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The Efficiency Costs of Local Property Tax¹

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I. INTRODUCTION

One of the most critical questions faced by the government of any local jurisdiction is the choice of tax instruments used to finance own-source revenues as well as the relative weights to be placed on each of those instruments. In the U.S., the property tax is still the most heavily utilized local tax. However, in recent years the trend has been for local governments to simultaneously reduce the share of property taxes in own-source revenues while increasing their reliance on alternative taxes, especially local sales/excise taxes and personal income taxes, while also expanding their utilization of user charges and fees. For example, the property tax accounted for 76% of total own-source revenue for local governments in 1970, but only 65% by 2006. Simultaneously, reliance on alternative taxes has increased in recent years. For example, sales taxes and personal income taxes accounted for 7% and 2% of total local own-source revenue, respectively, in 1970, but these figures roughly doubled to 15% for sales taxes and 4% for personal income taxes by 2006.²

A second general trend has been an increased share of financing of local public expenditures at the state level, especially those on primary and secondary education. Numerous factors have contributed to this trend, including various court cases requiring that the level of education expenditures be less dependent on local property wealth and large enough to finance educational adequacy, as well as various property tax limitation measures, most prominently in California and Massachusetts. These changes have also implied reduced overall reliance on property taxation, as state funds are typically generated by sales and use taxes, excise taxes, and corporate and personal income taxes rather than by state-level property taxes.³

² U.S. Bureau of Economic Analysis, National Income and Product Accounts, Table 3.21.

³ Only a few states levy state-level property taxes, and the revenue raised by such taxes is relatively small, accounting for less than 2% of total own-source state tax revenues for all years between 1970 and 2006. For all

Both of these trends have resulted in reduced overall reliance on the property tax in the mix of state and local finance. A natural question is whether such a change is desirable from a social perspective. There are of course many dimensions in which such a question might be answered, including the equity, simplicity, revenue stability, and revenue adequacy properties of the various tax alternatives.⁴ In this paper, however, we focus on a single dimension – the efficiency properties of the local property tax. We construct a numerical simulation model to estimate these efficiency costs purely from the perspective of a single taxing jurisdiction, such as a local municipality, modeled as a small open economy facing a net return to capital and a price of a tradable good that are determined nationally (or internationally) and are thus unaffected by the policy choices made by the local government.⁵

The paper proceeds as follows. The following section briefly reviews the literature on the efficiency effects of the property tax. Section III presents the details of our model of local use of the property tax. Simulation results for the efficiency costs of local property taxation are presented in section IV for a variety of model scenarios. These results are then compared to existing estimates of the efficiency cost of various tax alternatives in Section V. Section VI summarizes the results and suggests some directions for future research.

years during the same time period, sales tax revenues accounted for 40-50%, personal income taxes accounted for 18-30%, and corporate income tax revenues accounted for 5-7% of total own-source revenues. In 2006, property tax revenues accounted for 1.2%, sales tax revenues accounted for 41%, personal income tax revenues accounted for 31% and corporate income tax revenues accounted for 7% of total state own-source revenues. All figures are taken from U.S. Bureau of Economic Analysis, National Income and Product Accounts, Table 3.2.

⁴ For example, see Zodrow (2008a) and the papers by Sheffrin, by Bahl and Wallace, and by Martinez-Vazquez and Rider in this volume.

⁵ In related research, we are using a general equilibrium model to analyze the efficiency costs of nation-wide use of the property tax when individuals are perfectly mobile across all jurisdictions (Muthitacharoen and Zodrow, 2008b).

II. AN OVERVIEW OF THE EXISTING LITERATURE

The literature on the property tax is voluminous. In this section, we review briefly the ongoing debate regarding the incidence of the tax and its economic effects – the benefit tax view vs. the capital tax view – and then describe some studies that attempt to assess the quantitative significance of those effects, including efficiency costs, under the capital tax view.

The Incidence of the Property Tax

Any analysis of the efficiency effects of the property tax must begin with a discussion of the controversial issue of which of two alternative views – the “benefit tax” view and the “new” or “capital tax” view – better describes the economic effects of the tax. Under the benefit tax view, the property tax is an efficient benefit tax or user charge paid in exchange for the receipt of local public services received, along the lines envisioned in the celebrated Tiebout (1956) model, as extended by Hamilton (1975, 1976), Fischel (1975, 2001a, b), White (1975) and Oates and Schwab (1988). Indeed, this paper would be exceedingly short under the benefit tax view, as it implies that the efficiency costs of the property tax are zero, since it does not distort any production, consumption or location decisions and results in efficient levels of local public expenditures. In marked contrast, under the capital tax view as developed by Mieszkowski (1972) and extended by Zodrow and Mieszkowski (1986b), the property tax is a tax on the use of capital within a local jurisdiction and causes numerous distortions.⁶ These distortions include reductions in the capital intensity of production and in the consumption of capital-intensive goods, reductions in the overall supply of capital to the taxing jurisdiction, and tax-induced misallocations of businesses and households across jurisdictions (Ross and Yinger, 1999;

⁶ A third “traditional view” of the property tax, which argues that the property tax is fully shifted forward to consumers in the form of higher prices, can be shown to be a special case of the capital tax view (Wildasin, 1986; Zodrow, 2001a, b).

Zodrow, 2001a, b). Moreover, use of the local property tax can lead to inefficient underprovision of local public services, as government officials, concerned about property-tax-induced outflows of mobile capital from their jurisdictions, reduce the level of public services provided (Zodrow and Mieszkowski, 1986a; Wilson, 1986).

In this paper, we do not revisit at any length the debate between these two alternative views of the effects of the property tax, an issue that has been discussed extensively elsewhere, including in a recent Lincoln Institute of Land Policy volume examining property taxation and local government finance (Oates 2001a); for example, see Fischel (2001a, b), Zodrow (2001a, b), Nechyba (2001), Netzer (2001), Musgrave (2001) and Oates (2001b). Instead, we simply assume the validity of the capital tax view and then assess its implications for the efficiency costs of local use of the property tax. Before proceeding, however, it may be useful to note several arguments that might be offered in support of our assumption of the validity of the capital tax view.

First, as stressed by Zodrow (2001a, b), the capital tax view does not imply that the residents of a taxing jurisdiction do not value public services or ultimately pay for them. In particular, Zodrow and Mieszkowski (1986b) derive all of the essential elements of the capital tax view within the context of a model that incorporates many of the Tiebout-type features of a local public goods equilibrium stressed by proponents of the benefit tax view.⁷ Moreover, they also show that under certain circumstances the entire burden of a property tax imposed by a single taxing jurisdiction is borne by its residents in the form of either increases in the prices of nontradable goods including housing or reductions in the incomes of locally-owned factors.

⁷ In particular, the Zodrow and Mieszkowski (1986b) model explicitly considered interjurisdictional competition, individual utility functions that include varying tastes for local public services, segregation of the population into differing communities according to individual tastes for local public services, and a simple form of land use zoning; all of these factors were ignored in the original Mieszkowski (1972) derivation.

Thus, as stressed by Zodrow (2001a, b), this derivation of the capital tax view, while still obtaining its primary results, has a definite “benefit tax “flavor.

