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State Government Tax Revenue, Tax Revenue Composition and Tax Effort Index: An Assessment of the 1978-97 period[†, ‡]

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Abstract

Fiscal deficit concerns, especially during sever downturns, and uncertainties regarding future federal grants have underscored the importance of relying on state own-revenues including taxes. In this paper, we derive an equation for state total tax revenue-output ratio and estimate it using a panel of forty-nine states over the period 1978-97 (the sample period reflects a break in some key series after 1997). The predicted values from the estimated model are used as a measure of "tax capacity." We then construct period averages of an index of "tax effort" defined as actual tax collection divided by the tax capacity to assess the extent to which states exploited their tax capacity. The regression based approach adopted here may serve as an efficient alternative to the highly data intensive "representative tax system approach" in estimating state tax capacity and tax effort indices. We also examine the tax revenue composition by estimating equations for the relative share of six tax types in total state tax revenue and use the predicated and actual values to assess whether a particular tax type was "overused" or "underused." In view of the effects of tax revenue level and mix on growth, employment, income distribution, and the importance of stability and growth potential of tax revenues, the results of our analysis may have implications regarding the need for tax portfolio reshuffling in some states.

Keywords: state tax revenue, state tax effort, and state tax composition.

JEL Classifications: H71 and H72

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‡ Preliminary draft. Please do not quote without the expressed written consent of the author.

I. Introduction

In the past several decades, state finances have been characterized by changes in both the level and composition of tax revenues. According to the Census Bureau data, the relative share of tax revenues in state general revenues fell from an average of 60.7 percent to 49.3 percent between 1972 and 2003. This significant drop in the share of the largest component of state (general) revenues raises concerns regarding the "adequacy" of the level of taxation in the face of increased state financial burden. These concerns are heightened during the recessionary phase of business cycles. In this connection, Giertz and Giertz (2004) presented evidence indicating that the tax revenues of 48 (out of 50) states underperformed in 2002. They pointed out that such underperformance could not have been prevented through budget rules. Rather, major discretionary structural changes in state revenues and expenditures were required to restore fiscal balance. As for tax revenue composition, an analysis by Garrett and Wagner (2004) found that the relative shares of individual income and general sales taxes increased while the relative shares of taxes on the sales of alcohol, tobacco and motor fuel declined over the period 1950-2001. Based on magnitudes of the income elasticity of corresponding tax bases, the authors concluded that "a typical state's tax portfolio shifted away from revenue sources that are less cyclical and toward revenue sources that are more cyclical than the economy" (p.15).[1]

In addition to the cyclical sensitivity of tax revenue components, the composition of tax revenue has been analyzed from a variety of other perspectives. These include studies that emphasized the effects on state (and/or local) tax revenue structure of institutional factors and rules such as "federal deductibility provision," (Gade and Adkins, 1990), "tax and expenditure limitations," (Joyce and Mullins, 1991; Shadbegian, 1999), liberalism (Sauser, 1993), and state legislative structure and party control (Ho, 2003).

[1] Other notables changes identified were an increase in the relative importance of "intergovernmental revenue" (mainly in the form of federal grants) and the emergence of "nontraditional revenue sources" (mainly in the form of state lotteries and casino gaming).

Several other studies focused on how tax revenue composition affects certain macroeconomic variables. Lee (1995), for example, assessed the impact of state-local tax revenue structure on state economic performance and concluded that, among revenue sources, general sales taxes have the most favorable effect and property taxes the least favorable effect on economic growth. In a similar study, Miller and Russek (1997) investigated the relationship between the fiscal structure of state and local government and economic growth. Their analysis of the data suggested that corporate taxes accounted for a relatively small share of total revenue and sales taxes for a relatively large share. The authors' regression models further suggested that state economic growth would benefit from relatively less reliance on sales taxes and more on corporate taxes. Harden (1997) tested the relationship between state tax structure and employment and found that, given the level of total expenditures, a reduction in marginal corporate income taxes offset by an increase in another tax type would have a beneficial effect on state employment. Braun and Otsuka (1998) found that, for a given economic condition, sales taxes are a less stable but faster growing revenue source than individual income taxes. Accordingly, a greater reliance on general sales taxes at the expense of individual income taxes increases the instability of the tax revenue portfolio but increases its growth rate.

The redistributive aspect of state and local government tax revenues was examined by Bahl *et al*. (2002). The authors used the share of the individual income and corporate income taxes in total state-local own-source revenue as a proxy for redistributive revenues and found it to be more emphasized in states that are relatively less urbanized, poorer, and have larger black and elderly populations. In his analysis of state revenue cyclicality, Dye (2004) attempted to informally assess the sensitivity of various revenue sources to business cycles and the extent to which the choice of tax revenue mix could mitigate the severity of cyclical budget crises.

In view of increased reliance on federal grants and other revenue sources by state governments and the differential effects of the components of total tax revenue on economic growth, employment, income distribution, and stability and growth of tax revenue noted above, two potentially important questions arise: First, how does a state's actual total tax revenue compare to its tax capacity? More specifically, is the state "underexploiting" or "overexploiting" its own tax potential/capacity? Second, which particular tax type is "overused" or "underused" *within* a given tax revenue portfolio? This paper sets out to empirically investigate these questions. To this end, we derive and estimate an equation for state total tax revenue (as a ratio of state output, or GSP). The predicated value from this equation is then used as an estimate of "tax capacity" for each year. We then construct a state "tax effort index" defined as the ratio of a state's actual tax revenue collection to its tax capacity and calculate the index value averages for each state over the sample period for comparison purposes. In a similar fashion, we estimate equations for the relative share of six tax types in total tax revenue and use the actual and predicated values to construct period averages for a "tax share index" to assess the reliance on a particular tax type for a given total tax revenue. To gain a quantitative appreciation of the stability of the index values over time in each state, we further calculate the coefficient of variation (CV) for each index. Finally, we construct a measure to assess the deviation of the actual tax revenue mix from that suggested by the tax share equations for each state.

The contribution of this paper to the empirical literature is twofold: (a) unlike previous studies, it specifies and estimates a complete system of tax equations consisting of total tax revenue and six tax type shares using advanced estimation methods and a relatively large panel data set and (b) it uses a regression-based approach to estimate state tax effort index as a practical alternative to the approach employed by the now-defunct U.S. Advisory Commission on Intergovernmental Relations (ACIR).[2] Our results have policy implications for adjusting the

[2] ACIR employed the "representative tax system" or RTS methodology. The index values were reported for a total of fourteen years between 1967 and 1991. Berry and Fording (1997) used a combination of interpolation, extrapolation, and a simple regression to generate a complete set of tax effort index values for total tax revenue over the period 1960-91. More recently, Tannenwald (2002a) and Tannenwald and Turner (2006), Ylimaz *et al*. (2006) employed the RTS methodology to compute the index values for a few more years in the 1990s and 2002. The authors caution against drawing conclusions based on intertemporal comparisons of index values due to modification of their methodology from year to year. See Section 4 for some major methodological differences between the approach adopted in this paper and RTS.

level of state tax revenue in state overall revenue portfolio and reshuffling tax revenue mix. They also provide an opportunity to compare state tax effort index values obtained from different approaches. The remaining part of this paper is organized as follows. In Section 2, we derive the total tax revenue and tax revenue share equations from a simple theoretical model. In Section 3, we specify the corresponding empirical models. The estimation results based on a panel of 49 states for the 1978-97 period are discussed in Section 4. This section also includes the definitions of the measures noted above and a discussion of their values. Section 5 offers some concluding remarks.

II. The Theoretical Model

Following Heller (1975), Leuthold (1991) and Ghura (1998), we derive an equation for the total tax revenue assuming that the state government *actual* tax to gross state product (GSP) ratio, (T/Y), is a function of a vector of the state's tax bases (**B**), and *desired* tax-GSP ratio (T/Y)*. Symbolically,

$$(T/Y) = f\,[\mathbf{B}, (T/Y)^*] \qquad (1)$$

We further assume that (T/Y)* is the result of a constrained utility maximization model within the state government. For our purpose, the state government is assumed to have a utility function of the following form:

$$U = U(\overset{+}{Y-T}, \overset{+}{G}, \overset{\pm}{\Delta D}, \overset{+}{F}, \overset{+}{R}) \qquad (2)$$

where, Y-T is disposable income, G is government expenditures, ΔD is net government borrowing as measured by the change in the stock of debt, and F is the size of federal grants, and R is non-tax revenues. All the variables are measured on a real *per capita* basis. The government budget constraint is represented by:

$$T + \Delta D + F + R = G \quad (3)$$

Following Ghura (1998) and others, we assume that the utility function in (1) above is of quadratic form. The constrained utility maximization with respect to T and G yields the following equation for the *desired* tax-GSP ratio:

$$(T/Y)^* = f\,[(\Delta D/Y), (F/Y), (R/Y), (1/Y)] \quad (4)$$

By combining (1) and (4), we can derive the equation for the *actual* tax-GSP ratio:

$$(T/Y) = g\,[\overset{\pm}{(\Delta D/Y)}, \overset{-}{(F/Y)}, \overset{-}{(R/Y)}, \overset{?}{(1/Y)}, \mathbf{B}] \quad (5)$$

where the positive or negative sign above each variable indicated its expected effect and "?" indicates an ambiguous effect.[3] Equation (5) can be manipulated to derive the share equations for various tax types in order to analyze the *composition* of total tax revenue. Thus, we rewrite Equation (5) as follows:

$$\sum_{j=1}^{n}(T_j/T) = g\,[(\Delta D/Y), (F/Y), (R/Y), (1/Y), \mathbf{B}]\,(Y/T) \quad (6)$$

where T_j is the revenue from the jth tax type. The final form of Equation (6) is:

$$\sum_{j=1}^{n} S_j = h\,[(Y/T), (\Delta D/T), (F/T), (R/T), (1/T), \mathbf{B}^*] \quad (7)$$

In Equation (7), $S_j = (T_j/T)$ is the total tax revenue share of the jth tax type and $\mathbf{B}^* = (\mathbf{B})(Y/T)$.

