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Federal-State Tax Interactions in the United States and Canada

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The potential for vertical tax competition is strongest when different levels of government share the same base. Because there is greater sharing of common tax bases in Canada than in the United States, we expect vertical tax competition to be weaker in the United States than in Canada. Econometric analysis of US data supports this hypothesis. Taking account of the deductibility-related endogeneity of federal tax burdens by state, federal income tax burdens have no effect on average state income tax burdens. Introducing distributional considerations into the vertical tax competition model, we do find a significant displacement effect for higher income taxpayers, with higher federal burdens associated with lower state income tax burdens in the highest income quintile. For low-income taxpayers, federal and state tax burdens are complementary.

In a federal system, the level and structure of subnational taxation depends on both the assignment of tax bases to the various levels of government as well as the interdependent decisions of national and subnational governments regarding rates of taxation. In principle, federal taxation may be competitive or substitutive of subnational taxation—higher federal tax rates associated with lower state or provincial rates—complementary—higher federal rates associated with higher provincial rates—or neutral, with little systematic relationship between the two. Studies for Canada and the United States have tended to find complementary relationships for the income tax, and for excise taxation. Results in other countries have indicated a more substitutive relationship.

Vertical fiscal competition is particularly relevant when different levels of government share the same tax. The potential for vertical fiscal competition has been formally recognized in the Canadian system, where from time to time the federal government has explicitly ceded so-called “tax points” to the provinces, at the same time offloading certain expenditure responsibilities to the provincial level.

An example of implicit vertical fiscal competition is given by the US cigarette tax. Though both federal and state levels impose a cigarette excise tax, at present

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the tax is primarily the province of the states, with state collections almost double federal collections. Though the tax was first imposed at the federal level in 1865, by not raising rates the federal government has over time implicitly ceded the tobacco tax base to the states. The 2009 increase in the federal cigarette excise tax rate to help pay for expanded health insurance for the poor puts the states in more direct competition with the federal government for this tax base.¹

The paper is divided into two parts. In the first part, we compare fiscal systems in the United States and Canada, focusing on those features which are likely to have an effect on vertical fiscal interactions. The first section of part one provides an overview of the issues, while the second part presents a critical review of the relevant literature. In the second, empirical section of the paper, we specify and estimate a model of the effect of federal tax burdens, both overall and for the income tax alone, on state tax burdens in the United States. Reflecting the theoretical ambiguity of the vertical tax interactions in federations, the model takes into account both the potential competitive or displacement effects of federal taxation on subnational tax rates, and the offsetting complementary effect that occurs through deductibility of state and local taxes. The final section of the paper summarizes findings for the United States, and again draws comparisons with the Canadian fiscal system.

The main empirical contribution is to address the endogeneity in state tax rates that stems not only from the effect of deductibility on the state tax price and but also its effect on federal tax burdens. A second important contribution is to introduce distribution into the vertical tax competition literature. Drawing on rich data from the simulation analyses of tax incidence by state by the Citizens for Tax Justice—Institute for Taxation and Economic Policy (CTJ-ITEP), we are able to estimate the effect of federal taxation not only on the total burden, but also on the distributional incidence of state and local taxes. We decompose federal tax rates by income class, and estimate the effects on state tax burdens by income class.

Comparing Vertical Fiscal Relationships in Canada and the United States

The fiscal role of Canada's provinces comes about primarily through income taxation (Lazar 1999). Joint federal and provincial occupancy of personal and corporate taxes is a fundamental feature of Canada's fiscal structure. The structure is based on the principle of tax harmonization, with a common definition of taxable income, and centralized collection of taxes, which are then remitted to the provinces. Before 2001, the provincial income tax was expressed as a percentage of the federal tax (the so-called tax-on-tax). After 2001, provincial governments have been allowed to independently set their own personal income tax rates and tax structure, (tax on income), but using a common definition of the tax base.

Corporate taxes have long been structured this way. With the exception of Quebec and Alberta, all provinces are parties to the tax harmonization arrangement. Hale (1999) argues that conversion from a tax-on-tax to a tax on income has led to a substantial decentralization of the Canadian tax system.

The harmonization of federal and provincial tax structures has allowed the federal government to fund national initiatives by transferring tax points to the provinces, as opposed to exclusive reliance on cash transfers. A tax point is a transfer of income tax room between the federal and provincial governments. The first transfer of tax points, in 1941, was in fact an upward transfer from provinces to the federal government. In a downward transfer, the federal government reduces its basic tax rate by a specific percentage and the provinces increase theirs by an equivalent amount, thereby leaving total federal and provincial tax unaffected. Tax points can be applied to the personal or the corporate income tax. In 1977, a mixed system of tax abatements was replaced by a 30.5 percent reduction in the basic federal tax.² This reduction was used to provide the provinces with the fiscal capacity to fund the Canada Health and Social Transfer block grant. Provincial tax rates, expressed as a percentage of basic federal tax, could be increased by more or less than 30.5 percent. All provinces responded by raising their tax rates to fully occupy the new tax room, with two provinces raising their rates even more than the federal reduction (Government of Canada 1997).

At the point of implementation, the transfer of tax points is largely an accounting exercise, with an individual's total tax bill unchanged. However, over time the transfer has helped to promote a long-run trend toward decentralization of the Canadian fiscal system. In part because the transfer of tax points represents a permanent substitution of provincial for federal taxation, such transfers have been quite infrequent. The models of vertical tax interactions are most relevant for periods between the transfers of tax points. As discussed below, these models do not give clear-cut predictions as to whether federal/provincial tax relationships will be substitutive or complementary.

While the Canadian fiscal system has gradually decentralized, the fiscal systems of US states are structurally more independent of the federal level. Reflecting both differences in the constitutional underpinnings of fiscal federalism in the two countries, as well the much greater population and economic size of the US federation, state tax structures are substantially more varied than their provincial counterparts. For example, as of 2008, seven states do not have broad-based personal income taxes, while two others tax only capital income. Five states do not conform at all to the federal tax base, nine states use federal taxable income as their tax base, one imposes a tax surcharge on federal tax liability, and the remainder use federal adjusted gross income as the tax base. The greater independence of federal and state tax systems in the United States suggests that vertical tax interactions are likely to be weaker in the United States than in Canada. Under the US personal

income tax, taxpayers can deduct state and local income and property taxes from the federal income tax base.³ Deductibility reinforces the greater structural independence of subnational taxation in the United States than in Canada. Cost sharing with the federal government lowers the price to subnational governments of raising an additional dollar of taxes. Canada lacks this mechanism for mitigating direct competition between federal provincial governments. Because deductibility is not allowed, the price of an extra dollar of provincial taxation—i.e. the cost to taxpayers—is a full dollar.

