DEMOGRAPHICS, COMPETITION, AND STATE TAX PROGRESSIVITY*

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INTRODUCTION

THEORETICAL EXPLANATIONS OF DIFFERENCES in tax structure across and within nations has been the subject of decades of research in economics. Whether redistribution can take place through subnational policies and documenting the driving forces behind political decisions on tax structure represent two areas characterized by considerable research but unclear answers. The determinants of tax structure and progressivity at the state level in the United States has been the subject of a small number of empirical papers, but the results have been quite mixed (e.g., Chernick, 2005; Fletcher and Murray, 2006; Fletcher and Murray, forthcoming; Bahl et al., 2002). Specifically, many population characteristics such as the share of elderly and poverty households that might be predicted to influence tax decisions in standard models of political economy are often found to be only weakly related, if related at all, to tax structure outcomes. These mixed results are puzzling and consistent across measures of progressivity and specific disaggregated provisions within tax structures. Spatial econometric techniques have also been used to examine potential tax competition in sales and income tax structure, but again the results have been mixed. Some research finds evidence of positive spatial dependence suggesting yardstick competition (Fletcher and Murray, 2006 in the context of the sales tax), other research points to negative dependence or so called income tax haven effects (Chernick, 2005; Hettich and Winer, 1999), while still other research finds no evidence of spatial influences on the income tax (Fletcher and Murray, 2006b).

The purpose of this paper is to reexamine the determinants of state income tax progressivity. We are particularly interested in clarifying the influence of demographic features and tax competition on the progressivity of state income taxes. Standard spatial regression techniques are used to examine evidence of negative spatial correlation in progressivity in adjacent states—the so called "tax haven effect" (Chernick, 2005). We also examine whether the relationships between state characteristics and progressivity vary across space using the recently developed geographically weighted regression (GWR) technique. Finally, consideration is given to both structural income tax provisions and progressivity indexes, as well as their changes over time.

BACKGROUND

A progressive tax system suggests the intent to redistribute income. If this is in fact the goal, one would expect the degree of progressivity to be affected by characteristics of the population (like income distribution and socio-demographics), political structure (e.g., party affiliation), tastes, and perhaps the redistributive policy decisions of other jurisdictions. The small empirical literature that exists offers weak and inconsistent evidence on the role that these factors play in affecting state income tax structure choice and tax system progressivity. Certainly some of this inconsistency is due to differences in data and methodology. For example, Bahl et al. (2002) look at factors affecting the degree of reliance on the income tax, Morgan (1994) looks at progressivity indexes and Fletcher and Murray (forthcoming) consider specific structural features of state income tax systems like the top bracket rate. But the puzzles, inconsistencies and unintuitive results seem to go beyond differences in methodology.

Bahl et al. (2002) find that more poverty households increase income tax reliance. But neither Chernick (1992) nor Morgan (1994) find that poverty households affect the degree of progressivity; Fletcher and Murray (forthcoming) find that more poverty households actually reduce the likelihood of a state earned income tax credit (EITC) and lower the top bracket rate, counter to what one might expect. Bahl et al. (2002) also find that a larger black population means less reliance on the income tax while Fletcher and Murray (forthcoming) show a positive association between

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blacks and the income tax threshold. Chernick (2005) finds that the share of young people has no impact on progressivity and Fletcher and Murray (forthcoming) find that a larger youth population is associated with a lower child exemption value. Finally, Chernick (2005) finds that only in one-of-five cases does income distribution affect progressivity. Fletcher and Murray (forthcoming) find that income inequality lowers the top bracket rate, while at the same time increasing the exemption value and the income threshold.

The role of political factors in affecting progressivity is also unclear. For example, Chernick (2005) finds that republican dominance of both the legislature and statehouse tends to reduce progressivity, but a democratic governor has no affect; Morgan (1994) finds little support for political factors influencing progressivity. Fletcher and Murray (forthcoming) show that single party dominance is associated with the number of tax brackets, the top bracket rate, a lower income threshold and the presence of an exemption for the handicapped. And like Chernick (2005), democratic governors have no affect on structural provisions.

A final consideration is the potential for yardstick competition to affect the degree of progressivity. Chernick (2005) and Hettich and Winer (1999) both produce evidence of negative interstate responses, in the former case for tax progressivity and in the latter case for income tax reliance. In each of these cases a tax haven interpretation is applied to the results. But Fletcher and Murray (forthcoming), using the tools of spatial econometrics, find no evidence of interstate competition in their examination of structural income tax provisions like EITCs or top bracket rates.