III. The Empirical Model

In this section, we specify a regression model for relative shares of various tax types using Equation (7) as a guide. The categories selected for the purpose of our analysis are general sales, selective sales (mainly taxes on alcoholic beverages, amusements, insurance premiums,

[3] See Ghura (1998) for specific assumptions and derivation of a similar equation.

motor fuels, tobacco products, public utilities, and pari-mutuels), license (mainly taxes on alcoholic beverages, corporation, hunting and fishing, motor vehicle and motor vehicle operators, public utility, and occupation and business), individual income, corporate net income, and "other" taxes (mainly severance, death and gift, documentary and stock transfer taxes). These categories add up to hundred percent of state total tax revenue.[4]

As for the explanatory variables, we first identify proxies for some major tax bases. They initially enter the model as part of **B**. The size of potential state tax bases may be represented by the value added of different sectors (or industries using SIC classifications) as a share of the size of the state economy (GSP). To specify a parsimonious model, we reduce the number of the sectors represented by combining some of them. As a result, the size of the following six sectors is used as proxies for state tax bases: (1) finance, insurance, real estate, and services (2) mining and construction, (3) manufacturing, (4) transportation and utilities, (5) wholesale and retail trades, and (6) the state government.[5] The relative size of each sector is subsequently expressed as a percent of total tax revenue and becomes a component of **B***.[6]

In general, an expansion of a tax base is expected to boost the size of total tax revenue (TAX/GSP) as it increases the amount of taxable activity, all else being equal.[7] The relative size of the government sector (GOV/GSP), however, may positively affect (TAX/GSP) to the extent that the amount of tax revenues collected reflects the amount of public spending prior commitments.[8] Different tax types may respond differently to a given change in any of these tax bases. One can reasonably hypothesize about some of these responses. For example, the effect

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[4] Over the sample period, general sales taxes and personal income taxes were the top two tax types with the relative shares of 31.3 and 26.7 percent, respectively. Corporate net income taxes ranked last with a 7.1 percent share.

[5] The "agriculture, forestry, and fishing" sector is excluded to avoid perfect colinearity among the tax base variables. Thus, a rise in the size of any one of the six included sectors comes at the expense of this sector.

[6] Strictly speaking, in subsequent discussions "total tax revenue" and "tax revenue components" refer to the corresponding scaled values of these variables as opposed to their absolute values.

[7] This implicitly assumes that the tax revenue is more responsive to an increase in the size of the included sectors than that of the excluded sector.

[8] This channel of influence has come to be known as "spend-and-tax" hypothesis in the public finance literature (see Peacock and Wiseman, 1979).

of an increase in the size of the wholesale and retail trade sector on general sales taxes, a rise in the size of the manufacturing sector on corporate net income taxes, or an increase in the size of the mining and construction on "other" taxes (through "severance" taxes) is expected to be positive. However, a boost in a particular share in response to a tax base (or any other) variable change has to be necessarily accompanied by a decline in one or more of the remaining shares. The declining share(s) cannot be easily identified *a priori*. For this reason, the direction of the effect of each of the six tax base variables in the six relative tax share equations of our system remains largely an empirical question.[9]

Next, we augment the model by including several variables that condition the relationships between the tax bases and actual tax revenue. The first of these variables is a measure of economic instability or business fluctuations. Increased level of economic uncertainty that accompanies economic volatility is expected to adversely affect economic activity and the level of tax revenue. Moreover, as noted in the literature review, some components of tax revenue such as general sales taxes that tend to be more sensitive to economic contractions are likely lose shares to the less sensitive components such as selective sales taxes.

The second control variable is the proportion of the elderly population (defined as individuals aged 65 and over) in a state. The age composition of population, through saving-consumption and work-leisure decisions, may affect both the level and composition of total tax revenue. For example, as individuals reach the retirement age, they typically begin to save (consume) a smaller (larger) *fraction* of their incomes. This reflects a diminishing level of labor income which may not be fully offset by a fall in consumption. The *absolute* amount of

[9] In this connection, note that the tax base-tax revenue nexus may be weakened by a variety of factors. Tannewald (2002b) identifies the shift in the mix of production and consumption from goods to services, a larger role in generating value added of intangible assets, the growing importance of e-commerce, and the intensification of competition among sub-national governments for attracting corporate businesses as structural changes in the economy that may adversely affect the revenue productivity of sales and corporate income tax bases.

consumption, however, is likely to fall at old ages and lead to reductions in the general and selective sales taxes.

The ideological inclination of the state legislature is another potentially important variable that is added to the model. In general, more liberal states assign greater social and economic roles to the public sector. The public sector in these states, thus, tends to have higher spending and tax ratios than those in more conservative states. In fact, party affiliation of the state legislators, as an indicator of state public sector decision-makers' ideology, was found to positively affect measures of tax revenue and public spending (Merrifield, 2000). Moreover, there is some evidence suggesting that states with a liberal political ideology tend to place a greater emphasis on income taxes as a source of revenue (Sauser, 1993). This may reflect, among other things, a preference for a higher degree of income equality through a progressive tax type.

Finally, we control for the extent of state fiscal centralization. States differ with respect to the extent to which local governments bear the burden of taxing and providing public goods and services. As the share of taxes collected by local governments in state-local tax revenues rises (for example, through higher property taxes) the degree of fiscal centralization diminishes. This is expected to reduce the level of total taxes collected by a state as the need for tax revenues collected by the state falls. In addition, the state tax revenue composition should reflect greater reliance on individual income and selective sales taxes, for example, whose collections are traditionally within the purview of the state government.

Based on the above discussions, the empirical version of Equation (7) for the relative share of the jth tax share for the ith state at time t (S_{jit}) is specified as follows:

$$\begin{aligned} S_{jit} = {} & \alpha_j + \beta_j (GSP/TAX)_{it} + \delta_j \Delta(DEBT/TAX)_{it} + \phi_j (IGR/TAX)_{it} + \varphi_j (NTR/TAX)_{it} \\ & + \eta_j (1/PCTAX)_{it} + \kappa_j (FIR/TAX)_{it} + \lambda_j (MNC/TAX)_{it} + \gamma_j (MFG/TAX)_{it} + \pi_j (TUT/TAX)_{it} \\ & + \sigma_j (WRT/TAX)_{it} + \psi_j (GOV/TAX)_{it} + \theta_j (CVINC)_{it} + \tau_j (POP65)_{it} + \omega_j (DEML)_{it} \\ & + \zeta_j (SHLTAX)_{it} + \mu_{jit} \qquad (8) \end{aligned}$$

where S_1= (GSL/TAX), S_2 =(SSL/TAX), S_3 =(LIC/TAX), S_4=(INC/TAX), S_5 = (CRP/TAX), and S_6 = (OTH/TAX) are the percent share in total tax revenue of general sales taxes, selective sales (excise) taxes, license taxes, individual income taxes, corporate net income taxes, and other taxes, respectively.

(GSP/TAX) is the inverse of the share of total tax revenue in gross state product. It controls for the size of the overall tax revenue (percent).

Δ(DEBT/TAX) is the ratio of change in the stock of state debt to total tax revenue (percent). It is a proxy for net borrowing.

(IGR/TAX) is the ratio of intergovernmental revenue (mainly federal grants) to total tax revenue (percent).

(NTR/TAX) is the ratio of non-tax general revenue (current charges and miscellaneous general revenue) to tax revenue (percent).