An important implication of deductibility in the United States is that, because the subsidy rate rises with income, the benefits are concentrated in high income, high tax states.⁴ Higher income taxpayers in the United States are more likely to itemize their deductions, and face higher marginal tax rates. Hence, they are able to offset their state taxes at higher rates than lower-income taxpayers. In 2002, the average offset on a dollar of state and local taxes was about 16 cents for high-income taxpayers, versus 8 cents overall (Citizens for Tax Justice 2002).

Though deductibility is important, the United States also has an alternative tax structure, known as the Alternative Minimum Tax (AMT), which has served to attenuate the ability to deduct state and local taxes, particularly in high tax states. The AMT, which was first introduced in 1969, was designed to prevent high income taxpayers from legally escaping all income tax liabilities. If tax due under the ordinary income tax is less than the AMT tax, then the taxpayer pays the AMT. The AMT treats state and local taxes as a preference item, i.e. an item which under the regular tax system would be deductible, but which loses this preferred status under the AMT. Hence taxes are not deducted in computing taxable income. Thus for taxpayers subject to the AMT, the price of an additional dollar of state and local taxes is a full dollar. Though the overall proportion of taxpayers subject to the AMT remains small, because the threshold level for the AMT has not been indexed, the proportion rises rapidly with income. This is particularly the case in high tax states. The reduced role of deductibility means that, *de facto*, the US system is converging on the Canadian system, under which national and provincial governments compete for revenues from a shared tax base for a major tax instrument.

While Canada does not allow an explicit provincial price incentive through deductibility, it has been argued that its fiscal equalization program provides an implicit subsidy for recipient provinces to raise their tax rates. Smart (2007) provides evidence that recipients of the equalization grant actually do raise their tax rates as a consequence. This price effect may also have an indirect secondary influence on federal–provincial tax interactions, because any increase in tax rates in the subset of five wealthier provinces that make up the standard tax base for equalization leads to an increase in equalization payments.

To summarize, Canada's system of subnational taxation is more uniform horizontally—across provinces—and more closely harmonized with the federal tax system than is the case for the United States. The US fiscal system is more decentralized, but provides a fiscal incentive to states through tax deductibility. While Canada does not allow deductibility, its system of fiscal capacity equalization plays a somewhat analogous role.

Research on Vertical Fiscal Interactions in the United States and Canada

Vertical tax interactions have received more attention in the Canadian than in the US literature on fiscal federalism. Both the theoretical and empirical studies emphasize the reciprocal relationship between federal and provincial taxation. When both levels of government utilize the same tax base, a decision to raise or lower tax rates can affect the size of the tax base available to the other level. Because each level does not take account of the potentially adverse effect on the tax base of the other level, the theory predicts that sharing of tax bases will tend to raise the overall level of taxation in a federation, as compared to the assignment of different tax bases to each level (Dahlby 1996). Devereux et al. (2007) show that for excise taxes in the United States the more inelastic the demand, the weaker the state response to a federal tax increase.

A second implication of the vertical tax setting model is that larger provinces or states may behave differently than smaller provinces. The greater the share of the national tax base in a single province, the greater the potential effect of a tax change in that province on the national tax base. Similarly, larger provinces are likely to be less susceptible to tax competition from other provinces, because they have other features which make the tax base less mobile than is the case for smaller provinces.

Hayashi and Boadway (2001) study the interaction between corporate income tax rates at the federal and provincial level in Canada. Because of the complexity of business taxation in Canada, provincial and federal tax rates are measured in terms of average rates, defined as business tax revenues divided by corporation net income. The authors estimate a system of equations in which the federal tax rate depends on the rates in Ontario, Quebec, and the average of all other provinces. Provincial rates for Ontario, Quebec, and all other provinces, are in turn a function of federal rates, as well as the rates in other provinces. To take account of other factors that might affect either average tax rates or tax decisions, their model also includes the national inflation rate, the (US) interest rate, and provincial growth rates, wages, budget deficits, and political party control variables.

Hayashi and Boadway find that the federal rate has no effect on Ontario's rate, but a significant negative effect on corporate tax rates in Quebec and the other

provinces. The crowding out effect is particularly strong in Quebec. A possible reason for the strong Quebec effect is that the province views its closest competitive locations as being US states, rather than other Canadian provinces. Hence, it may adjust its corporate income tax rate to maintain an overall federal-plus-provincial rate differential with US locations. By contrast, Ontario's tax rate has a positive affect on the federal rate, whereas the rates in other provinces do not influence the federal rate. Ontario's large size may allow it to set its taxes independent of other governments. However, the reverse effect of Ontario on the national rate may be spurious. If changes in Ontario's corporate tax base are strongly correlated with changes in the national corporate base, because of the large size of Ontario's corporate sector, this could impart a positive bias to the Ontario coefficient.

In their study of the Canadian income tax, Esteller-Moré and Solé-Ollé (2002) regress provincial tax burdens on the federal tax burden, the income tax burdens of geographic neighbors, federal government transfer payments and an interaction term between the national equalization rate, and those provinces receiving equalization transfers. The latter term is included to test whether equalization, by offsetting any tax-related decline in the provincial tax base, encourages recipient provinces to raise their tax rates. They find a significant positive interdependence between federal rates and provincial rates, with a 1 percentage point change in the federal rate associated with a 0.2 percentage point change in the provincial rate.

Though the magnitude of the coefficient is relatively small, the authors also find a significant positive effect of the national equalization tax rate on tax rates in provinces receiving equalization grants. They argue that this result shows that the price effect of equalization—encouraging higher taxes by compensating for any loss in tax base—dominates the income effect—the incentive to pass some of the equalization grant back to the taxpayers in the form of lower tax rates. However, they also find a strong negative effect of general transfers on tax rates. Since general transfers are mainly comprised of equalization grants, the magnitude of the transfer effect would seem to imply that the income effect of equalization does in fact dominate the price effect. If this interpretation is correct, the net effect of equalization is to lead to convergence in provincial income tax rates.

Complementing their Canadian study, Esteller-Moré and Solé-Ollé (2001) examine the effect of both vertical and horizontal tax competition on state income taxation in the United States. Using a sample of the forty-one states with income taxes, for the years 1987–1996, they test for the differential effects of reciprocal deductibility of state and federal income taxation, as opposed to the norm of one-way deductibility. They also test for fiscal illusion, as measured by dummy variables for whether or not a state's income tax base conforms to the federal tax base, or whether a state's income tax is set as a proportion of the taxpayers' federal income tax liability. The extent to which states which conform to the federal tax base do not completely undo the automatic response of state tax burdens to a

change in the federal tax base is taken as a measure of fiscal illusion, because the resultant change in tax rates does not result from fiscal choices reflecting fundamental demand and supply relationships in the state's public economy.

They find a positive relationship between federal and state income tax burdens in the United States. A one percentage point increase in the federal tax burden is associated with a 0.10 percentage point increase in state income tax burdens, and a 0.22 percentage point change in the combined state income and sales tax. The magnitude of the response in states that conform to the federal income tax base is almost twice as high as in those states that do not conform. This supports the notion that fiscal illusion matters in determining state income tax burdens.

