level; indeed, Bahl and Cyan (2008, p. 265) stress that, "some subnational governments now have taken on a substantial redistribution role [and] regularly use tax policies to stimulate their economies …" The most prominent example is the use of progressive state income taxes in the United States, which both redistribute income (e.g., the state of California has a progressive marginal tax rate structure with a top marginal rate of 12.3 percent) and serve a stabilization function as revenues under a progressive income tax are counter-cyclical. Similarly, the U.S. states play a major role in determining participation in and the parameters of redistributive policies such as the Medicaid program, and local governments in some larger cities (e.g., Houston, Los Angeles, San Francisco, and Denver) are experimenting with ways of addressing problems of homelessness in their localities.[3] [4] Thus, while Musgrave's three-function categorization is certainly a helpful way to think about the allocation of governmental service responsibilities, there are many exceptions to this general rule. As a result, in practice many decisions remain to be resolved on the specific service delivery roles for subnational governments, and these resolutions naturally differ significantly both across and within countries.

All of the seminal studies cited above agree on the general prescription that the distribution of revenues across and within levels of government should follow functional expenditure responsibilities; that is, both vertically and horizontally subnational governments must – at least at the margin – have access to own-source revenues sufficient to finance the public services they deliver. This dictum does not, however, preclude national grants to subnational governments. As will be discussed in the following section, such grants may be desirable to promote efficiency and equity, and collecting taxes at the national level and then distributing the revenues to subnational governments also has advantages on administrative and efficiency grounds. These arguments suggest that a perhaps significant level of subnational public services

[3] For a discussion of the Houston program, see Nicholas Kristof, "Here's How Houston is Fighting Homelessness – and Winning," *New York Times*, Nov. 22, 2023, https://www.nytimes.com/2023/11/22/opinion/homeless-houston-dallas.html.

[4] Pauly (1973) stresses that subnational income redistribution is likely to be desirable if local residents are more concerned about the welfare of the low-income residents of their own jurisdictions than they are about the low-income residents of all other jurisdictions.

should be financed with national grants. Nevertheless, as will be discussed further below, the allocative efficiency arguments made by Musgrave for subnational provision of certain public services – primarily those with benefits that are entirely or largely subnational in scope – are valid only if subnational governments use own-source revenues to finance marginal expenditures that benefit their residents (McLure, 2001).[5] [6]

This line of reasoning indicates that some own-source revenue must be raised by subnational governments, but provides little guidance on the specific revenue sources that should be utilized. Many studies have attempted to provide more precise guidance by identifying the best subnational revenue sources. In particular, although Martinez-Vazquez (2015) notes that there is no generally applicable theory of the best approach to subnational finance, he provides an excellent comprehensive survey of options for subnational taxes and their relative advantages and disadvantages.[7]

Our paper begins with a summary of the general consensus among public sector economists regarding subnational tax assignment. The discussion is relatively brief, as this topic has been addressed in many earlier studies and is summarized thoroughly by Martinez-Vazquez (2015). We then examine how technological advances in a rapidly evolving and increasingly digital economy are altering the capacity of subnational governments to effectively impose some of their traditional broad-based taxes, and discuss some major structural reforms that might facilitate continuing to raise revenues using these tax instruments. These economic changes are more likely to affect larger cities and more developed countries than lower-income cities and countries that often rely on simpler revenue structures. Nevertheless, the impacts of these technological changes will be felt across the world over time, and national and subnational governments in lower-income countries will eventually experience the same issues with their tax instruments as more developed jurisdictions. In any case, these economic changes will require many difficult policy decisions both within individual governments and in governmental interactions to yield workable subnational tax structures, given the increasingly digital nature of economic activity and the impacts of ever-changing technologies. Moreover, the accelerating pace of change creates pressures on governments to adapt more quickly than in the past – a potentially difficult task, given that history indicates that revenue sources are typically changed very infrequently.

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[5] One commonly cited benchmark is that tax assignment should be structured so that the richest jurisdictions are able to use own-sources of revenue to finance all of their local public expenditures (other than those that generate external benefits).

[6] However, as will be discussed further below, this conclusion must be tempered by the fact that local use of taxes applied to mobile factors of production or local consumption goods may result in tax competition that leads to the under-provision of local public services.

[7] See also Bahl and Bird (2008). Many papers focus on how the tax assignment issue has been addressed in individual countries; for example, see Fox and Wallich (1998) for discussion of tax assignment in Bosnia and Herzegovina.

II. Rationales for National and Subnational Tax Assignment

Large differences exist across the world in the revenues that countries raise and the role played by subnational governments in raising those revenues, reflecting many factors including differences in demands for government services and in levels of economic development. Thus, different countries have solved the tax assignment problem in many different ways. Nevertheless, the literature cited above suggests that some general principles can be broadly applied to addressing the tax assignment issue. These principles fall under two general headings: (1) some services provided by subnational governments should be financed by grants provided by the national government and funded from national revenue sources,[8] and (2) some services provided by subnational governments should be financed with own-source revenues.

A. National Grants to Subnational Governments

As noted above, a well-designed revenue system should have vertical balance between national and subnational governments, so that each level has the resources it needs to finance its own service delivery responsibilities. Beyond that, however, transfers or grants from the national government financed from national tax instruments play a key role for most subnational governments that have significant expenditure responsibilities.[9] There are three primary reasons for using national transfers to finance subnational expenditures.

First, national grants or transfers to subnational governments are required on efficiency grounds to the extent that the grants are designed to reflect nationwide external benefits of public services provided at the subnational level. In the absence of such grants, subnational governments will consider only the benefits that accrue to their own citizens in determining service levels, which will result in inefficiently low levels of such services.[10]

Second, national grants may be desirable on equity grounds to offset imbalances across subnational governments in the resources available to finance public services of a given quality, especially since such services, like education and police and fire protection, are often essential to citizen well-being. For example, such differences may arise between relatively wealthy and

[8] The "national/subnational" terminology used throughout the paper should be interpreted as referring either to interactions between national and state/provincial or local governments or between state/provincial and local governments.

[9] We do not directly address the issue of the magnitude or design of transfers in this paper. Boadway (2015), Bahl and Bird (2018) and Lago, Lago-Peñas, and Martinez-Vazquez (2023) provide excellent discussions of the roles and effects of intergovernmental transfers.

[10] On the other hand, transfers that are too large relative to positive national externalities will encourage over-spending at the subnational level.

relatively poor jurisdictions[11] and between rural and urban jurisdictions if their costs of providing certain services differ significantly. National grants can ensure some level of horizontal balance among subnational governments so that each can provide at least minimum levels of the most essential public services, regardless of the resources (tax bases) available to each government or the relative costs of providing such services.[12] [13] [14] Alternatively, national governments may anticipate that pressure to provide transfers to offset resource differentials will arise and prefer to provide the services at the national level.

Third, national governments have inherent efficiency and administrative advantages in raising revenues effectively – advantages which suggest that it may be desirable to collect taxes at the national level and then use a revenue-sharing mechanism to return the revenues to the subnational government where the taxes were collected. Three arguments underpin this conclusion. First, tax bases at the national level are relatively immobile. In particular, capital and high-skilled labor are more mobile across subnational jurisdictions than across nations (although international factor mobility is of course also an issue) and the mobility of sales (cross-border shopping) is more problematic at the subnational level as well. Subnational taxes are thus more likely to result in allocative efficiency losses, as mobile factors of production leave jurisdictions that impose taxes that are high relative to benefits received – the subject of the voluminous tax competition literature.[15] In particular, the resulting tax competition may result in inefficient under-provision of public services.[16] Second, cross-border transactions complicate the administration of most taxes, especially the value-added tax (VAT) and the corporate income tax, and these complexities are much more pronounced with subnational than with national

[11] Note, however, that direct transfers to poor individuals may be a more effective and less costly means of correcting distributional problems than transfers to political jurisdictions with disproportionately poor populations.

[12] Note that national governments are concerned primarily with ensuring a minimum level of provision of essential services rather than matching local tastes, because targeting larger transfers to places with higher service demands would be politically difficult, would likely be viewed as inequitable, and would likely promote inefficiency to the extent that central revenues would be used to finance relatively large marginal expenditures that benefit only local residents.

[13] Note that both horizontal and vertical balance should be evaluated dynamically, so that the revenue mix reflects changes in administrative tax collection capabilities over time and revenue growth is consistent with growth in the demand for public services.

[14] McLure (1998) notes that a prime example of such resource differentials arises if subnational governments are assigned taxes on natural resources; accordingly, he recommends that resource taxes be assigned to the national government, a practice that is followed in most countries other than the United States, which is characterized by large differences in subnational natural resource tax bases.

[15] See Zodrow and Mieszkowski (1986a) and Wilson (1986) for early contributions and Wilson (1999), Zodrow (2010), and Agrawal, Hoyt, and Wilson (2022) for reviews of the tax competition literature.

[16] On the other hand, as stressed by McLure (2001), such inter-jurisdictional competition may be efficiency-enhancing if it forces local jurisdictions to provide the service/tax packages that are desired by its residents and businesses, including the avoidance of business taxes that are not related to benefits received; see Wilson and Wildasin (2004) and Zodrow (2003) for reviews of these arguments.

taxes. Finally, there are often significant economies of scale in tax collection that are maximized with taxes that are national in scope.[17] [18]

From the perspective of the national government, several additional considerations support the desirability of revenue collection at the national level. Central governments may fear that they will lose some control over the macroeconomy if some taxes and public expenditures are set subnationally without attention to a hard budget constraint (although this concern is not especially relevant in the U.S. context, given current fiscal imbalances at the federal level coupled with state-level balanced budget requirements). A related concern is that subnational governments may fail to follow national priorities – although it should be noted that allowing such differences in tastes and priorities to be manifested at the subnational level is the prime rationale for decentralization. National governments may also be concerned that subnational taxes will substitute for national taxes and reduce their ability to generate revenues. These vertical externalities may arise because higher subnational tax rates reduce the base available to the national government, because they increase combined tax rates and thus increase the efficiency costs of using a given tax, and because they may reduce the political capacity for the national government to raise rates.[19] [20]

B. Subnational Own-Source Revenues

The discussion thus far has focused on the rationales for, and the advantages of, collecting taxes at the national level – effectively avoiding the problem of assigning taxes to different levels of

[17] As will be discussed further below, partially for these reasons, Martinez-Vazquez (2015) characterizes the value-added tax (VAT), and the corporate income tax as "possible bad choices" for subnational taxes.

[18] Mobility considerations, especially for high-income taxpayers, also suggest that a progressive individual income tax can be imposed more effectively at the national level. The extent of mobility of high earners, however, is a contentious issue in the literature. Kleven, Landais, Muñoz, and Stantcheva (2020) review the literature and conclude that certain population subgroups, such as highly compensated entertainers and athletes, star scientists, or foreigners subject to preferential tax regimes, appear to be quite mobile in response to income tax differentials. However, Young, Varner, Lurie, and Prisinzano (2016), drawing on Young and Varner (2011), examine state "millionaire taxes" in the United States and conclude that tax incentives for migration are largely offset by "elite embeddedness" due to strong social and economic locational ties that inhibit migration. Young, Varner, Lurie, and Prisinzano (2016, p. 423) conclude that, "millionaire migration is indeed responsive to top income tax rates. However, the magnitude of the migration response is small and has little effect on the millionaire tax base." In marked contrast, Rauh and Shyu (2024) estimate that 2012 increases in marginal state income tax rates in California of as much as 3 percentage points increased outmigration rates of top-bracket taxpayers by 0.8 percent, relative to a baseline outmigration rate of 1.5 percent. Similarly, Cassidy et al. (2024, p. 359), using U.S. data for 1900 to 2010, find that the introduction of state income taxes during the post-World-War II period "induced significant outmigration to non-income-tax states by middle- and high-earning households." Jakobsen et al. (2024) find that wealth taxes affect out-migration flows but have quantitatively small aggregate economic effects.

[19] See Brulhart and Jametti (2006) for an example of related literature.

[20] National governments may also be concerned that subnational governments do not have the administrative capacity to collect taxes effectively. However, this is primarily an argument for capacity building or for having local governments "piggy-back" on central governments collections (e.g., with a surtax on the national tax base) rather than long-term transfers.

government. Indeed, the advantages of subnational government service provision generally lie not in the ability of such governments to levy taxes effectively (with the possible exception of the local property tax), but instead in their ability to provide certain services – those whose benefits are primarily local in scope – more effectively than their national counterparts. These advantages are numerous. For example, subnational government leaders, especially those at the local level, are "closer to the people" in their jurisdictions. As a result, subnational governments are more likely to be held accountable by their constituencies for the revenues generated from highly visible and thus more transparent payments by their own residents and businesses that are determined through the local political process; indeed, some have suggested that taxpayers are more willing to pay taxes at the local level if they are able to see that the revenues are used effectively to benefit them.[21] Local residents may have more direct access to government leaders, and local provision increases the transparency of public service provision, including their costs and the efficiency with such services are provided, both relative to competing private services and in comparison to similar services provided in nearby competing jurisdictions. In addition, service provision at the subnational level implies that public service and tax packages can be tailored to the tastes of the citizens of each jurisdiction, which are very likely to vary across jurisdictions, rather than adopting the "one size fits all" public good approach typically associated with national public good provision. Indeed, as stressed in the famous Tiebout (1956) model, the combination of different service/tax packages across competing local jurisdictions and consumer mobility creates the potential for efficiency in public service provision. Under this scenario, consumers "vote with their feet" by choosing their jurisdiction of residence (which is characterized by residents who are homogeneous with respect to demands for public services) while local governments compete to attract residents, both by offering a desirable service/tax package and by providing that package efficiently.