(1/PCTAX) is the inverse of per capita state tax (PCTAX in $1,000s)

(FIRS/TAX), (MNC/TAX), (MFG/TAX), (TUT/TAX), (WRT/TAX), (GOV/TAX) are the ratios of the value added of finance, insurance, real estate, and services, mining and construction, manufacturing, transportation and utilities, wholesale and retail trades, and the government sector, respectively, to total tax revenue (percent). These serve as proxies for potential tax bases.

CVINC is the coefficient of variation of state per capita personal income. For year t, CVINC is calculated using the income levels of year t-2 through t.

POP65 is the proportion of state population aged 65 and above. It is a proxy for the elderly/retired portion of the population.

DEML is the average of the percent of seats held by Democrats in each of the two chambers of state legislature. It is a proxy for the ideological inclination of the state legislature.

SHLTAX is the share of local taxes in total state-local taxes. It is a proxy for the degree of fiscal decentralization (percent).

$\mu_{jit} = \upsilon_i+\nu_t+\varepsilon_{it}$ is a well-behaved error term associated with the jth tax share, υ_i is an unobserved state effect, ν_t is an unobserved period effect, and ε_{it} is an unobserved random term.

Since for the ith state at time t the sum of tax shares must necessarily add up to one (or 100 percent) we have:

$$\sum_{j=1}^{6} S_{jit} = \sum_{j=1}^{6} \alpha_j + \sum_{j=1}^{6} \beta_j (GSP/TAX)_{it} + \sum_{j=1}^{6} \delta_j \Delta(DEBT/TAX)_{it} + \sum_{j=1}^{6} \phi_j (IGR/TAX)_{it}$$
$$+ \ldots\ldots\ldots\ldots + \sum_{j=1}^{6} \psi_j (DEML)_{it} + \sum_{i=1}^{6} \xi_j (SHLTAX)_{it} + \sum_{i=1}^{6} \mu_{jit} = 1 \qquad (9)$$

Moreover, since the above equation must necessarily and identically hold true for each observation, it imposes the following restrictions on the parameters of the models:

$$\sum_{j=1}^{6}\beta_j = \sum_{j=1}^{6}\delta_j = \sum_{j=1}^{6}\phi_j = \ldots\ldots\ldots\ldots = \sum_{j=1}^{6}\psi_j = \sum_{j=1}^{6}\xi_j = 0 \qquad (10.a)$$

$$\sum_{j=1}^{6}\alpha_j = 1 \ (or\, 100\%) \qquad (10.b)$$

$$\sum_{j=1}^{6}\mu_{jit} = 0 \qquad (10.c)$$

According to Equation (10.a), the coefficients of each variable of the model across the share equations add up to zero, because the gain in one (or) more tax revenue share(s) should necessarily come at the expense of the remaining shares. This implies that the sum of the intercept terms across the share equations (10.b) should add up to one. Equation (10.c) indicates that, for the ith country at time t, the underestimation of the share of one tax type (implying a positive error term) is associated with overestimation of the other shares (implying a negative error term). Therefore, the error-terms across the share equations are correlated and the relative share equations comprise a seemingly unrelated (SUR) system of equations.[10]

Finally, we use Equation (5) for the purpose of specifying the empirical model of *total* tax revenue. The dependent variable in this case is (TAX/GSP). The explanatory variables differ from those in the tax share equations in two respects: First, the variable (GSP/TAX) is deleted from the right-hand side. Second, all variables in the hare equations that are expressed as a percent of TAX are replaced by similar variables expressed as a percent of GSP.

IV. Data and Empirical Results

a. Data

The data for the variables in Equation (8) were collected over the period 1978-1997 for 49 states. The choice of the sample period reflects the discontinuity in the GSP series published by the Bureau Economic Analysis of the Department of Commerce. Prior to 1998, the GSP data were based on Standard Industrial Classifications (SIC). Beginning 1998, however, the Bureau adopted the North American Industry Classifications (NAICS) industry definitions. As a result, relatively longer time-series data on GSP and its sectoral composition (used as proxies for various tax bases in our model) were available on a consistent basis up to 1997 than after this year. As for the number of states, Nebraska was deleted from our sample, because no data on the composition of the state legislature based on the party affiliation are reported for this state. This is due to the fact that Nebraska has a "unicameral" state legislature. Finally, not all the states in the sample have all the six tax types in their tax revenue mix over the sample period. Specifically, Alaska, Delaware, Montana, New Hampshire, and Oregon are states with no general sales taxes. Alaska (from 1989 on), Florida, Nevada, Texas, Washington, and Wyoming do not levy individual income taxes. Nevada, Texas, Washington, and Wyoming do not have corporate

[10] In the special case that all the explanatory variables in the equations of the system are identical, SUR yields the same results as OLS applied to individual equations. Thus, while the restrictions in 10a-10.c still hold, the SUR system estimation method need not be used.

net income taxes. In these cases, we assign a zero value to the nonexistent tax types in our analysis of the tax revenue composition.

b. Total Tax Revenue (TAX/GSP) Equation

Several econometrics issues and trade-offs should be noted at the outset. First, a number of explanatory variables (for example, non-tax revenues and the size of government spending) are likely to be endogenous. Second, there are period and state specific effects in the panel data set that must be controlled for. We thus estimate the tax revenue equation allowing for different combinations of the fixed and random effects. Third, the error terms in the estimated equations may not satisfy the classical regression assumptions. With these points in mind, we employ an instrumental variable approach to estimation called the generalized method of moments (GMM) to address possible endogeneity problem and a non-conventional error covariance structure.[11] Finally, we allow for different instrument weights and residual variance structures.

Table 1 presents several estimates of the parameters of the tax revenue equation. In Models 1-4, the coefficient estimates are based on 2SLS instrument weighting matrix and their standard errors are computed using "period SUR" method. The latter uses GMM weights that that are formed under the assumption of *period* heteroskedasticity (time-varying variances) and general serial correlation in residuals within a given cross section.[12] Models 5 and 6 employ cross-section and period specific heteroskedasticity instrument weighing matrixes, respectively. The "cross section SUR" coefficient covariance estimator in Model 5 is robust to cross-equation (contemporaneous) correlation as well as different error variances in each *cross-section*. As can

[11] "GMM estimation is based upon the assumption that the disturbances in the equations are uncorrelated with a set of instrumental variables. The GMM estimator selects parameter estimates so that the correlation between the instruments and disturbances are as close to zero as possible, as defined by a criterion function. By choosing the weighting matrix in the criterion function appropriately, GMM can be made robust to heteroskedasticity and/or autocorrelation of unknown form." See User's Guide (p.696), EViews (5.1). Given the large number of variables and difficulties in finding appropriate instruments, we chose lagged values of the explanatory variables plus the contemporaneous value of POP65 as our instruments. Admittedly, these instruments are not necessarily orthogonal to the disturbances leaving the estimation concerns less than fully addressed.

[12] Period (cross section) SUR method is a variant of Panel Corrected Standard Errors (PCSE) methodology (Beck and Katz, 1995).

be seen, Models 1 and 3 are superior to the other models in terms of the size of adjusted R^2 (reflecting the inclusion of state fixed effect dummy variables), but inferior based on the size of regression standard errors.

As for the estimated parameters, the coefficient of the intergovernmental variable (IGR/GSP) is positive and statistically significant in most models suggesting that federal grants supplement rather than substitute state tax revenues. The coefficient of the net flow of debt variable, Δ (DEBT/GSP), is also positive but statistically insignificant in all models. This weak nexus suggests that state tax revenue level is fairly independent of state borrowing. State non-tax revenue (NTX/GSP), on the other hand, seems to displace tax revenue and has a significant coefficient in all but one model. Accordingly, tax revenue is more likely to fall in response to an increase in state non-tax revenues than other sources of fund.

The coefficient of the inverse of per capita GSP, (1/PCGSP), passes the significance test in Model 3 only. Its negative sign implies that the level of state taxation *rises* with the level of per capita GSP. As for the proxies for the size of various tax bases, only the coefficient the relative size of the finance, insurance, real estate, and services (FIRS/GSP) does not pass the significance test in some models. All other tax bases positively and significantly affect total tax revenue. In this connection, note that (WRT/GSP) and (TUT/GSP) have the largest quantitative impact on the tax revenue variable. Also, the positive sign of the coefficient of (GOV/GSP) is consistent with the spend-tax hypothesis. There is some evidence that the extent of economic volatility (CVINC) exerts a depressing effect on the level of taxation as hypothesized. The proportion of the elderly population (POP65) displays a negative sign in most models, but is statistically insignificant. The same holds true of the variable (DEM). This result does not provide statistical support the notion that the *level* of taxation is higher in states where the composition of the legislature favors Democrats. Note, however, that there is strong evidence suggesting that an increase in the degree of state fiscal decentralization, as represented by a higher value of (SHLTAX), is associated with a lower level of state taxation.