In their US model, Esteller-Moré and Solé-Ollé do not take account of another source of bias, namely the differential effect of deductibility across states, as a function of differences in state marginal tax rates. With deductibility, state income taxation is endogenous, since higher state income taxation implies a lower federal tax burden. The negative correlation between the federal burden and the error term biases the income tax coefficient downward.

Besley and Rosen (1998) and Devereux et al. (2007) study vertical tax relationships for excise taxation in the United States. Both find evidence of complementarity for cigarettes and gasoline, with states raising their own rates in response to increases in federal rates.

A potential problem in much of the empirical work on vertical tax competition comes from the endogeneity, or simultaneous determination, of the dependent variable—the subnational tax rate—and the independent variable—the federal tax rate. In a regression of state tax burdens on federal tax burdens, common shocks to both federal and state income taxation could bias the federal tax coefficient upward. For example, if a national recession decreases both federal and state taxable income, then the effective rates might rise at both levels. This type of specification bias is particularly problematic when the tax variables are measured as national and state income tax revenues divided by state/provincial personal income, as in Esteller-Moré and Solé-Ollé's work, or corporate profits, as in Boadway and Hayashi. Because changes in personal income or corporate profits automatically affect both the dependent and the independent variable, there is a built-in bias towards finding a positive relationship between the two levels of taxation.

All of the authors discussed try to address the issue of simultaneity by including controls for shocks common to both state and federal income taxation. In Esteller-Moré and Solé-Ollé, controls include personal income and a national time trend. In their US paper, Esteller-Moré and Solé-Ollé also use the method of instrumental variables. However, because their instruments—percent of the US population over sixty five, and political party of the President—vary over time but not across states, the first stage prediction equation will not vary across states. In the empirical work in this article, we address the simultaneity issue by

decomposing state tax burdens by income level, and by constructing a pseudo federal tax burden variable, which is constructed as a national average tax burden, adjusted for differences in income between the nation and any particular state.

There have been a number of studies of the effect of tax deductibility in the United States. Feldstein and Metcalf (1987), and Gade and Atkins (1990) find that deductibility has a powerful effect on mix of taxes, leading states to greater reliance on deductible personal taxes, rather than personal use charges (which are not deductible) or corporate taxes and fees. Chernick (2005) finds that deductibility increases the progressivity of state and local taxes, but does not affect the overall level. Metcalf (2008) finds that deductibility affects both the incidence and the level of state and local taxes, and predicts that reduced deductibility would lead to reduced spending and a more regressive tax structure.

A Model of Vertical Tax Interactions in the United States

Income, Displacement, and Price Effects

The analysis of federal-state tax interactions typically starts with the assumption that the federal government acts as a Stackelberg first mover, setting tax rates to which states or provinces respond by setting their own tax rates. In their responses, states do not assume or take into account the possibility that the federal government will in turn respond to their responses, nor does the federal government actually respond to state initiatives. While this framework is undoubtedly a simplification of the continuous bargaining between what goes on between the federal government and the states over both taxation and spending policies, it seems a reasonable first approximation for statistical work.

Federal taxation can be analyzed in terms of three effects on subnational taxation: a displacement effect, an income effect, and a price effect. Because these effects work in different directions, the net effect on state taxation is theoretically ambiguous. The displacement effect works through its effect on shared tax bases. If the federal government raises its tax rate on a shared tax base, this increases excess burdens at the subnational level, providing an incentive to reduce the rate of state taxation on the shared base. The magnitude of the displacement effect depends on the elasticity of demand for goods, in the case of excise taxation, or the elasticity of taxable income, in the case of income taxation. In terms of aggregate effect, displacement of state by federal taxation could lead to a reduction in overall rates of state taxation, and/or to an increase in rates on non-shared tax bases. If there is displacement, the net effect on state tax rates depends on whether increased rates on other tax bases are sufficient to offset the decrease in taxation on the shared base.

The income effect is more general than the displacement effect on shared taxes. Higher overall rates of federal taxation reduce the after-tax income of state

residents. If the demand for government spending and the taxes to finance this spending are normal goods, as most evidences indicate, then the income effect should lead to a reduction in subnational taxation. However, it is important to distinguish between tax levels and tax rates. If the elasticity of tax rates with respect to income is greater than zero, implying an elasticity of tax levels with respect to income greater than one, the income effect will produce a decline both in levels of taxation and tax rates in response to higher federal taxes. However, if the elasticity of tax rates with respect to net income is negative, then the higher federal taxation would lead to an increase in state tax rates, and possibly an increase in state taxes. The latter result would reflect the perceived need of state governments to raise tax rates to maintain subnational revenues. For most excise taxes, the income effect of shared tax bases is unimportant, because the share of income spent on the taxed commodities is low. If there is just one federal tax and one state tax, then the income and displacement effects are conflated.

The price effect works through the deductibility of state and local taxes from federal taxable income under the individual income tax. This effect, which is operative in the United States, but not in Canada, lowers the price of a dollar of deductible taxes for itemizers by one minus the taxpayer's marginal tax rate. The price effect of federal deductibility provides an unambiguous incentive for states to increase the rate of taxation on deductible taxes, relative to non-deductible taxes. The overall effect of deductibility on state and local taxation depends on the elasticity of substitution between deductible and non-deductible taxes. If the elasticity of substitution is less than one, then a decrease in deductibility, as has been occurring in the United States because of the increasing share of income subject to the AMT, would lead to a reduction in overall state and local tax rates and a shift away from income and property taxes toward consumption taxes and charges.

The displacement and price effects work in the opposite direction. An increase in federal marginal tax rates lowers the price of deductible taxes, which should lead to a substitution towards deductible taxes. At the same time, an increase in federal marginal tax rates should lead to a higher effective federal tax burdens for some or all income levels. The displacement effect of such an increase will cause a reduction in state taxes. Because these effects are offsetting, the net effect of an increase in the federal income tax rate on the state rate is ambiguous.

The various effects may be summarized in the following equation, where j indexes states and i indexes tax type.

$$\text{StateTaxBurd}_{i,j} = f(\text{Fedtaxburd}_j, \text{Fedinctaxburd}_{i,j}, \text{Taxprice}_{i,j}) \quad (1)$$

Statetaxburd is state taxes of type i relative to state income, Fedtaxburd is the overall federal tax burden, Fedinctaxburd is the federal income tax burden, and $\text{Taxprice}_{i,j}$ is the average cost to residents of j from raising an additional dollar of

state taxes from tax type j . If itemizers are allowed to deduct tax type i , then TAXPRICE is approximately equal to

$$\text{TAXPRICE}_{i,j} = [1 - (\text{FMTR}_j \times \text{PCTITEM}_j) \times (1 - \alpha_{j,AMT})] \quad (2)$$

where $\alpha_{j,AMT}$ is the proportion of taxpayers subject to the AMT, FMTR is the federal marginal tax rate among itemizers and PCTITEM is the percentage of itemizers.