Second, zoning is a central element in theoretical analyses that demonstrate how the property tax can be converted to a benefit tax (Hamilton, 1975; Fischel, 1985, 1995). However, it is important to note that the fact that zoning is clearly an important and pervasive phenomenon is not enough to demonstrate that it is sufficiently binding to preclude any adjustments whatsoever in the capital stock, as assumed in derivations of the benefit tax view (Mieszkowski and Zodrow, 1989). Instead, the capital tax view results will obtain – in the long run – as long as capital can be reallocated in response to property tax differentials; moreover, as noted above, this result can be obtained within the context of a model with a limited form of land-use zoning (Zodrow and Mieszkowski, 1986b).

Third, more general derivations of the benefit tax view require the capitalization of fiscal differentials (the present value of future differences between property taxes paid and the benefits of local public services received) into house values (Hamilton, 1976), so that potential entrants into a community pay for public services, either directly in the form of property taxes or indirectly in the form of lower or higher house prices, when they purchase property in the community. However, even if such capitalization occurs in equilibrium, any change in property taxation will give rise to capitalization effects that are not related to services received with, for example, individuals who own relatively high value houses paying much more for the increase in services due to changes in the size of capitalized fiscal differentials. Such changes in home values attributable to a change in property taxes are inconsistent with a benefit tax view of the property tax, even if the benefit tax view does hold for new entrants into the community once the new equilibrium is reached.

Fourth, proponents of the benefit tax view sometimes argue that empirical evidence of capitalization of property taxes and local public expenditure levels into housing prices provides evidence of the validity of the benefit tax view (Fischel, 2001a, b). However, the property-tax induced reallocations of capital associated with the capital tax view are also consistent with such capitalization, for both interjurisdictional capitalization (Zodrow and Mieszkowski, 1983; Kotlikoff and Summers, 1987) and intrajurisdictional capitalization (Zodrow, 2008b). Thus, empirical evidence of fiscal capitalization is not sufficient to distinguish between the two views.

Finally, two recent empirical studies provide limited support for the capital tax view. First, Wassmer (1993) finds evidence that property tax differentials reduce capital intensity, as predicted by the capital tax view but not the benefit tax view. However, the magnitudes of his results are fairly small, the measure of capital stock utilized is rather imprecise, and Wassmer analyzes property tax differences across central cities rather than the suburban jurisdictions that are the focus of benefit tax view proponents. Second, Lutz (2006) examines the effects of a school finance reform in New Hampshire that dramatically reduced property taxes. He shows that in general there was a significant increase in housing investment in the state over the five years after the property tax reduction, consistent with the capital tax view, with an implied investment elasticity of roughly one. However, Lutz also finds no evidence of an investment response in the suburban ring surrounding Boston, where the property tax reduction was instead largely capitalized into house values, results that are consistent with the benefit tax view; he attributes this finding to a combination of limited land for new development and zoning in Boston and its suburbs⁸

⁸ In addition, several researchers have examined the extent to which property taxes are shifted forward to renters. In the most recent and careful study, Carroll and Yinger (1994) argue that early studies of this issue are inconclusive and suffer from a variety of methodological problems. After introducing corrections for these problems, Carroll and Yinger (1994, p. 311) find that landlords bear a significant fraction of the tax and conclude that “the property tax on

In any case, for purposes of this paper, we simply assume the validity of the capital tax view of the incidence of the property tax. We then construct a model to analyze the efficiency costs of local use of the property tax in this context.

Estimates of the Economic Effects of the Property Tax

Although there are many studies that address the economic effects of the property tax, there are surprisingly few – especially in light of the importance of the tax in local revenues – that attempt to estimate the efficiency costs of the tax. The most relevant are the recent studies by Arnott and Petrova (2006), Nechyba (1998), Wildasin (1989), Ballard, Shoven and Whalley (1985a, b), Jorgenson and Yun (1996) and Sennoga, Sjoquist and Wallace (2007).

Arnott and Petrova (2006) investigate the deadweight loss associated with the property tax. Their partial equilibrium analysis considers the differential incidence of a property tax applied to single parcel of land, ignoring the effects of the tax on the level of rents. They assume a CES production technology with capital and land as the only two inputs, with capital immutable once the structure is constructed. Although they consider a variety of property tax systems, the one most relevant to our study assumes uniform rates applied to land and structures. In this case, Arnott and Petrova find that the developer responds to the introduction of the property tax primarily by lowering capital intensity, although the timing of development can also be affected. They stress that the property tax becomes more distortionary the higher the elasticity of substitution between land and capital, as the tax causes greater distortions in decisions regarding capital intensity. Arnott and Petrova obtain very large estimates of for the deadweight loss of the property tax, sometimes in excess of 100 percent. However, these results are not directly relevant to the approach used in this paper, as they reflect the assumptions that rents are

rental housing is far short of being a benefit tax.” However, such studies do not address the central issue of whether the benefit view of the property tax applies for owner-occupied housing.

exogenously determined and that property tax rates analyzed are rather high in comparison to rates of return, often exceeding the revenue-maximizing property tax rate.

Nechyba (1998) studies the efficiency consequences of replacing an income tax on mobile capital with land value taxation, holding revenues constant. He constructs a single sector model with capital and land as inputs in a CES production function. The supply of land in the taxing jurisdiction is fixed, while the supply of capital to the economy is perfectly elastic. Nechyba focuses on the effects of the property tax in a model with homogeneous land. Starting from an initial equilibrium where the tax rates on land rent and capital income are 17% and 27.4%, respectively, he simulates the tax rate on land rents required to eliminate the tax on capital. The elasticity of substitution between land and capital also plays an important role in these simulations. The higher the elasticity of substitution, the more effective any incremental increase in the tax on land rents will be in lowering the tax on capital, as a larger increase in the capital stock translates into a larger increase in the level of output and tax revenues. For example, if the capital-land substitution elasticity equals 0.25, a 60.45 percent tax on land rents is sufficient to eliminate the tax on capital income and the substitution of land taxes results in a 43% increase in the capital-land ratio, and a 32% increase in output. However, if this elasticity is 0.5, the tax rate on land rents has to rise to only 50.9 percent to eliminate the capital income tax, and this policy change causes the capital-land ratio to more than double and output to rise by 89%. These results are suggestive of significant efficiency costs from the taxation of capital income. However, Nechyba does not calculate the efficiency costs of such taxation in his model.⁹

⁹ In an empirical study of such a tax substitution, Oates and Schwab (1997) suggest that differentially high property taxation of land in Pittsburgh stimulated additional development, relative to what would have occurred with a uniform property tax.

Wildasin (1989) investigates another source of efficiency losses due to local property taxation – the underprovision of public services that arises when local officials are reluctant to use the property tax because they are concerned it will drive mobile capital out of their jurisdiction. He shows that this inefficiency can be interpreted as a fiscal externality – an increase in the property tax rate in one jurisdiction causes a flow of capital to other jurisdictions that increases their tax revenues, a social benefit that is ignored by the taxing jurisdiction. The cost of local public goods perceived by the locality is thus overstated, and jurisdictions will tend to underspend on local public goods. Wildasin presents some illustrative calculations of the welfare losses due to this underprovision of local public services. In the case in which local governments rely entirely on property taxation – which requires a property tax rate of 30% – the deadweight loss from distorted local public spending is substantial, equaling 8.2% of total local public expenditure. His results also suggest, however, that these deadweight losses are far lower when taking into account the fact that local governments receive substantial transfers from higher levels of government, reducing their revenue needs. With a property tax rate of 10%, Wildasin estimates that the deadweight loss due to the property tax is on the order of only 0.3-0.6 percent of total public expenditure.