As shown in Table 1, Models 1-6 yield results which are fairly similar based on the sign and statistical significance of the estimated coefficients. However, for reasons that will be explained later, Models 1 and 3 with fixed cross-section effects are not suitable for construction of the tax effort index. Among the remaining models, we select Model 6, because it performs better based on the values of the adjusted R^2 and standard error of regression.

c. Tax Revenue Composition

We estimate the system tax share equations (Equation 8) using the same estimation approach and robust coefficient variance computation method as in Model 6 of Table 1. The results are presented in Table 2. One may recall that, due to the restrictions in Equation (10.a), the sum of the coefficients of a variable across the share equations add up to zero. The signs of the coefficient of the variable, therefore, indicate how a change in that variable redistributes the tax revenue shares. Moreover, since we control for the level of taxation through (GSP/TAX), the gain in total revenue share of a particular tax type implies an increase in its ratio to GSP at the same time.

Focusing on the statistically coefficients in Table2, an increase in the level of taxation (a decrease in GSP/TAX) shifts the tax revenue mix in favor of the shares general sales taxes (GSL/TAX), selective sales taxes (SSL/TAX) and “other” taxes (OTH/TAX) and against the shares of individual income taxes (INC/TAX). Thus, it appears that high-tax states rely more heavily on indirect taxes. The effects of federal grant, net borrowing, and non-tax revenue variables on the composition of tax revenues are too varied to lend themselves to easy generalizations. Both grants and net borrowing are associated with a higher share of selective sales taxes. In the case of net borrowing, this is accompanied by redistribution in favor of “other” taxes at the expense of personal income taxes. The non-tax revenue variable seem to be the most important of these three variables when judged based on the number of statistically significant effects on the components of total tax revenue. Its coefficient signs together suggest that this source of fund allows states to increase their reliance on “other” taxes while lowering the shares of the *remaining* tax types. It is worth noting that in all cases, direct individual and corporate incomes taxes lose shares when grants, net borrowing, and non-tax revenues relative to tax revenues rise.

The coefficients of the variable (1/PCTAX) suggest that as *per capita* tax rises there is a shift in the tax revenue composition in favor of personal income and corporate income taxes and against the remaining tax types. This pattern is very similar to that of the tax scale variable noted earlier.[13] The proxies for tax bases display stronger correlations with the relative shares of general sales and individual income taxes than the rest of tax revenue shares. Moreover, when statistically significant, the six tax base variables shift the tax revenue composition in favor of the shares of general sales, selective sales, and "other" taxes and against the shares of license, individual income, and corporate income taxes. This implies that states have been moving away from the more visible direct taxes and towards indirect taxes. In this connection, also note that an increase in (GOV/TAX) boosts the share of general sales taxes at the expense of individual income taxes.

Surprisingly, the proxy for economic volatility (CVINC) does not appear to have a statistically significant impact on the tax revenue *mix*. The effect of this variable on the *level* of taxation, one may recall, was negative. According to our results, a rise in the proportion of the elderly population (POP65) is associated with a smaller share of general sales taxes which is accompanied by a larger share of corporate income taxes. The phenomenon of "graying of population" is thus expected to counter the current trend in state tax revenue mix which characterized by a rising weight of general sales taxes and a diminishing weight of corporate income taxes. The significant coefficients of the variable DEML imply that a Democrat-dominated state legislature tends to favor more individual income taxes and less general sales and license taxes. The composition of the state legislature based on party affiliation, thus, seems to be

[13] This may be interpreted to suggest that personal and corporate income taxes are "superior" source of revenue (Gade and Atkins 1990).

more of a factor in affecting the *structure* of tax revenues than its level.[14] Finally, a higher degree of state-local fiscal decentralization redistributes tax revenue shares in favor of selective sales and income taxes and against general sales, license, and "other" taxes in the state tax revenue mix. This rebalancing is consistent with a greater emphasis placed on tax revenue types whose collections normally are a responsibility of the state government.

d. Tax Effort Index

The concept of "tax effort" may be defined as the extent to which a taxing unit utilizes or exploits its "tax capacity." Most previous attempts to construct measures of tax capacity and tax effort for the American states were based on the "representative tax system" (RTS) approach adopted by the ACIR (see footnote 2). Briefly, the RTS approach involves the following steps: (1) For each tax type define a uniform/standard tax base for the nation as a whole using the value (or volume) of all economic stocks and flows that would be taxed if the base were defined comprehensively. This *potential* base is devoid of nonstandard tax exemptions, deductions, preferences, and reliefs the components of which are somewhat subjectively determined. (2) Calculate a set of representative/ standard rates by dividing the *national* revenues actually collected from each tax base by the corresponding *national* standard tax base. (3) For each state and tax type, then multiply the standard rate by the corresponding tax base to estimate "tax capacity" i.e., what the state would collect if it applied the national-average rate to the state-specific tax base. (4) For each state and tax type, divide the (per capita) actual tax collection by the corresponding (per capita) tax capacity to calculate the state's "tax effort." (5) Finally, index the tax effort to the national average to arrive at a "tax effort index."[15] The RTS approach has the advantage of defining a large standard tax base and estimating its categories and subcategories (twenty seven altogether) using a fairly elaborate methodology. It should be noted, however, that the RTS approach is highly data intensive, involves casual empiricism and, as noted earlier,

[14] Note that DEML was found to be statistically insignificant in the equation for the level of taxation.
[15] See, for example, Yilmaz *et al*. (2006) for components of the standard tax base and detailed explanations of the methodology.

yields results that are not comparable over time due to methodological changes. Moreover, it does not account for a variety of factors (institutional and political, for example) that may modify the extent to which potential tax bases can be actually exploited. Finally, its index of tax effort in a particular year indicates how intensively a state taxes its bases relative to *the national average*, as opposed to its own average.

The alternative regression based approach adopted here, on the other hand, is much less data intensive. It uses the data on the value added of different sectors of state economy as proxies for its potential tax bases. The data, while less detailed and specific compared with those used in the RTS approach, have the advantage of being readily available for a relatively long period and for all states on a uniform basis. In the regression approach, the "representative rates" are replaced by the estimated coefficients. The tax capacity in a period is then estimated as the predicted values from a regression model in which tax revenue is regressed on its potential bases while systematically and explicitly controlling for some of the factors that affect the extent to which these bases translate into actual revenue collection. For each period, the "tax effort index" (TEI) is simply defined as the ratio of actual tax collection to the predicted value scaled by GSP.[16]

Accordingly we define our total tax effort index for the ith state in year t as follows:

$$TEI_{it} = \left[actual\ (TAX / GSP)_{it} / predicted\ (TAX / GSP)_{it} \right](100) \qquad (11)$$

If $TEI_{it} > 100$ ($TEI_{it} < 100$) then the state has taxed more (less) than what is predicted by its "tax capacity" and other state specific characteristics. We may use "high tax effort" and "low tax effort" to refer to these cases. The sample mean of TEI_{it}, or $\overline{TEI}_i$, is can be calculated for each

[16] The definitions of tax capacity and TEI employed here have been used in a number of cross-country studies of tax revenues. See, for example, Piancastelli (2001), Stotsky and WoldeMariam (2002), Bird *et al.* (2008) and references cited therein. To the best of our knowledge, the regression based approach has not been applied to the subnational data for estimating the tax effort index.

state for the purpose cross state comparisons and rankings. In this context, a high value of the tax effort index may be also interpreted as a measure of "fiscal stress" as governments experiencing a fiscal crisis may have to even more intensively exploit their tax capacity (Hannarong and Akoto, 2004).[17]

For a given (TAX/GSP), states may choose different tax portfolios reflecting their preferences and constraints. A particular tax type within a state's selected portfolio, however, may be "overused" or "underused" relative to its predicted value. To examine this aspect of the tax portfolio, we define what may be termed "individual tax share index," or TSI as follows:

$$TSI_{jit} = \left[actual\ S_{jit} \,/\, predicted\ S_{jit} \right](100) \qquad (12)$$

where S_{jit} is the share of the jth tax type in the ith state in year t. An index value greater (smaller) than one hundred is interpreted to mean that the corresponding tax type was "overused" ("underused"). The average value of TSI over the sample period, or $\overline{TSI}_{ji}$, is then calculated for comparison purposes.

Average index values defined above are not informative regarding their variations over time. To gain a quantitative appreciation of the "stability" of the tax effort index *over time*, we further calculate the coefficient of variation (or CV) of TSI_{jit}. This coefficient is a unit-free measure of relative variability. It is defined as the ratio of the standard deviation of TSI_{jit} (STD_{ij}) to the average value of TSI_{jit} (or $\overline{TSI}_{ji}$) expressed in percentage terms.

[17] The $\overline{TEI}_i$ index simply indicates how the ith state performed, on average, in collecting taxes relative to its potential. It does not, however, provide information as to *why* the state "over" or "under" performed. This, therefore, may raise legitimate concerns regarding the normative connotations of the index value. However, virtually all assessments of actual tax revenues from the simplest comparisons to the most sophisticated analyses explicitly or implicitly involve some norms.

