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TAX STRUCTURE AND PUBLIC SECTOR GROWTH

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ABSTRACT

It has been hypothesized that a jurisdiction's tax structure exerts an independent effect upon the growth of its public sector. We test this hypothesis by examining the relationship between the growth of state general expenditure and the elasticity of tax revenues with respect to income. The work takes advantage of a very careful set of income elasticities for the personal income and sales tax systems for each state, for every year from 1978 to 1983. The main conclusion is that the data do not support the notion that the form of the tax structure exerts an independent effect on public sector growth.

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I. Introduction

There is much theoretical and empirical work on the determinants of public sector growth. (See the surveys by Inman [1979] and Rubinfield [1983].) One hypothesis is that a jurisdiction's tax structure exerts an independent effect upon the growth of its public sector. James Buchanan, for example, notes that "In a period of rapidly increasing national product, that tax institution characterized by the highest elasticity will tend, other things equal, to generate the largest volume of public spending." (Quoted in Oates [1975, 140-141].) Why should the elasticity of tax revenue with respect to income influence spending? After all, standard theoretical considerations suggest that public sector size should depend on the variables that determine citizens' demands for public goods and services (e.g., income, demographic characteristics, etc.), and those that determine the supply of public goods and services (e.g., input costs). The fact that tax revenues happen to be elastic or inelastic with respect to income is of no particular significance, according to this story. If, for example, incomes increase so that a highly elastic tax structure produces more revenue than is required to provide the optimal amount of public goods, then the excess revenues should simply be rebated to taxpayers.

One possible explanation is that the association between income elastic revenue systems and government growth is a consequence of "tax structure illusion" on the part of uninformed voters.[1] Suppose that legislators desire to make the public sector as large as possible. In the presence of statutory or constitutional constraints on deficit spending, tax increases are needed to fuel public sector growth. However, legislators realize that the process of enacting tax increases focuses a lot of attention upon themselves, and this may invite a negative reaction from taxpayer/voters who do not wish to see their tax burdens grow larger. On the other hand, the automatic revenue increases generated by an elastic tax schedule (when income is increasing) engender no such attention. As Wagner [1976, p. 87] argues, "Everyone is aware of a consciously enacted tax surcharge; a similar surcharge is enacted every year when income grows under progressive taxation, but many taxpayers remain unconscious of this surcharge."[2]

However, uninformed voters are not required to rationalize a correlation between income elastic tax structures and public sector growth. Such a correlation might reflect the desires of citizens who want the public sector to grow at a proportionately higher rate than their incomes, and regard an income elastic tax system as the most efficient way of achieving this goal. Continual reexamination of budgetary parameters absorbs legislative resources. In effect, an income elastic tax structure routinizes such changes, and hence reduces transactions costs. An interesting special case of this transaction costs view occurs when a majority of voters desires tax rates to increase with income, while a minority does not.[3] Suppose that in the future the minority can thwart the majority's desire for higher tax rates, perhaps because the former dominates the relevant legislative committees. The income elastic structure can be viewed as a way of preventing the minority from using this power to extract special benefits for itself.

Before struggling to determine whether uninformed or informed voter models better explain the relationship between the income elasticity of tax revenues and public sector growth, we should make sure that the relationship actually exists. In an influential paper, Oates [1975] examined the growth in public expenditure of the 50 states from 1960 to 1970 to determine whether states which experienced larger growth had more elastic tax schedules. He found that there was such a relationship in the data, but that it was of modest order.

One problem with Oates's paper and succeeding studies is that very crude measures are used to characterize the income elasticity of tax structures. Specifically, the elasticity of the tax structure is proxied by the proportion of state revenues obtained from income taxation. To the extent that income tax elasticities vary from state to state, such a measure will give misleading estimates. In addition, it fails to take into account that general sales taxes, the other key component of state tax systems, are also heterogeneous. Oates recognizes these facts, and indicates that he is forced to use the potentially unsatisfactory proxy because of the absence of better data.

Recently, we compiled a very careful set of income elasticities for the income and sales tax systems for each state, for every year from 1978 to 1983. (See Feenberg and Rosen [1986].) This work suggests that across states, there is a considerable variation in the elasticity of a particular tax instrument.[4] For example, in 1983, for those states which had individual income tax systems, the elasticities ranged from 1.0 to 2.2, with a mean of 1.54 and a standard deviation of 0.39. When we consider income and sales taxes as a single system, this heterogeneity continues to obtain--the mean elasticity is 1.09, with a standard deviation of 0.26.

In this paper, we take advantage of this unique data set to find out whether or not there really is a relationship between the income elasticity of state revenue systems and public sector growth. Another advantage of these data is that they provide observations on the relevant variables for a <u>series</u> of years. Analysis of such a panel allows us to control for effects of national conditions on state public sector growth, which cannot be done when only the difference between one pair of years is examined.