Using a multi-sector dynamic computable general equilibrium model that takes into account the negative effects of taxes on labor supply and savings decisions, Ballard, Shoven and Whalley (1985a, b) compute the average and marginal efficiency costs of several taxes, including the national system of local property taxes in the U.S.¹⁰ They model corporate income

¹⁰ Their model is characterized by 19 producer goods industries that use capital and labor in constant elasticity of substitution (CES) value-added functions and intermediate goods in fixed proportions. Each of the producer goods is used directly for investment, for net exports, and by the government, and can be transformed into consumer goods using a Leontief function. On the consumer side of the model, there are 12 consumer groups distinguished by income. Each group has an initial endowment of capital and labor and its preferences are characterized by a nested CES utility function. Consumer decisions regarding factor supplies are made jointly with consumption decisions.

taxes (including state and local), corporate franchise taxes and property taxes as ad valorem taxes on the use of capital services in each industry, and estimate the efficiency costs of taxation for a variety of assumptions regarding saving and labor supply elasticities. Ballard, Shoven and Whalley find that the average efficiency costs from all of the capital taxes they analyze range from 15 to 35.5 percent of tax revenues, while marginal efficiency costs range from 18.1 to 46.3 percent of tax revenues.

Jorgenson and Yun (1996) also use a dynamic computable general equilibrium model to compute the average and marginal excess burdens associated with the use of various taxes, including the national system of local property taxes¹¹ Property taxes are imposed on corporate, noncorporate and household assets. They estimate that the average efficiency cost associated with nationwide use of the property tax is 16.7 percent of tax revenue, and that the marginal efficiency cost is 18.6 percent of tax revenue.¹²

Finally, Sennoga, Sjoquist and Wallace (2007) analyze the economic effects of the property tax in the context of developing countries. They construct a computable general equilibrium model of a hypothetical developing economy, taking into consideration the fact that the assumption of perfect mobility of capital underlying the capital tax view may not be applicable. Specifically, Sennoga, Sjoquist and Wallace assume there are two types of capital –

The government collects taxes from both producers and consumers and uses the revenue to purchase producer goods (with constant expenditure shares), make direct transfer payments to consumers, and subsidize government enterprises.

¹¹ In their model, a single representative producer employs capital and labor to produce outputs of consumption and investment goods, and an infinitely-lived representative consumer supplies labor services, demands consumption goods, and allocates income between consumption and saving. Consumer behavior is based on an intertemporally additive utility function that depends on levels of full consumption (defined to be an aggregate of consumption goods, household capital services and leisure) in all time periods. All agents have perfect foresight about future prices and rates of return.

¹² These results are so similar because of the unusual way that Jorgenson and Yun define average efficiency costs; specifically, marginal efficiency costs are calculated when property taxes are increased from 95 to 100 percent of their 1985 levels, while reported average efficiency costs are calculated when the tax is increased from 0 to 10 percent of their 1985 levels.

domestic and foreign, with domestic capital fixed in total supply, sector-specific capital used in the informal sectors, and foreign capital that is either fixed in total supply or can be acquired at an increasing price. Within this context, they find that burden of property taxes imposed on capital and land is borne by the owners of land and primarily domestic capital and is not significantly influenced by assumptions regarding capital mobility. However, they also do not report any estimates of the efficiency costs associated the use of property tax.

III. THE MODEL

As noted above, under the capital tax view, the capital component of property tax causes numerous distortions, most of which are captured in the model utilized in this analysis. (The land component of the tax is widely viewed as non-distortionary.) The distortions analyzed in the model fall into three general categories. First, local use of a source-based tax on capital income, such as the property tax, drives mobile capital out of the taxing jurisdiction. Indeed, a standard result in the public finance literature is that such source-based taxation of capital income is inherently undesirable if the taxing jurisdiction can reasonably be modeled as a small open economy, which is arguably the case for all municipal governments, at least in the long run. The intuition behind this result is simply that the tax will drive mobile capital out of the taxing jurisdiction until its before tax rate of return rises by enough to entirely offset the tax (Zodrow and Mieszkowski, 1983; Gordon, 1986; Razin and Sadka, 1991). This outflow of capital lowers the productivity of the fixed factors in the taxing jurisdiction – land and labor (or at least relatively immobile labor), so that local factors of production ultimately bear the entire burden of the capital income tax, including its efficiency costs. The clear implication is that, solely from the viewpoint of the residents of the taxing jurisdiction, it is preferable simply to tax local factors directly, and thus avoid at least the excess burden of the tax on capital income.

Second, the property tax, as a tax on capital income, causes a variety of production and consumption distortions. It creates a tax bias against the production of capital-intensive goods and, to the extent the tax is shifted forward in the form of higher consumer prices, it creates a tax bias against consumption of capital-intensive goods. Because the model utilized in this paper includes two production sectors (tradable and nontradable goods), it captures these distortions to a limited extent.

Third, as suggested in the voluminous property tax competition literature (Zodrow and Mieszkowski, 1986a, Wilson, 1986, 1999; Zodrow, 2004; Wildasin and Wilson, 2004) and discussed above, the property tax may create a tax bias toward underprovision of local public services. This effect is captured in the model by assuming that local government officials act to maximize the welfare of their residents, but are constrained to finance public services by taxing mobile capital and thus may elect to under-provide local public services in order to avoid the negative economic effects of tax-induced capital outflows.¹³

Although all of these distortions are analyzed in the model utilized in this paper, it does not capture several other important distortions. In particular, use of the property tax, especially when considered from a national perspective with virtually all local jurisdictions utilizing the tax, represents a tax on capital income that distort savings and investment decisions. Such taxes on capital income are often viewed to be especially distortionary.¹⁴ In addition, property taxes have differential impacts on the industries within both the tradable and nontradable goods sectors. Because the model examines efficiency from the perspective of a single taxing jurisdiction that faces a fixed return to capital and has only two (tradable and nontradable goods)

¹³ Deskins and Fox (this volume) examine numerous other distortions caused by the property tax, including business and individual location decisions, housing abandonment, urban sprawl, agricultural vs. urban land use, and housing price volatility.

¹⁴ For a recent review of these arguments, see Zodrow (2007).

production sectors, these efficiency costs of local use of the property tax are not captured. It is also important to note that neither the deductibility of property taxes against federal income tax liability nor the preferential tax treatment of owner-occupied housing under the federal personal income tax is considered.

Local use of the property tax also might have a distortionary effect on individual location decisions and on land use; these effects, however, are ignored in the analysis. Specifically the analysis assumes that labor, while perfectly mobile across production sectors so that there is only a single wage, is fixed in total supply in the taxing jurisdiction. In addition, the analysis assumes that the amount of land used in each production sector is fixed, implying that property taxes can be differentially capitalized into the values of the two types of land. The resulting efficiency cost estimates thus reflect an “intermediate run” analysis that is likely to be highly relevant for policy purposes, at least during the presumably long transition to a true long equilibrium in which labor would be perfectly mobile across all jurisdictions in the nation and land would be perfectly mobile among all uses.