More specifically,

$$CV_{ji} = \left[STD_{ji} / \overline{TSI}_{ji} \right] (100) \qquad (13)$$

We define and calculate a similar CV measure for the TEI.

Finally, to assess the extent of "deviation" of the actual tax revenue composition from the composition implied by the estimated share equations, we introduce the following index:

$$K_i = \left[\sum_{j=1}^{6} (\overline{TSI}_{ji} - 100)^2 / 6 \right]^{1/2} (100) \qquad (14)$$

K_i is a standardized measure of the cumulative deviation of $\overline{TSI}_{ji}$ (j=1 to 6) from one hundred in the ith state. The logic behind the construction of K_i is that, as noted above, the deviation of each $\overline{TSI}_{ji}$ from one hundred indicates the extent to which the corresponding tax type is "underused" or "overused." In the special case that all $\overline{TSI}_{ji}$ values are equal to one hundred, the value of K_i would be equal to zero implying that the actual composition of the tax revenue is in perfect alignment with the one predicated by the regression models. Thus, as the value of K rises the degree of this alignment diminishes.

There are two practical problems in constructing these indexes based on predicated values that have to be addressed. First, the models with cross-section fixed effects are not suitable for the purpose calculating the average index values, for they yield averages that are always equal to *one hundred* for each state. (This reflects the fact that the sum of the residuals is equal to zero for the ith state implying that K_i=0). Secondly, some predicted *tax share* values obtained from the estimated share equation for "other" taxes turn out to be negative for some states regardless of the effects specification. For these states, we report the index values obtained from (mostly) positive values, but do not use them for comparison and analysis purposes to avoid distortions.[18]

The calculated values of the indexes defined above are presented in Table 3. For each state, the first value recorded in the first row is the average value of the tax effort index ($\overline{TEI}$). The next six recorded values are the $\overline{TSI}$ corresponding to the six types as shares of total tax revenue. The corresponding values of the coefficient of variation (CV) are recorded in the second row. The values of the extent of deviation in the composition of tax revenue (K) are shown in the last column corresponding to each state. The following is a summary of the results:

1. Total Tax Revenue Ratio (TAX/GSP)

1.1. There is a wide variation in the average tax effort index among the states. The range for $\overline{TEI}$ in the sample is 77 (TN) to 128 (NY). TN, TX, LA, MO, GA, and AL are the states with a "low" tax effort index defined as states with $\overline{TEI}$ <85. ME, VT, RI, MN, IA, WI, AK, and NY are the states with a "high" tax effort index defined as states with $\overline{TEI}$ > 115.

1.2. The CV value ranges from 2 (AL) to 16 (WY) with a sample average of 5. The five states with the lowest degree of variability in their TEI are AL, NC, GA, IL, and PA. The five states with the highest degree of TEI variability are OR, MA, SD, AK, and WY. It is worth noting that both AK and WY are oil and mineral rich states and their severance taxes fluctuate significantly.

1.3. The simple correlation coefficient between $\overline{TEI}$ and CV is r = 0.25 (p=0.09). Thus, there is weak statistical evidence suggesting that a higher tax effort level is accompanied by a higher degree of tax effort instability.

[18] One possible approach to this problem is to re-estimate the tax share equations by employing the Tobit estimation method and using zero and one hundred as the left and right "censoring values," respectively. To the best of our knowledge, existing econometric software packages do not support the use of instruments and effects specification with the Tobit estimation method.

2. Tax Composition

2.1. The bottom (top) five states in terms of the value of $\overline{TSI}$ corresponding to the share in total revenue of six tax types are as follows:[19]

- General sales taxes (0, 182): *AK, DE, MT, NH,* and *OR* (WA, MS, FL, HI, and SD).
- Selective sales taxes (48, 172): CA, NY, MA, AK, and MI (AL, SD, TX, NH, and NV).
- License taxes (32, 312): HI, IN, NY, MA, and GA (OK, TX, MT, WY, and DE).
- Individual income taxes (0, 235): *FL, NV, SD, TX, WA,* and *WY* (UT, NY, MA, DE, and OR).
- Corporate income taxes (0, 524): *NV, TX, WA, WY,* and VA (CA, MT, ND, NH, and AK).
- Other taxes (9, 440): HI, ID, UT, MN, and IN (WY, TX, ND, MD, MT, and WA).[20]

Further analysis of the $\overline{TSI}$ values yields several results worth noting: First, the two categories of "other" taxes and license taxes are the most "underused" categories based on the *numbe*r of states whose corresponding $\overline{TSI}$ values are less than 100. However, if we calculate the *average shortfall* (from 100) for all the states with $\overline{TSI}$ <100, the most "underused" categories are individual income and "other" taxes. Second, the simple correlation coefficient between the $\overline{TEI}$ values for the level of taxation and the $\overline{TSI}$ values for the individual tax types is statistically significant in two cases (see Appendix Table A1). They suggests that the average tax effort corresponding to total tax revenue tended to be higher in states where the average selective sales tax TSI was lower and the average corporate income TSI was higher. Third, the correlation coefficients between $\overline{TSI}$ values further imply that the general sales tax is a substitute for license, income, and corporate taxes within state tax revenue portfolio. Similarly, selective sales tax and

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[19] In what follows, states are listed based on the values of $\overline{TEI}$ (CV) sorted in ascending order. Figures in parentheses immediately following each tax type is the range corresponding to $\overline{TEI}$ (CV). In each one of the six categories that listed, states whose names appear in italic do not levy the corresponding tax.

[20] Ten states (CO, FL, GA, IA, KS, MO, NH, SD, TN, and VA) had negative predicted values for the "other" tax category in some or all years. With the exception of SD and VA, it was possible to calculate average TEI (and CV) from mostly positive values.

individual income taxes are substitutes. Interestingly enough, there is no evidence of supplementarity based on the $\overline{TSI}$ values.

2.2. The bottom (top) five states based on the value of CV_j are as follows:

- General sales taxes (2, 26): WA, NM, AR, CA, and UT (VT, OK, GA, WY, and ND).
- Selective sales taxes (4, 43): TX, WA, VA, NM, and AR (HI, ND, GA, AK, and WY).
- License taxes (4, 50): MO, IA, PA, DE, and WA (SC, WY, HI, NJ, and AK).
- Personal income taxes (3, 355): WA, SC, MD, NC, and GA (ND, NM, CT, AK, and NH).
- Corporate income taxes (9, 56): WI, MA, NC, GA, and IL (ND, WV, IN, SD, and AK).
- Other taxes (11, and 101): KY, NM, MT, OK, and SC (NJ, ID, WV, MN, and OH).

According to the average values of CV_j shown in Table 3, the least stable TSI corresponds to "other" taxes and personal income taxes. The most stable TSI is observed in relation to general sales and selective sales taxes.[21] Moreover, all six tax types have average CV values that are significantly larger than that of the overall tax revenue. This suggests that TEI is much more stable than TSIs which itself is a reflection of the fact the tax portfolio is more stable than its constituent components. The $\overline{TSI}$ and the CV values for the same tax type are correlated in a statistically significant fashion in only two cases: A negative (positive) correlation coefficient is observed in the case of personal income (corporate income) taxes. However, there are several cases of statistically significant cross correlations which are mostly positive (see Appendix Table A2).

2.3. The extent of deviation of the actual tax revenue composition from that predicted by the estimated revenue shares model (as measured by K) is the smallest in SC (36) and the largest in AK (94). The average value of K is 47. The five states with the lowest degree of deviation in the tax revenue composition are SC, IN, WI, HI, and OH. The top five states are ND, DE, MT,

[21] In this connection, also note that based on the CV values corresponding to the actual revenues, these two tax types ranked second and first, respectively, in terms of stability over the sample period.

WA, and AK.[22] An auxiliary regression of K on the CV of total tax revenue and the $\overline{TSI}_j$ values indicates that K falls as the $\overline{TSI}$ for general sales, selective sales, or personal income taxes rises and the $\overline{TSI}$ for license, corporate, and "other" taxes falls. However, only the coefficients of the latter group of tax types are statistically significant.

3. Additional Empirical Results

We calculated geographical division averages of the indexes discussed above using the Census Bureau classifications (see Appendix Table A3). For the total tax revenue, the Middle Atlantic division (NJ, NY and PA) has the highest average tax effort index value ($\overline{TEI}$ = 113.1) among the nine divisions. The West South Central (AR, LA, OK, and TX) and the East South Central (Al, KY, MS, and TN) divisions rank at the bottom ($\overline{TEI}$ = 86). It is worth noting that the Middle Atlantic division has relatively high $\overline{TSI}$ values corresponding to personal and corporate income taxes while the opposite holds true of the West South Central and the East South Central divisions.