In Section II we briefly review Oates's analysis, and subsequent studies in this area. Section III describes the models to be estimated. Section IV discusses the data, and Section V presents the results. The main conclusion is that the data do not support the notion that the income elasticity of the tax structure exerts an important independent effect on public sector growth. Section VI concludes with a summary.

II. Previous Work

Oates [1975] conducted the first systematic examination of the relationship between income elasticity of the tax system and public sector growth. He postulates that the change in the level of state per capita general expenditure for state i in year t is a linear function of changes in: (a) a set of socio-economic determinants of public spending (e.g., median family income); (b) per capita federal grants; and (c) the percentage of state-local spending that is undertaken by the state government. He augments this differenced equation with a measure of the income elasticity of the tax structure for each state.

Oates investigates several proxies for the income elasticity of state tax structure: the sum of individual tax receipts as a percentage of the sum of total tax receipts; the sum of corporation tax receipts a percentage of total tax receipts; and the sum of individual and corporate income tax receipts as a percentage of total tax receipts. The general notion is that the higher the proportion of tax receipts generated by income taxes, the higher the income elasticity of the tax system as a whole. When the various measures are entered in the expenditure growth regression, they tend to have positive (but small) and statistically significant coefficients.

Despite the importance of this finding, little effort has been made to confirm or reject it. DiLorenzo [1981] is the only other study we have been able to find which tries to examine the effect of the tax structure's income elasticity upon expenditure growth. His observations are on county governments rather than states. He finds a significant and negative relationship between an Oates-type tax structure characterization and growth in expenditure. DiLorenzo attributes this to the fact that at the county level, Tiebout considerations may result in out-migration from communities that have highly elastic tax schedules.

Several other studies have examined the effect of tax structure upon the level of expenditure (or revenues). (See Craig and Heins [1980], Baker [1983], and Breeden and Hunter [1985].) Such a specification seems curious to us. If income elasticity of the tax system has an effect, the only mechanism we can imagine is one in which changes in income lead to changes in revenue, which lead to changes in spending. Apparently, the reason some authors nevertheless look at levels is the fact that carried to its extreme, the hypothesis that the income elasticity of tax structure affects changes in spending implies that spending can increase without bound. (See Craig and Heins [1980, p. 268].) This observation is valid, but the correct way to account for it is to respecify the equation so that the effect of tax structure on public sector growth may fall as public sector size increases. In any case, like the Oates and DiLorenzo analyses, these studies also use fairly crude measures of income elasticity of the tax structure, and do not follow their cross sections over time.

III. Models

A. The Basic Set-Up

Assume we have data for each of I states over a period of T consecutive years. Let E_{it} be real per capita expenditure for state i in year t.[5] What are the determinants of E_{it}? Previous theoretical and empirical studies have suggested that real per capita income, Y_{it}, and total population, P_{it}, are potentially important variables.[6] If public expenditures are a normal good, E_{it} should vary positively with Y_{it}. If congestion is a factor in the consumption of public goods and services, E_{it} should vary with P_{it}. (See Borcherding and Deacon [1972].) In addition, we consider the state share of direct state-local expenditures, S_{it}, and real per capita grants received by the federal government, G_{it}.[7] Presumably, the fewer the responsibilities of the local sector, the larger will be state expenditure, so E_{it} should vary positively with S_{it}. Grants should also have a positive effect.

Assuming linearity and taking first differences, we can summarize these considerations by writing

$$\Delta E_{it} = \beta_0 + \beta_1 \Delta Y_{it} + \beta_2 \Delta P_{it} + \beta_3 \Delta S_{it} + \beta_4 \Delta G_{it} + v_{it}, \qquad (1)$$

where v_{it} is a random error term.[8] Government expenditure functions are sometimes assumed to be linear in logarithms rather than levels. Our substantive results are unchanged when a logarithmic specification is employed.

Our basic model is equation (1) augmented with two sets of variables. First, for each year we create dichotomous variables, D_t, which take the value 1 in year t, and zero otherwise. (The omitted year is 1983.) These variables control for factors in the national economic and political environment that affect states in the same way. Second, we add a variable EL_{it}, which is the income elasticity of state i's tax structure in year t.[9] According to the hypothesis that states with more elastic tax structures experience higher growth in their public sectors, EL_{it} should appear with a positive sign. Adding these variables to (1), we arrive at the basic equation

$$\Delta E_{it} = \beta_1 \Delta Y_{it} + \beta_2 \Delta P_{it} + \beta_3 \Delta S_{it} + \beta_4 \Delta G_{it} + \beta_5 EL_{it} + \sum_{t=1}^{T-1} \beta_{5+t} D_t + v_{it}. \tag{2}$$