Fedtaxburd is expected to have a negative effect, as higher federal taxes reduce the income available to state taxation. Fedinctaxburd is expected to have a negative effect on state income tax rates, but an ambiguous effect on the overall level of taxation. The price effect is expected to be negative for a specific tax and negative or zero for the overall level of taxation.

Vertical Tax Interactions by Income Level

Our analysis expands the analysis of tax interactions to consider the distributional impact of federal taxation. Subnational responses to federal tax policy are reflected not only in the mix and structure of different tax instruments, but also in the income class incidence of the tax system. In particular, we would like to know whether a change in the progressivity of the federal tax system leads to an offsetting change in the progressivity of state tax systems, or whether changes in progressivity are complementary across levels of government.

Equation (1) may be rewritten replacing the subscript i for individual tax instruments with the subscript k ($k = 1, 3, 5$) denoting the k th income quintile of a state's population.

$$\text{StateTaxBurd}_{j,k} = f(\text{Fedtaxburd}_{j,k}, \text{Fedinctaxburd}_{j,k}, \text{Taxprice}_{j,k}) \quad (3)$$

In (3), the income effect of Fedtaxburd, the overall burden of federal taxation, depends on the income elasticity of state tax rates at different positions in the state's income distribution. If the income elasticity of state tax rates for a given income class is positive, then we would expect that higher federal tax burdens on high income households would lead to a decreased state burden, thus reducing state tax progressivity. However, based on evidence from Chernick (2005) that the income elasticity of progressivity is approximately zero in US states, we do not expect the overall income effect to exert a substantial influence on progressivity in the United States.

Based on our discussion of displacement effects, the federal income tax burden (Fedinctaxburd) for a given income slice is expected to have a negative effect on state income taxes, but an ambiguous effect on overall subnational tax rates on that same slice. Recall that in equation (1), the magnitude of the displacement effect depends on the elasticity of substitution between taxes. In Equation (3),

progressivity can be affected both by substitution across tax instruments—for example, a substitution of consumption taxes for personal income taxes will make the subnational tax system more regressive—and by altering the incidence of particular taxes—for example, by changing the rate structure of the income tax or adjusting the base of the general sales tax. The price effect is unambiguously negative for the income class incidence. An increase in the deductibility related price of federal taxation for the top quintile(s) is expected to decrease the burden on that quintile(s), relative to lower slices of the income distribution.

The distributional response will be greater the greater the latitude states or provinces have in structuring their individual taxes. If states or provinces are constrained to only allow a change a single proportional tax rate on income, then the leeway for distributional responses will be much less than if states can determine the degree of graduation in tax rates, the composition of the tax base, standard deductions and exemptions, and the level of tax credits.

Excise Taxes and Base versus Rate Changes

Though we do not estimate separate models for excise taxes, they are included in the aggregate burden estimates. Vertical interactions for excise taxes on alcohol, tobacco, and gasoline are likely to be affected by the fact that such taxes are specific, rather than *ad valorem*, with tax rates denominated in cents per pack or per gallon. In the absence of specific actions to raise nominal tax rates, effective rates for these taxes diminish with inflation. If interstate tax competition prevents a state from raising its own tax rate, without the assurance that other states will go along with the increase, an increase in the federal tax rate on a shared base may act as a first-mover type signal for all or most states to raise their own rates. This type of behavior may help to explain the federal-state complementarity result for cigarette and gasoline tax rates found by Besley and Rosen (1998) and Devereux et al. (2007).

Effective rates can be changed by changing tax rates, or by changing the definition of the tax base. Among conforming states, a change in the federal tax base will automatically lead to an equivalent change in the state tax base, and consequently the tax burden, unless an offsetting adjustment is made. Because rate increases may incur substantial political costs, and the revenue effect of base changes is uncertain, there may be a bias towards underadjustment in rates. (Esteller-Moré and Solé-Ollé 2001) Thus tax base conformity may tend to promote complementarity in federal and state taxation. An example is the Tax Reform Act of 1986, which reduced personal income tax rates, but expanded the tax base. While the next change at the federal level was approximately revenue neutral, Ladd (1993) shows that at the state level the reduction in tax rates did not fully offset the increase in the base, thus leading to at least a short-term increase in state income tax revenues.

Empirical Specification of US Tax Model

Dependent Variables

In the first set of equations, the dependent variables are the burdens, by income quintile, of total state and local taxes, and the personal income tax. Variables are denoted by $\text{Statetaxburd}_{\text{quintile } k}$ and $\text{Inctax}_{\text{quintile } k}$, where k denotes income quintile 1, 3, or 5. Statetaxburd is the total state and local tax burden, while Inctax is the personal income tax burden. The second set of dependent variables are total state taxes as a share of personal income (Statetaxburd), state income taxes (Inctaxburd), and state sales taxes (Salestaxburd), each as a share of personal income.

Endogeneity of Tax Price and Federal Tax Burden

Two federal tax variables are used as independent variables. The first is the aggregate federal tax burden by income quintile, $\text{Fedtaxburd}_{\text{quintile } k}$, where k refers to quintiles 1, 3, or 5. This variable includes all federal taxes, allocated by income quintile. The second is the federal individual income tax as a share of family income, by quintile. The variable is denoted by $\text{Fedinctaxburd}_{\text{quintile } k}$. In the US fiscal system, the deductibility of state and local taxes makes federal tax burdens a function of state and local tax burdens, implying that Fedtaxburd , Fedinctaxburd , and Taxprice are endogenous to a state's tax choices. This endogeneity biases the relationship between the federal tax burdens and the state's own tax burden, as well as the price effect. To address this endogeneity, we create instruments for federal tax burdens and state tax price.

The total burden of all federal taxes is taken from annual calculations by the Congressional Budget Office (CBO no date). The CBO calculations are national in scope, and do not vary by state. However, the progressivity of the federal income tax means that among higher income states the federal tax burden at a given position in the state's own income distribution will be higher than the national burden for the equivalent national quintile. Similarly, the federal burden will be lower in states with incomes below the national average.

The actual federal burden in any state is endogenous to state tax choices, because higher state taxes reduce federal taxable income via the deductibility mechanism. To address the bias in the federal tax effect from this source of endogeneity, we use as an instrument the hypothetical federal tax burden which would be faced by taxpayers in a particular state, if state taxpayers were to have the national average of deductions and exemptions for a given income level. To create this instrument, we map each state's income distribution onto the grid of federal tax burdens by income level and interpolate between the federal income breaks. For example, the top quintile of income in NY in 2002 is close to the top ten percent of income nationally. Hence, the federal tax burden assigned to NY is assumed to lie between the top ten percent nationally and the top quintile nationally, but closer

to the top ten percent. This procedure creates an instrument for the federal tax burden which is identified by a state's income distribution, but is exogenous to a state's own choice of tax structure and level.