These advantages of subnational public service provision have resulted in a worldwide movement toward decentralization of public services – a trend that makes the determination of the solution to the tax assignment problem especially critical.[22] Examples of public services that are provided locally and vary across local jurisdictions include public schools, police and fire protection, parks and green spaces, sanitation, road quality, etc. However, the efficiency advantages of delivering services at the subnational and especially the local level can be achieved only if subnational governments finance marginal expenditures with own-source revenues. Only in this way can subnational jurisdictions avoid the political economy and allocative efficiency problems that arise when local residents enjoy the benefits of an expansion of public services without incurring the full costs of providing those benefits. That is,

[21] Some evidence for this argument is provided by Simonsen and Robbins (2003), who examine the effects of a one-time property tax revenue loss in Waterford, Connecticut. They show that voter satisfaction with general local public services helps to explain public support for the tax increases that were needed to finance continuation of the services.

[22] The Tiebout (1956) model offers no help on this score, as Tiebout assumed that all local public services were simply financed with head taxes.

subnational governments will operate more efficiently if their marginal expenditure decisions are based on a comparison between the perceived cost of the last dollar raised from local populations and the local benefits from the services financed by that last dollar; in particular, expansions of local public services should move forward only if local marginal benefits equal or exceed local marginal costs. Thus, McLure (2001, p. 344) stresses that, "Only if "benefit" taxes reflect benefits received *at the margin* will the taxes not distort economic decisions." By comparison, apart from the external effects and equity concerns noted above, inefficient over-expansion of public services is likely if local benefits of marginal public services are compared to the local cost of using funds transferred from a higher level of government that may be perceived to be "free" or to other costs borne by non-residents (including taxes "exported" to the residents of other jurisdictions that are not offset by external benefits of local public services provided by the taxing jurisdiction). Similarly, the Tiebout model of local jurisdictions competing to attract potential residents based on differential tax/expenditure packages will result in an efficient allocation of resources to the public sector – the public sector analog to private markets – only if residents pay in full for the services they receive.[23] Thus, as long as efficiency requires the provision of some public services at the subnational level as envisioned by Musgrave, some revenues must be raised by subnational governments and the tax assignment problem must be resolved.

The main thesis of this paper is that technology is complicating the solution to the tax assignment problem. In particular, technological changes are making more difficult the imposition of some broad-based taxes commonly used by subnational governments – and some national taxes as well, although to a lesser extent. This raises the issue of whether transfers will become a relatively more important source of revenues for subnational governments in the future.

III. Determining Subnational Revenues

A. What is Subnational Own-Source Revenue?

We begin by considering what it means for a subnational government to have access to its own revenue source. Tax assignment can be separated into four components, involving which level of government determines the tax base, sets the tax rate, uses the tax revenues, and administers the tax. Subnational access to only the use of revenue is not sufficient to deem a revenue as "own-source." Rather, taxes are considered to be "shared" when the higher-level government sets the tax base and rate and administers the tax but allows a local government to use the revenues; such revenues may be used where the funds are collected or shared on some other

[23] A separate issue is that transfers may not be transparent to local populations, especially since information on the extent of transfers may be difficult to obtain or interpret, again implying that political decisions regarding the level of public services may not be efficient.

basis (e.g., a revenue sharing formula). Under these circumstances, the national government owns the revenues but chooses to share them with the local governments. Tax sharing has been used in several countries including Russia, Croatia, Hungary, and Bangladesh, and the United States had a general revenue sharing program from 1972 to 1986.

Subnational revenues could be considered own-source if the subnational government sets the rate and/or base and/or administers the tax. However, the freedom to set the rate is the defining characteristic of own-source revenues, as the rate is the most visible element of a tax structure and plays the key role in determining the local tax burden. Moreover, there are often compelling reasons for a tax base to be set at the national level (to avoid the complexity of multiple bases for businesses that operate in many jurisdictions) and for administration to occur at higher levels of government (to take advantage of economies of scale in tax collection and greater tax collecting capacity). As long as the selection of the rate falls under the control of the subnational government, revenue can be considered own-source, facilitating the greater accountability, responsiveness, and efficient decision-making that provides the rationale for decentralization of expenditure and tax responsibilities.[24]

B. Determining Tax Assignment

Given that subnational governments must raise some own-source revenue, the tax assignment problem must be resolved. Some general guidelines can provide direction on the assignment of various taxes to national or subnational levels of governments, although there are few absolutes and the appropriate guidance may differ across jurisdictions depending on their individual characteristics; in addition, some subnational jurisdictions may choose taxes that are inconsistent with conventional guidance.[25] Martinez-Vazquez (2015) provides such an analysis, constructing a comprehensive table illustrating the advantages and disadvantages of a wide range of taxes that have at various times and in various places been utilized at the subnational level; this table clearly illustrates the many trade-offs among alternative criteria that must be made in determining tax assignment.[26] His analysis suggests that, primarily on efficiency and

[24] We also note below that taxpayers may perceive the collecting government as accountable for a tax regardless of other tax ownership components, suggesting that subnational collection may also be important where viable.
[25] For example, most U.S. states and New York City impose corporate income taxes, although most academic experts argue that such taxes are a poor choice for a subnational tax instrument and we do not discuss them in this paper. For an investigation of the issues raised by implementing state corporate income taxes in the digital age, including the use of formula apportionment to determine the allocation of profits among the states, see McLure (2000).
[26] Specifically, Martinez-Vazquez (2015) considers 25 different taxes in terms of 15 different criteria: revenue potential, elasticity of revenues or buoyancy, the mobility of the tax base, overall potential efficiency costs, sensitivity to the business cycle, adaptability to the benefit principle of taxation, uniformity of the distribution of the tax base across jurisdictions, vertical equity, cost of administration if assigned to subnational governments, compliance costs, potential for corruption, acceptability by politicians and the private sector, exportability, and visibility/accountability.

administrative grounds, certain taxes, such as corporate income taxes and the VAT, should probably be national taxes. By comparison, other taxes, such as income and payroll taxes, sales taxes, certain license fees, various business taxes, and the property tax are potentially "good choices" for subnational taxes. We focus on the following four especially important criteria for determining tax assignment.

First, ease of tax administration is a particularly critical issue for tax assignment, especially in developing countries where lack of administrative capacity at the subnational level is likely to be quite problematic. The national government should administer taxes that are difficult to administer locally. For example, some taxes, such as the corporate income tax and the VAT (as well as customs duties) are difficult to allocate across subnational jurisdictions and are best assigned to the national government. Similarly, central governments should administer taxes for which there are significant economies of scale in collection. On the other hand, local information may be valuable for collecting property taxes or certain business taxes, in which case subnational governments may have an administrative advantage. And, as stressed above, even if a national government collects a tax, it can still be regarded as a subnational own-source tax as long as the lower-level government can set the rate. Indeed, in some cases, it may be appropriate for the national and subnational governments to divide the functions associated with administering a tax. For example, a national government might maintain a national property cadaster while the lower-level (often local) governments collect property tax revenues. Because local residents are likely to attribute tax revenues to the level of government responsible for collecting the tax regardless of which level of government is responsible for the other aspects of tax policy and administration, local accountability is enhanced by having collection undertaken by the local government.

Second, subnational taxes with high compliance costs should be avoided. A key consideration is that the compliance costs for a system of subnational taxes can be significantly reduced if the national government defines the tax base so that regional or national firms confront the same tax structure wherever they operate. If subnational governments are allowed to modify the federal tax base (e.g., as is the case with the personal income tax in the United States), the scope of permissible modifications should be kept to a minimum. In marked contrast, state corporate income taxes in the United States generate needless complexity, as each taxing state is allowed to set its apportionment formula independently, creating an inconsistent, incoherent, and opaque tax "system" that creates significant compliance problems for multi-state firms and can result in double taxation or no taxation.[27]

[27] Determination of the tax base at the national level may also limit the extent of tax exporting attributable to different tax structures or regulations. On the other hand, a higher level of government may face a greater incentive to curry political favor by granting tax concessions if all of the revenue consequences of such decisions are borne by lower-level governments.

Third, the national government should be assigned taxes that are assessed on mobile bases that are highly elastic to differential local tax rates. Subnational taxation of mobile tax bases will result in tax competition as taxing jurisdictions attempt to attract mobile economic activity by lowering the relevant tax rates. Such "harmful" tax competition can lead to an inefficient allocation of capital and (especially high-skilled) labor, and may result in under-provision of public services as local governments attempt to attract mobile factors of production by reducing their tax rates.[28] Taxes on capital gains are another example, as differential tax rates across jurisdictions may induce higher-income individuals to alter where they live or realize their gains. National imposition of a lower bound on subnational tax rates is one means of limiting the extent of harmful tax competition and the propensity to export tax burdens. As discussed further below, technological advances may be raising the elasticity of several tax bases, further complicating the tax assignment problem.

Fourth, all of the seminal papers noted in the introduction favor using benefit taxation to the maximum extent possible at the subnational level. Benefit taxation is most consistent with the subnational government's primary role of achieving allocative efficiency in the provision of public services that primarily benefit local residents. In particular, taxation on the basis of benefits received, while often difficult to implement due to problems in determining the value of benefits and excluding those who do not pay tax, is more feasible at the subnational rather than the national level, especially for smaller local jurisdictions. In addition to promoting efficiency, benefit taxes offer the advantages of financing service delivery and yielding information on public service demands.[29] Subnational taxes that approximate benefit taxes are thus highly desirable. An appropriately set user charge is an ideal benefit tax as it involves direct charges for the value of public services consumed and, to the extent that only residents benefit from local public services, can be imposed on those who live or conduct business in a jurisdiction.

[28] As noted previously, inter-jurisdictional competition to attract residents and businesses may be efficiency-enhancing if it creates incentives for local jurisdictions to provide the service/tax packages that are desired by current or potential residents and businesses and/or creates incentives for efficient (cost minimizing) provision of such services as suggested by the Tiebout model. Brueckner (2004) constructs a simulation model in which the gains from Tiebout competition outweigh the costs of tax competition if the dispersion of consumer preferences for public services is sufficiently large and the nature of the production function implies that capital outflows in response to capital taxation are relatively modest; the opposite conditions imply that the costs of tax competition outweigh the benefits of Tiebout competition. In general, and especially in the latter case, Brueckner (2004, p. 150) notes that, "Policy measures intended to circumvent these [tax competition] costs, such as tax exemption of the most-mobile subnational tax bases, would strengthen the case for fiscal decentralization."

[29] See Ebel and Wang (2018) for a comprehensive discussion of user charges. In particular, Ebel and Wang document that the utilization of user charges has increased in the United States in recent years and argue that this trend is likely to continue.

Benefit taxation in the form of user charges is straightforward for services that can be sold directly to consumers or businesses, such as utilities and various licenses or registrations. [30] Benefit taxes can also be approximated by indirect charges on those who disproportionately benefit from public services. For example, a proportional income tax might approximate a benefit tax if the benefits from public services are proportional to income, the people who live on a street could be charged to build and maintain the street, and the users of roads and highways could be subject to a gasoline tax. These applications are sufficiently approximate that they represent rough justice at best. Similarly, as will be discussed below, some argue that property taxes can be viewed as equivalent to local benefit taxes. In addition, business fees and licenses as well as taxes on business production can be viewed as approximating benefit taxes financing the public services, including infrastructure, provided to businesses and are thus less distortionary than business taxes that target capital investment (Bird, 2000, Bahl and Bird, 2008, Gugl and Zodrow, 2015, 2019).

However, in practice, the role of benefit taxes is fairly limited. Direct charges are much less applicable for many public services, including education, health care, safety, subsidies to mass transit, access to parks, etc., which are commonly viewed as "merit" goods so that exclusionary pricing is inconsistent with service delivery goals and would be viewed as highly inequitable. Direct benefit taxation will be insufficient or inappropriate for funding such public services, in which case the arguments for assigning subnational governments access to own-source revenues are again applicable. In addition, Dafflon (2015) observes that a number of services that in principle could be sold may also have public good aspects or externalities associated with them, implying that some central government financing is required for efficiency to be attained. For example, easy access to drinkable water can aid in overall economic development and reduction in the spread of disease and garbage collection can offer environmental benefits in addition to their direct benefits.

Another general principle related to benefit taxation is that households and businesses should pay taxes in the jurisdiction in which they benefit from public services – even if ability-to-pay taxes are used – that is, the beneficiaries of local public services are typically the businesses that produce in the jurisdiction or the households who reside there. However, mechanisms for applying this in practice can be challenging. Below we discuss reasons why determining the jurisdiction where people and businesses are located for tax purposes is becoming increasingly difficult. Subnational governments are defined by physical space and focus on delivering services to people and businesses located in that physical space. Economic activity however is increasingly disconnected from physical space, as people, businesses and transactions often flow across jurisdictions and countries, as do the beneficiaries of public services. For example, people may live in rural or suburban areas but work in cities, or the opposite. Businesses sell

[30] Of course, in some cases, the issue immediately arises as to why the public sector is providing services that can be sold and in principle could be delivered by the private sector.

remotely or produce from multiple locations in the country. The incongruence of physical space and economic activity is growing over time and only makes it more difficult to define taxes that are related to where public service benefits are received.