B. Other Issues

1. Computation of EL. As noted earlier, Oates relied on the proportion of all tax revenues collected by income taxes as his measure of revenue elasticity. Implicitly, this assumes that all state income taxes have about the same elasticity, as do other components of the state revenue systems. In previous work, we undertook a detailed analysis of the personal income and sales tax systems for each of the fifty states over the period 1978-1983. (See Feenberg and Rosen [1986].) The study was based on a stratified random sample of 25,000 Federal Income Tax returns. The tax return data included the state of each taxpayer. We programmed each year's major income and sales tax rules. With this information we were able to estimate state personal income and sales tax liabilities for each taxpaying unit. It was then straightforward to find the elasticities of the income and sales tax systems--increase each unit's income by one percent, and find the overall implied percentage increase in tax liability.[10]

Suppose we call ε the elasticity of the combined income-sales tax system, and μ the proportion of all revenues attributable to income and sales taxes. (For readability, we suppress state and time subscripts.) Let ε_o be the elasticity of the "other" components of the state tax system. Then by definition,

$$EL = \mu \varepsilon + (1-\mu) \varepsilon_o. \tag{3}$$

Now, while we know how ε varies across states and over time, we did not have the data required to compute ε_o. Neither have we been able to find from other sources comprehensive and consistent estimates of this variable. We therefore assume that ε_o is a constant $\bar{\varepsilon}_o$. Our guess is that this assumption is unlikely to do serious damage. On average, general sales and income taxes account for more than half of state tax revenues. The fact that the "other" component may vary across states is unlikely to be very important for assessing the importance of the elasticity of the system as a whole.[11]

Substituting (3) into (2) we find

$$\Delta E_{it} = \beta_1 \Delta Y_{it} + \beta_2 \Delta P_{it} + \beta_3 \Delta S_{it} + \beta_4 \Delta G_{it} + \beta_5[\mu_{it}\varepsilon_{it}] + \beta_5 \bar{\varepsilon}_o[1-\mu_{it}] + \sum_{t=1}^{T-1} \beta_{5+t} D_t + v_{it}. \quad (4)$$

Note that dividing the coefficient on $[1-\mu_{it}]$ by that on $[\mu_{it}\varepsilon_{it}]$ gives us an estimate of $\bar{\varepsilon}_o$.

For the sake of comparison, we also estimated (2) using Oates's proxy for of the elasticity of the tax system, μ_p, the percentage of tax revenues collected by the personal income tax. Here, we simply set $EL_{it} = \mu_{pit}$, and substitute into (2).

2. Interaction of elasticity with size of public sector. Obviously, the public sector cannot increase without bound. Hence, β_5 of equation (2) cannot be positive for all sizes of the public sector. We therefore hypothesize that the effect of the tax structure's income elasticity on public sector growth depends negatively on the size of the public sector relative to income.[12] Specifically, we write β_5 of equation (4) as

$$\beta_5 = \delta_0 + \delta_1 \frac{E_{it}}{Y_{it}} . \quad (5)$$

If the hypothesis is correct, we expect $\delta_0 > 0$ and $\delta_1 < 0$.

Substituting (5) into (4) we find

$$\Delta E_{it} = \beta_1 \Delta Y_{it} + \beta_2 \Delta P_{it} + \beta_3 \Delta S_{it} + \beta_4 G_{it}$$

$$+ \delta_0 [\mu_{it} \varepsilon_{it} + \bar{\varepsilon}_o (1-\mu_{it})] + \delta_1 \{\frac{E_{it}}{Y_{it}} [\mu_{it} \varepsilon_{it} + \bar{\varepsilon}_o (1-\mu_{it})]\}$$

$$+ \sum_{t=1}^{T-1} \beta_{5+t} D_t + v_{it}. \qquad (6)$$

Note that equation (6) is nonlinear in the parameter $\bar{\varepsilon}_o$. The simplest way to deal with this fact econometrically is to perform a grid search over $\bar{\varepsilon}_o$, and find the value that minimizes the sum of squared residuals.

3. Correlation between right-hand side variables and the error term. Oates pointed out that the share of state spending in state-local spending (S_{it}) and federal grants (G_{it}) may be endogenous. In addition, the tax structure itself may be correlated with the error term. To investigate this endogeneity issue, we execute the specification test suggested by Wu [1973]. The test requires a set of predetermined variables for use as instrumental variables. Following standard practice with panel data, we employ the current and lagged values of the predetermined variables, and the lagged values of the endogenous variables. Of course, if the error term v_{it} is autocorrelated, use of lagged endogenous variables will lead to inconsistent estimates. We therefore also obtained estimates with the lagged endogenous variables omitted from the set of instrumental variables.