We carried out further analysis to assess the validity and robustness of our results. First, we compared our regression based *TEI* values with those calculated based on the RTS approach by Tannenwald and Turner (2006, Table 5, p. 28). The authors report TEI values for the level of taxation for four years two of which (1996 and 1997) are the last two years of our sample. The simple correlation coefficients for the *TEI* values from the two approaches are r =0.75 (p=0.0) and r = 0.80 (p=0.0) for 1996 and 1997, respectively. These relatively high degrees of correlation are reassuring as they suggest the state tax effort index series obtained from these two completely different methodologies are fairly consistent.[23] Second, we compared *TEI* and *TSI* values obtained from alternative estimation methods (two-way random model, mixed effects model with

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[22] In interpreting the value of K, it should be noted that the introduction or elimination of a tax type during the sample period inflates its size.

[23] Unfortunately, we could not make the same comparison for the TEIs of the individual tax types as Tannenwald and Turner use more disaggregated categories than ours and report corresponding TEI values for 1999 only.

no instruments) with those reported here. In most cases, we found a high degree of correlation between the series across different estimation methods. [24]

V. Concluding Remarks

In this paper, we analyzed government total tax revenue and its composition for 49 American states over the period 1978-97 with the objective of assessing the extent to which states exploit their tax capacity. From a methodological perspective, our regression-based approach may provide an attractive alternative to the "representative tax system approach," because it has much more limited data requirements and generates more intertemporally consistent estimates of tax effort index. Nevertheless, our results reflect limitations of the regression approach. With this caveat in mind, the following is a summary of our main findings:

1. According to our results, grants supplemented tax revenues while non-tax revenues displaced them. In addition, these two variables had different effects on the composition of total tax revenue. This suggests that the source of fund received by states matters in relation to both the level and mix of their tax revenues.
2. There was fairly strong statistical evidence consistent with a general shift in the composition of tax revenue away from income taxes and towards general sales taxes as the level of tax revenue (relative to the size of the economy), per capita tax, proxies for several tax bases, and the size of the public sector increased. (A shift in the opposite direction was associated with a rise in the percent of Democrats in the state legislative chambers and the degree of fiscal decentralization). As both general sales and income taxes are relatively unstable, this shift probably reflects states' tendency to substitute relatively fast growing (indirect) sales tax for relatively slow growing (direct) income tax. The reduction in the income tax share noted

[24] We also tried to assess the impact of "outliers" on our results. However, this task was complicated by the fact that there was no common set of outliers in the estimated total tax and tax share equations.

above was also accompanied with gains in the shares of selective sales and "other" tax shares; although the evidence in these cases was less consistent.

3. In relation to total tax revenue, we identified Tennessee, Texas, Louisiana, Missouri, Georgia, and Alabama as states with relatively low tax effort index. If necessary, these states should be more easily able to increase their tax revenues by more intensively exploiting their existing tax capacity. On the other hand, Maine, Vermont, Rhode Island, Minnesota, Iowa, Wisconsin, Alaska, and New York were found to be relatively high tax effort states. These states may already have a high degree of "fiscal stress" and will have a harder time dealing with fiscal crises through raining their tax collections.
4. We found statistical evidence suggesting that improving the tax effort may come at the expense of more stability of tax effort over time. Thus, those states that have both a low average tax effort and a low degree of variation in tax effort may be in a better initial position to achieve higher levels of tax effort. In this connection, further evidence suggested that higher effort index for the total tax revenue was associated with a higher tax share index value for corporate net income tax and a lower tax share index value for general sales tax. Comparisons of regional averages also indicated that high tax effort regions had a higher tax share index values for personal and corporate income taxes and a lower tax share index values for general sales and selective sales taxes relative to low tax effort regions.
5. Among the components of tax revenues, "other" and license taxes were the two categories which were "underutilized" by the largest number of states in the sample. An alternative approach based on the average shortfall ranked individual income taxes and "other" taxes the most "underutilized" taxes. "Other" taxes, followed by individual income taxes, had the highest average variation of tax effort. Since severance taxes (levied on the extraction of a state's minerals and natural resources) are an important component of "other" taxes, oil and mineral rich states may find it desirable to lessen their reliance on severance taxes through tax portfolio diversification over time.

6. Attempts to change the tax effort associated with one tax type should take into account the substitutability among tax efforts. We found statistical evidence of such substitutability between, for example, taxes on income and general sales.

Different tax revenue sources have different implications regarding efficiency, equity, as well as saving, investment and work decisions. They also differ in terms of potential for growth and stability over time. As our analysis illustrated, often, there are trade-offs among different objectives and desirable characteristics of a tax system making tax policy “the art of the possible rather than the pursuit of the optimal” (Tanzi and Zee, 2001). The empirical evidence presented in this paper suggests that intergovernmental transfers, non-tax revenues, fiscal decentralization, and the political composition of the state legislature can serve as channels through which discretionary structural changes are introduced to affect total tax revenue and its components.

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Table 1. GMM Estimates of State Total Tax Revenue (TAX/GSP) Equation: Panel Data (1978-97, NxT=980)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Common C	-7.7638	-2.6604	-10.9310	-3.1809	-2.4422	-2.9017
	(0.90)	(0.47)	(1.05)	(0.67)	(0.46)	(0.60)
(IGR/GSP)	0.1704	0.2559 ***	0.2564 ***	0.2161 **	0.1689 *	0.2076 **
	(1.36)	(3.09)	(3.00)	(2.25)	(1.83)	(2.12)
Δ (DEBT/GSP)	0.2623	0.2046	0.2412	0.1563	-0.0327	0.1340
	(1.45)	(1.22)	(1.52)	(0.72)	(0.10)	(0.61)
(NTX/GSP)	-0.2121 ***	-0.1104 **	-0.1851 ***	-0.1028 **	-0.0878	-0.1047 **
	(3.55)	(2.80)	(3.80)	(2.46)	(0.92)	(2.48)
(1/PCGSP)	5.0940	-6.1057 *	-4.0760	-5.7440	-5.0983	-5.8966
	(0.66)	(1.91)	(0.88)	(0.91)	(0.81)	(0.92)
(FIRS/GSP)	0.1221	0.0887	0.1625	0.0968 **	0.0948 *	0.0940 *
	(1.33)	(1.61)	(1.53)	(2.04)	(1.79)	(1.96)
(MNC/GSP)	0.1439 *	0.0947 *	0.1661 *	0.1090 **	0.1235 *	0.1069 *
	(1.72)	(1.77)	(1.79)	(2.01)	(1.93)	(1.96)
(MFG/GSP)	0.1348 *	0.1029 **	0.1733 *	0.1131 **	0.1218 **	0.1111 **
	(1.67)	(2.06)	(1.89)	(2.44)	(2.28)	(2.38)
(TUT/GSP)	0.2201 **	0.1625 **	0.2303 **	0.1762 ***	0.1725 **	0.1740 ***
	(2.34)	(2.37)	(2.09)	(3.00)	(2.43)	(2.93)
(WRT/GSP)	0.2613 **	0.1655 **	0.2947 **	0.1624 **	0.1551 **	0.1577 **
	(2.14)	(1.97)	(2.05)	(2.31)	(2.23)	(2.22)
(GOV/GSP)	0.1809 **	0.1266 **	0.1895 **	0.1430 ***	0.1230 **	0.1416 **
	(2.27)	(2.24)	(2.07)	(2.81)	(2.22)	(2.74)
CVINC	-0.0372	-0.0555 **	-0.0597 **	-0.0734	-0.1211	-0.0739
	(0.61)	(2.28)	(2.06)	(1.21)	(1.24)	(1.22)
POP65	-0.0279	-0.0089	0.0198	-0.0055	0.0041	-0.0033
	(0.48)	(0.20)	(0.37)	(0.12)	(0.10)	(0.07)
DEML	-0.0029	-0.0024	-0.0028	-0.0033	-0.0029	-0.0031
	(0.53)	(0.59)	(0.55)	(0.79)	(0.91)	(0.74)
SHLTAX	-0.0709 ***	-0.0766 ***	-0.0697 ***	-0.0812 ***	-0.0900 ***	-0.0817 ***
	(4.45)	(8.60)	(5.30)	(7.19)	(5.73)	(7.18)
Cross section effect	fixed	random	fixed	random	random	random
Period effect	fixed	random	random	fixed	fixed	fixed
Instrument weights	2SLS	2SLS	2SLS	2SLS	cross section	period
Covariance method	period SUR	period SUR	period SUR	period SUR	cross section SUR	period SUR
Adjusted R^2	0.86	0.40	0.85	0.48	0.43	0.49
S.E. of regression	0.40	0.38	0.41	0.36	0.37	0.35

Notes:

Absolute values of the t-statistic (based on panel corrected standard errors and period weights) are shown in parentheses.