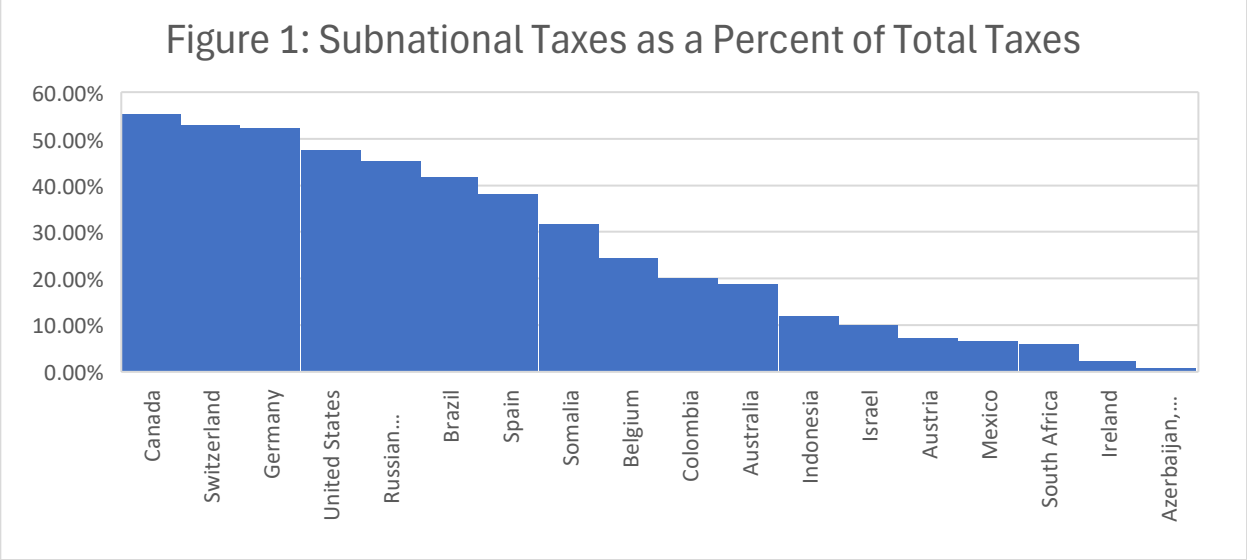
IV. Subnational Taxation in Practice

Countries differ significantly in the share of tax revenues raised by subnational governments. However, despite the benefits that accrue when subnational governments generate significant own-source revenues, in practice subnational revenue autonomy is extremely limited in most countries. Bahl and Martinez-Vazquez (2008) demonstrate that subnational taxes as a share of total government tax revenues rose from the 1970s through the 2000s but remained less than one-fifth of revenues in the average country. Further, they show that subnational governments in OECD countries had an approximately 80 percent larger share of total revenues than developing countries, and subnational governments in transition countries had more than twice as large a share of total revenues as those in developing countries. More recently, Agrawal, Brueckner, and Brulhart (2024) calculate that subnational taxes were 20 percent of government revenues for OECD countries and 13 percent for non-OECD countries in 2019. Figure 1 illustrates that subnational governments in Canada (55 percent), Switzerland (53 percent), and Germany (52 percent) raise more than one-half of total government tax revenues, while in the United States this figure is 47.7 percent.[31] By comparison, subnational governments in Azerbaijan, Ireland, and South Africa raise less than 6 percent of total revenues. These wide differences illustrate the difficulty of characterizing simply the role of subnational governments. These dramatic differences also raise the question of why relative roles by level of government differ so dramatically if there is compelling guidance on what is good policy. We will not seek to address this issue here, but will observe that changing tax assignments within a country is very difficult to achieve.

We do not attempt to summarize the details of actual subnational taxes used by the many countries across the world. Instead, we provide a few anecdotes, often based on older data, to give some perspective and illustrate the breadth of taxes that are imposed. Subnational governments in developing countries not only raise a much smaller share of revenues than in higher-income countries but often raise revenues by monopolizing some services that would otherwise be private, which of course do not represent tax revenues. Parking and rental of markets are examples. Public monopolization of these services can lead to inefficiencies in provision.

[31] Data used in the chart are derived from the IMF Government Finance Statistics, https://data.imf.org/?sk=a0867067-d23c-4ebc-ad23-d3b015045405. Data for 2019 are used to avoid any bias in more recent data caused by Covid impacts.

The property tax is the largest subnational tax in the United States, followed by the sales tax and the personal income tax. Bangladeshi local governments impose property taxes, property transfer taxes, building permit fees, advertisement taxes, amusement taxes, and taxes on professions and trade, though the specific set of taxes varies by type of local government. Bangladeshi local governments also have access to a large set of other sources that generate little revenue. Dhaka City raised 36.5 percent of own-source revenue from the property tax in 2005/06, but the share appears much smaller in many other Bangladeshi local governments. Sri Lanka provincial own-source revenues were only 17.5 percent of total provincial revenues in 2004, with most revenues coming from intergovernmental transfers. Provincial own-source revenues include a business turnover tax, stamp duties, and licenses as the primary sources. Sri Lankan local governments relied more on the property tax than those in Bangladesh. Colombo collected noticeably more than one-half of own-source revenue from the property tax, but the share was much lower than half in most other Sri Lankan local governments. Property taxes represent about one-tenth of municipal revenue in Jordan. Transition countries have frequently relied on shared taxes, such as the personal income tax in Croatia, which generated 47.9 percent of revenues in the mid-1990s. Two-thirds of 2019 Croatian local government revenues were from taxes on income.



V. Technological Factors Affecting the Ability to Impose Subnational Taxes

A. Overview

Technological advances, including those leading to increased digitization of the economy, have altered the ability to successfully levy many taxes, and the effects are likely greatest for

subnational governments. These changes may have altered the optimal balance between national and subnational taxes as well as the evaluation of which taxes can best be applied at the subnational level. We examine these two key tax assignment issues in this section.

The evolution of technology has dramatically changed all aspects of the modern economy. Among many others, these changes have occurred in the goods that are purchased (smartphones, tablets, video games, drones, etc.), the services that are purchased and their delivery (ride-sharing, home rentals, travel arrangements and accommodations, food delivery, etc.), how items are obtained (e-commerce and digitized services rather than from brick and mortar stores), the form of purchases (streaming movies rather than renting videos, purchasing digital books for e-readers rather than print books), the way services are monetized (advertising or sale of data rather than fee for service for social media and search engines), where work occurs (remote or hybrid versus at a physical workplace), and the role of capital versus labor in production (automation and artificial intelligence including replacing people with robots).

Each of these changes has implications for taxation, including the ability to tax at the subnational level. In particular, the evolution of technology has made tax bases more elastic with respect to subnational tax rates and has made it much more difficult to determine the location (situs) of subnational tax bases. These two phenomena make national collection of taxes more desirable on both efficiency and administrative grounds. More generally, technologies that allow greater separation between where people live, work, and shop will tend to place downward pressure on tax rates and increase the risk of predatory tax competition. These issues are, however, of less importance for some taxes than others. Many (often) modest taxes imposed in developing countries or in smaller taxing jurisdictions may be little affected by ongoing changes in technology; these include some user charges, amusement taxes, taxes on advertising, hotel taxes, stamp taxes, animal taxes, and alcohol taxes. However, even some of these taxes may be affected at least indirectly; for example, social media may be an important substitute for other amusements.

On a more positive note, technology also enhances the ability to administer many taxes, and thus may facilitate more taxation at the subnational level. Okunogbe and Tourek (2024) discuss how developing countries have used technology to enhance taxpayer identification, determine tax liabilities through better third-party information, and process tax returns and payments at the national level. They find evidence that adoption of more advanced technologies is positively correlated with a higher tax revenue-to-GDP ratio, and may allow higher tax rates, partially through greater productivity for tax personnel. Subnational governments can also take advantage of some of these technologies. For example, property tax collection may benefit significantly from better registration and valuation techniques. But technology applied to collection practices alone may not be enough to offset many of the problems described below.

In this section, we discuss some of the implications of technological changes for subnational taxation on a tax-by-tax basis for the main taxes that are candidates for subnational taxation. The discussion focuses on the taxable base, but rates and administration are likely affected as well.

B. Personal Income Taxes

Following Musgrave (1983), Martinez-Vazquez (2015) argues that progressive personal income taxes are not suitable for subnational governments, primarily because income redistribution and macroeconomic stabilization should be left to the national level. However, he characterizes flat rate income taxes that "piggyback" on federal taxes (as well as payroll taxes) as "good choices" at the subnational level, noting that flat rate income taxes may be broadly consistent with the benefit principle, have a revenue-elastic base, and, as highly visible taxes, promote accountability among local officials. This is especially the case if the subnational personal income tax base minimizes administrative and compliance costs by having few if any deviations from the national tax base. Indeed, some subnational governments use personal income taxes. For example, Croatian (and some other transition country subnational governments) local governments levy a surcharge on the national personal income tax, with the revenue accruing to the place of residence (Fox and Jurlina-Alibegovic, 1998). The personal income tax is the largest state tax in the United States and the third largest for state and local governments combined and, contrary to the conventional wisdom, often includes progressive rates. Numerous cities also utilize a personal income tax; Beijing, Moscow, and Dar es Salam are among the large cities that impose personal income taxes on their residents.

A longstanding key issue with the use of the personal income tax as a subnational tax is where tax should be paid when people do not live and work in the same taxing jurisdiction, for example, whether people who commute from a residential jurisdiction to a work jurisdiction should pay subnational personal income taxes at the place of employment or the place of residence.[32] The debate on this issue typically focuses on benefit tax concerns. Arguments for payment at the place of employment center on the role of local public services and infrastructure in enhancing worker productivity. By comparison, arguments for payment at the place of residence center on the presumption that most subnational services are delivered to people where they live. U.S. state (and some local) governments differ as to where personal income tax is due. In some cases, both jurisdictions impose tax but the residence state provides a credit for taxes paid to other states; in other cases, reciprocity agreements specify that tax is to be paid to the state of residence. Agrawal and Tester (2024) observe that U.S. states generate 7.5 percent of personal income tax revenues from non-residents, and that the share is as high as 15 percent in some states.

[32] See Agrawal and Stark (2022) for an excellent discussion of how cross-jurisdiction income is taxed in the United States and how remote work affects the ability to collect state personal income taxes.

Recent advances in technology, especially improvements in and widespread acceptance of video conferencing using platforms created by Zoom, Microsoft, Cisco, and others, which were significantly augmented during the COVID pandemic years, have enhanced the ability of employees to work remotely and have thus exacerbated these problems.[33] Indeed, in some cases, jobs can be fully remote, with employees never or only very seldom going into an office. Even if remote work is only part-time, both tele-commuting technology and business practices have progressed to the point that the distance between home and office can be quite great. This increases the likelihood of significant separation between the place of work and the place of residence and thus exacerbates the problems of administering the personal income tax, in particular determining where tax is due, as noted above. In addition, people may work in many taxing jurisdictions (examples include consultants, accountants, lawyers, and professional athletes). Rules, involving factors such as a determination of where the preponderance of time is spent or following an apportionment approach (e.g., based on the percentage of work in each place), are usually employed to determine where work income is taxed when work occurs in more than one jurisdiction. Such rules add significant complexity and increase compliance costs, as individuals face the possibility of being required to file tax returns in many jurisdictions. Compliance costs can be reduced if de minimis rules limit the number of jurisdictions in which returns must be filed, but this raises the issue of where tax should be paid for income below the de minimis threshold.

In addition, remote and hybrid work raise the different but related issue of determining where a person is deemed to work. For example, the tax could be due where a person is physically present, which requires a rule for allocating the time of a hybrid worker who works both at home and at the employer's place of business. Alternatively, a person might be viewed as working at the principal place of their employer even if they work remotely and never enter the taxing jurisdiction. Such rules previously existed in some places (such as New York where the tax is due at the location of the employer unless work at home is for the convenience of the employer), and several U.S. states added similar provisions during the COVID pandemic as remote work grew dramatically.[34]

[33] See Zarate et al. (2024) for a discussion of "work from home" across countries.

[34] Six states had principal place of work statutes prior to the Covid 19 pandemic, including Arkansas, Connecticut, Delaware, Nebraska, New York, and Pennsylvania (Hamilton, 2024). Massachusetts passed legislation indicating that telework was considered work at the principal place of work during the pandemic. Ohio applied similar legislation to its local governments during the pandemic. Ohio's statute determined that tax was to be paid to the city that was the principal place of business and not the place where the work was performed. The constitutional ability to levy taxes on workers who never enter a state has been questioned in court. The Ohio Supreme Court recently affirmed that the Ohio legislature could direct the tax to the principal place of business inside the state (*Schaad v. Alder* (Slip Op. No. 2024-Ohio-525)). The legal capacity to impose tax in a place where a person never becomes physically present continues to be litigated in some states (including New York).

In the longer term, tax competition will limit the capacity of subnational governments to impose tax on remote workers not physically present in the jurisdiction, even if such taxes are deemed legal.[35] Firms could be expected to set up offices in lower tax jurisdictions if their workers are subject to the tax regardless of where they live or physically perform their work. Also, agglomeration benefits have allowed workers to earn higher salaries in some larger cities and the cities often responded by imposing high tax rates on the rents accruing to their workers.[36] These agglomeration benefits will decline as more work is performed remotely, likely reducing worker earnings and the ability of the larger city governments to impose high personal income tax rates on a broadly defined base including remote workers. Business options for reducing taxes for their employees include starting-up in low tax jurisdictions, relocating to low tax jurisdictions, moving the principal place of business for remote workers to low tax jurisdictions, etc. All of these responses will place downward pressure on subnational personal income tax rates.