A similar approach is used to create an instrument for the federal income tax burden by state. The federal tax liability in state j , quintile k , is a function of the level of taxable income, and the federal tax rate schedule. Taxable income is equal to Adjusted Gross Income minus exemptions and deductions. However, because state and local taxes are deductible, the federal tax variable is an inverse function of state and local tax levels. Therefore, we construct a pseudo federal tax burden based on national rather than state-specific deduction levels. Denoting the constructed tax by the prefix PS, the instrument for the federal income tax instrument is defined as

$$\text{PS_Fedinctaxburd}_{j,k} = [\text{FAMINC}_{j,k} - \text{EXEMPT}_k - \text{DEDUCT}_k] \times t_{fed,k}, k = 1,3,5. \quad (4)$$

Thus the pseudo taxable income is equal to the state's average family income for a given quintile, minus the national average of exemptions and deductions for that income level. Note that deductions other than state and local taxes, for example for mortgage interest, may differ across states, even at a given income level. We were unable to incorporate these differences at this stage in the analysis. Though this introduces some imprecision into the federal tax burden instrument, given that income is the primary determinant of the amount of deductions, the resulting measurement error should not be substantial.

In constructing the federal income tax instrument, we map state income by quintile onto a national grid that gives the average ratio of taxable income to adjusted gross income for each range of AGI. The data source for the grid is various years of the Individual Income Tax Returns, Statistics of Income.⁵ Tax due is determined by applying the federal rate schedule to taxable income so defined. Thus the federal tax variable is identified by differences in the income distribution by state. The pseudo federal tax burden is measured by

$$\text{PS_Fedinctaxburd}_{j,k} = \text{PS_Fedinctax}_{j,k} / \text{FAMINC}_{j,k}, k = 1,3,5 \quad (5)$$

We measure Taxprice as the average tax price by income quintile, defined as the ratio of net to gross tax burdens. Net state burden is defined as

$$\text{Statetaxburdnet}_{j,k} = \{(\text{BURD_PIT} + \text{BURD_PROPTAX}) \times (1 - \text{MTR}_{\text{itemizer}}) \\ \times \text{PCT_ITEMIZE} + \text{BURD_CONSUMPTIONTAXES}\}_{j,k}$$

The average tax price is defined as the ratio of net to gross tax burdens.

$$\text{TaxPrice}_{j,k} = \text{StatetaxBurdnet}_{j,k} / \text{StatetaxBurd}_{j,k} \quad (6)$$

Taxprice will also be endogenous to a state's tax structure, because the

federal offset through tax deductibility is itself a function of a state's choices. Taxpayers in states that rely more heavily on taxes which are deductible at the personal level, mainly income and property taxes, as opposed to taxes on consumption, which were not deductible for most of the sample period, will have higher amounts of allowable deductions. Hence they will be more likely to choose the itemized rather than the standardized deduction on their federal returns. This will lower the marginal tax price in high personal-tax states, relative to low tax states. Since tax burdens are the dependent variable in our analysis, a state with a higher burden on say the top quintile, will automatically have a lower tax price. This biases the estimated tax price effect upward (in absolute value).

To address the endogeneity of the tax price variable, we construct a pseudo tax price which purges the state measure of the influence of its own income distribution. As an instrument, we compute the tax price a state would face "given its own tax structure, but the national income distribution." Whereas for the federal tax burden, we map state income onto a national income grid, for Taxprice we map national income onto a state income grid. Because of the positive relationship between probability of itemizing and income, a state with income higher than the national average will have a lower tax price. For example, for the top quintile in New York State, the pseudo tax price is measured as the weighted average of the tax prices of quintiles 4 and 5, where the weights reflect the position of the national average fifth quintile income level, relative to the fourth and fifth quintile income levels in New York.

The construction of tax price as net burden for a given income quintile divided by gross burden for that quintile creates a simultaneity problem in specifications where the dependent variable is the gross state tax burden by income quintile. This is because TaxPrice as defined in Equation (6) is related by definition to the dependent variable. In this article, we therefore exclude TaxPrice from the distributional specifications.

Other independent variables include state per capita income, as a measure of demand for public services, federal grants, which are expected to lower state tax burdens, and demographic characteristics of states, which affect both cost and demand. Demographic variables include *pctold* (percentage greater than sixty four), *pctyoung* (percentage less than nineteen), and *pctblk* (percentage African-American). All specifications also include state and year fixed effect dummy variables.

Data

Data on tax burdens come from Citizens for Tax Justice—Institute on Taxation and Economic Policy, based on their simulation models of the state and local tax

systems in all 50 states (Institute on Taxation and Economic Policy 2003). CTJ-ITEP presents data for representative families of four by income quantile. The years for the CTJ-ITEP data are 1985, 1991, 1995, and 2002, and we estimate a panel of 48 contiguous states for these years. The CTJ-ITEP microsimulation models use a sample of over 500,000 individual taxpayers, and take great care to incorporate all of the relevant features of each state's tax system. Incidence assumptions, as described in Chernick (2005), are standard in the tax literature. The only major omission is that it does not take account of interstate tax exporting for consumption taxes. However, the basic results are the most accurate available, and importantly, are consistent over time.

The data are described in table 1. There is substantial variation in simulated federal income tax burdens across states and in the tax price. At the fifth income quintile, the standard deviation of the variable $Fedinctaxburd$ is about 21 percent of the mean. As constructed, the variation reflects cross-state differences in the level and distribution of income. The range in $Fedinctaxburd_{quintile5}$ is very large, from 8 percent (in Alabama in 1991) to 25 percent (in Connecticut in 1995). This variation shows how the burden of a graduated national income tax differs across states with different income levels. By contrast, the variation in the overall federal tax burden ($Fedtaxburd_{quintiles}$) is only 8 percent of the mean, reflecting the fact that the personal income tax is more progressive than the overall federal tax burden. The variation in the federal income tax burden across states ($Fedinctaxburd$) is somewhat smaller in the middle of the income distribution (c.v. = 17) versus the top quintile (c.v. = 24.5).

The average tax price is 0.92 for the middle quintile, and 0.82 for the top quintile. Over time, the tax price on the top quintile of each state's income distribution has risen substantially, from an average of 0.71 in 1977 to 0.89 in 2002. This increase is primarily due to an increase in the number of taxpayers and the amount of taxable income subject to the AMT, though it also reflects an increase in the share of non-deductible charges and miscellaneous relative to taxation in state and local revenues.⁶ The AMT reduces the ability to export state and local taxes through the deductibility mechanism, since under the AMT state and local taxes are treated as an expense item and not deducted from taxable income. The incidence of the AMT is particularly important in states with high incomes and relatively high state and local taxes, such as California, New York, and Massachusetts. For example, in 2002, 43 percent of tax filing in the 95th to 99th percentile of the income distribution in New York State were subject to the AMT (CTJ-ITEP 2002).