The rest of this section describes the model utilized in this analysis. It describes the optimization problems faced by consumers, producers and the government, and the calculation of the efficiency costs of local use of the property tax.

Producer Optimization

The taxing jurisdiction is assumed to be a small open economy that faces a fixed net rate of return on capital and a fixed price of the tradable good, which is the numeraire. All markets are competitive. There are two production sectors which produce tradable goods (X) and nontradable goods (Y). The analysis assumes that both production sectors use capital, labor and land as inputs, with the amount of land in each production sector fixed. Both production sectors

are characterized by constant elasticity of substitution (CES) technology

$$Q_X = \Psi_X \left(\alpha_{KX} K_{Xj}^{\rho_X} + \alpha_{LX} L_{Xj}^{\rho_X} + \alpha_{VX} \bar{V}_{Xj}^{\rho_X} \right)^{1/\rho_X}, \sigma_X = \frac{1}{1-\rho_X}$$

$$Q_Y = \Psi_Y \left(\alpha_{KY} K_{Yj}^{\rho_Y} + \alpha_{LY} L_{Yj}^{\rho_Y} + \alpha_{VY} \bar{V}_{Yj}^{\rho_Y} \right)^{1/\rho_Y}, \sigma_Y = \frac{1}{1-\rho_Y},$$

where subscript j denotes production sectors X and Y , Q_j is the amount of good j produced within the jurisdiction, K_j is the amount of capital used in sector j , and L_j is the amount of labor used in sector j and \bar{V}_j is the fixed amount of land in sector j . Labor is assumed to be partially mobile in the sense that it is perfectly mobile across productions sectors but the total supply of labor (\hat{L}) is fixed, so that $L_X + L_Y = \bar{L}$. Capital is perfectly mobile across production sectors and is supplied perfectly elastically to the taxing jurisdiction, implying that the net rate of return on capital, r , is fixed.

Using the restricted profit function approach for the CES production functions (Diewert, 1978), gross returns to land (residual profits) are

$$\Pi_X = \alpha_{VX}^{\sigma_X/(\sigma_X-1)} \bar{V}_X \left[(P_X \Psi_X)^{1-\sigma_X} - \alpha_{KX}^{\sigma_X} (r(1+T))^{1-\sigma_X} - \alpha_{LX}^{\sigma_X} w^{1-\sigma_X} \right]^{1/(1-\sigma_X)}$$

$$\Pi_Y = \alpha_{VY}^{\sigma_Y/(\sigma_Y-1)} \bar{V}_Y \left[(P_Y \Psi_Y)^{1-\sigma_Y} - \alpha_{KY}^{\sigma_Y} (r(1+T))^{1-\sigma_Y} - \alpha_{LY}^{\sigma_Y} w^{1-\sigma_Y} \right]^{1/(1-\sigma_Y)},$$

where Π_j denotes gross return to land in sector j .

Differentiation of the restricted profit expressions with respect to output prices yields the output levels in the two production sectors

$$Q_X = \frac{\partial \Pi_X}{\partial P_X} = \alpha_{VX}^{\sigma_X/(\sigma_X-1)} \Psi_X^{1-\sigma_X} P_X^{-\sigma_X} \left[(P_X \Psi_X)^{1-\sigma_X} - \alpha_{KX}^{\sigma_X} (r(1+T))^{1-\sigma_X} - \alpha_{LX}^{\sigma_X} w^{1-\sigma_X} \right]^{\sigma_X/(1-\sigma_X)} \bar{V}_X$$

$$Q_Y = \frac{\partial \Pi_Y}{\partial P_Y} = \alpha_{VY}^{\sigma_Y/(\sigma_Y-1)} \Psi_Y^{1-\sigma_Y} P_Y^{-\sigma_Y} \left[(P_Y \Psi_Y)^{1-\sigma_Y} - \alpha_{KY}^{\sigma_Y} (r(1+T))^{1-\sigma_Y} - \alpha_{LY}^{\sigma_Y} w^{1-\sigma_Y} \right]^{\sigma_Y/(1-\sigma_Y)} \bar{V}_Y$$

and differentiation of the restricted profit expressions with respect to factor prices yields the factor demands in the two industries

$$L_X = \frac{\partial \Pi_X}{\partial w} = \alpha_{VX}^{\sigma_X / (\sigma_X - 1)} \left(\frac{\alpha_{LX}}{w} \right)^{\sigma_X} \left[(\Psi_X P_X)^{1 - \sigma_X} - \alpha_{KX}^{\sigma_X} (r(1+T))^{1 - \sigma_X} - \alpha_{LX}^{\sigma_X} w^{1 - \sigma_X} \right]^{\sigma_X / (1 - \sigma_X)} \bar{V}_X$$

$$K_X = \frac{\partial \Pi_X}{\partial r(1+T)} = \alpha_{VX}^{\sigma_X / (\sigma_X - 1)} \left(\frac{\alpha_{KX}}{r(1+T)} \right)^{\sigma_X} \left[(\Psi_X P_X)^{1 - \sigma_X} - \alpha_{KX}^{\sigma_X} (r(1+T))^{1 - \sigma_X} - \alpha_{LX}^{\sigma_X} w^{1 - \sigma_X} \right]^{\sigma_X / (1 - \sigma_X)} \bar{V}_X$$

$$L_Y = \frac{\partial \Pi_Y}{\partial w} = \alpha_{VY}^{\sigma_Y / (\sigma_Y - 1)} \left(\frac{\alpha_{LY}}{w} \right)^{\sigma_Y} \left[(\Psi_Y P_Y)^{1 - \sigma_Y} - \alpha_{KY}^{\sigma_Y} (r(1+T))^{1 - \sigma_Y} - \alpha_{LY}^{\sigma_Y} w^{1 - \sigma_Y} \right]^{\sigma_Y / (1 - \sigma_Y)} \bar{V}_Y$$

$$K_Y = \frac{\partial \Pi_Y}{\partial r(1+T)} = \alpha_{VY}^{\sigma_Y / (\sigma_Y - 1)} \left(\frac{\alpha_{KY}}{r(1+T)} \right)^{\sigma_Y} \left[(\Psi_Y P_Y)^{1 - \sigma_Y} - \alpha_{KY}^{\sigma_Y} (r(1+T))^{1 - \sigma_Y} - \alpha_{LY}^{\sigma_Y} w^{1 - \sigma_Y} \right]^{\sigma_Y / (1 - \sigma_Y)} \bar{V}_Y$$