C. Indirect Taxes

Many governments around the world use indirect taxes of various forms. At the national level, by far the most popular is the value-added tax (VAT), utilized by some 175 countries; indeed, the United States is the only major industrialized country that does not use the tax. The widespread adoption of the VAT is commonly attributed to two main features: (1) the almost universally-used invoice-credit approach to implementing the VAT provides a paper trail that facilitates auditing and enforcement, and (2) much of the VAT is collected from upstream firms where compliance is better than from retailers (Brockmeyer et al., 2024). In addition, as a destination-based tax under which tax is paid where a good or service is consumed, the VAT is less likely to be subject to tax competition and to cause transfer pricing problems (and is more consistent with the benefit principle as a subnational tax). However, because the VAT collects tax at each stage of the production and distribution process, it requires some type of border tax adjustments if production or distribution span more than one jurisdiction, making it much less desirable as a subnational tax. Various mechanisms have been discussed to facilitate subnational implementation, which Martinez-Vazquez (2015, p. 376) argues "clearly demonstrate that subnational VATs on a destination basis using the invoice-credit method are feasible." Canada, Brazil, and India have subnational VATs, although the "dual VAT" implemented in Canada (Bird and Gendron, 1998) is the only tax that appears to work reasonably well; it requires zero-rating of exports to other states, coupled with deferral of tax on imports until the importer pays the VAT, who receives a credit for the tax on imports.[37] Despite these possibilities

[35] See Kleven et al. (2020) for a survey of the literature on individual migration responses to tax rates.
[36] See Agrawal and Stark (2022).
[37] Varsano (1999) and McLure (1999) discuss the CVAT, which requires zero-rating of exports and the payment of a "compensating VAT" on all cross-border sales that is creditable to the importer. Keen and Smith (1996) discuss the VIVAT or "variable integrated VAT," which imposes a constant-rate VAT on all in-state and out-of-state registered

for the implementation of a subnational VAT, Martinez-Vazquez (2015) characterizes the VAT as a "possible bad choice."

The main indirect tax alternative to the VAT is the general retail sales tax. In the United States, sales taxes are second in importance only to the property tax as a source of revenue for state and local governments. Sales taxes are used to a much more limited extent in the rest of the world. At the national level, these are typically imposed at relatively low rates on the order of 4-6 percent, presumably because higher rate sales taxes result in too much evasion, given that all revenues are collected at the retail level, the weakest link in the tax collection chain. Indeed only a few countries have experimented with sales taxes with rates in excess of 10 percent – none of which are currently in force. Several U.S. states (Louisiana and Tennessee) have average combined state and local rates of nearly 10 percent and the rate exceeds 10 percent in a few places. Some local governments outside the United States also utilize municipal sales taxes, including Bogota, Manila, and Buenos Aires. A few governments still rely on gross receipts taxes, although they have largely been replaced by the VAT. For example, some provinces in Sri Lanka impose a business turnover tax. Finally, selective sales taxes or excise taxes, typically assessed on products such as on gasoline (discussed further below), alcohol, tobacco products, hotels, and amusements, are levied by many governments around the world.

Like the VAT, retail sales taxes are typically implemented on a destination basis. Historically, sales taxes have offered a significant advantage relative to a VAT in implementing a subnational destination-based tax in that retail vendors only had to remit revenue to the government where it was collected without needing to make border adjustments. By comparison, as discussed above, a VAT requires some type of mechanism to deal with cross-border transactions.

Some of the advantages of retail sales taxes as subnational taxes are, however, being eroded by technological changes. Remote sales and cross-border shopping have always created problems for administering sales taxes, since they in principle require payment of tax to the destination government (the jurisdiction where the buyer resides) by the seller (who is physically in a different jurisdiction). However, these problems are greatly increasing in scope with the rapid growth of electronic commerce in both goods and services. Requiring vendors to remit sales tax to every jurisdiction where customers reside is one solution, but this requires good information on the destination of sales and may increase compliance costs significantly for vendors who must calculate and remit sales taxes in every jurisdiction in which they have significant sales – although technology may mitigate this problem with software that calculates sales tax liabilities at low cost.

traders and taxes sales to consumers and non-registered traders at the tax rate of the seller's jurisdiction. For a comparison of the dual VAT, CVAT, and VIVAT subnational tax options, see Bird and Gendron (2000) and Bird (2015).

Without reforms, the share of consumption taxed under sales or transactions taxes is likely to decline as various technological transitions occur. Two broad problems are how the increasing importance of remote sales and the changing nature of goods and services affect the ability to impose tax and the level of collections. We consider each of these in turn.

Since 2018 all U.S. sales taxing states require remote vendors that meet various de minimis customer thresholds to collect and remit tax due from buyers in the state, even if the vendors have no physical presence in the destination state.[38] Prior to this, many buyers effectively had a zero-tax option by purchasing online from vendors without physical presence in their state.[39] All sales taxing states also levy a use tax, which requires buyers to remit tax not collected by the seller, but these taxes are seldom audited, particularly for consumers, and compliance was generally believed to be poor. The requirement that sellers without physical presence collect the tax has significantly enhanced the ability to enforce destination-based sales taxation (Fox, Hargaden, and Luna, 2022), but raises compliance costs.[40] States seldom have the capacity to audit remote firms which presumably results in reduced compliance, although the degree to which non-compliance continues has not been examined.

Elimination of the zero-tax online option (except for sellers below the de minimis thresholds) means that buyers wanting to reduce their sales tax liability must physically shop in lower tax jurisdictions. Initial evidence indicates that cross-state border shopping has increased in the United States since better enforcement of tax on remote sales was initiated (Bruce, Fox, and Shute, 2023). Thus, improvements in destination-based taxation may not be as large as initially thought, but the scope of cross-border shopping is much less than the possibilities that were formerly available with tax-free electronic commerce. Both the sales tax and the VAT would likely leave revenues from cross-border shopping in the vendors' jurisdiction, since destination data on the buyer only exists with delivery or with customs' border checks.

More specifically, without requirements for firms to collect tax for remote jurisdictions, such as those now imposed in the United States, two potential problems exist. First, tax collected on an origin basis, that is, in the jurisdiction in which the sale occurs,[41] provides an incentive for cross-border shopping in nearby lower-tax jurisdictions, resulting in tax competition that may be harmful and lead to much lower tax rates. Second, the revenue accrues to the origin jurisdiction and not to the destination where consumption of the goods or services occurs, as is generally

[38] This requirement followed a U.S. Supreme Court ruling in South Dakota v. Wayfair, Inc.,138 S. Ct. 2080, 201 L. Ed. 2d 403, 2018 that eliminated the constitutional prohibition that prevented states from requiring remote vendors to collect the tax.

[39] See Agrawal (2021).

[40] Compliance costs are higher for firms that must remit in multiple states, but may not be higher than having use tax remitted by every consumer in their destination state.

[41] Note that determining the origin of a sale can raise many issues. For example, how is the origin of a sale determined for a transaction that is ordered via e-commerce from a firm in another jurisdiction but fulfilled from a warehouse in yet another jurisdiction?

required under the benefit principle. Revenues may thus be reduced leading to under-provision of public services in the jurisdiction where the consumer resides and consumes those public services.

Similar to the sales tax reforms in the United States, some other countries have reformed their VAT to collect tax on remote transactions more effectively, though these changes are generally at the national rather than subnational level.[42] The European Union shifted VAT liability on digital sales from the supplier's location to the consumer's location and requires tax collection at the destination country's tax rate if the firm's combined EU sales exceed $10,000. The EU also requires digital marketplaces to ensure that their third-party sellers register to collect VAT for the destination country; this differs from the U.S. rules, where states generally require the marketplace facilitators to determine taxability and collect the tax. India broadened its Goods and Services Tax (GST) to include many online information database access retrieval (OIDAR) services;[43] it requires OIDAR service providers to register and collect GST for non-taxable customers. India also requires online marketplaces to ensure that third-party vendors are registered for GST collection.

In addition, the increased movement from the sale of physical goods to digitized transactions, such as from rental of movie cartridges to streaming or from print books to digital books, likely significantly expands the challenge of collecting tax on remote transactions for both the sales tax and the VAT. The shift from a physical to a digitized transaction may affect both the determination of taxability and the ability to collect tax. First, digitized transactions may originate from outside the taxing jurisdiction or country without needing to cross physical borders, so that enforcement can be difficult because of the inability to audit or even see the providers or consumers. Second, previously unanticipated products, such as digitized services, may not be covered by existing tax statutes (Agrawal and Fox, 2021). This would not be a problem for sales taxes or VATs with sufficiently broadly defined tax bases, but could be an issue in countries that focus their indirect taxes on goods, depending on how digitized sales are defined for tax purposes. The failure of existing statutes to impose tax on all consumption is a frequent problem for sales taxes. For example, all 45 sales taxing U.S. states tax video rentals, but only 28 tax cable television and only 18 tax digital rentals. This is not an inherent problem with sales taxes, but harkens back to development of the tax, which generally imposed tax on all goods (unless otherwise exempted) but only on services that were specifically articulated in statute. Political and technological factors have limited the efforts of the states to tax many newer products. As a result, the sales tax base has shrunk relative to total consumption with the expansion of these newer sales options.

[42] The discussion of non-U.S. indirect tax rules here and below draws heavily from Herzburg and Howsare (2024) and Klein, Ludwig, and Spengel (2022).
[43] Examples include advertisement on the Internet, provision of digital media, and digital data storage.

Transactional, single-sided platforms, such as Amazon and Airbnb, have generally been brought under sales tax statutes. For example, every U.S. state requires e-commerce platforms, often referred to as marketplaces, to collect tax on all taxable transactions on the platforms. The approach of collecting from the marketplace rather than from individual vendors (such as individual landlords for Airbnb) reduces administration and compliance costs and probably increases collections. But marketplaces such as Amazon may be less able to determine taxability than many individual vendors with a better understanding of their products. Many details associated with marketplace collection are still evolving, such as how marketplaces are defined for collection responsibility, how auditing will take place, how refunds are treated, and so forth. As noted above, the EU and India collect VAT on marketplace transactions, though by requiring that marketplaces ensure that the third-party vendors are registered for collection.

Social media, such as YouTube, TikTok, Facebook and others, provide significant services to users, and both sales taxes and VAT systems are challenged by these multi-sided platforms. The providers typically monetize their services differently than traditional service vendors as they may only partially or not at all monetize their sales to consumers. Instead, social media revenues often derive largely or entirely from advertising and the sale of user data. Netflix is a long-time exception to competitors in the streaming/social media context in that it monetizes its services by directly charging consumers. Other social media companies, however, such as Amazon Prime and Spotify, collect some revenue from consumer charges, but obtain significant revenue from other sides of the platform, and Facebook monetizes little or nothing from its consumers. The different sides of the platform within a firm often do not relate directly to each other. Thus businesses paying for advertising or data often do not relate directly with consumers of social media, though externalities often exist between the businesses and consumers. For example, advertisers benefit from having more consumers, though consumers may think of advertising as a bad that reduces the consumption value of social media. Some firms, such as Amazon Prime and (relatively recently) Netflix, charge consumers less if advertising is permitted, suggesting a negative externality is expected between the different sides of the platforms.

Taxing consumption broadly, which presumably includes the services provided by social media, is a traditional tax policy goal for indirect taxes, as it enhances vertical and horizontal equity, raises revenue, and supports revenue elasticity over time. Neutrality of tax treatment between different forms of social media and between different forms of consumption is also a tax policy goal. Consumption of social media has risen rapidly in recent decades and widespread difficulties in taxing it fully almost surely mean the share of total consumption that is taxable is declining and tax neutrality is being violated. Social media generally compete directly with each other, but the differing pricing models complicate the potential sales tax or VAT approach (Agrawal and Fox, 2021). Taxing only direct consumer charges is an option often employed by U.S. states, but it creates relative price distortions since social media vary in the degree to which services to consumers are monetized. If only user charges are in the tax base, higher tax burdens are levied on the elements of social media services that are most monetized to

consumers. Imposition of the tax on consumer fees also creates incentives for social media companies to monetize through other sides of the platform.

Tax neutrality for both consumers and producers within this set of competitors is difficult to achieve. Taxing all of the revenues of social media companies would move towards neutrality, at least in the sense that the firm's decision on how to generate revenue would no longer be distorted. It would also imply that the monetized value of social media in every form would be taxed, so consumption would be taxed more broadly. India taxes advertising through its OIDAR definitions, presumably to collect more revenue and to lessen the incentives to monetize through advertising rather than consumer fees. Neutrality still may not result from the consumer perspective because consumers would only see tax on that portion monetized to them, unless companies have a means to implicitly shift forward to the consumer the tax paid on other sides of the platform. For example, companies could respond to a tax on all revenues by including more advertising in the media mix, and consumers could see this as a tax imposed through the negative externality.

Of course, a series of administrative challenges exist with a base equal to all revenues from a multi-sided social media platform. For example, how are taxable social media defined? How is tax imposed if a service is simultaneously provided to the same user in multiple locations, such as if an economic forecast is provided for use by all locations of a multi-jurisdictional business or if family members share access to social media?

Regardless of whether neutrality is improved, determining which jurisdiction should receive the tax revenues challenges tax systems, particularly for subnational taxes. Taxes on consumer monetized revenues can be situsued to the location of consumers, though social media companies may not always know where their consumers/users are located. No direct means exist to situs tax revenues on monetization that occurs through other sides of the platform. Revenues would need to be apportioned, though as has already been observed, firms may not know where their consumers are located. Apportionment can be based on where IP addresses are located. Apportionment may not be viable for smaller local governments but seems much more tractable for larger provincial governments.