4. Interaction with nominal income. Oates's [1975] original specification included the tax structure variable by itself on the right hand side. Equations (4) and (6) are in that spirit. Perhaps, however, the income elasticity of the tax structure should be interacted with the change in

nominal income, ΔY^n. After all, if nominal income does not change, then why should the elasticity of tax revenues with respect to nominal income matter? Indeed, if ΔY^n negative, then if elasticity matters, presumably real expenditures will fall more in states with highly elastic tax systems than in those with inelastic systems, <u>ceteris paribus</u>.[13] These considerations suggest that in equation (2), the elasticity term EL_{it} should be multiplied by the change in nominal income. Given identity (3), this implies that instead of equation (4), one should estimate

$$\Delta E_{it} = \beta_1 \Delta Y_{it} + \beta_2 P_{it} + \beta_3 \Delta S_{it} + \beta_4 \Delta G_{it} + \beta_5 [\mu_{it} \varepsilon_{it} \Delta Y^n_{it}] + \beta_5 \bar{\varepsilon}_o [(1-\mu_{it}) \Delta Y^n_{it}] + \sum_{t=1}^{T-1} \beta_{5+t} D_t + v_{it}. \quad (7)$$

Similarly, the analogue to equation (6) is

$$\Delta E_{it} = \beta_1 \Delta Y_{it} + \beta_2 \Delta P_{it} + \beta_3 \Delta S_{it} + \beta_4 \Delta G_{it} + \delta_0 \{[\mu_{it} \varepsilon_{it} + \bar{\varepsilon}_o (1-\mu_{it})] \Delta Y^n_{it}\} + \delta_1 \{\frac{E_{it}}{Y_{it}} [\mu_{it} \varepsilon_{it} + \bar{\varepsilon}_o (1-\mu_{it})] \Delta Y^n_{it}\} + \sum_{t=1}^{T-1} \beta_{5+t} D_t + v_{it}. \quad (8)$$

5. <u>Tax and expenditure limitations.</u> During our sample period, 19 states had either constitutional or statutory limits on the growth of expenditures or revenues.[14] (See Kenyon and Benker [1984.) Perhaps the failure to control for such rules might bias the coefficients on the tax structure variables. We therefore estimated variants of the basic equation including a dichotomous variable which controlled for the presence of fiscal limitation measures.

IV. <u>Data</u>

Preliminary analysis of the data indicated that because of extraordinarily heavy reliance on severance fees associated with mineral and oil extraction, Alaska's system of public finance was sui generis. That state was therefore excluded from our sample, leaving us with the remaining 49, for the period 1978-83. The data sources, and how dollar values were converted to real per capita terms, are described in the Appendix.

The sample means and standard deviations of the key variables are reported in Table 1. The outstanding features of the table are: (1) on average, real magnitudes did not change much during 1978-83; but (2) some states experienced quite large changes, as evidenced by the relatively large standard deviations. Thus, for example, the average change in real per capita public sector spending is only \$0.25, but its standard deviation is \$39.2.

V. Results

A. Estimating the Basic Model

Although ordinary least squares estimation may be inappropriate, it provides a good starting point, so OLS coefficients for the various models are reported in Table 2. Column (1) shows the estimates of equation (4). Before examining the tax structure variables, we note that the other variables have expected signs and magnitudes. Increases in per capita income and per capita grants have positive effects on per capita spending changes, and are statistically significant at conventional levels. Evaluated at the means, the elasticity of expenditures with respect to income is 0.272; with respect to grants it is 0.205. Increases in the state share of state-local spending increase ΔE_{it}, but the coefficient is not statistically significant; similarly, increases in population over the range in our sample appear to exert no important effect on changes in public sector spending. The variables controlling for "year effects" indicate a rough downward trend in per capita spending during our sample period.

We now turn to the coefficients of the tax structure variables. These results are not encouraging for the hypothesis that more elastic tax structures are associated with larger growth in government expenditure. In column (1), the parameter β_5, which multiplies the elasticity of the tax system is negative, although it exceeds its standard error only by a factor of 1.44. In addition, comparison of the coefficients on $(1-\mu_{it})$ and $\mu_{it}\varepsilon_{it}$ implies that the income elasticity of the "other" component of the tax system is about -8.9. This seems absurd. However, this estimate of $\bar{\varepsilon}_o$ is quite imprecise; we used an approximation for the standard error of the ratio of two normal variables[15] and found that its standard error is 7.67.

As suggested earlier, however, perhaps states with highly income elastic tax structures have experienced large expenditure growth in the past, and now have large public sectors, which are growing slowly. Column (2) of Table 2 reports the results for specification (6), which allows interaction between the income elasticity of the tax system and the ratio of public sector spending to income. The coefficient multiplying $\mu_{it}\varepsilon_{it}$, δ_0, is still negative, but now it exceeds its standard error by a factor of 3. The value of $\bar{\varepsilon}_o$, found by a one-dimensional grid search, is 0.72. The ordinary least squares results in columns (1) and (2) are simply not supportive of the notion that more elastic revenue structures are associated with higher public sector growth.