Consumer Optimization

The analysis assumes that the utility function of the representative resident of the taxing jurisdiction is characterized by a constant elasticity of substitution function (CES) defined over consumption of the tradable good (X), the nontradable good (Y) and local public services (G), or

$$U(X, Y, G) = \left(\delta_X X^\rho + \delta_Y Y^\rho + \delta_G G^\rho \right)^{1/\rho},$$

where $\sigma_D = 1/(1 - \rho)$ is the elasticity of substitution between each pair of goods. Local public services are assumed to be publicly provided private goods. Since the level of public services (G) is fixed from the perspective of the individual, the restricted indirect utility function can be written as

$$V(P, M; G) = \left[(\delta_X^{\sigma_D} P_X^{1 - \sigma_D} + \delta_Y^{\sigma_D} P_Y^{1 - \sigma_D})^{1/\sigma_D} M^{(\sigma_D - 1)/\sigma_D} + \delta_G G^{(\sigma_D - 1)/\sigma_D} \right]^{\sigma_D / (\sigma_D - 1)}.$$

where M is the income of the representative resident of the taxing jurisdiction and reflects returns individual holdings of capital, labor and land, or

$$M = r\bar{K} + w\bar{L} + \frac{\Pi_X}{1+T} + \frac{\Pi_Y}{1+T} - \phi H,$$

where T is the property tax rate, H is the total amount of head tax needed in the initial

equilibrium to finance the efficient level of government services (assuming the head tax is the only source of government revenue), ϕ is the extent of head taxation allowed, \bar{K} is the total amount of capital owned by residents in the initial equilibrium, \bar{L} is the total amount of labor supply, r is the after-tax rate of return on capital, w is the wage rate and, as defined above, Π_j ($j = X, Y$) is gross land rent in sector j . Note that capital services can be exported but the income generated from them must be spent within the taxing jurisdiction, either on local housing or on consumption of the composite good, which is either produced within the taxing jurisdiction or imported from the other jurisdictions.

Given the level of public good provided by the government (G), the representative resident spends after-tax income (M) on tradable goods (X) and nontradable goods (Y). The utility maximization problem of the representative resident is thus

$$\text{Max}_{X,Y} \left[(\delta_X X^\rho + \delta_Y Y^\rho + \delta_G \bar{G}^\rho)^{1/\rho} \right], \text{ subject to } P_X X + P_Y Y \leq M,$$

Solving this problem yields consumer demands:

$$X = \left(\frac{\delta_X}{P_X} \right)^\sigma M \left(\delta_X^\sigma P_X^{1-\sigma} + \delta_Y^\sigma P_Y^{1-\sigma} \right)^{-1}$$

$$Y = \left(\frac{\delta_Y}{P_Y} \right)^\sigma M \left(\delta_X^\sigma P_X^{1-\sigma} + \delta_Y^\sigma P_Y^{1-\sigma} \right)^{-1}.$$

Government Optimization

The government of the taxing jurisdiction is assumed to maximize the utility of its residents, which can be modeled as the utility level of a representative resident, since all individuals are identical and, as discussed above, are assumed to remain in the taxing jurisdiction regardless of its taxing policies. The analysis assumes that the public good can be converted costlessly from the tradable good. In the initial equilibrium, which is analogous to the efficient

local public goods equilibrium envisioned by Tiebout (1956), the government finances all purchases of the public good using revenues from a head tax. Then, following Zodrow and Mieszkowski (1986a, b), property taxes are introduced into the model by assuming an exogenously specified permitted level of head taxation, denoted by the variable ϕ ; for example, the use of head taxes might be constrained on equity grounds. Specifically, head taxes per capita are ϕZ where $\phi = 1$ in the initial equilibrium and $\phi < 1$ reflects reductions in head taxes below their efficient level. The revenues lost to reduced head taxation are assumed to be replaced by imposing a uniform property tax on all uses of capital and land at the same rate; no other taxes are considered. This implies a government budget constraint

$$P_x G = G = \phi H + T \left(rK + \frac{\Pi_x}{1+T} + \frac{\Pi_y}{1+T} \right).$$

The government optimization problem is thus

$$\text{Max}_T \left\{ V \left[P, r\bar{K} + w\bar{L} + \frac{\Pi_x}{1+T} + \frac{\Pi_y}{1+T} - \phi H, \phi H + T \left(rK + \frac{\Pi_x}{1+T} + \frac{\Pi_y}{1+T} \right) \right] \right\},$$

and the first order condition for the optimal property tax rate, for any exogenously specified level of ϕ is

$$\left\{ \begin{array}{l} -(\delta_x^\sigma P_x^{1-\sigma} + \delta_y^\sigma P_y^{1-\sigma})^{(1-\sigma)/\sigma} \delta_y^\sigma P_y^{-\sigma} \frac{dP_y}{dT} \\ +(\delta_x^\sigma P_x^{1-\sigma} + \delta_y^\sigma P_y^{1-\sigma})^{1/\sigma} M^{-1/\sigma} \left[\bar{L} \frac{dw}{dT} + \frac{1}{1+T} \left(\frac{d\Pi_x}{dT} + \frac{d\Pi_y}{dT} \right) - \frac{\Pi_x + \Pi_y}{(1+T)^2} \right] \\ +\delta_G G^{-1/\sigma} \left[rT \frac{dK}{dT} + rK + \frac{(\Pi_x + \Pi_y)}{(1+T)^2} + \frac{T}{1+T} \left(\frac{d\Pi_x}{dT} + \frac{d\Pi_y}{dT} \right) \right] \end{array} \right\} = 0,$$

where

$$\frac{d\Pi_X}{dT} = \bar{V}_X^{1-\sigma_X} \left(\frac{\Pi_X}{\alpha_{vX}} \right)^{\sigma_X} \left(-\alpha_{kX}^{\sigma_X} r^{1-\sigma_X} (1+T)^{-\sigma_X} - \alpha_{lX}^{\sigma_X} w^{-\sigma_X} \frac{dw}{dT} \right),$$

$$\frac{d\Pi_Y}{dT} = \bar{V}_Y^{1-\sigma_Y} \left(\frac{\Pi_Y}{\alpha_{vY}} \right)^{\sigma_Y} \left(P_Y^{-\sigma_Y} \Psi_Y^{1-\sigma_Y} \frac{dP_Y}{dT} - \alpha_{kY}^{\sigma_Y} r^{1-\sigma_Y} (1+T)^{-\sigma_Y} - \alpha_{lY}^{\sigma_Y} w^{-\sigma_Y} \frac{dw}{dT} \right).$$

Note that in solving this optimization problem, the government has to take into account the general equilibrium effects $\left(\frac{dP_Y}{dT}, \frac{dw}{dT} \text{ and } \frac{dK}{dT} \right)$ that result from the imposition of the property tax. In the simulations, this expression is solved numerically for the optimal value of property tax rate (T^*).

The Efficiency Cost of the Property Tax

The efficiency cost associated with the use of property taxation in the model is measured using an equivalent variation approach. Given that the property tax revenue is spent on financing government services (replacing revenues initially obtained with the head tax), the excess burden from the imposition of the property tax is the amount that the representative consumer would be willing to pay to return to the initial equilibrium in which there are no property taxes.

For a CES utility function, the expenditure function associated with prices (P_X, P_Y) and utility level U is $e(P, U) = (\delta_X^{\sigma^D} P_X^{1-\sigma^D} + \delta_Y^{\sigma^D} P_Y^{1-\sigma^D} + \delta_G^{\sigma^D} P_X^{1-\sigma^D})^{1/(1-\sigma^D)} U$. Denoting P^0, U^0 as the price levels and utility level before the use of property tax, and U^1 the utility level after the use of property tax, the efficiency cost associated with raising revenue R with the property tax, expressed as a percentage of revenue raised, is $EC = -EV / R = -[e(P^0, U^1) - e(P^0, U^0)] / R$. In addition, the marginal efficiency cost of the property tax (MEC) is the change in efficiency costs, relative to revenue raised, for a marginal increase in the property tax rate.