***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2. GMM Estimates of State Tax Share Equations: Panel Data (1978-97; NxT=980)

	(GST/TAX)		(SST/TAX)		(LCT/TAX)		(INC/TAX)		(CRP/TAX)		(OTH/TAX)	
Common C	42.1708	***	8.0949	**	1.5356		21.6412	***	-2.2087		28.1208	***
	(10.31)		(2.83)		(1.12)		(4.95)		(0.92)		(6.72)	
(GSP/TAX)	-0.0550	**	-0.0256	**	0.0074		0.1021	***	0.0082		-0.0363	*
	(2.49)		(2.02)		(1.14)		(4.77)		(0.74)		(1.90)	
(IGR/TAX)	0.0346		0.0963	***	-0.0180		-0.0345		-0.0239		-0.0282	
	(0.92)		(3.73)		(1.52)		(0.90)		(1.13)		(0.82)	
Δ (DEBT/TAX)	0.0010		0.0044	*	0.0015		-0.0051		-0.0080	***	0.0088	**
	(0.26)		(1.72)		(1.25)		(1.35)		(3.64)		(2.49)	
(NTX/TAX)	-0.0480	**	-0.0187	*	-0.0061		-0.0877	***	-0.0037		0.1695	***
	(2.79)		(1.67)		(1.10)		(5.06)		(0.40)		(10.89)	
(1/PCTAX)	4.6280	**	2.2536	**	1.5359	***	-8.2654	***	-4.6375	***	4.4972	**
	(2.78)		(2.62)		(3.02)		(4.94)		(4.81)		(2.80)	
(FIRS/TAX)	0.0441	*	0.0333	**	0.0003		-0.1101	***	0.0006		0.0289	
	(1.99)		(2.64)		(0.05)		(5.12)		(0.05)		(1.54)	
(MNC/TAX)	0.0501	**	0.0162		-0.0071		-0.1118	***	-0.0053		0.0605	***
	(2.26)		(1.27)		(1.10)		(5.21)		(0.48)		(3.13)	
(MFG/TAX)	0.0381	*	0.0208	*	0.0011		-0.1002	***	0.0100		0.0272	
	(1.91)		(1.83)		(0.19)		(5.17)		(1.01)		(1.57)	
(TUT/TAX)	0.0363		0.0335	**	-0.0054		-0.1037	***	0.0054		0.0405	*
	(1.41)		(2.24)		(0.71)		(4.16)		(0.41)		(1.79)	
(WRS/TAX)	0.1573	***	0.0200		-0.0226	**	-0.1319	***	-0.0426	**	0.0258	
	(4.93)		(1.04)		(2.38)		(4.22)		(2.59)		(0.91)	
(GOV/TAX)	0.0428	**	0.0166		0.0035		-0.0643	***	0.0154		-0.0152	
	(2.29)		(1.48)		(0.63)		(3.53)		(1.50)		(0.86)	
CVINC	-0.2901		0.1194		-0.0298		0.0483		0.0967		0.0129	
	(1.38)		(0.84)		(0.47)		(0.23)		(0.74)		(0.06)	
POP65	-1.1709	***	0.4736		0.1447		0.4482		0.4308	**	-0.3533	
	(4.01)		(0.38)		(1.57)		(1.50)		(2.66)		(1.32)	
DEML	-0.1112	***	0.0083		-0.0254	***	0.0935	***	0.0187		-0.0064	
	(4.88)		(0.54)		(3.60)		(4.08)		(1.40)		(0.28)	
SHLTAX	-0.1264	*	0.0894	*	-0.0396	*	0.2430	***	-0.0266		-0.1339	*
	(1.76)		(1.91)		(1.75)		(3.36)		(0.68)		(1.98)	
Adjusted R^2	0.20		0.24		0.20		0.29		0.18		0.30	
S.E. of regression	3.10		2.22		0.96		3.10		2.02		3.24	

Notes:

a. GMM estimates based on period weights weighting matrix.

b. Absolute values of the t-statistic (based on panel corrected standard errors) are shown in parentheses.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3. State Tax Indexes: Mean, Coefficient of Variation, and Measure of Deviation [a-c]

State	TAX/GSP	GSL/TAX	SSL/TAX	LIC/TAX	INC/TAX	CRP/TAX	OTH/TAX	K
AK	**125**	**0**	**56**	**164**	**5**	**524**	**133**	94
	7	NA	31	49	295	55	15	
AL	**84**	**94**	**153**	**99**	**93**	**57**	**86**	41
	60	8	5	18	6	19	18	
AR	**92**	**144**	**106**	**99**	**90**	**75**	**31**	39
	36	3	5	10	7	13	29	
AZ	**105**	**127**	**83**	**82**	**83**	**98**	**118**	40
	17	5	8	15	8	23	38	
CA	**100**	**97**	**48**	**61**	**130**	**186**	**121**	47
	31	3	7	14	7	11	22	
CO	**89**	**73**	**76**	**68**	**170**	**71**	***282***	*60*
	25	9	8	9	5	24	*122*	
CT	**111**	**139**	**106**	**61**	**60**	**146**	**68**	42
	15	12	16	12	64	19	30	
DE	**93**	**0**	**85**	**312**	**197**	**89**	**30**	65
	20	NA	5	7	11	27	17	
FL	**99**	**171**	**104**	**86**	**0**	**88**	***1036***	*177*
	25	5	8	8	NA	14	*47*	
GA	**83**	**86**	**71**	**50**	**142**	**119**	***578***	*103*
	42	18	22	14	5	10	273	
HI	**108**	**179**	**82**	**32**	**97**	**46**	**8**	37
	23	7	16	29	6	28	32	
IA	**121**	**133**	**99**	**114**	**93**	**65**	***91***	*41*
	22	7	10	5	8	15	*62*	
ID	**104**	**96**	**108**	**122**	**105**	**130**	**16**	42
	21	9	8	12	7	18	67	
IL	**97**	**89**	**91**	**78**	**128**	**116**	**100**	41
	41	6	6	12	6	11	26	
IN	**93**	**136**	**76**	**39**	**131**	**69**	**23**	36
	22	5	9	18	9	45	40	
KS	**99**	**106**	**91**	**78**	**94**	**100**	***331***	*65*
	27	5	5	9	7	12	*88*	
KY	**95**	**98**	**120**	**75**	**97**	**77**	**127**	41
	27	13	11	15	5	15	11	
LA	**79**	**102**	**118**	**149**	**81**	**135**	**69**	46
	15	15	13	11	21	28	17	
MA	**114**	**80**	**55**	**47**	**189**	**142**	**35**	43
	11	6	9	15	6	9	28	
MD	**112**	**79**	**97**	**61**	**133**	**68**	**193**	46
	27	6	5	11	4	11	33	
ME	**116**	**110**	**88**	**107**	**114**	**104**	**46**	39
	15	8	10	9	9	23	33	
MI	**112**	**99**	**62**	**73**	**127**	**179**	**62**	44
	26	4	7	8	10	16	26	
MN	**119**	**87**	**98**	**115**	**137**	**116**	**21**	41
	27	6	6	9	6	12	75	
MO	**83**	**108**	**68**	**88**	**134**	**61**	***52***	*36*
	26	5	8	4	7	14	*30*	
MS	**91**	**167**	**96**	**109**	**54**	**75**	**51**	41
	26	9	15	15	11	15	32	
MT	**106**	**0**	**113**	**177**	**99**	**234**	**263**	70
	18	NA	5	13	8	25	12	
NC	**89**	**75**	**121**	**83**	**134**	**80**	**64**	39
	52	11	7	8	4	9	22	
ND	**108**	**104**	**141**	**155**	**40**	**244**	**168**	63
	13	26	19	14	31	29	30	