Table 2 compares the United States and Canada in terms of the dispersion in provincial/state and national tax rates, as measured by the coefficient of variation. The first row of table 2 shows that the dispersion in per capita income, which approximates the fiscal base for the income tax, is slightly greater in Canada than

Table 1 Data description

Variable	Description	# Obs.	Mean	SD	Min.	Max.
Statetaxburd _{quintile1} ^a	State/local gross tax burden, 1st income quintile	192	11.60	2.39	4.69	17.60
Statetaxburd _{quintile3} ^a	State/local gross tax burden, 3rd income quintile	192	9.24	1.67	4.79	14.33
Statetaxburd _{quintile5} ^a	State/local gross tax burden, 5th income quintile	192	8.27	1.86	3.45	13.86
Inctax _{quintile1} ^a	Gross income tax burden, 1st income quintile	144	0.61	0.87	-1.90	3.70
Inctax _{quintile3} ^a	Gross income tax burden, 3rd income quintile	144	2.28	1.41	0.00	5.00
Inctax _{quintile5} ^a	Gross income tax burden, 5th income quintile	144	3.21	1.75	0.00	6.92
Statetaxburd	Total state taxes collected as share of state personal income	192	6.44	1.19	2.66	11.27
Inctaxburd	Income tax burden	192	1.39	0.83	0.00	3.42
Inctaxshare	Income tax as a share of total state taxes	192	0.22	0.12	0.00	0.46
Salestaxburd	State and local sales tax burden	192	2.06	0.91	0.00	4.66
Constaxburd	General Sales plus excise taxes divided by personal income	192	3.18	0.99	0.64	5.88
Constaxshare	General Sales plus excise taxes as a share of total state taxes	192	0.56	0.17	0.14	1.10
Fedtaxburd _{quintile1} ^b	Aggregate federal tax burden, 1st income quintile, CBO data with interpolation	192	7.67	2.03	4.70	11.53
Fedtaxburd _{quintile3} ^b	Aggregate federal tax burden, 3rd income quintile, CBO data with interpolation	192	16.75	1.76	11.41	20.36
Fedtaxburd _{quintile5} ^b	Aggregate federal tax burden, 5th income quintile, CBO data with interpolation	192	25.49	2.01	21.54	31.49

(continued)

Table 1 Continued

Variable	Description	# Obs.	Mean	SD	Min.	Max.
Fedinctaxburd _{quintile1} ^c	Federal income tax burden, 1st income quintile	192	4.43	1.46	2.1	8.70
Fedinctaxburd _{quintile3} ^c	Federal income tax burden, 3rd income quintile	192	9.39	1.6	4.8	12.36
Fedinctaxburd _{quintile5} ^c	Federal income tax burden, 5th income quintile	192	15.53	3.31	8.10	24.52
Taxprice _{quintile5} ^d	Quintile tax price if a state had its own tax structure but national income distribution, interpolated	192	0.82	0.05	0.68	0.95
Federal grants	Intergovernmental grants, Millions of 2005 dollars	192	\$960.50	\$348.79	\$378.63	\$2,474.59
pincome	Per capita income, 2005 dollars	192	\$28,622.00	\$4,841.08	\$18,276.30	\$47,014.71
pctyoung	Percent under 17 years old	192	26.12	2.24	21.81	37.19
pctold	Percent over 65 years old	192	12.55	1.77	7.91	18.52
pctblk	Percent African American	192	10.24	9.47	0.27	36.94

^aCITJ-ITEP simulation model, various years. See text for explanation.

^bFederal tax burden, from CBO, adjusted to reflect state income distribution. See text for details.

^cNational average federal income tax liability, adjusted to reflect state income distribution. See text.

^dNet State/Local tax burden, divided by gross state/local tax burden, adjusted to reflect national income distribution. See text.

in the United States. However, as shown in the second row, there is greater variation in the burden of the state level income tax across US states than across Canadian provinces. This difference reflects the greater decentralization and more diversified revenue structures of state fiscal systems in the United States. It also suggests that horizontal tax competition, the incentive to mimic changes in tax rates in neighboring jurisdictions, may be stronger in Canada than in the United States. As discussed above, it has been argued that an indirect effect of Canada's fiscal equalization program has been to increase horizontal tax competition. However, the greater convergence in provincial than in US state tax rates shown in table 2 could also reflect the role of fiscal equalization in allowing poorer provinces to achieve given spending levels at lower rates of taxation.

The third row of table 2 shows that the variation in the effective burden of the federal income tax is slightly higher in Canada than in the United States. However, the simulated burden has a higher variation in the United States than in Canada. Recalling that the simulated burden is constructed using national average deductions, the difference in variation between Canada and the United States, and the much greater variance of simulated versus actual federal income tax burdens in the United States, suggests the important role of tax deductibility in attenuating fiscal differences across states.

Results

Regression results are shown in tables 3–5. In tables 3 and 4, the dependent variables are quintile specific tax burdens: total burdens in table 3, and income tax burdens in table 4. There are 126 observations in table 4 versus 192 observations in table 3. The smaller sample for the income tax stems from the fact that we restrict the analysis to states with non-zero income tax collections and because income tax burdens by quintile were not available for 1995. In table 5, the dependent variables are taxes relative to income, for all taxes, consumption taxes, and income taxes, and the share of total taxes from consumption and income taxes. Consumption taxes include general sales taxes plus excise taxes. As discussed above, tax price is excluded from the quintile specific regressions in tables 3 and 4, but is included in table 5.

As shown in columns (3) and (5) of table 3, there is a negative relationship between the total federal tax burden on the top quintile of a state's income distribution and the state's own burden on that group. Though the positive and significant coefficient on $Fedinctaxburd_{quintile5}$ indicates complementarity between income tax rates at the federal and state levels, the effect is outweighed by the negative effect of $Fedtaxburd_{quintile5}$, the overall federal tax burden. Since the two measures are highly correlated, it is the net effect which is most relevant. Using the estimates from column (5), a one percentage point increase in federal tax burdens

Table 2 Comparison of fiscal data for Canada and the United States

Variable	United States ^a			Canada ^b		
	Mean	SD	CV	Mean	SD	CV
Per capita income	\$28,622	\$4,841	0.17	\$15,005	\$3,518	0.23
Provincial/state income tax rate	1.59	0.69	0.46	6.8	2.1	0.31
Federal tax rate (simulated)	9.77	1.58	0.16			
Quintile 1	4.40	1.46	0.33			
Quintile 3	9.40	1.60	0.17			
Quintile 5	15.50	3.30	0.21			
Federal tax rate (actual ³)	9.50	0.94	0.10	10.3	1.4	0.14

^aSee table 1.

^bEsteller-Moré and Solé-Ollé (2002), table 1.