IV. RESULTS

This section provides the results of some illustrative numerical simulations of the efficiency costs of a finite increase in the property tax in the small open economy model described above. Six cases are considered. The first is an example of the Y=Housing case, where the tradable sector (X) and the nontradable sector (Y) are assumed to be primarily manufacturing and housing services, respectively. The production cost shares for both sectors are calculated using the U.S. Benchmark Input-Output Accounts for 2002¹⁵. The tradable sector is relatively labor intensive ($\theta_{KX} = 0.35$, $\theta_{LX} = 0.61$, $\theta_{VX} = 0.03$), while the nontradable sector is relatively capital intensive and has a significant land production cost share ($\theta_{KY} = 0.45$, $\theta_{LY} = 0.26$, $\theta_{VY} = 0.29$). The substitution elasticities in both production and consumption are taken from Morgan, Mutti and Partridge (1989), who estimate that $\sigma^X = 0.8$, $\sigma^Y = 0.1$ and $\sigma^D = 0.75$.^{16 17} The share of consumption expenditure on housing services ($\beta = 0.18$) is based on data from the National Income and Product Accounts (NIPA, 2007).¹⁸

The second case is an example of the Y=Services case, where the tradable sector (X) is still assumed to be manufacturing but the nontradable sector (Y) is now assumed to be services. The nontradable sector is now relatively labor intensive with a very small land production cost

¹⁵ The U.S. Benchmark Input-Output Accounts are published by the Bureau of Economic Analysis. All subsequent cost shares are also based on this calculation.

¹⁶ Antras (2004) finds that the elasticity of substitution between capital and labor for an U.S. aggregate production function, which might correspond roughly to the same elasticity in the tradable sector, is considerably below one, ranging from 0.55 to 0.95. McDonald (1981) estimates that the elasticity of substitution between land and non-land inputs in the housing sector ranges from 0.36 to 1.13. Since no clear consensus on the values of these elasticities exists, various values are simulated below.

¹⁷ All subsequent elasticities of substitution, unless otherwise stated, are taken from Morgan, Mutti and Partridge (1989).

¹⁸ See U.S. Bureau of Economic Analysis, National Income and Product Accounts, Table 2.3.6. All subsequent expenditure shares are also based on data from this table. Housing services are defined as housing and all household operations (except electricity and gas).

share ($\theta_{KY} = 0.30$, $\theta_{LY} = 0.67$, $\theta_{VY} = 0.03$ and $\sigma^Y = 1$). The share of consumption expenditures on services is $\beta = 0.39$.¹⁹

The third case, which is the benchmark case, assumes that the nontradable sector (Y) is an aggregate of housing and services. The share of consumption expenditures on housing and services is $\beta = 0.57$. Cost share parameters and the elasticity of substitution for the nontradable sector are computed as the weighted averages of the housing and services sector, using the consumption expenditure shares for these two sectors as weights.²⁰ This results in estimates of $\theta_{KY} = 0.35$, $\theta_{LY} = 0.54$, $\theta_{VY} = 0.11$ and $\sigma^Y = 0.72$.

The results in this benchmark case are then compared to those in three alternative scenarios. The fourth case studied is a “low substitutability” case, in which all parameters are the same as in the benchmark case except that all elasticities of substitution are assumed to be 0.5 ($\sigma^X = \sigma^Y = \sigma^D = \sigma = 0.5$).

The fifth case is the “Cobb-Douglas” case, in which all parameters are the same as in the benchmark case, except that both production technologies and the household utility function are assumed to be Cobb-Douglas ($\sigma^X = \sigma^Y = \sigma^D = 1$).

The sixth case is the “high substitutability” case, under which all parameters are the same as in the benchmark case except that the elasticities of substitution in both sectors are assumed to be 1.25 ($\sigma^X = \sigma^Y = \sigma^D = \sigma = 1.25$).

In the initial equilibrium for all simulations, local government expenditures are assumed

¹⁹ Services are defined as non-housing services, including transportation, medical care, recreation and other services.

²⁰ The weights, which are also based on NIPA data, are 0.31 for housing and 0.69 for services.

to be 8.6% of total income,²¹ with all government expenditures initially financed by head taxation. In the simulations, the level of head taxation allowed (ϕ) is exogenously reduced from 1 to 0.157, a figure chosen to yield an optimal property tax rate of 18% in the benchmark case; this admittedly rough estimate is consistent with an estimate of an average property tax rate in the US of 18.2%.^{22 23}

²¹ This reflects the ratio of total local government expenditures to GDP in 2005 (U.S. Bureau of Economic Analysis, National Income and Product Accounts, Tables 1.1.5 and 3.21).

²² Note that the property tax rate is expressed relative to income rather than asset value. Poterba (1998) estimates that the pre-tax return on capital was 8.6% over the period 1990-1996. Gravelle (2008) estimates effective property tax rates on real and personal property for all states in the year 2000. Weighting by state GDP (obtained from Bureau of Economic Analysis: <http://www.bea.gov/regional/gsp/>), the weighted effective property tax rate is 1.56% which, given a pre-tax return on capital of 8.6%, implies an average property tax of 18.2%. Note that this estimate of the average property tax rate is on the high side in the sense that it results in a head tax share of local revenues of 15.7%; by comparison, the share of local personal income and sales taxes, relative to the sum of these taxes and local property taxes, was 22.1% in 2006 (Bureau of Economic Analysis, National Income and Product Accounts, Table 3.21, Local Government Current Receipts and Expenditures).

²³ We also performed some simulations with the level of government services fixed, with the property tax rate adjusting to yield a constant level of government revenue. In this case, the tax rate and both average and marginal efficiency costs were slightly higher than those obtained in Table 1, resulting in a relatively larger capital outflow and, thus, relatively larger reductions in the marginal productivity of local factors.

**Table 1: Three Major Distortions and Efficiency Cost
Associated with the Use of Property Tax – with $\phi = 0.157$**

Variables	Y= Housing	Y= Services	Bench- mark	Low Sub- stitu- tability	Cobb- Douglas	High Sub- stitu- tability
ϕ	0.150	0.150	0.150	0.150	0.150	0.150
T	0.155	0.209	0.180	0.185	0.172	0.158
\hat{K}	-13.60	-22.97	-16.91	-11.98	-20.47	-23.25
\hat{X}	2.21	0.44	1.14	0.52	2.04	2.60
\hat{Q}_x	-6.16	-13.63	-13.05	-9.29	-16.90	-19.09
\hat{Y}	-1.01	1.19	-0.00	-0.22	0.51	0.80
\hat{G}	-19.37	-16.36	-11.03	-5.37	-18.67	-23.70
\hat{w}	-7.63	-9.53	-8.22	-8.75	-7.59	-6.83
\hat{P}_y	4.36	-1.00	1.53	1.49	1.53	1.43
Property Tax Revenue	5.65	5.90	6.36	6.85	5.70	5.27
Efficiency Cost	0.33 (5.77%)	0.92 (15.57%)	0.58 (9.11%)	0.40 (5.80%)	0.70 (12.31%)	0.84 (15.88%)
Marginal Efficiency Cost	19.25%	43.65%	18.98%	8.16%	26.69%	32.14%

Note: Superscript '^' denotes the percentage change of a variable.