In Fletcher and Murray (2006), the empirical work was motivated by several factors, including the issues noted previously. But the use of structural income tax provisions in lieu of progressivity indices and tax reliance measures, along with applications of spatial econometrics, raised as many questions as were answered. Here we take the analysis in several different directions. First, we make use of composite state progressivity indexes like those used by Chernick (2005) and Morgan (1994) and apply regressors similar to those used in our earlier work. Second, we look at changes in progressivity across time, alternately using progressivity indexes and specific structural provisions. Third, we use standard spatial autoregressive (SAR) models, as well as less well known GWR models, to help clarify the role of yardstick competition in affecting income tax structure choices.

METHODOLOGY

The conceptual model that underlies the empirics is that of Hettich and Winer (1999), where politicians seek to maximize votes by tailoring the tax system to the benefit of specific taxpayer groups. The choice to pursue progressivity will generate votes from low-income people who receive tax relief, as well as those with tastes for tax redistribution; financing income tax progressivity (alone) requires higher-income tax burdens on middle- and/or upper-income taxpayers.

Several regression techniques are used to examine the determinants of progressivity across states. In addition to standard OLS and OLS with state fixed effects, we use SAR and GWR models as noted previously. SAR models are used to detect potential strategic interaction in state progressivity choices (see Anselin, 1988 for further discussion of the models). In matrix form, the SAR model can be written as:

$$\textbf{(1)} \quad y = \rho W y + X\theta + \varepsilon,$$

where W is a spatial weights matrix assumed by the econometrician, and ρ and θ are unknown parameters to be estimated. These weights define the states (neighbors) for which policy outcomes are believed to affect progressivity choices. Contiguity is typically assumed when assigning weights. This makes considerable sense when looking at progressivity choices as voters and politicians in one state can be expected to look closely to the behavior of adjacent states when evaluating these outcomes.[1] Under the contiguity scheme, ω_{ij} (an element of W) equals one for jurisdictions j that share a border with state i and equals zero for all other jurisdictions. By convention, the weights are normalized so that their sums equal one for each individual state.

We also use GWR analysis to examine the potential heterogeneity in relationships between population characteristics and tax progressivity. GWR allows the relationships between dependent and independent variables to vary across geographic space in the context of regression analysis. Allowing this type of flexibility in the analysis of the determinants of tax structure might uncover relationships in the data that have previously been

masked by focusing on "average" correlations across the nation. This type of analysis might also be able to connect the current set of mixed results that indicate that specific groups do not seem to matter for the setting of tax policy—it may be that specific groups do indeed matter but their importance is magnified in some parts of the country and diminished or nonexistent in other parts.

The GWR specification is quite similar to the standard OLS regression framework:

$$\textbf{(2)} \quad y_i = \beta_0 + \sum_k \beta_k x_{ik} + \varepsilon_i ,$$

where the outcome of interest for observation *i* is regressed on a vector of covariates.

The GWR equivalent is specified as:

$$\textbf{(3)} \quad y_i = \beta_0(u_i, v_i) + \sum_k \beta_k(u_i, v_i) x_{ik} + \varepsilon_i ,$$

where (u,v) specifies the location of each observation (e.g., longitude, latitude) and the β coefficients are now functions of the locations. This specification allows spatial heterogeneity of the parameters.[2] It is important to note that with the GWR specification, a set of estimated beta coefficients are produced for each observation.[3] That is, the number of weighted regressions that are estimated is equal to the number of observations, 48 regressions for 48 states in our case, with 48 sets of regression coefficients. In each regression, the focal observation is assigned highest weight, and its neighbors are assigned higher weights than its non-neighbors. These regression coefficients for each observation can then be plotted on a map in order to examine the variation in the estimated relationships across space.

DATA

We extend our previous work by using data drawn from the progressivity indexes developed by Citizens for Tax Justice (CTJ) for the 1995 data and Institute for Taxation and Economic Policy for the 2002[4] data that are similar to those used by Chernick (2005). We are not able to replicate Chernick exactly as we were not able to acquire the underlying data from CTJ. The measure of progressivity used here is the ratio of the share of the state and local tax burden for those in the bottom 75 percent of the top quintile relative to the burden in the bottom quintile of the income distribution. This measure is highly correlated with similar measures. For example, the simple correlation coefficient between our chosen measure and the ratio of burdens for the top 1 percent relative to the bottom quintile is 0.92.