State	TAX/GSP	GSL/TAX	SSL/TAX	LIC/TAX	INC/TAX	CRP/TAX	OTH/TAX	K
NH	**90**	**0**	**172**	**92**	**73**	**263**	***773***	*94*
	26	NA	16	8	355	16	*164*	
NJ	**106**	**87**	**104**	**88**	**122**	**156**	**56**	43
	32	14	12	31	9	14	65	
NM	**98**	**147**	**101**	**101**	**51**	**73**	**90**	40
	14	3	5	18	45	26	11	
NV	**89**	**139**	**172**	**142**	**0**	**0**	**48**	44
	23	7	5	7	NA	NA	47	
NY	**128**	**75**	**52**	**46**	**183**	**123**	**128**	45
	37	7	10	17	6	12	56	
OH	**94**	**97**	**105**	**88**	**133**	**66**	**37**	38
	21	9	8	11	7	19	105	
OK	**94**	**74**	**115**	**166**	**93**	**56**	**155**	47
	19	17	11	12	5	16	12	
OR	**108**	**0**	**63**	**146**	**235**	**137**	**59**	53
	12	NA	14	8	7	27	23	
PA	**105**	**103**	**93**	**128**	**102**	**110**	**91**	43
	39	6	6	6	7	12	28	
RI	**117**	**131**	**90**	**61**	**130**	**93**	**27**	39
	16	6	9	17	6	18	35	
SC	**90**	**112**	**103**	**73**	**118**	**69**	**25**	36
	31	11	12	23	4	23	14	
SD	**111**	**182**	**153**	**96**	**0**	**110**	-	-
	8	8	9	16	NA	46	-	
TN	**77**	**131**	**110**	**112**	**9**	**114**	***105***	*42*
	32	12	14	11	17	13	*883*	
TX	**78**	**108**	**162**	**168**	**0**	**0**	**161**	50
	18	6	4	14	NA	NA	21	
UT	**90**	**98**	**66**	**57**	**175**	**114**	**21**	41
	26	4	6	12	15	22	40	
VA	**88**	**69**	**109**	**54**	**141**	**45**	-	-
	21	7	4	10	3	17	-	
VT	**116**	**63**	**134**	**127**	**134**	**112**	**33**	44
	13	16	8	11	9	18	57	
WA	**100**	**166**	**100**	**79**	**0**	**0**	**441**	81
	17	2	4	7	NA	NA	27	
WI	**124**	**110**	**84**	**70**	**133**	**87**	**41**	37
	37	7	9	9	5	9	43	
WV	**101**	**138**	**114**	**118**	**100**	**112**	**28**	44
	19	10	12	12	12	41	75	
WY	**89**	**113**	**66**	**255**	**0**	**0**	**161**	54
	6	25	43	27	NA	NA	25	
Averages:								
K								**47**
CV	**5**	**9**	**10**	**14**	**25**	**20**	**38**	

Notes:
a. The figures in the first row corresponding to each country are the mean values of the tax effort (share) index. A mean value greater (less) than one hundred implies that the corresponding tax type is "overused" ("underused.") A '-' indicates that the index value could not be calculated due to all-negative predicated values. Index values shown in italics were calculated after dropping a few negative predicted values. **b**. The figures in the first row corresponding to each country are the values of the coefficient of variation (CV) of the tax effort (share) index. The larger (smaller) the value of the CV the more (less) stable is the corresponding tax effort index. NA (not applicable) means that the value of CV cannot be computed due to zero mean value. **c**. The figures in the column with the heading "K" are the values of the measure of deviation of the tax revenue composition from that predicated by the models. The larger (smaller) the value of K, the larger (smaller) is the extent of the deviation. Source: Author's calculations

Appendix

Data Sources:

Department of Commerce, Bureau of Economic Analysis
(http://www.bea.gov/bea/regional/gsp/default.cfm?series=SIC)
for state gross product (GSP) and its sectoral composition and state per capita personal income.
Census Bureau: Government Finances and *Statistical Abstract of the United States*
(http://www.census.gov/govs/www/state.html
, http://www.census.gov/prod/www/statistical-abstract.html , and
http://www.census.gov/statab/www/minihs.html)
for the remaining variables .

Table A1. Average Tax Indices: Simple Correlation Coefficient (*p*-value)

	(TAX/GSP)	(GSL/TAX)	(SSL/TAX)	(LIC/TAX)	(INC/TAX)	(CRP/TAX)	(OTH/TAX)
(TAX/GSP)	1.00						
(GSL/TAX)	-0.07	1.00					
	(0.61)						
(SSL/TAX)	**-0.31**	0.11	1.00				
	(0.03)	(0.46)					
(LIC/TAX)	-0.14	**-0.37**	0.19	1.00			
	(0.33)	(0.01)	(0.20)				
(INC/TAX)	0.18	**-0.47**	**-0.49**	-0.23	1.00		
	(0.22)	(0.00)	(0.00)	(0.12)			
(CRP/TAX)	**0.38**	**-0.53**	-0.17	0.09	-0.02	1.00	
	(0.01)	(0.00)	(0.25)	(0.56)	(0.88)		
(OTH/TAX)	-0.17	-0.06	0.08	0.15	**-0.45**	0.02	1.00
	(0.90)	(0.70)	(0.62)	(0.36)	(0.00)	(0.91)	

Table A2. Average Tax Indices and Coefficient of Variation: Simple Correlation Coefficient (*p*-value)

CV→ TEI↓	(TAX/GSP)	(GSL/TAX)	(SSL/TAX)	(LIC/TAX)	(INC/TAX)	(CRP/TAX)	(OTH/TAX)
(TAX/GSP)	**0.25**	-0.12	0.03	0.20	0.08	0.10	0.10
	(0.09)	(0.42)	(0.82)	(0.16)	(0.63)	(0.50)	(0.54)
(GSL/TAX)	-0.07	-0.25	-0.08	-0.06	**-0.44**	-0.02	-0.12
	(0.63)	(0.10)	(0.56)	(0.70)	(0.00)	(0.89)	(0.44)
(SSL/TAX)	-0.08	0.20	-0.22	-0.20	0.22	0.06	**0.29**
	(0.57)	(0.19)	(0.13)	(0.17)	(0.15)	(0.69)	(0.06)
(LIC/TAX)	**0.44**	**0.55**	**0.30**	0.03	0.13	**0.28**	-0.17
	(0.00)	(0.00)	(0.04)	(0.82)	(0.41)	(0.06)	(0.29)
(INC/TAX)	**-0.36**	-0.17	**-0.29**	-0.24	**-0.41**	**-0.29**	0.07
	(0.01)	(0.26)	(0.04)	(0.10)	(0.01)	(0.05)	(0.68)
(CRP/TAX)	**0.30**	0.20	**0.33**	**0.46**	**0.73**	**0.41**	0.11
	(0.04)	(0.19)	(0.02)	(0.00)	(0.00)	(0.00)	(0.50)
(OTH/TAX)	-0.07	0.01	0.09	-0.15	**0.55**	-0.16	**-0.33**
	(0.63)	(0.93)	(0.54)	(0.33)	(0.00)	(0.30)	(0.04)

Table A3. Tax Indexes, CV, and K: Divisional Averages

Region	(TAX/GSP)	(GSL/TAX)	(SSL/TAX)	(LIC/TAX)	(INC/TAX)	(CRP/TAX)	(OTH/TAX)	K
NENG	110.5	87.1	107.5	82.3	116.6	143.3	41.9 (L)	41.4
	6.8	*9.9*	*11.4*	*11.8*	*74.7*	*17.1*	*57.8*	
MATL	113.1 (H)	88.4	82.9	87.3	135.6 (H)	129.6	91.7	43.7
	2.8	*8.8*	*9.2*	*18.1*	*7.6*	*12.5*	*49.9*	
ENCT	104.1	106.4	83.8	69.7 (L)	130.5	103.4	52.6	39.3
	3.6	*6.3*	*7.9*	*11.7*	*7.2*	*19.8*	*48.0*	
WNCT	106.8	120	108.2	107.6	82.9	116.1	93.6	48.4
	6.0	*9.5*	*9.6*	*9.7*	*11.9*	*21.5*	*49.4*	
SATL	94.4	91.3	100.6	104.6	120.8	83.8	67.9	45.9
	3.8	*9.7*	*9.5*	*11.6*	*6.0*	*19.0*	*32.3*	
ESCT	86.6	122.5 (H)	119.6	98.6	63.4 (L)	81	87.9	40.7
	3.1	*10.4*	*11.2*	*14.7*	*9.8*	*15.6*	*20.2*	
WSCT	86 (L)	107.1	125.1(H)	145.4 (H)	66	66.5 (L)	104	45.6
	5.1	*10.4*	*8.2*	*11.7*	*10.9*	*18.8*	*19.9*	
MONT	96.4	99.1	98	125.4	85.4	90	102.3	47.4
	6.5	*8.8*	*11.1*	*14.2*	*14.9*	*23.1*	*34.3*	
PACF	108.3	88.3 (L)	69.9 (L)	96.4	93.4	178.5 (H)	152.3 (H)	62.6
	7.1	*4.4*	*14.4*	*21.6*	*78.8*	*30.5*	*23.7*	

Note:

The following regions are based on the Census Bureau classifications:

NENG: New England (CT, MA, ME, NH, RI, and VT);
MATL: Middle Atlantic (NJ, NY, and PA)
ENCT: East North Central (IL, IN, MI, OH, and WI)
WNCT: West South Central (AR, LA, OK, and TX)
SATL: South Atlantic (DE, FL, GA, MD, NC, SC, VA, and WV)
ESCT: East South Central (Al. KY, MS, and TN)
WSCT: West North Central (IA, KS, MN, MO, ND, and SD)
MONT: Mountain (AZ, CO, ID, MT, NM, NV, UT, and WY)
PACF: Pacific (AK, CA, HI, OR, and WA)

H and L represent the highest and lowest calculated value, respectively.