Perhaps that these results are an artifact of our particular method of characterizing the tax structure elasticity. To examine this possibility, we show in column (3) the results when equation (2) is estimated with the income elasticity proxied by μ_{pit}, the percentage of revenues raised by the personal income tax. Recall that this is one of the variables used by Oates in his analysis of changes between 1960 and 1970.[16] Column (4) contains a term interacting μ_{pit} with E_{it}/Y_{it}. Strikingly, even with Oates's measure there is no support for a positive relationship between income elasticity and public sector growth. The coefficients on μ_{pit} are negative both in the presence of the interaction term and in its absence.

The estimates in Table 2 may be inconsistent due to correlation between some of the right hand side variables and the error term. In light of this possibility, we applied the specification test suggested by Wu [1973]. The outcome of the test was as follows: G_{it} and S_{it} do not appear to be correlated with the error term, but the tax structure variables do appear to be correlated, at least in some variants of the basic model.[17] It is therefore more appropriate to employ two stage least squares, treating the tax structure variables as endogenous.[18]

The results are reported in Table 3. Consider first the regressions using our estimates of income elasticity of the tax structure, which are in columns (1) and (2). With respect to the view that more elastic tax systems lead to large growth in public expenditure, the outcome in column (1) is still "wrong" -- the coefficient multiplying $\mu_{it}\varepsilon_{it}$ is negative. Things in column (2) are somewhat more promising for the hypothesis -- when the interaction term is included, the coefficient multiplying the elasticity of the tax structure, δ_0, is positive, and the coefficient multiplying the interaction term, δ_1, is negative. But both δ_0 and δ_1 are estimated very imprecisely.[19] A test of the joint significance of the tax structure variables yields a test statistic $F(2, 234) = 0.229$, which is significant only at the 0.80 level.

When we examine the results using Oates's proxy in columns (3) and (4), the main result that emerges is that if the interaction term is included and two stage least squares is applied, then the higher the proportion of revenues raised by the personal income tax, the greater the growth in government expenditure, ceteris paribus. Without the interaction term, the coefficient on the tax structure variable is negative. With the interaction term, the parameters have the "right" sign. Individually, they are insignificant; jointly, they are barely significant at conventional levels. ($F(2,234) = 3.23$.)

So far our discussion of the parameter estimates has been mostly in qualitative terms. Are the numbers quantitatively important? Consider the point estimates in column (2) of Table 3, ignoring for the moment that they are statistically insignificant. Suppose that state spending growth is governed by those coefficients. Consider state i for which $\mu_{it} = 0.50$, $\varepsilon_{it} = 1.0$, and $E_{it}/Y_{it} = 0.10$. Now consider state j which is identical except that its tax structure has a much higher income elasticity, $\varepsilon_{jt} = 1.25$. By how much will their growths in public expenditure differ?[20] According to the coefficients in column (2), the answer is 8.686 x 0.5 x 0.25 - 58.53 x 0.10 x 0.5 x 0.25, or $0.35. Thus, the coefficients of the tax structure variables are not only statistically insignificant; they are inconsequential in magnitude as well.

B. Further Results

We next consider the outcomes when several changes are made in the basic model's specification or its method of estimation. The various experiments produced only minor changes in the estimated coefficients on the income, population, revenue sharing, and state share of state and local expenditure variables. To conserve space, we report only the results for the tax structure variables and any other variables that may be of particular interest for a given specification.

1. Interactions with the change in nominal income. As the discussion

surrounding equations (7) and (8) indicated, a proper test of the hypothesis that tax structure elasticity matters may require multiplying EL by the change in nominal income, ΔY^n. In Table 4, row (1) reports the OLS estimate of β_5 from equation (7); row (2) has OLS estimates of δ_0 and δ_1 from equation (8). The corresponding 2SLS estimates are in rows (3) and (4). Apparently, incorporating nominal income changes into the analysis does not save the hypothesis. In rows (1) and (3) (which exclude E/Y) β_5 is positive, but very small in magnitude and estimated imprecisely. Turning now to the specifications that include E/Y, the OLS estimates of δ_0 and δ_1 in row (2) have the "wrong" signs, and the 2SLS estimates in row (4) are small in absolute value and statistically insignificant. The tax structure variables in row (4) are also jointly insignificant; the test statistic for their exclusion, $F(2, 234)$, is 0.095, which is significant only at the 0.91 level.