Structural income tax provisions for 2003 that were used in Fletcher and Murray (forthcoming) are reexamined, augmented with structural provisions data for 1995. A primary focus will be analysis of the factors that are associated with changes in structural provisions that affect progressivity between 1995 and 2003.

An array of data is used to explain the tax policy choices of the states. Descriptive statistics are reported in Table 1. As can be seen from the table, we rely on variables that capture the size of important demographic groups (like the share of population in poverty) that will be affected by state tax structure choices, as well data on political structure. A variety of other important controls are included as well, such as the propensity to deduct state and local taxes under the federal income tax. The ratio of highest per capita county income to lowest per capita county income in a state is used to capture the income distribution. Net migration should reduce progressivity to the extent higher-income households are the movers. Voting participation rates are included to capture citizen involvement in the political process. The maximum monthly welfare benefit for a family of four could capture tastes for redistribution; alternatively, states may use the spending side of the budget as a substitute for the tax side of the budget in targeting equity relief to households. Finally, we include the time since adoption of the state income tax and the state sales tax to account for long-term tastes and inertia in the setting of tax policy. We have experimented with a variety of other regressors that had little impact on our empirical models, which is an important conclusion of our analysis. All regressors are lagged one year in the models.

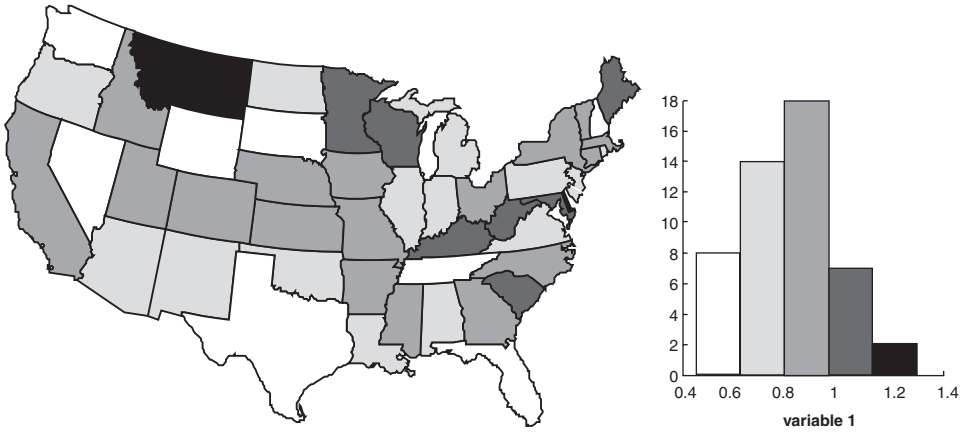
RESULTS

Before presenting the regression results, we present maps of the progressivity index across the United States (see Figure 1).[5] The "tax haven" phenomenon documented by Chernick (2005) is clearly visible for many of the areas of the United States, where states with low progressivity values are adjacent to states with high progressivity values. Pair-wise examples include Tennessee and Kentucky, Montana and Wyoming, South Dakota and Minnesota, Maine and New Hampshire. But as we discuss later, out empirical findings offer

Table 1
Summary Statistics for the 48 Lower U.S. States: 1994-2002

Variable	*Year*	*Mean*	*Std. Dev.*	*Min*	*Max*
Progressivity Index	2002	0.82	0.18	0.45	1.30
Progressivity Index	Difference	0.05	0.09	-0.21	0.24
Top Bracket	2000	5.9	3.0	0	12
Top Bracket	Difference	0.1	1.7	-6.46	6.05
County Income Ratio	2000	2.70	1.00	1.31	6.15
County Income Ratio	Difference	0.35	0.54	-0.17	3.12
Net Migration	2000	7433	32480	-48800	151500
Net Migration	Difference	6727	69362	-97421	409391
Democrat Vote for President	2000	45.38	8.28	26.34	60.99
Democrat Vote for President	Difference	4.14	5.07	-7.34	13.99
Federal Aid ($100000)	2000	5892.60	6471.35	899.68	33157.56
Federal Aid ($100000)	Difference	-74.33	206.53	-1080.84	394.57
Percent Black	2000	10.20	9.66	0.30	36.30
Percent Black	Difference	-0.01	0.52	-1.52	1.53
Percent in Poverty	2000	12.02	3.16	6.50	19.90
Percent in Poverty	Difference	-1.20	2.01	-6.10	3.10
Percent Voting	2002	42.23	6.98	28.99	64.09
Percent Voting	Difference	-4.72	5.43	-16.71	6.86
Welfare Benefits Max/Month	2000	398.48	137.84	164.00	720.00
Welfare Benefits Max/Month	Difference	-46.06	46.64	-140.00	141.00
Years Since PIT Adoption		57.1	28.7	0	92
Years Since Sales Tax Adoption		53.0	20.6	0	73