^cEsteller-Moré and Solé-Ollé (2001), table 1.

in the fifth quintile decreases a state's tax burden on that group by 0.24 percentage points. About a third of this effect is offset by a positive income tax burden effect, so the net effect is a decrease of about 0.16 percentage points (0.24–0.089). Table 4 for the income tax alone reinforces the pattern in table 3. As shown in column 3 of table 4, federal tax burdens have a significant negative effect on state income tax burdens at the top quintile. Thus, even though the price of state taxation falls with higher federal income tax rates, the displacement effect appears to dominate, leading states to cut back on their own willingness to tax higher income taxpayers when federal tax rates are higher.

Columns (1) and (4) of table 5 indicate that consumption taxes, relative to personal income and as a share of state taxation, are complementary with federal tax burdens on the bottom quintile, while column (5) shows a substitutive (negative) relationship for the tax share from income taxation. The overall burden of state taxation tends to be largely independent of federal tax burdens. Moreover, in contrast to the negative relationship between federal and state tax burdens among high income taxpayers found in tables 3 and 4, as shown in column (2) of table 5, state income tax burdens are not significantly related to federal tax burdens.⁷ While column (1) of Table 5 shows a negative effect of federal taxation of high income taxpayers on the burden of state consumption taxes, the coefficient is significant only at the 10 percent level.

Taken together, the results from the three regression tables tell a consistent story: higher federal tax burdens on the "rich" are partially offset by lower state tax burdens on the same income group. This offset is accomplished by reducing the progressivity, though not the overall burden, of income taxation in those states

with income taxes. State taxes on consumption—general and specific sales taxes—are complementary with federal taxation of low-income households, a result which is consistent with prior studies of the complementarity of federal and state excise taxation

Table 5 also shows that the tax price on the top quintile of state taxpayers has a negative effect on income taxation, but an offsetting positive effect on consumption taxes. These results hold both in terms of the burdens relative to income and the share of taxes. Multiplying the estimated coefficient of -14.2 and -14.3 by the increase in the top quintile tax price from 0.81 in 1985 to 0.86 in 2002 implies a *ceteris paribus* reduction in state income tax burdens of 0.7 percentage points, and a comparable increase in consumption tax burdens. These estimates imply that, other things equal, the reduction in the effective deductibility offset to state and local taxes in the period from 1985 to 2002 would have led to a five percent reduction in total state tax burdens, relative to the average income tax burden of 6.3 percent. The decrease in the deductibility offset results from the increase in the standard deduction under the Tax Reform Act of 1986, and the growing importance of the AMT.

Conclusion

The advantages of a decentralized system of fiscal federalism, as delineated by authors such as Oates (1972), Boadway and Flatters (1982), and Inman (1997) are well known. The *sine qua non* of true decentralization is that subnational governments be assigned sufficient independent revenue sources to meet the preponderance of their fiscal needs. There is, however, a built-in tension between the need for revenue independence on the one hand, and the policy flexibility and economies in administration and tax compliance that result from harmonization of federal and provincial tax systems on the other. The more harmonized revenue systems are—i.e. the more the national and provincial/state level share the same tax bases—the greater the potential for competition between levels of government, and the greater the potential for overall rates of taxation to be inefficiently high.

Reflecting differences in the political origins of the two federations, Canada has opted for a more harmonized fiscal system, while the United States is more varied and decentralized. The underlying constitutional principle in the United States is one of subsidiarity, with powers not specifically assigned to the central government left to the states. By contrast, in Canada powers not assigned to the provinces are left to the central government. The Canadian constitution, which was formulated in reaction to what was viewed as insufficient central power in the United States, gives national government more taxing authority than the US constitution. While state revenue systems in the United States have been substantially influenced by federal policies, for example, in the enactment of state income taxes, US states continue to

Table 3 Aggregate state and local tax burden, by quintile

Dependent variable	1	2	3	4	5
	Statetaxburd _{quintile1}	Statetaxburd _{quintile2}	Statetaxburd _{quintile3}	Statetaxburd _{quintile4}	Statetaxburd _{quintile5}
Fedtaxburd _{quintile1}	-0.230	0.365	0.195		
	-0.65	1.73	1.08		
Fedtaxburd _{quintile3}	-0.649*	-0.585**	-0.193	-0.354*	
	-2.01	-3.04	-1.17	-1.99	
Fedtaxburd _{quintile5}	0.068	-0.205*	-0.264***		-0.242**
	0.47	-2.40	-3.59		-3.23
Fedinctaxburd _{quintile1}	0.102	0.198*	0.268***		
	0.69	2.26	3.55		
Fedinctaxburd _{quintile3}	0.364	0.221	0.154	0.029	
	1.57	1.57	1.30	0.21	
Fedinctaxburd _{quintile5}	0.085	0.123*	0.12*		0.089*
	0.99	2.38	2.71		2.02
N	192	192	192	192	192
Adj. R ²	0.756	0.824	0.895	0.797	0.88

Notes. Values in italics represents *t*-statistics. All regressions include year, region and demographic variables.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table 4 State income tax burden, by quintile

	1	2	3	4	5
	<i>Inctax_{quintile3}</i>	<i>Inctax_{quintile5}</i>	<i>Inctax_{quintile5}</i>	<i>Inctax_{quintile3}</i>	<i>Inctax_{quintile5}</i>
Fedtaxburd _{quintile1}	0.307	0.277			
	<i>1.44</i>	<i>1.34</i>			
Fedtaxburd _{quintile3}	0.224	0.268			
	<i>1.51</i>	<i>1.86</i>			
Fedtaxburd _{quintile5}	-0.395**	-0.402***	-0.344***		
	-5.28	-5.53	-4.75		
Fedinctaxburd _{quintile1}	8.826	14.97*			
	<i>1.15</i>	<i>2.01</i>			
Fedinctaxburd _{quintile3}	6.713	7.392		2.366	
	<i>0.63</i>	<i>0.72</i>		<i>0.26</i>	
Fedinctaxburd _{quintile5}	0.646	4.278	2.252		-1.275
	<i>0.15</i>	<i>1.00</i>	<i>0.63</i>		<i>-0.32</i>
pcincome	0.00014*	0.00016*	0.0002**	0.00004	0.00008
	<i>2.02</i>	<i>2.34</i>	<i>3.32</i>	<i>0.69</i>	<i>1.31</i>
N	126	126	126	126	126
Adj R ²	0.891	0.919	0.906	0.843	0.878

Notes. Values in italics represents *t*-statistics. All regression include year, region and demographic variables.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

have more latitude in structuring their revenue systems than their Canadian counterparts.

In a federalist system, a progressive federal income tax imposes higher tax rates on higher income states or provinces. Hence, differences in the regional impact of federal income taxation depend on the interaction between the degree of graduation in effective federal tax rates and differences across provinces in average income. The regional dispersion of income is slightly higher in Canada than in the United States, and federal income tax rates show slightly more dispersion across provinces than across US states.