2. Tax and expenditure limitations. Several states introduced tax or expenditure limitation (TEL) rules during our sample period. Using information in Kenyon and Benker [1984, p. 437], we created the variable L_{it}, which takes the value of 1 if there was no tax or expenditure limitation in state i during year t, and zero otherwise. The results when the basic models (equations (4) and (6)) are augmented with L_{it} and estimated with two stage least squares are presented in rows (5) and (6) of Table 4. Two main results emerge:

a. Comparing rows (5) and (6) to columns (1) and (2) in Table 3, we find that controlling for TEL rules does not alter the basic result of a weak or nonexistent impact of tax structure on the growth of state expenditures. The coefficients barely change. (When equations using Oates's proxy are augmented with L_{it}, the results are similarly unchanged; these are not reported here.)

b. TEL rules exert virtually no impact on the growth in real expenditure, ceteris paribus. The coefficients on L_{it} are small both in absolute value and relative to their standard errors. Kenyon and Benker [1984] arrived at the same conclusion on the basis of a somewhat more informal analysis of the data. They provide an interesting discussion about the apparent inefficacy of these measures. One possible explanation is that on average, TEL's cover only 60 percent of state revenues or expenditures. Another is that sluggish growth in revenues during our sample period kept some states below their statutory limits. In any case, we do not regard these results as "proof" of the irrelevance of TEL's. The important point is that the apparent unimportance of tax structures is not a consequence of ignoring them.

3. Alternative instrumental variables. To the extent that the error term in our equation is autocorrelated, the use of lagged endogenous variables as instruments will lead to inconsistent estimates. We therefore repeated our two stage least squares procedure using only the current and lagged values of the predetermined variables as instruments. The results are presented in rows (7) and (8), which correspond to columns (1) and (2) of Table 3. These estimates suggest that if there was a bias operating in Table 3, it was in the direction of favoring the hypothesis that tax structure matters.

V. Summary

Does the revenue elasticity of tax structure with respect to income exert an independent effect on the growth of public spending? To answer this question, we examined the annual growth of real state per capita expenditure during the period 1978-83. Our main finding is that there is no evidence that more income elastic tax structures are associated with higher rates of public sector growth, ceteris paribus. This result is robust with respect to changes in how tax structures are characterized, changes in the choice of right hand side variables, and changes in estimation technique. If governments really are out to expand the public sector beyond the size desired by their citizens, they must be using some other mechanism.

APPENDIX

This Appendix documents the sources of data employed in the statistical analysis.

All figures on state expenditures and revenues (including grants) are from various editions of U.S. Department of Commerce, State Government Finances. Data for 1977 are found in the 1978 edition, 1978 data in the 1979 edition, etc. Population data for 1977 through 1979 are in the 1979 through 1981 editions of U.S. Department of Commerce, State Government Tax Collections. The 1980 through 1983 population figures are from Current Population Report, Series P-25, #944, "Estimates of the Population of States 1980-1983," January, 1984.

Total personal income by states for 1977-83 is from Department of Commerce, Survey of Current Business, August, 1984.

The elasticities of the state tax structures are from Feenberg and Rosen [1986]. Nominal dollar values for income were converted into 1977 terms by use of regional price deflators found in U.S. Department of Commerce [1982]. The price deflator for state and local public goods is from various editions of the U.S. Department of Commerce, Survey of Current Business. (September 1981, July 1983 and July 1984.)

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Table 1

Means and Standard Deviations of the Variables

real state government expenditure per capita (E_{it})	804 (161)
change in E_{it} (ΔE_{it})	\$ 0.253 (39.2)
real grants from federal government per capita (G_{it})	\$ 226 (59.1)
change in G_{it} (ΔG_{it})	\$ -7.09 (19.2)
state share in state-local spending (S_{it})	44.6 (9.40)
change in S_{it} (ΔS_{it})	0.140 (4.416)
real personal income per capita (Y_{it})	\$7038 (906)
change in Y_{it} (ΔY_{it})	\$ -10.0 (280)
population* (P_{it})	4540 thousand (4640)
change in P_{it}* (ΔP_{it})	59.8 thousand (129)
elasticity of combined personal income-sales tax system (ε_{it}) times income-sales tax share (μ_{it})	0.753 (0.915)
percentage of all taxes due to personal income tax (μ_{pit})	23.9 (14.6)

*Excluding armed forces overseas

Table 2

Parameter Estimates*
(Ordinary Least Squares)