Table 1 illustrates the three distortions discussed in the previous section. In all of the simulations (except the Y=Services case), the distortions follow the same pattern. The imposition of the property tax raises the cost of capital and drives capital out of the taxing jurisdiction, with the capital stock declining by 12.0-23.3 percent. Note that the easier it is for producers to substitute between capital and labor (a higher elasticity of substitution in production), the larger is this tax-induced outflow of capital. The level of government services declines as the imposition of the property tax creates the tax bias toward under provision of government services emphasized in the tax competition literature. The decline in the provision of government services

is relatively large in the cases in which the degrees of substitution between capital and labor in production and the degree of substitution between goods in consumption are relatively high, with public service declines that approach 20 percent. Finally the simulation results reveal the tax bias away from consumption of capital intensive goods (which is the nontradable good except when the nontradable good is services) and toward tradable goods (X) since their price does not increase while the price of the nontradable goods (Y) increases (again, except in the case where the nontradable good is services²⁴). Note that as the potential for substitution (in both consumption and production) gets larger, the increase in consumption of X is relatively larger, as there is a shift of consumption towards private goods as the underprovision of government services (G) becomes relatively larger.

The simulation results in the Y =Services case are of special interest. In this case, the outflow of capital and the reduction in government services are also relatively large, 23.0% and 23.3%, respectively. This occurs because both production sectors are heavily labor-intensive ($\theta_{LX} = 0.61$ and $\theta_{LY} = 0.67$). As a result, the government has to set the rate of property tax at a relatively high level (20.9%) in order to have enough property tax revenue to finance the optimal level of government services. This high rate of property taxation results in relatively large distortions in the economy. Note that the use of the property tax in this case does not decrease the consumption of the nontradable good (Y), as its price falls due to the reduction in wages.

Table 1 also shows that the efficiency cost of the property tax ranges from 5.8 to 15.9 percent in the simulations, with the distortions increasing with the magnitude of the elasticities of

²⁴ Note that when the nontradable goods sector is assumed to be labor-intensive services, its product price declines. The fact that the tradable goods sector, where forward shifting is impossible, is relatively capital-intensive in this case implies that equilibrium can be reached only if the price of labor falls by enough to absorb the significant burden of the property tax in the tradable goods sector. This in turn implies downward pressure on consumer prices in the nontradable goods sector. For a thorough discussion of this issue, see Muthitacharoen and Zodrow (2008a).

substitution (as discussed in Arnott and Petrova (2006) and Nechyba (1998)). Note that the high rate of property taxation in the $Y=Services$ case also implies a relatively large excess burden (15.6%). The marginal efficiency cost of the property tax is of course greater than the average cost. Indeed, in almost all simulations, marginal efficiency costs are more than double the levels of the average efficiency cost, ranging from 8.2-43.7 percent.

Finally, Tables 2 and 3 provide some sensitivity analysis with respect to the extent of government reliance on property taxation. For example, Table 2 considers the analysis for a relatively high tax state such as Texas, which is modeled as a property tax rate of 21.5 percent in the benchmark case (ϕ is reduced exogenously from 1 to 0.015).²⁵ By comparison, Table 3 considers a state, such as Georgia, where reliance on the property tax is more modest with a tax rate of 14 percent in the benchmark case (ϕ is reduced exogenously from 1 to 0.321).²⁶

Under both scenarios, the economic effects of the property tax are broadly similar to those observed in Table 1. The results show that these efficiency costs, especially at the margin, increase (decrease) if the assumed property tax rate is higher (lower). For example, Table 2 shows the simulation results with an optimal property tax rate of 21.5% in the benchmark case; in this case, average efficiency costs range from 6.8-19.1 percent of property tax revenue and marginal efficiency costs range from 19.1-56.9 percent. By comparison, Table 3 shows the simulation results with an optimal property tax rate of 14 percent in the benchmark case; under these circumstances, average efficiency costs range from 3.5-12.1 percent of property tax revenue, while marginal efficiency costs range from 9.2-27.6 percent.

²⁵ The effective property tax rate in Texas was 2.01% in 2000 (Gravelle, 2008) which, with a pre-tax rate of return to capital at 8.6% (Poterba, 1998), yields an average property tax rate of 23.4%.

²⁶ The effective property tax rate in Georgia was 1.19% in 2000 (Gravelle, 2008) which, with a pre-tax rate of return to capital of 8.6% (Poterba, 1998), yields an average property tax rate of 13.8%.

**Table 2: Three Major Distortions and Efficiency Cost
Associated with the Use of Property Tax – with $\phi = 0.0157$**

Variables	Y= Housing	Y= Services	Bench- mark	Low Sub- stitu- tability	Cobb- Douglas	High Sub- stitut- ability
ϕ	0.015	0.015	0.015	0.015	0.015	0.015
T	0.189	0.252	0.215	0.220	0.207	0.191
\hat{K}	-16.12	-26.65	-19.60	-13.94	-23.78	-27.00
\hat{X}	2.27	0.38	1.25	0.51	2.27	2.92
\hat{Q}_x	-7.38	-16.03	-15.65	-10.87	-19.75	-22.30
\hat{Y}	-1.39	1.31	-0.10	-0.35	0.47	0.79
\hat{G}	-21.05	-19.77	-13.05	-6.14	-21.89	-27.78
\hat{w}	-9.13	-11.24	-9.64	-10.30	-8.93	-8.03
\hat{P}_y	4.98	-1.23	1.80	1.72	1.81	1.69
Prop Tax Revenue	6.67	6.77	7.35	7.94	6.59	6.08
Efficiency Cost	0.50 (7.55%)	1.29 (18.99%)	0.80 (10.82%)	0.54 (6.83%)	0.98 (14.84%)	1.16 (19.09%)
Marginal Efficiency Cost	24.92%	39.88%	21.58%	19.13%	31.24%	56.87%

Note: Superscript '^' denotes the percentage change of a variable.

Table 3: Three Major Distortions and Efficiency Cost Associated with the Use of Property Tax – with $\phi = 0.321$

Variables	Y= Housing	Y= Services	Benchmark	Low Substitutability	Cobb-Douglas	High Substitutability
ϕ	0.321	0.321	0.321	0.321	0.321	0.321
T	0.115	0.159	0.140	0.144	0.131	0.120
\hat{K}	-10.45	-18.30	-13.54	-9.57	-16.28	-18.52
\hat{X}	2.07	0.46	0.96	0.46	1.72	2.15
\hat{Q}_x	-4.68	-10.69	-10.63	-7.34	-13.34	-15.11
\hat{Y}	-0.59	1.02	0.06	-0.13	0.52	0.75
\hat{G}	-17.24	-12.46	-8.44	-4.04	-14.81	-18.67
\hat{w}	-5.78	-7.44	-6.49	-6.90	-5.94	-5.35
\hat{P}_y	3.59	-0.74	1.20	1.18	1.20	1.11
Prop Tax Revenue	4.36	4.77	5.11	5.49	4.57	4.23
Efficiency Cost	0.15 (3.47%)	0.56 (11.73%)	0.36 (7.04%)	0.25 (4.52%)	0.43 (9.35%)	0.51 (12.14%)
Marginal Efficiency Cost	12.31%	27.56%	16.63%	9.24%	22.48%	26.71%

Note: Superscript '^' denotes percentage change of the particular variable.