In contrast to national income tax rates, provincial income tax rates show less variation than rates in US states. This may reflect the impact of Canada's fiscal capacity equalization system, as well as more uniform subnational expenditure responsibilities than in the United States. We find that in the United States, the mechanism of federal tax deductibility has served to reduce the regional disparity in combined federal plus state income tax burdens. Hence, the "back-door" reduction in deductibility which is occurring through the AMT may lead to increased conflict over the relative contributions of different states to the national fisc.

Table 5 State tax burden: shares of income and shares of taxes

Dependent variable	1	2	3	4	5
	Constaxburd	Inctaxburd	Statetaxburd	ConsTaxShare	onsTaxShare
Fedtaxburd _{quintile1}	0.389*** <i>2.85</i>	-0.071 <i>-0.86</i>	0.004* <i>1.92</i>	0.053*** <i>2.89</i>	-0.036** <i>-2.27</i>
Fedtaxburd _{quintile5}	-0.108* <i>-1.82</i>	0.030 <i>0.81</i>	-0.001 <i>-0.73</i>	-0.009 <i>-1.09</i>	0.006 <i>0.79</i>
Fedinctaxburd _{quintile5}	0.036 <i>0.84</i>	0.021 <i>0.75</i>	0.000 <i>-0.09</i>	0.003 <i>0.46</i>	0.004 <i>0.66</i>
Tax Price _{quintile51} ^a	14.18*** <i>9.63</i>	-14.3*** <i>-11.26</i>	-0.063*** <i>-2.90</i>	3.47*** <i>17.54</i>	-2.93*** <i>-12.13</i>
Federal Grants	-0.543** <i>-2.28</i>	0.832*** <i>4.02</i>	0.02*** <i>5.72</i>	-0.289*** <i>-9.03</i>	0.099** <i>2.52</i>
Per Capita Income/100	-1.185*** <i>-3.02</i>	0.381 <i>1.50</i>	-0.003 <i>-0.47</i>	-0.218*** <i>-4.13</i>	0.118** <i>2.44</i>
N	192	168	192	192	168
Adj. R ²	0.504	0.66	0.248	0.703	0.624

Notes. Values in italics represents *t*-statistics. All regressions include year, region and demographic variables; Dependent variables come from *Annual Survey of State and Local Government Finances and Census of Governments*. Columns 2 and 5 exclude states with zero income tax.

^aTax Price Quintile5 is instrumented using the pseudo tax price. See Text for details.

* $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$.

The empirical analysis contributes to our understanding of vertical tax competition in the United States by analyzing the distributional aspects of this competition, using instrumental variables for both the federal tax rate and the state tax price, to take account of simultaneity in the determination of federal and state tax rates. Drawing on a rich data set from Citizens for Tax Justice, we estimate models of vertical tax relationships by income quintile, as well as for aggregate tax burdens.

The greater decentralization in US subnational tax structures suggests that vertical tax competition is likely to be less direct in the United States than in Canada. Our results support this hypothesis. Overall, we find greater independence in the relationship between federal and state taxation than suggested by previous analysis. This independence holds both for all state taxes combined, and for the income tax in particular, suggesting that vertical tax interactions are less important in the United States than in Canada. However, we find a significant distributional response in the US analysis. Higher federal taxes on the top quintile displace state taxes on the same income group, though at a rate which is substantially less than one for one. This suggests that changes in the top federal marginal tax rate are partially undone or offset by state responses, and may have implications for the

most recent proposals to raise income tax rates for higher income groups (State of the Union Address 2010). Despite this substitutive relationship, there is no comparable reduction in overall rates of income taxation. Thus, the major effect of more progressive federal taxes is to reduce the progressivity of state taxes, without affecting the overall tax rate. Because states in the United States have more control over their tax structures than do Canadian provinces, we would expect the distributional offset to be stronger in the United States than in Canada.

The strongest vertical interaction occurs at the bottom of the income distribution. Higher federal tax burdens on the lowest quintile of a state's taxpayers are associated with a higher share for consumption taxes, a lower share for the income tax, and a small increase in the overall burden of state taxes. This result is consistent with prior research that finds a complementary relationship between gasoline and cigarette taxation at the federal and state level.

The effect of allowing the deductibility of income and property taxes in the United States is reflected primarily in the composition of state taxes, with a lower tax price for high income taxpayers—i.e. the cost to the taxpayer of an additional dollar of state taxes—leading to increased reliance on income taxation and reduced reliance on sales and excise taxes. The overall burden of state taxes is slightly reduced as tax price rises. However, despite a secular rise in the high-income tax price of about five cents over the sample period—from 0.81 to 0.86—the consumption tax share of state taxes was a little changed, while the income tax share actually increased slightly. This suggests that over time the effect of deductibility has been more than offset by other factors affecting state tax structure, including increases in personal income and federal grants, as well as changes in the distribution of federal tax burdens.

A counterpart to the analysis of potential distributional effects of vertical fiscal competition in the United States has not been conducted for Canada, and would be a useful subject for future research. Both tax deductibility in the United States and base equalization in Canada provide a form a price subsidy to subnational governments. The subsidy is direct in the case of deductibility, and implicit under fiscal equalization. However, the distributional effects are likely to differ substantially, both across regions of the federation and across income groups. A second task for comparative research in fiscal federalism would be to evaluate the relative efficacy of these two important fiscal institutions in terms of the efficiency and equity in fiscal federalist systems.

Notes

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1. All numbers in this paragraph come from *The Tax Burden on Tobacco*, 2006.
2. A tax abatement is a specified reduction in the federal tax, and appears in the federal tax form as a percentage of taxes owed.
3. The deductibility of the general sales tax was eliminated under the Tax Reform Act of 1986, but restored after 2004. During this latter period, itemizers can elect to deduct sales tax in lieu of income taxes.
4. More than half of all state and local tax deductions were claimed by the 8 percent of taxpayers with Adjusted Gross Incomes exceeding \$100,000. California and New York taxpayers alone received 30 percent of the total state and local tax deduction (Rueben, 2005).
5. It is important to note our income quintile data, denoted by $FAMINC_{j,k,t}$, utilizes a comprehensive income concept which is somewhat broader than Adjusted Gross Income. However, because we have no data on the ratio of AGI to comprehensive income, our method assumes the two are equal. Overall, this leads to an overestimate of the federal tax liability. The overestimate is likely to be greater for higher income levels, under the assumption that the ratio of comprehensive income to adjusted gross income rises with the level of comprehensive income. We also do not take account of credits in computing our simulated level of federal tax liability.
6. Between 1985 and 2002, state and local revenues from charges and miscellaneous, relative to tax revenues, rose from 34 to 41 percent (United States Census Bureau, various years).
7. This result holds when we drop the year 1995, to conform the sample in Table 5 to that in Tables 3 and 4.

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