	(1)	(2)	(3)	(4)
Constant	-19.40 (9.014)	7.696 (7.971)	-3.123 (6.474)	-3.048 (6.481)
β_1 (ΔY_{it})	0.0311 (0.011)	0.0371 (0.0110)	0.0380 (0.0104)	0.0384 (0.0104)
β_2 (ΔP_{it})	-0.00310 (0.0159)	0.004903 (0.01576)	-0.00347 (0.0161)	-0.002635 (0.0162)
B_3 (ΔG_{it})	0.7308 (0.1162)	0.7424 (0.1151)	0.7389 (0.1160)	0.7494 (0.1171)
β_4 ($\Delta \dot{S}_{it}$)	0.5254 (0.4829)	0.6769 (0.4837)	0.4931 (0.4824)	0.4870 (0.4829)
D78	28.47 (7.630)	30.86 (7.595)	30.13 (7.576)	30.44 (7.595)
D79	25.59 (9.982)	26.31 (9.899)	30.44 (9.704)	30.46 (9.71)
D80	20.76 (6.98)	19.12 (6.937)	21.60 (6.970)	21.32 (6.987)
D81	22.82 (7.98)	21.88 (7.938)	25.03 (7.904)	25.199 (7.915)
D82	-10.64 (7.826)	-10.58 (7.769)	- 9.190 (7.819)	-8.899 (7.837)
β_5 ($\mu_{it}\varepsilon_{it}$)	-3.341 (2.217)			
β_5 ($\varepsilon_o(1-\mu_{it})$)	29.89 (14.86)			
δ_0		-41.12 (13.08)		
δ_1		213.3 (71.79)		
$\bar{\varepsilon}_o$	-8.9	0.72		
μ_{pit}			-0.2971 (0.1366)	-0.6285 (0.4825)
$(E_{it}/Y_{it})\mu_{pit}$				2.7844 (3.888)
R^2	0.29	.30	0.29	0.29

*Numbers in parentheses are standard errors.

Table 3

Parameter Estimates*
(Two Stage Least Squares)

	(1)	(2)	(3)	(4)
Constant	14.63 (11.11)	19.48 (5.952)	27.12 (6.266)	25.51 (6.448)
β_1 (ΔY_{it})	0.0198 (0.0179)	0.03916 (0.01775)	0.04264 (0.01102)	0.04037 (0.01131)
β_2 (ΔP_{it})	-0.01367 (0.0176)	-0.003386 (0.01752)	-0.01141 (0.01689)	-0.01263 (0.01722)
β_3 (ΔG_{it})	0.7064 (0.1328)	0.7421 (0.1312)	0.7276 (0.1280)	0.6803 (0.1335)
β_4 (ΔS_{it})	0.5425 (0.5204)	0.2988 (0.5188)	0.3763 (0.4934)	0.3937 (0.5029)
D79	-6.564 (10.24)	0.9703 (9.878)	2.977 (8.389)	3.816 (8.564)
D80	-5.947 (7.599)	-8.808 (7.640)	-8.893 (7.163)	-7.110 (7.377)
D81	-6.415 (7.226)	-5.227 (7.139)	-5.074 (6.984)	-4.876 (7.118)
D82	-37.58 (7.409)	-39.62 (7.37)	-38.91 (7.143)	-38.71 (7.28)
β_5 $(\mu_{it}\varepsilon_{it})$	-12.18 (8.165)			
β_5 $(\bar{\varepsilon}_o(1-\mu_{it}))$	32.94 (16.82)			
δ_0		8.6864 (21.08)		
δ_1		-58.53 (134.5)		
$\bar{\varepsilon}_o$	-2.74	-0.98		
μ_{pit}			-0.2948 (0.1501)	0.6388 (0.5732)
$(E_{it}/Y_{it})\mu_{pit}$				-7.752 (4.606)

*Numbers in parentheses are standard errors.

Table 4

Further Results*

		β_5	δ_0	δ_1	L_{it}
Interactions with ΔY^n**					
(1)	[eq. (7), OLS]	1.059 (1.735)			
(2)	[(eq. (8), OLS]		-34.75 (14.78)	200.8 (80.96)	
(3)	[eq. (7), 2SLS]	9.128 (5.795)			
(4)	[eq. (8), 2SLS]		22.49 (34.77)	-122.4 (200.4)	
TEL					
(5)	[eq. (4) + L_{it}, 2SLS]	-12.61 (8.278)			2.686 (5.612)
(6)	[eq. (6) + L_{it}, 2SLS]		9.674 (21.29)	-67.11 (136.6)	3.150 (5.560)
Alternative Instrumental Variables					
(7)	[eq. (4), 2SLS]	-11.37 (10.65)			
(8)	[eq. (6), 2SLS]		-31.11 (49.05)	88.73 (313.7)	

*Numbers in parentheses are standard errors.

**In rows (1) through (4), each figure is multiplied by 10^3 to enhance readibility.

Footnotes

[1]For a discussion of other types of fiscal illusion see Oates [1985]. One possibility is that the more <u>complex</u> the tax structure, the more difficult it is for taxpayers to figure out the tax burden of public programs. As Oates observes, however, it is far from obvious how to measure tax system complexity. The Herfindahl index of tax instrument concentration is often used, but it does not correspond to intuitive notions of what "complexity" is. In any case, we believe that inability to control for complexity will not seriously bias our estimates of the impact of elasticity on tax structure.