V. CONCLUSION

This paper analyzes the efficiency cost of the property tax from the perspective of a small open economy facing a perfectly elastic supply of capital. The model utilized in this analysis is able to capture three major distortions associated with the use of property tax. First, the imposition of the property tax raises the cost of capital and drives capital out of the taxing jurisdiction, reducing the productivity of other local factors of production. Second, the property

tax creates tax biases against the production and consumption of capital-intensive goods. Third, it creates a tax bias toward underprovision of local public services.

The analysis shows that, as expected, the key parameters in determining the efficiency costs of the property tax are the elasticities of substitution in production and consumption – higher elasticities of substitution result in larger distortions. In particular, the tax-induced outflow of capital from the taxing jurisdiction and the reduction in local government services are larger as substitutability in both production and consumption becomes easier. Moreover, the simulated efficiency costs of the property tax are significant, and vary with the property tax rate in the taxing jurisdiction. In the simulations with an optimal property tax rate of 18% (the benchmark case), average efficiency costs range from 5.8-15.9 percent of property tax revenue, with marginal efficiency costs that range from 8.2-43.7 percent. These efficiency costs, especially at the margin, increase if the assumed property tax rate is higher. For example, for a property tax rate of 21.5%, average efficiency costs range from 6.8-19.1 percent of the property tax revenue and marginal efficiency costs range from 19.1-56.9 percent. By comparison, with a lower property tax rate of 15 percent, average efficiency costs range from 3.5-12.1 percent of property tax revenue while marginal efficiency cost range from 9.2-27.6 percent. Note that these estimates understate, perhaps significantly, the efficiency costs of the property tax, as they reflect only distortions in production and consumption, ignoring the distortions of saving and labor supply decisions that are the focus of the ongoing debate regarding the relative merits of income and consumption taxes (Zodrow, 2007).

A natural question is how the efficiency costs of the property tax estimated in this paper compare to the efficiency costs associated with alternative sources of revenue for state and local

governments, such as sales or income taxes.²⁷ Although no directly comparable estimates for state or local income taxes are available, for sales taxes, the recent estimates by Hawkins (2002) are loosely related to the efficiency cost estimates of property taxes calculated in this paper.²⁸ Hawkins examines the excess burdens associated with the use of sales taxes with various patterns of exemptions, using a partial equilibrium analysis that simulates the effects of small increases in sales tax rates. Like our analysis, he focuses on allocative consumption and production distortions, ignoring effects on labor supply and saving. Hawkins reports excess burdens for three progressively narrower tax bases – (1) exemption of food produced for home consumption and most services, (2) exemption of home food, services and utilities, and (3) exemption of home food, services, utilities and gasoline – relative to a broad base that includes most consumption. Unfortunately, he does not report the efficiency costs of the uniform base, so that his estimates reflect only the additional excess burdens attributable to the various exemptions. However, since labor supply and saving effects are ignored and Hawkins reports that the range of compensated elasticities for the goods analyzed is fairly narrow, the efficiency costs of the uniform base, relative to a lump sum tax, seem likely to be small; as a result, the efficiency costs estimated for the various tax bases will be approximately equal to, although presumably somewhat smaller than, the actual marginal efficiency costs of the various sales taxes analyzed.

²⁷ Ballard, Shoven and Whalley (1985a, b) and Jorgenson and Yun (1996) also provide estimates of the efficiency costs of sales taxes. However, these estimates, which range from 25.6 to 38.8% for the former and 20.3 to 26% for the latter, are not directly relevant because they reflect the effects of nationwide use of sales taxes, rather than a sales tax increase enacted by a single city or state; they also include the effects of tax-induced labor supply and savings distortions.

²⁸ Russo (2005) also investigates the efficiency costs associated with the use of sales taxes for a state government; however, his focus is on the efficiency consequences of various tax reforms rather than the efficiency costs of the existing system. Bruce, Deskins and Fox (2006) estimate the tax base elasticities of state sales, corporate income and personal income taxes, but also do not calculate their efficiency costs.

In any case, neglecting the effects of pyramiding due to sales taxation of business inputs, Hawkins estimates that the efficiency costs of the three sales tax options, relative to a uniform base, range from 23.3-38.5 percent of revenues, with the excess burdens rising as the tax base become narrower and rates increase.²⁹ He then considers the effects of the tax pyramiding which arises to the widespread sales taxation of business input stressed by Ring (1999); these estimates most closely reflect the efficiency costs of existing sales tax structures. Somewhat surprisingly, Hawkins finds that pyramiding reduces the efficiency costs of sales taxation. This result obtains because taxed inputs are disproportionately important in the production of goods that exempt from the sales tax and are demanded relatively inelastically (e.g., services and utilities), so that pyramiding on average reduces the rate differentials between taxed and exempt commodities. Specifically, with pyramiding, the efficiency costs of the three sales tax options, relative to a uniform base, range from 17.9-26.7 percent of revenues, with the excess burdens again rising as the tax base become narrower and rates increase.³⁰

It is of course rather speculative to compare these results to our own, given the considerable differences between the two approaches. Nevertheless, the two sets of results suggest at a minimum that, at least under the capital tax view, it is far from obvious that local use of the property tax is especially non-distortionary as is sometimes asserted,³¹ and in particular that it is less distortionary than local use of a sales tax. For example, the Hawkins estimates of the incremental efficiency costs of the sales tax with pyramiding and the most exemptions, relative to a uniform tax, are 26.7 percent of revenues, while our estimates of the average

²⁹ Hawkins assumes a one percentage point increase in the sales tax rate on the uniform base, and then assumes equal yield tax rates on the narrower bases; these rates range from 2.4-3.3 percent. These estimates are thus intermediate between marginal and average efficiency costs, but presumably closer to average efficiency costs.

³⁰ The equal yield tax rates range from 1.8-2.2 percent.

³¹ For example, see the papers by Martinez-Vazquez and Rider and by Bahl and Wallace in this volume.

efficiency costs of the property tax range from 4.6-19.1 percent of property tax revenue, with marginal efficiency costs that range from 9.6-44.7 percent (with a property tax rate of 20%). In states with heavier reliance on property taxes, the excess burdens associated with the use of property tax would of course be even higher. Moreover, if distortions of saving and labor supply decisions were added to the analysis, the literature on the relative merits of income and consumption taxation suggests that sales taxes are generally more efficient than taxes on capital income such as the property tax. In any case, these results suggests that a very useful avenue for future research is an evaluation of the relative efficiency costs of various state and local tax instruments within the context of a single model that simultaneously includes property taxes, sales taxes and income taxes and considers both distortions of consumption and production decisions as well as distortions of saving and labor supply decisions.

Finally, we note briefly that most of the studies in the property tax literature assume the nontradable sector is primarily housing. However, our analysis demonstrates that for a general property tax that applies to both residential and nonresidential property, the effects of the property tax on the non-housing components of the nontradable sector are important and rather different from those on housing. Thus, including such effects is crucial to developing a full understanding of the implications of the property tax; in particular, when the nontradable sector is assumed to be relatively labor-intensive services, the optimal property tax rate must be relatively high to raise sufficient revenues, which implies that the tax causes relatively large distortions and has relatively high efficiency costs.

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