Imposing a tax on all of the revenues of social media companies has some similarities to the Digital Sales Tax (DST) proposed by the European Union.[44] The DST was proposed as a 3 percent tax on advertising on digital interfaces that target users of the interface, the provision of digital

[44] Hines (2023) summarizes the experience of 21 countries that have implemented a DST since 2016. A number of countries have independently adopted Digital Services Taxes. These have generally been enacted under the argument that the corporate income tax does not currently reflect the revenues that should be received by the destination country rather than as attempts to tax the consumption value of social media in destination countries. Maryland has adopted a tax on digital advertising and at least 12 other U.S. states considered some form of a digital tax during their 2023 or 2024 legislative session (Carstens et al., 2024).

interfaces to users (including to exchange goods and services), and transmission of user data from users' activities. Firms needed to exceed a total revenue threshold of 750 million euros and a tax liability of 50 million euros to be liable. The DST differs from the proposal to apply sales tax all revenues of the multi-sided platform. Sales tax would not be imposed on transactional platforms used to exchange goods and services, since the goods and services themselves would be in the tax base and their prices would include payments by the selling vendor for use of the platform. Also, sales tax would be levied on any payments by service consumers, which are not listed directly as a DST revenue source. Tax would also be assessed for any other platform that firms may choose to monetize.

D. Motor Vehicle Fuel Taxes

Motor vehicle fuel taxes are often imposed at the state/provincial level, usually at rates based on the number of units purchased rather than price. Martinez-Vazquez (2015, p. 373) describes these as "generally attractive subnational taxes" primarily because (1) they can be loosely justified on both benefit principle grounds to the extent that fuel usage is related to usage of roads and highways, and (2) they can also be viewed as Pigouvian taxes that offset negative pollution and congestion externalities. Similarly, McLure (1998, p. 670) argues that, "Motor vehicle taxes make an ideal source of tax revenues for subnational governments" noting also that they are relatively easy to implement in the absence of large interjurisdictional tax rate differentials.

New vehicle technologies, however, have made motor vehicle taxes less productive. Vehicles that get higher mileage per gallon (e.g., hybrids and/or more efficient vehicles with internal combustion engines) reduce fuel tax revenues for any given number of miles driven since increased mileage lowers the unit tax per mile. Electric vehicles potentially eliminate motor fuel tax revenues altogether (Fox, 2020).[45]

Alternative sources must be found to generate revenue from vehicles, particularly if the revenues are used to build and maintain the mobility infrastructure. Higher unit tax rates will be needed to offset the effects of better fuel economy unless additional revenue sources are identified; with unit taxes, periodic rate increases are already needed to offset the effects of inflation.[46] Failure to include electric vehicles in the tax system means both lower revenues and highly problematical horizontal inequities as traditional fuel taxes remain on internal combustion engine vehicles (perhaps at higher rates) while no fuel tax is imposed on electric

[45] In addition, technological changes may affect revenues from license and registration fees and fees on the sale of vehicles as the transition to autonomous vehicles may lead to fewer, more intensively used vehicles as more ownership becomes concentrated in fleets.

[46] For example, in the United States, the federal gasoline tax has been 18.4 cents per gallon since 1993. Had it been adjusted for inflation, the rate in 2023 would 39.6 cents per gallon (Aloisi et al., 2023).

vehicles. In particular, rural and lower income users may be the last to transition to electric or autonomous vehicles, so they are most likely to continue paying traditional fuel taxes while residents of cities and suburbs pay less tax.

Options must thus be found to bring electric vehicles into the tax system. For example, taxing electricity used to charge vehicles is an option, though this may be effective only if vehicles are charged at public stations, rather than at home. Taxing electric charging at home would require accurately identifying the amount of electricity used for charging, using a method that would not be difficult to evade. Aloisi et al. (2023) argue these (and other) concerns are sufficiently problematical that taxing the electricity used at home to charge electric vehicles or hybrids is not a "viable alternative." Moreover, if home charging is untaxed, taxing public charging stations becomes less attractive on both efficiency grounds (as it favors home charging) and equity grounds (as it favors those who can easily charge their vehicles at home).

Another approach is to assess a special one-time or annual charge on electric vehicles and hybrids. Indeed, in the Unites States, 31 states have introduced special supplemental fixed license fees for electric vehicles and 18 states have such fees for hybrid vehicles, which generates revenues in addition to reducing inefficiencies and horizontal inequities. These could in principle raise the desired level of revenues, although in practice they are set too low to replace the lost gas tax revenues (Aloisi et al., 2023). However, unlike fuel taxes, fixed fees impose no tax at the margin for distance travelled. They thus have only a tenuous link to the benefits received (miles traveled on public roads), no effect on marginal driving decisions, and inequitably favor high-mileage drivers.

Vehicle miles traveled (VMT) charges are an often discussed, but less frequently imposed option. Key advantages of VMT fees are that they impose charges for marginal use of the roads and can be the same for all vehicle technologies, mitigating horizontal equity concerns if internal combustion engine and electric vehicles are taxed the same.[47] [48] However, developing both the infrastructure to impose VMTs and the willingness to accept them may be a slow process in many places.

VMT programs might be implemented in a number of ways, including on-board monitoring systems, data collected by the automobile manufactures via wireless transmission, and cell phone applications. Concern about the privacy implications of collecting data on how much and perhaps where vehicles travel may be a contentious issue, although widespread acceptance of electronic tolls and smartphone apps suggests this concern may be overstated.

[47] In the United States, the Department of Transportation is developing a national pilot program to test a VMT system, and several states, most notably Oregon, are experimenting with VMT programs.

[48] A separate issue is whether VMT charges should vary according to vehicle weight to reflect differences in road damages, especially with respect to large trucks.

E. Property Taxes

We save for last our discussion of property taxes, which are often characterized as the most appropriate taxes (other than user charges) for use by subnational – and especially local – governments. For example, after reviewing tax assignment recommendations from the literature, Bird (2008, p. 8) concludes that, "The upshot of the standard literature is thus that local governments are almost invariably left only with the property tax and user charges as proper sources of local government taxation."[49] Similarly, Martinez-Vazquez (2015, p. 370) observes that, "there is ample consensus in the public finance literature identifying the property tax as one of the best mainstays at the subnational level."[50]

This conclusion is generally based on several arguments. One often-cited contention is that the tax base for the property tax – residential and non-residential property – is relatively immobile so that the property tax is a relatively efficient tax instrument and thus more conducive to growth than most other potential subnational taxes. Martinez-Vazquez (2015, pp. 370-371) argues that "the tax, for the most part, falls on an unmovable base" and the "property tax is also generally thought of as one of the most efficient forms of taxation since its base is not movable ..." Support for this proposition is provided in an analysis of the effects of alternative taxes on economic growth in OECD countries by Arnold et al. (2011), who conclude that the property tax, especially on residential property, is the preferred tax instrument, relative to consumption taxes, property transfer taxes, personal income taxes and corporate taxes. However, they argue that this is the case primarily because investment in housing capital is taxed favorably under the income tax in most of the countries they analyze and the property tax acts to offset the resulting tax bias that inefficiently favors housing investment and thus reduces economic growth.

More generally, the argument that the property tax applies to an immobile base is accurate for the land component of the tax base, although differential property tax treatment favoring agricultural land over urban land can lead to significantly reduced urban development (Deskins and Fox, 2010).[51] It is also roughly accurate for capital improvements in the short run, primarily due to the relatively slow depreciation rates of real property. However, immobility of the property tax base seems much less likely in the long run. Instead, over relatively long time

[49] Bird (2008, p. 8) continues, "The literature is less clear with respect to intermediate (regional) governments such as states or provinces, but in the end, much as Musgrave (1983) argued, the only acceptable regional general taxes are likely to be a flat rate personal income (or payroll) tax or a retail sales tax (RST) levied directly on final (resident) consumers."

[50] Note, however, that this conventional wisdom does not necessarily apply in a developing country context. For example, Martinez-Vazques, Noiset, and Rider (2010), drawing on Bahl and Martinez-Vazquez (2008), suggest that confidence in the property tax as an effective subnational tax in developing countries may be misplaced, in part due to severe difficulties with property tax administration, and note that evidence in support of this argument is provided by relatively low property tax collections in developing countries. This point is discussed further below.

[51] See Slack and Youngman (2024) for a recent discussion of land value taxation.

periods, the property tax as a tax on capital is likely to distort both the levels and the allocation of residential and non-residential capital,[52] distort the allocation of capital between taxed and untaxed activities (including both exempt property and non-property capital), and reduce the level of public services as local governments avoid using the tax out of concerns that it will drive out mobile capital.[53] For example, using data on Alberta municipalities, Dahlby et al. (2021) estimate that the elasticity of non-residential business investment in buildings and structures with respect to the property tax rate is 0.7; they also cite several other studies that demonstrate similar sensitivity of business investment with respect to property taxation, including Giroud and Rauh (2019) in the United States, who found that the share of property taxes in state and local tax revenues had a negative effect on the number of business establishments in a state.[54]

The effects of property taxes on housing investment are more difficult to ascertain. Lutz (2015) examines the effects of a state-financed 15 percent reduction in property taxes in New Hampshire. He finds that building permits increased significantly in municipalities 50 miles or more from Boston, consistent with an investment elasticity of approximately -1 and a relatively "movable" tax base. By comparison, there was no investment effect in communities within a 50-mile radius of Boston over the four years he analyzed, as the effects of the property tax change were fully capitalized – a result that he attributes to stringent zoning regulation that largely preclude new housing construction.[55] The general implications of this result are, however, far from clear. Gyourko, Saiz, and Summers (2008) show that the extent of zoning and other land use regulations differs considerably across states and municipalities, and that Boston (along with Providence, Rhode Island) has the most stringent zoning regulations in the United States. The level of land use regulation in Boston area municipalities – and the degree of housing "immobility" – in Boston are thus not representative of most of the rest of the country.[56]

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[52] This is especially likely if non-residential property is taxed at higher rates than residential property, even though the former is likely to receive fewer benefits from local public services and be more mobile. For example, Slack (2023) shows that the ratio of commercial to residential property tax rates is quite large in some (but not all) U.S. and Canadian cities – with a few ratios exceeding 4.0 – and Bird and Slack (2004) find that such differentials are common around the world.

[53] Indeed, much of the capital tax competition literature is set in the context of the use of the property tax by competing local jurisdictions. For example, Brueckner and Saavedra (2001, p. 2004) emphasize that "local property taxes are the best real-world analog to the capital taxes analyzed" in the tax competition literature.

[54] Such negative effects on investment would be expected to translate into negative effects on economic growth. For example, Ojede and Yamarik (2012) find that sales taxes and property taxes in U.S. states have similar negative effects on real income growth, and Gale, Krupkin and Rueben (2015) find that property taxes reduce the growth rates of real per capita income in U.S. states.

[55] In earlier work, Groves (2011, p. 22) uses data from three counties in the St. Louis metropolitan area and estimates a tax rate elasticity of residential investment (modeled as square feet of living space) between –0.20 and –0.25, which he concludes supports the view that "residential capital decisions are responsive to [property] tax differentials."

[56] Indeed, Glaeser (2017, p. 4-5) suggests that overly stringent land use controls are "America's most important, and potentially costly, regulations," and (to anticipate the discussion below) argues that the benefit tax view of the property tax, which posits that such regulations are designed simply to offset the negative externalities of new construction, is "untenable."

In addition, note that even in the short run, property taxes will distort decisions regarding both improvements of existing properties and new construction within established neighborhoods ("tear downs" and "infills," which accounted for 25 percent of new single-family home construction in 2020[57]) as well as purchases of existing housing. Martinez-Vazquez (2015, p. 380) seems to have somewhat ambiguous views on this point; despite his statements cited above, he ranks the property tax as having "low potential" as a subnational tax in terms of the two key criteria of mobility of the tax base and efficiency costs. We agree with this characterization and would argue that, at least in the long run, the argument that the property tax base, apart from land, is "immovable" is suspect.[58] [59]

Another argument for the property tax applies at any level – it is a relatively highly visible tax in comparison to the most likely alternatives, including in the case of residential property where homeowners receive an annual property tax bill (or an annual escrow evaluation if their tax payments are included with their mortgage payments).[60] This argument is valid, at least by comparison with sales and excise taxes, although arguably less so with respect to the income tax, which is also subject to a highly visible annual accounting (although taxes on wages are generally withheld). However, as also noted by Martinez-Vazquez (2015), high visibility is a key factor in the relative unpopularity of the property tax among homeowners, in addition to liquidity concerns for taxpayers who may be "property rich but income poor," especially elderly homeowners who are reluctant to borrow against their property in order to satisfy their tax liabilities.[61] [62] The unpopularity of the property tax among homeowners is also likely to translate

[57] National Association of Home Builders, "25% of New Single-Family Homes Are Infills or Teardowns," https://www.nahb.org/blog/2021/12/25-percent-of-new-single-family-homes-are-infills-or-teardowns.

[58] Similarly, Bahl, Martinez-Vazquez, and Youngman (2010) discuss the immobility of the property tax base only in the context of its land component.

[59] Muthitacharoen and Zodrow (2010) utilize a computable general equilibrium model to analyze the long run efficiency costs of use of the local property tax by a single taxing jurisdiction under the assumption of perfectly mobile capital. They obtain average efficiency costs that range from 6 to 16 percent of revenues and marginal efficiency costs that range from 8 to 44 percent of revenues, and argue that these are roughly comparable to estimates in the literature of the efficiency costs of local sales taxes.