[2]Apparently Wagner believes that if citizens understood the fiscal system, they could control it. Hence, his view is less extreme than Brennan and Buchanan's [1980, p. 35]: "The citizenry has no effective control over government, once established, beyond the constraints that are imposed constitutionally."

[3]We are grateful to a referee for pointing out this possibility to us.

[4]Moreover, the elasticity of the income tax is quite different from that of the general sales tax. Of the states with income taxes, the minimum elasticity in 1983 was 1.0. On the other hand, the maximum sales tax elasticity was 0.73.

[5]It could be argued that our focus should be state and local expenditure combined. There are two reasons for concentrating on state expenditure: (1) the state is a single budgetary unit; and (2) we do not have good information on state by state variation in the income elasticity of the local property tax.

[6]Because voter participation rates vary positively with income, and the income distribution is positively skewed, majority voting may be indicative of the preferences of the voter with mean rather than median income. (See Atkinson and Stiglitz [1980, p. 217].)

[7]Inman [1979] and others have noted that matching grants have price effects, so that strictly speaking, they should not be combined with lump sum grants to form a single "grants variable." In light of this problem, the coefficient on grants must be interpreted with caution.

[8]Equation (1) can be viewed as a relation in the levels which has been differenced in order to remove a fixed effect. The possibility of sluggishness in changing fiscal behavior could be incorporated by using a stock adjustment model, which amounts to including the lagged dependent variable on the right-hand side. When we tested such a model, we discovered that the coefficient on the lagged dependent variables was insignificant, and that its inclusion had little effect on the other coefficients. While we do not regard this as "proof" that intertemporal considerations are unimportant, it does suggest that allowing for dynamics, at least in a simple way, does not affect our substantive conclusions.

[9]We also experimented with specifications in which the lagged value of EL was employed, and the outcome did not change appreciably.

[10]Note that the relevant elasticity is that of nominal tax revenue with respect to nominal income. Hence, for a completely indexed system, if all prices and nominal incomes increased by the same percentage, the elasticity would be one.

[11]In one set of experiments we divided the portion of revenues due neither to personal income nor general sales taxes into corporate income tax and non-corporate income tax components. Hence, instead of (3) we have $EL = \mu\varepsilon + \mu_c\varepsilon_c + (1-\mu-\mu_c)\varepsilon_{nc}$, where the c subscript denotes corporate, the nc subscript denotes noncorporate, and the other variables are defined analogously to those in (3). This change in specification had no effect on our substantive conclusions.

[12]In a somewhat different context, Courant et al. [1979] present a formal model of the forces that would tend to put limits on the process of government growth.

[13]The change in nominal per capita income was negative in only 4 percent of our observations. We experimented with a specification which allowed an asymmetric response in those cases, but found that it did not add to the explanatory power of the equation. Perhaps that is because there were so few of these cases.

[14]However, Nevada and Rhode Island had nonbinding limits, and Utah's limit was never implemented. For our purposes, these states are classified as not having limitations.

[15]Set $r = y/x$. Then $\text{var}(r) \simeq (1/x^2)\,[\text{var}(y) + r^2\text{var}(x) - 2r\,\text{cov}(y,x)]$. See Kish [1967, p. 207].

[16]We also employed another of Oates's proxies, the proportion of total revenue comprised of corporate and personal income taxes. The results are substantially unchanged.

[17]The instruments used in the test were the contemporaneous values of the predetermined variables, and the lagged values of all the variables. These are the same instruments used in the two stage least squares regressions reported later. For the specification (6), the joint test of whether the tax structure variables are uncorrelated with v_{it} yields $F(2,232) = 3.54$, which is significant at the 0.031 level. In the model without interactions, the F statistic is only 0.956, which is not significant at conventional levels. However, for the sake of completeness, we estimated both specifications by two stage least squares.

[18]In comparing the results to those in Table 2, note that in Table 3 one observation is "lost" due to the fact that lagged values are used as instruments. However, when OLS is applied to the shortened sample, the results are very similar to those in Table 2.

[19]One wonders whether the negative sign on the interaction term has nothing to do with tax structure issues, and merely reflects the fact that already large public sectors tend to grow slowly. To investigate this possibility, we augmented equation (4) with the variable E_{it}/Y_{it}. Under both OLS and 2SLS,

the coefficient on E_{it}/Y_{it} was statistically insignificant, and the coefficients on the tax structure variables differed little from their counterparts in Tables 3 and 4.

[20]Note that in this particular conceptual experiment, the value of $\bar{\varepsilon}_o$ is irrelevant.