[60] Note, however, that Cabral and Hoxby (2012) find that property tax payments are less salient to taxpayers with tax escrow, as they report property taxes paid much less accurately than taxpayers who remit property tax payments once or twice a year. In addition, Cabral and Hoxby show that more salient property taxes in a jurisdiction result in lower property tax rates and a greater likelihood of property tax limitations.

[61] Public opinion polls have historically found that the property tax is the least popular tax in the United States. However, the federal income tax surpassed the property tax in this dimension in a recent Gallup poll, which found that 34 percent of the population in the United States felt that the federal income tax was the worst (least fair) tax, compared to 29 percent of the population that felt that distinction rightly belonged to the local property tax. For further details, see Gallup, Jeffrey M. Jones, May 19, 2023, "Americans' Views of Federal Income Taxes Worsen," https://news.gallup.com/poll/505970/americans-views-federal-income-taxes-worsen.aspx.

[62] Such concerns have led to special exemptions in many countries, such as homestead exemptions and income-conditioned "circuit breakers" designed to reduce property tax liabilities for lower-income households. In the United States, 44 states and the District of Columbia provide homestead exemptions or credits, and 34 states and the District of Columbia provide circuit breakers (Fisher, 2021).

into unpopularity among politicians, as suggested by the many property tax limitations in effect in U.S. states, most prominently as a result of the passage of Proposition 13 in California, which, among other provisions, capped growth in residential property taxes until time of sale, creating both severe horizontal inequities and lock-in problems.[63] Similarly, Bird and Bahl (2008, p. 16) note that "experience around the world suggests that the political costs of reliance on residential property taxes are so high that no government with access to politically 'cheaper' sources of finance will willingly do so" which in turn is likely to lead to "increases in property taxes … concentrated primarily on those non-residential properties that most lend themselves to tax exporting, thus undercutting one of the principal arguments for local use of this tax base." The property tax is also often viewed as a relatively stable and elastic tax, at least to the extent that property values are relatively stable and property valuations are frequent, and in the absence of binding property tax limitations. Another advantage is that compliance costs for homeowners are relatively low under the property tax – unless they choose to appeal their assessments.

The argument for the property tax that has received the most attention, however, is that it approximates a benefit tax, with annual property tax payments for each taxpayer roughly equal to the value the taxpayer places on the local public services received. Indeed, Martinez-Vazquez (2015) ranks the property tax as having "high potential" as a subnational tax on these grounds. This conclusion, however, is quite contentious and has been debated at length in the literature. There are two versions of the underlying "benefit tax view" of the property tax. The first is due primarily to the work of Hamilton (1975) who argues that local communities use binding zoning restrictions which, combined with consumer mobility following Tiebout (1956) and enough local communities to match all desired housing/public service combinations, result in communities that are perfectly homogeneous in demands for housing and public services; this in turn implies that the property tax is a benefit tax, as all homeowners within each community pay the same tax and demand/receive the same services. Fischel (1985, 1995, 2015) argues that in practice, broadly defined zoning ordinances are sufficiently restrictive to make this model a reasonable approximation to reality. The second version of the benefit tax view, due to Hamilton (1976), relaxes the assumption of all homogeneous communities, and instead assumes a mix of perfectly homogeneous communities and some heterogeneous communities. In the latter communities, capitalization of fiscal differentials (the present value of all future differences between taxes paid and benefits received) into the prices of existing housing – the stock of which is assumed to be fixed – is again sufficient to convert the property tax into a benefit tax.

As suggested above, the alternative view of the property tax is that it is primarily a distortionary tax on capital, the "capital tax view" of the property tax developed in a national context by Mieszkowski (1972), extended to include many features of local property taxation by Zodrow and Mieszkowski (1986b), and summarized in Mieszkowski and Zodrow (1989) and Zodrow

[63] See Haveman and Sexton (2008) and Zodrow (2023) for discussions of property tax limitations.

(2001a, b). The capital tax view argues that zoning generally is not sufficiently binding to convert the property tax into a benefit tax, and that capitalization is incomplete and in any case may simply reflect changes in land values attributable to the capital reallocations predicted by the capital tax view (Zodrow, 2014). Moreover, as suggested by the discussion of zoning in Boston above, the most restrictive zoning ordinances seem likely to be designed not to yield a benefit view result but instead to extract rents from potential residents (Gyourko, Saiz, and Summers, 2008); such a result characterizes the long run equilibrium in the comprehensive simulation model of property taxation and zoning constructed by Barseghyan and Coate (2016). In addition, school finance reforms in virtually all of the U.S. states have broken any potential link between school taxes paid and services received, ensuring that the capital tax view of the property tax is applicable for such taxes. Further, it is commonly asserted that the benefit view is relevant only for suburban communities as central cities are too heterogeneous for it to apply. For further discussion of these competing two views of the property tax, see Oates and Fischel (2016, p. 426), who suggest that "the vast majority (70-80 percent) of the U.S. population would be candidates for the benefit view of property taxes" and Zodrow (2023, forthcoming), who argues that this figure is significantly overstated. One potential caveat is provided by Gallagher (2019), who builds on Kurban, Gallagher, and Persky (2012), and stresses that communities are typically not homogeneous with respect to either housing consumption or demand for public services, especially public education. In particular, demands for housing and for education (and perhaps other public services) are likely to be correlated, as households with larger homes are likely to have more children and thus greater demand for public education – that is, they utilize to a greater extent the public services offered by their local jurisdiction. In this case, the higher property taxes paid by households with higher value homes could roughly reflect the greater quantity of public services received, which would be loosely consistent with the benefit view. Note, however, that obvious counterarguments are that higher-income households are more likely to utilize private schools and thus have relatively low demand for public education, as are higher-income households without children. In any case, note that to the extent that the capital tax view is valid, the property tax (1) is indeed undesirable on efficiency and tax base mobility grounds as noted above, and (2) is not a close approximation to a benefit tax (except in an aggregate sense as local budget constraints ensure that total revenues, including state grants, must equal total expenditures),[64] so that the conclusion that the property tax is a desirable subnational tax on benefit tax grounds is suspect.

[64] An alternative benefit-view-related approach also drops the Tiebout-Hamilton assumption that households sort into local jurisdictions that are homogeneous with respect to demands for public services and impose uniform head taxes (or head tax equivalents), and assumes instead that the valuation of local public services – and thus the appropriate benefit tax – increases with income. Using Florida data, Ihlanfeldt and Rodgers (forthcoming) conduct such an analysis of public expenditures on non-education goods financed with residential and non-residential property taxes and find a mix of pro-rich and pro-poor net fiscal benefits, depending on the service provided; this work builds on Martinez-Vazquez (1982).

Technological change and the increased digitization of economic activity have had less of an impact on the property tax than the other taxes we have discussed. Perhaps the most important effect has been that intangible assets make up a disproportionate share of the capital stocks of high-tech industries and such assets are seldom included in the bases of local property taxes. This creates a tax bias favoring high-tech industries, similar to the tax biases that currently exist favoring firms whose capital stocks are taxed relatively lightly (or not at all) under many current property taxes; these include equipment, vehicles, inventories, agricultural land, etc., as well as the assets held by tax-exempt institutions.[65] In addition, the trend toward increased remote work (work from home) noted above is likely to change relative property values with offsetting effects on property tax revenues. For example, Chernick et al. (2022) consider a sample of 8 major U.S. cities for which commercial real estate accounts for 37 percent of property tax revenues. They estimate that to the extent that the higher levels of remote work that occurred during the pandemic continue, commercial real estate values could on average fall by between 12 and 25 percent, with general revenue losses on the order of 1 percent (for Charlotte and Los Angeles) to nearly 6 percent (for Atlanta). Similarly, Collins (2021) documents that the COVID pandemic and the associated increase in remote work resulted in booming housing markets in many areas of the United States coupled with falling commercial real estate values. She shows that the net effects on revenues varied across different metropolitan areas, depending on both policy responses as well as structural features such as the mix of, and extent of property tax rate differentials across residential and commercial properties.

A second issue is that technology-based improvements in the data generation, gathering and processing required for property tax collection and administration, including the use of sophisticated computer-assisted mass appraisal (CAMA) property valuation practices, may be improving assessment practices. This would be especially important in developing countries, which Bahl, Martinez-Vazquez, and Youngman (2010, p. 9) note are commonly viewed as simply "unable to administer a well-functioning property tax" given severe problems with poor record keeping, incomplete tax rolls, and unreliable comparable sales data (Bahl and Wallace, 2010).[66]

For example, Okunogbe and Tourek (2024) note that geographic information system (GIS) data can be used to identify property location and features, and electronic data bases can be used to help limit corruption and to evaluate alternative tax enforcement measures, such as notifications of tax liabilities with and without information about penalties for delinquency. They also note that GIS and other technologies can result in productivity gains in property tax administration, citing an experiment in Ghana where tax collections doubled when tax collectors were provided with a tablet-based technology containing a database of property

[65] For example, Sjoquist (2010) stresses these distortions of the property tax as it is commonly applied.

[66] Martinez-Vazquez, Noiset, and Rider (2010, p. 325) provide a comprehensive discussion of the problems with applying the conventional wisdom that the property tax is the preferred tax instrument at the subnational level to developing countries, noting that "policies and experiences of developing countries often do not achieve the same results when they are transferred to developing countries."

information and revenue management software (Dzansi et al., 2022). Similarly, Knebelmann (2022) surveys over 15 recent and ongoing property tax digitization projects in a group of low- and middle-income countries and concludes that technological advances, especially satellite imagery and GIS data linked to property tax registers coupled with the use of computers and mobile devices have the potential to significantly improve property tax administration; she notes, however, that implementation of such schemes is costly, complex, and may be politically difficult. Okunogbe and Tourek (2024) also caution that technological approaches to tax collection may lose some of the advantages of repeated personal interactions between taxpayers and tax collectors (e.g., better access by local tax collectors to private information), and the adoption of technological improvements, especially those that monitor the activities of tax collectors, may be stymied by resistance from tax officials.

Such technological improvements should result in assessments that are more accurate and thus a fairer distribution of tax burdens from the perspectives of both horizontal equity (taxpayers with similar value homes pay similar taxes) and vertical equity (taxpayers with higher value homes pay proportionately higher taxes). This has two important implications. First, it seems likely to diminish the extent to which the property tax is better administered by local governments on the grounds that they have more knowledge about local market conditions; improved data gathering and data processing may be accomplished at any level and indeed there may be important economies of scale in implementing CAMA property valuation practices at the state/provincial level. As noted above, this argument is clearly much less applicable in a developing country context, where valuation techniques are far less advanced so that local expertise is likely to be much more valuable. Second, any improvements in valuation that can be obtained through more sophisticated computer-based assessment techniques are sorely needed and may significantly improve the accuracy of tax assessment and thus the fairness and efficiency of the tax. Current research suggests that there is considerable room for improvement even in developed countries including the United States.[67] For example, building on a large literature examining problems with property tax assessment practices,[68] Berry (2021) examines assessment-sales ratios for a national sample of over 26 million residential property sales over the period 2007 to 2016. He finds that current assessment practices result in pervasive regressivity. For example, in a national sample (that excludes California which is characterized by unique assessment rules), homes in the bottom decile of the sales price distribution have an assessment-sales price ratio that is on average more than twice that for homes in the top decile of the distribution. Berry also estimates an intrajurisdictional elasticity of the effective property tax rate with respect to home sales price of –0.37.[69] These figures (and similar results found in other studies) suggest that significant improvements in assessment practices – even in high-

[67] Slack (2023) notes that annual reassessments under the property tax are rare around the world and indeed occur very seldom in some countries. More generally, she stresses that property taxes in practice often differ considerably from the taxes envisioned in theoretical arguments supporting their use.

[68] See Zodrow (2023) for a recent discussion of this literature.

[69] These results are roughly consistent with those found by McMillen and Singh (2020).

income countries with sophisticated assessment processes – are needed if the property tax is to be accurately viewed as a well-administered and equitable tax instrument for subnational governments.[70]

VI. Conclusion

Innovative technologies change how we produce, what we consume, and how we obtain goods and services. Transitions in response to such innovations are not new, but technologies are currently evolving at a quicker pace than in the past and appear to have more pervasive implications for taxation. Certainly, technological changes are occurring at a faster pace than tax and government policy have been responding. Nonetheless, the changes of the past several decades do not radically alter the traditional conclusion of the tax policy literature on the importance of subnational governments raising some of their own revenues. However, continued rapid, large transitions raise the possibility that subnational governments will need to rely on national transfers for relatively more revenues – although it must be noted that some of the effects of technological changes on subnational taxes are also being felt by national governments, especially those related to the dramatic rise of social media.

Technological developments also leave largely unaffected the thinking of Musgrave, McLure, Bird and Slack, Martinez-Vazquez, and others on the best options for subnational revenue sources. User charges and benefit fees remain the preferred option to the maximum extent possible. The local property tax base is likely less mobile – at least in the short run – than the other prominent tax options available to subnational governments, such as the sales tax, VAT, and personal income tax. The property tax has the additional advantages of being highly visible (although this feature contributes to its lack of popularity among both taxpayers and politicians). Moreover, technological changes in assessment practices and tax administration more generally may improve rather than limit the effectiveness of the tax. All of these factors reinforce the traditional conclusion that the property tax is the best subnational tax option. On balance, this conclusion may still be valid, although it is supported to a significant extent by two factors not often stressed in the tax assignment literature: (1) the property tax may be a relatively efficient tax not because its capital tax component applies to a relatively immobile base but because it often offsets distortions due to favorable treatment of housing under the income tax, while subnational income taxes and to a lesser extent sales taxes exacerbate the inefficiencies of their national counterparts, and (2) the property tax may be loosely related to a benefit tax not because it results in uniform tax payments by the residents of jurisdictions that are homogeneous with respect to demands for public services, but because higher property tax

[70] Note, however, that property tax regressivity can be viewed as an indirect ad hoc means of moving the property tax in the direction of a benefit tax, as such regressivity may reduce the extent to which high-value (low-value) homes over-pay (under-pay) for local public services.

payments for households with high-value homes may partially reflect greater demands for local public services, especially education.

More generally, however, the conclusion that the property tax is a good subnational tax instrument must be tempered by the realization that the tax suffers from numerous important limitations. First, in the long run, it likely distorts the levels and allocation of capital in several dimensions and, due to interjurisdictional tax competition, inefficiently reduces the level of provision of local public services. Second, some technological changes reduce the attractiveness of the property tax. In particular, increases in remote work and the resulting declines in the values of commercial real estate may cause significant declines in property tax revenues and increase their instability, and the relative expansion of intangible property in high tech companies and others adopting new technologies reduces the fraction of capital subject to the property tax and increases its distortions of the allocation of capital to the extent that intangible and tangible property are substitutes. Third, the extent to which the property tax functions as a benefit tax remains highly contentious; at a minimum the benefit view of the property tax is not likely to obtain under many empirically relevant conditions, especially in the presence of zoning restrictions that are designed to extract rents from potential new residents rather than convert the property tax to a uniform benefit tax. Finally, due to administrative and other concerns, the traditional arguments favoring the property tax as a subnational tax carry much less force in a developing country context.

With respect to other potential subnational tax instruments, technological changes have not altered our broad thinking, but they still have important implications for the extent of subnational taxation and for the structure of specific tax instruments. In particular, we have discussed three ways that both indirect and direct taxes are affected by technological transitions. First, situsing tax base is increasingly difficult as the propensity for cross-border transactions grows for both the sales tax and the VAT, making it more difficult to ensure taxation is at destination or even that tax is imposed. Also, consumption may occur simultaneously at multiple locations, such as with social media or password sharing for streaming services, complicating the definition of the tax base and the identification of which jurisdiction should receive revenues – while also raising the possibility of double taxation. Similarly, the proliferation of remote work confuses the determination of origin and destination and place of work for income tax purposes. Second, greater mobility increases the relevant elasticities for all potential subnational taxes, which erodes tax bases and places downward pressure on tax rates as governments are increasingly concerned about the potential loss of tax base. Higher elasticities also increase the excess burdens of subnational taxes. Recent legislation in the U.S. that enables states to collect sales tax on remote sales and in the EU and India to collect VAT on cross border transactions enhance the ability to collect destination taxes and are steps in limiting the tax base losses associated with mobility. Third, new products raise the prospect of more consumption lying outside legislated tax bases, such as with digital products and social media in many places. Policymakers can expand the legislated base in some cases, although this

is often politically challenging. In addition, determining the appropriate tax base, such as with multi-sided platforms, remains an unsettled area for some emerging products.

On a more positive note, applications of some new technologies can make tax compliance and administration more efficient, although we have not discussed these issues in detail. In particular, new means of imposing user fees have become possible. For example, VMT charges have become technically more viable options for transportation funding. Still, remote transactions and remote work increase the possibility that governments will be unable to levy their taxes on certain activities, either because they are unaware that it is taking place (especially if they are unable to audit taxpayers) or because the costs of administration and compliance remain prohibitively high even with new administrative techniques.

References

Agrawal, David, 2021. "The Internet as a Tax Haven." *American Economic Journal: Economic Policy* 13 (4), 1-35.

Agrawal, David, Jan K. Brueckner, and Marius Brulhart, 2024. "Fiscal Federalism in the 21st Century," CESifo Working Paper 1095. CESifo, Munich.

Agrawal, David, and William Fox, 2021. "Taxing Goods and Services in a Digital Era," *National Tax Journal* 74 (1), 257-301.

Agrawal, David, William H. Hoyt, and John D. Wilson, 2022. "Local Policy Choice: Theory and Empirics." *Journal of Economic Literature* 60 (4), 1378–1455.

Agrawal, David, and Kenneth Tester. "State Taxation of Nonresident Income and the Location of Work," *American Economic Journal: Economic Policy* 15 (1): 447-481.

Agrawal, David, and Kirk Stark, 2022. "Will the Remote Work Revolution Undermine Progressive State Income Taxation." *Virginia Tax Review* 42 (1), 47-152.

Arnold, Jens Matthias, Bert Brys, Christopher Heady, Asa Johansson, Cyrille Schwellnus, and Laura Vartia, 2011. "Tax Policy for Economic Recovery and Growth." *Economic Journal* 121 (Feb.), 59-80.

Aloisi, James, Bhuvan Atluri, Jinhua Zhao, Yunhan Zheng, and Seamus Joyce-Johnson, 2023. *Replacing the Gas Tax: Leveraging the Electric Vehicle Transition to Build a Stronger Transportation Funding System in the United States.* MIT Mobility Initiative and JTL Transit Lab, Cambridge, MA.

Bahl, Roy, and Richard M. Bird, 2008. "Subnational Taxes in Developing Countries: The Way Forward." *Public Budgeting and Finance* 28, 1-25.

Bahl, Roy, and Richard M. Bird, 2018. *Fiscal Decentralization and Local Finance in Developing Countries.* Edward Elgar Publishing, Cheltenham, UK.

Bahl, Roy, and Musharraf Cyan, 2011. Tax Assignment: Does the Practice Match the Theory?" *Environment and Planning C: Government and Policy* 29, 264-280.

Bahl, Roy, and Jorge Martinez-Vazquez, 2008. "The Property Tax in Developing Countries: Current Practice and Prospects." In *Toward a Vision of Land in 2015: International Perspectives*, edited by Gary C. Cornia and Jim Riddell, pp. 23-46. Lincoln Institute of Land Policy, Cambridge, MA.

Bahl, Roy, Jorge Martinez-Vazquez, and Joan Youngman, 2010. "Whither the Property Tax: New Perspectives on a Fiscal Mainstay." In *Challenging the Conventional Wisdom on the Property Tax*, edited by Roy Bahl, Jorge Martinez-Vazquez, and Joan Youngman, pp. 3-14. Lincoln Institute of Land Policy, Cambridge, MA.

Bahl, Roy, and Sally Wallace, 2010. "A New Paradigm for Property Taxation in Developing Countries." In *Challenging the Conventional Wisdom on the Property Tax*, edited by Roy Bahl, Jorge Martinez-Vazquez, and Joan Youngman, pp. 165-201. Lincoln Institute of Land Policy, Cambridge, MA.

Barseghyan, Levon, and Stephen Coate, 2016. “Property Taxation, Zoning, and Efficiency in a Dynamic Tiebout Model.” *American Economic Journal: Economic Policy* 8 (3), 1–38.

Berry, Christopher, 2021. “Reassessing the Property Tax.” Working Paper. University of Chicago, Harris School of Public Policy, Chicago, IL.

Bird, Richard M., and Enid Slack, 2000. “Rethinking Subnational Taxes: A New Look at Tax Assignment.” *Tax Notes International* 8, 2069-2096.

Bird, Richard M., 2000. “Subnational VATs: Experience and Prospects.” In Proceedings, Annual Conference on Taxation, pp. 223-228. National Tax Association, Washington, DC.

Bird, Richard M., 2008. “Tax Assignment Revisited.” Working Paper 0805. International Center for Public Policy. Andrew Young School of Policy Studies, Georgia State University, Atlanta, GA.

Bird, Richard M., 2015. “Below the Salt: Decentralizing Value-Added Taxes.” In *Handbook of Multilevel Finance*, edited by Ehtisham Ahmad and Giorgio Brosio, pp. 291–333. Edward Elgar Publishing, Cheltenham, UK.

Bird, Richard M., and Pierre-Pascal Gendron, 1998. “Dual VAT and Cross-Border Trade: Two Problems, One Solution? *International Tax and Public Finance* 5 (3), 429-442.

Bird, Richard M., and Pierre-Pascal Gendron, 2000. “CVAT, VIVAT, and Dual VAT: Vertical ‘Sharing’ and Interstate Trade.” *International Tax and Public Finance* 7 (6), 753-761.

Bird, Richard M., and Enid Slack, 2004. *International Handbook on Land and Property Taxation.* Edward Elgar Publishing, Cheltenham, UK.

Boadway, Robin, 1997. “Tax Assignment in the Canadian Federal System.” In *Reshaping Fiscal Federalism in Australia*, edited by Neil A. Warren, pp. 61-90. Australian Tax Foundation, Sydney, AU.

Boadway, Robin, 2015. “Intergovernmental Transfers: Rationale and Policy.” In *Handbook of Multilevel Finance*, edited by Ehtisham Ahmad and Giorgio Brosio, pp. 410-436. Edward Elgar Publishing, Cheltenham, UK.

Brockmeyer, Anne, Giulia Mascagni, Verdanth Nair, Mazhar Waseem and Miguel Almunia, 2024. “Does the Value Added Tax Add Value? Lessons Using Administrative Data from a Diverse Set of Countries.” *Journal of Economic Perspectives* 38 (1), 107-132.

Bruce, Donald, William Fox, and Alannah Shute, 2023. “Wayfair: A Step Towards the Destination but Sales Tax Competition Remains.” NBER Working Paper No. W31074. National Bureau of Economic Research, Cambridge, MA.

Brueckner, Jan K., 2004. Fiscal Decentralization with Distortionary Taxation: Tiebout vs. Tax Competition.” *International Tax and Public Finance* 11, 133-153.

Brueckner, Jan K., and Luz A. Saavedra, 2001. “Do Local Governments Engage in Strategic Property-Tax Competition?” *National Tax Journal* 54 (2), 203-229.

Brulhart, Marius, and Mario Jametti, 2006. “Vertical versus Horizontal Tax Externalities: An Empirical Test.” *Journal of Public Economics* 90, 2027-2062.

Cabral, Marika, and Caroline Hoxby, 2012. “The Hated Property Tax: Salience, Tax Rates, and Tax Revolts.” NBER Working Paper 18514. National Bureau of Economic Research, Cambridge, MA.

Carstens, Eric D., Brian Moore, Mary Kay Martire, and Jonathan C. Hague, 2024. “Navigating State Taxation of the Digital Economy.” *Tax Notes State* (August 26), 560-572.

Cassidy, Traviss, Mark Dincecco, and Ugo Antonio Troiano, 2024. “The Introduction of Income Tax, Fiscal Capacity, and Migration: Evidence from the U.S. States.” *American Economic Journal: Economic Policy* 16 (1), 359-393.

Chernick, Howard, David Copeland, and David Merriman, 2021. “The Impact of Work from Home on Commercial Property Values and the Property Tax in U.S. Cities.” Policy Brief. Institute on Taxation and Economic Policy, Washington, DC.

Collins, Catherine, 2021. *Property Tax Trends 2020-21*. Lincoln Institute of Land Policy, Cambridge, MA.

Dafflon, Bernard, 2015. “The Assignment of Functions to decentralized Government: From Theory to Practice.” In *Handbook of Multilevel Finance*, edited by Ehtisham Ahmad and Giorgio Brosio, pp. 163-199. Edward Elgar Publishing, Cheltenham, UK.

Dahlby, Bev, Ergete Farede, and Mukesh Khanal, 2021. “The Impact of Property Taxation on Business Investment in Alberta.” SPP Research Paper 14:8. School of Public Policy, University of Calgary, Calgary.

Deskins, John, and William Fox, 2010. “Measuring Behavioral Responses to the Property Tax.” In *Challenging the Conventional Wisdom on the Property Tax*, edited by Roy Bahl, Jorge Martinez-Vazquez, and Joan Youngman, pp. 47-66. Lincoln Institute of Land Policy, Cambridge, MA.

Dzansi, James, Anders Jensen, David Lagakos, and Henry Telli, 2022. “Technology and Local State Capacity: Evidence from Ghana.” NBER Working Paper 29923. National Bureau of Economic Research, Cambridge, MA.

Ebel, Robert D., and Yameng Wang, 2018. “User Charges to Fund State and Local Infrastructure Services.” Working Paper 18-13. International Center for Public Policy, Andrew Young School of Public Policy, Georgia State University, Atlanta, GA.

Fischel, William A., 1985. *The Economics of Zoning Laws: A Property Rights Approach to American Land Use Controls*. Johns Hopkins University Press, Baltimore, MD.

Fischel, William A., 1995. *Regulatory Takings: Law, Economics, and Politics*. Harvard University Press, Cambridge, MA.

Fischel, William A., 2001a. “Homevoters, Municipal Corporate Governance, and the Benefit View of the Property Tax.” *National Tax Journal* 54 (1), 157-173.

Fischel, William A., 2001b. “Municipal Corporations, Homeowners, and the Benefit View of the Property Tax.” In *Property Taxation and Local Government Finance*, edited by Wallace E. Oates, pp. 33-77. Lincoln Institute of Land Policy, Cambridge, MA.

Fischel, William A., 2015. *Zoning Rules! The Economics of Land Use Regulation*. Lincoln Institute of Land Policy, Cambridge, MA.

Fisher, Ronald C., 2021. “Property Taxes: What Everybody Needs to Know.” Working Paper WP21RF1. Lincoln Institute of Land Policy, Cambridge, MA.

Fox, William F., 2020. “The Influence of Autonomous Vehicles on State Tax Revenues.” *National Tax Journal* 73 (1), 199-234.

Fox, William F., and Christine Wallich, 1998. “Fiscal Federalism in Bosnia and Herzegovina: The Dayton Challenge. In *Fiscal Federalism in Developing Countries*, edited by Richard M. Bird and Francois Vaillencourt, pp. 271-300. Cambridge University Press, Cambridge, MA.

Fox, William F., and Dubravka Jurlina-Alibegovic, 1998. “Local Public Finance in Croatia: Overview and Issues.” Working paper. World Bank, Washington, DC.

Fox, William F., Enda Hargaden, and LeAnn Luna, 2022. "Statutory Incidence and Sales Tax Compliance: Evidence from Wayfair." *Journal of Public Economics* 213, 104716.

Gale, William G., Aaron Krupkin, and Kim Reuben, 2015. “The Relationship Between Taxes and Growth at the State Level: New Evidence.” *National Tax Journal* 68 (4), 919-942.

Gallagher, Ryan M., 2019. “Restrictive Zoning’s Deleterious Impact on the Local Education Property Tax Base: Evidence from Zoning District Boundaries and Municipal Finances.” *National Tax Journal* 72 (1), 11–44.

Giroud, Xavier, and Joshua Rauh, 2019. “State Taxation and the Reallocation of Business Activity: Evidence from Establishment-Level Data.” *Journal of Political Economy* 127 (3), 1262-1316.

Glaeser, Edward L., 2017. “Reforming Land Use Regulations.” *Brookings Report*. Brookings Institution, Washington, DC.

Groves, Jeremy, 2011. “Estimating the Responsiveness of Residential Capital Investment to Property Tax Differentials.” Working Paper no. WP11JG1. Lincoln Institute of Land Policy, Cambridge, MA.

Gugl, Elisabeth, and George R. Zodrow, 2015. “Competition in Business Taxes and Public Services: Are Production-Based Taxes Superior to Capital Taxes?” *National Tax Journal* 3S, 767-802.

Gugl, Elisabeth, and George R. Zodrow, 2015. “Tax Competition and the Efficiency of “Benefit-Related Business Taxes.” *International Tax and Public Finance* 26, 486-505.

Gyourko, Joseph, Albert Saiz, and Anita Summers, 2008. “A New Measure of the Local Regulatory Environment for Housing Markets: The Wharton Residential Land Use Regulatory Index.” *Urban Studies* 45 (3), 693-729.

Hamilton, Billy, 2024. “Remote Work and its Complications,” *State Tax Notes* (February 19), pp. 573-579.

Hamilton, Bruce W., 1975. “Zoning and Property Taxation in a System of Local Governments.” *Urban Studies* 12 (2), 205-211.

Hamilton, Bruce W., 1976. “Capitalization of Intrajurisdictional Differences in Local Tax Prices.” *American Economic Review* 66 (5), 743-753.

Haveman, Mark, and Terri A. Sexton, 2008. *Property Tax Assessment Limits: Lessons from Thirty Years of Experience*. Lincoln Institute of Land Policy, Cambridge, MA.

Herzberg, Kevin, and Brian Howsare, 2024. "OECD and Wayfair," *State Tax Notes* (March 11), pp. 775-779.

Hines, James R. Jr. "Digital Tax Arithmetic," *National Tax Journal* 76 (1), 119-143.

Ihlanfeldt, Keith, and Luke P. Rodgers, forthcoming. "Fiscal Incidence of the Property Tax." *Public Finance Review*.

Jakobsen, Katrine, Henrik Kleven, Jonas Kolsrud, Camille Landais, and Mathilde Munoz, 2024. "Taxing Top Wealth: Migration Responses and Their Aggregate Economic Implications." NBER Working Paper 32153. National Bureau of Economic Research, Cambridge, MA.

Keen, Michael, and Kai A. Konrad, 2013. "The Theory of International Tax Competition and Coordination." In *Handbook of Public Economics, Volume 5*, edited by Auerbach, Alan J., Raj Chetty, Martin Feldstein, and Emmanuel Saez. Elsevier, Amsterdam.

Keen, Michael, 2000. "Viva VIVAT!" *International Tax and Public Finance* 6, 741-751.

Klein, Daniel, Christopher A. Ludwig, and Christoph Spengel, 2022. "Taxing the Digital Economy: Investor Reaction to the European Commission's Digital Tax Proposals." *National Tax Journal* 72 (1), 61-92.

Kleven, Henrik Jacobsen, Camile Landais and Mathilde Munoz, and Stefanie Stantcheva, 2020. "Taxation and Migration: Evidence and Policy Implications." *Journal of Economic Perspectives* 34 (2), 119-142.

Knebelmann, Justine, 2022. *Digitalization of Property Taxation in Developing Countries: Recent Advances and Remaining Challenges*. ODI Report. Overseas Development Institute, London, UK.

Kurban, Haydar, Ryan M. Gallagher, and Joseph J. Persky, 2012. "Estimating Local Redistribution Through Property-Tax-Funded Public School Systems." *National Tax Journal* 65 (3), 629–651.

Lago, Manuel E., Santiago Lago-Peñas, and Jorge Martinez-Vazquez, 2023. "On the Effects of Intergovernmental Grants: A Survey." Working Paper. International Center for Public Policy, Andrew Young School of Policy Studies, Georgia State University, Atlanta, GA.

Lutz, Byron, 2015. "Quasi-Experimental Evidence on the Connection between Property Taxes and Residential Capital Investment." *American Economic Journal: Economic Policy* 7 (1), 300-330.

Martinez-Vazquez, Jorge, 1982. "Fiscal Incidence at the Local Level." *Econometrica* 50 (5), 1207-1218.

Martinez-Vazquez, Jorge, 2008. "Revenue Assignments in the Practice of Fiscal Decentralization." In *Fiscal Federalism and Political Decentralization: Lessons from Spain, Germany, and Canada*, edited by Núria Bosch and José M. Durán, pp. 27-55. Edward Elgar Publishing, Cheltenham, UK.

Martinez-Vazquez, Jorge, 2015. “Tax Assignments at the Regional and Local Level.” In *Handbook of Multilevel Finance*, edited by Ehtisham Ahmad and Giorgio Brosio, pp. 358-388. Edward Elgar Publishing, Cheltenham UK.

Martinez-Vazquez, Jorge, Luc, and Mark Rider, 2010. “Assignment of the Property Tax: Should Developing Countries Follow the Conventional View?” In *Challenging the Conventional Wisdom on the Property Tax*, edited by Roy Bahl, Jorge Martinez-Vazquez, and Joan Youngman, pp. 299-349. Lincoln Institute of Land Policy, Cambridge, MA.

McLure, Charles E., Jr., 1998. “The Revenue Assignment Problem: Ends, Means, and Constraints.” *Journal of Public Budgeting, Accounting, and Financial Management* 9 (4), 652-683.

McLure, Charles E., Jr., 1999. “Implementing Subnational VATS on Internal Trade: The Compensating VAT (CVAT).” Working Paper. Hoover Institution, Stanford, CA.

McLure, Charles E., Jr., 2000. “Implementing State Corporate Income Taxes in the Digital Age.” *National Tax Journal* 53 (4), 1287-1305.

McLure, Charles E., Jr., 2001. “The Tax Assignment Problem: Ruminations on How Theory and Practice Depend on History.” *National Tax Journal* 54 (2), 339-364.

McMillen, Daniel, and Ruchi Singh, 2020. “Assessment Regressivity and Property Taxation.” *Journal of Real Estate Finance and Economics* 60 (1-2), 155-169.

Mieszkowski, Peter and Zodrow, George R., 1989. “Taxation and the Tiebout Model: The Differential Effects of Head Taxes, Taxes on Land Rents, and Property Taxes.” *Journal of Economic Literature* 27 (3), 1098-1146.

Mieszkowski, Peter, 1972. “The Property Tax: An Excise Tax or a Profits Tax?” *Journal of Public Economics* 1 (1), 73-96.

Musgrave, Richard A., 1983. “Who Should Tax, Where and What?” In *Tax Assignment in Federal Countries*, edited by Charles E. McLure Jr., pp. 2-19. Canberra Center for Research on Federal Financial Relations, Canberra.

Musgrave, Richard A., 1959. *The Theory of Public Finance*. McGraw Hill, New York, NY.

Muthitacharoen, Athiphat, and George R. Zodrow, 2010. “The Efficiency Costs of a Local Property Tax.” In *Challenging the Conventional Wisdom on the Property Tax*, edited by Roy Bahl, Jorge Martinez-Vazquez, and Joan Youngman, pp. 15-42. Lincoln Institute of Land Policy, Cambridge, MA.

Norregaard, John, 1997. “Tax Assignment.” In *Fiscal Federalism in Theory and Practice*, edited by Teresa Ter-Minassian, pp. 49-72. International Monetary Fund, Washington, DC.

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

Oates, Wallace E., and William A. Fischel, 2016. “Are Local Property Taxes Regressive, Progressive, or What?” *National Tax Journal* 69 (2), 415-434.

Ojede, Andrew, and Steven Yamarik, 2012. “Tax Policy and State Economic Growth: The Long-Run and Short-Run of It.” *Economics Letters* 116 (2), 161-165.

Okunogbe, Oyebola, and Gabriel Tourek, 2024. "How Can Lower-Income Countries Collect More Taxes? The Role of Technology, Tax Agents and Politics." *Journal of Economic Perspectives* 38 (1): 81-106.

Pauly, Mark V., 1973. "Income Redistribution as a Local Public Good." *Journal of Public Economics* 2 (1), 35-58.

Rauh, Joshua, and Ryan Shyu, 2024. "Behavioral Responses tp State Income Taxation of High Earners: Evidence from California." *American Economic Journal: Economic Policy* 16 (1), 34-86.

Simonsen, Bill, and Mark D. Robbins, 2003. "Reasonableness, Satisfaction, and Willingness to Pay Property Taxes." *Urban Affairs Review* 38 (6), 751-871.

Sjoquist, David L., 2010. "Commentary." In *Challenging the Conventional Wisdom on the Property Tax*, edited by Roy Bahl, Jorge Martinez-Vazquez, and Joan Youngman, pp. 67-73. Lincoln Institute of Land Policy, Cambridge, MA.

Slack, Enid, 2023. "Property Taxes in the Real World." *Canadian Tax journal* 70 (S), 133-158.

Slack, Enid, and Joan Youngman, 2024. "Property Taxes from the Ground Up." Paper presented at a conference on *Future Challenges in Fiscal Decentralization* in honor of Professor Jorge Martinez-Vazquez, Andrew Young School, Georgia State University, October 17-19, 2024.

Tiebout, Charles M., 1956. "A Pure Theory of Local Expenditures." *Journal of Political Economy* 64 (5), 416-424.

Varsano, Ricardo, 1999. "Subnational Taxation and the Treatment of Interstate Trade in Brazil: Problems and a Proposed Solution." Paper presented at the ABCD-LAC Conference, Valdiva Chile.

Wilson, John D., 1986. "A Theory of Inter-Regional Tax Competition." *Journal of Urban Economics* 19 (3): 296–315.

Wilson, John D., 1999. "Theories of Tax Competition." *National Tax Journal* 52 (2), 269-304.

Wilson, John D., and David E. Wildasin. 2004. "Capital Tax Competition: Bane or Boon?" *Journal of Public Economics* 88 (6): 1065–1091.

Young, Cristobal, and Charles Varner, 2011. "Millionaire Migration and State Taxation of Top Incomes: Evidence from a Natural Experiment." *National Tax Journal* 64 (2), 255–283.

Zarate, Pablo, Mathias Dolls, Steven Davis, Nicholas Bloom, Jose Maria Barrero, and Cevat Girayu Aksoy, 2024. "Why Does Working from Home Vary across Countries and People?" CEPR Discussion Paper 19003. CEPR, Paris, FR.

Zodrow, George R., 2001a. "The Property Tax as a Capital Tax: A Room with Three Views." *National Tax Journal* 54 (1), 139-156.

Zodrow, George R., 2001b. "Reflections on the New View and the Benefit View of the Property Tax." In Oates, Wallace E. (ed.), *Property Taxation and Local Government Finance*. Lincoln Institute of Land Policy, Cambridge, MA.

Zodrow, George R., 2003. “Tax Competition and Tax Coordination.” *International Tax and Public Finance* 10 (6), 651-671.

Zodrow, George R., 2010. “Capital Mobility and Capital Tax Competition.” *National Tax Journal* 63 (4), 865-901.

Zodrow, George R., 2014. “Intrajurisdictional Capitalization and the Incidence of the Property Tax.” *Regional Science and Urban Economics* 45 (1), 57-66.

Zodrow, George R., 2023. “75 Years of Research on the Property Tax.” *National Tax Journal* 76 (4), 909-940.

Zodrow, George R., 2025, forthcoming. *Advanced Introduction to Taxation.* Edward Elgar Publishing, Cheltenham, UK.

Zodrow, George R., and Peter Mieszkowski, 1986a. “Pigou, Tiebout, Property Taxation and the Under-provision of Local Public Goods.” *Journal of Urban Economics* 19 (3), 356-370.

Zodrow, George R., and Peter Mieszkowski, 1986b. “The New View of the Property Tax: A Reformulation.” *Regional Science and Urban Economics* 16 (3), 309-327.