Figure 1: **Progressivity Index Values in the United States in 2002**



little evidence of a competitive tax haven effect, suggesting the need for an alternative explanation of the checkerboard pattern of highly and weakly progressive states.

Regression Results

Table 2 present the results of the estimation applied to the progressivity indexes for 1995 and 2003, as well as to changes in the progressivity indexes over this same time period. Note that the SAR models—indicated by inclusion of the spatial parameter RHO—fail to reveal a tax haven effect when neighbors are specified as contiguous neighbors. An extensive array of GWR models was also estimated and generally there was no evidence of spatial heterogeneity in the determination of tax system progressivity using this technique. We return to this important issue in the close of the paper.

Table 2
Association between State Characteristics and Progressivity Indices Cross-Sectional and Fixed-Effects Estimates

Outcome Sample	*Progressivity Differences*	*Progressivity Differences*	*Progressivity 2002*	*Progressivity 2002*	*Progressivity 1995*	*Progressivity 1995*
Net Migration	-0.004 (0.162)	-0.003 (0.281)	-0.085 (0.409)	-0.097 (0.244)	-0.006 (0.221)	-0.006 (0.161)
Democrat Share	0.005 (0.180)	0.006 (0.063)+	-0.000 (0.948)	-0.000 (0.973)	-0.001 (0.793)	-0.001 (0.775)
Fed Aid	-0.026 (0.019)*	-0.022 (0.015)*	0.000 (0.982)	-0.000 (0.853)	-0.001 (0.487)	-0.001 (0.402)
% Black	0.042 (0.137)	0.039 (0.109)	0.002 (0.647)	0.003 (0.414)	0.001 (0.761)	0.001 (0.683)
% Poverty	0.009 (0.219)	0.006 (0.381)	-0.021 (0.237)	-0.029 (0.055)+	-0.011 (0.300)	-0.012 (0.190)
Max Welfare	0.001 (0.002)**	0.001 (0.000)**	0.000 (0.488)	0.000 (0.320)	0.000 (0.719)	0.000 (0.604)
PIT Adoption	-0.000 (0.270)	-0.001 (0.074)+	0.003 (0.011)*	0.002 (0.006)**	0.003 (0.001)**	0.003 (0.000)**
Sales Adoption	0.001 (0.029)*	0.001 (0.244)	-0.002 (0.143)	-0.002 (0.087)+	-0.002 (0.049)*	-0.002 (0.016)*
Median Income	0.010 (0.833)	-0.054 (0.346)	-0.121 (0.289)	-0.149 (0.110)	-0.071 (0.457)	-0.070 (0.387)
Itemization	0.026 (0.863)	0.014 (0.915)	0.089 (0.691)	0.159 (0.391)	0.186 (0.301)	0.189 (0.208)
RHO		0.008 (.967)		-0.432 (0.090)		-0.134 (0.570)
Observations	48	48	48		48	48
R-squared	0.523		0.418	48	0.544	

We also control for voting participation, county income ratio, and proportion of itemizers (which are never significant). Robust p-values in parentheses. **1 percent, *5 percent, +10 percent levels of significance.

What is most striking in these results is the lack of statistical significance for most of the variables. For the progressivity indexes in the respective years, the only factors to consistently show significance are the time since tax adoption variables for the personal income and sales taxes. Generally, the early adopters of the state income tax have more progressive taxes while the early adopters of the sales tax tend to have more regressive tax systems. Changes in progressivity are also affected by the year of tax adoption, but in these models the early adopters of both sales and income taxes enhanced tax system progressivity between 1995 and 2003. Higher welfare benefits are associated with greater progressivity, suggesting complementarity across the tax and spending sides of the budget, with welfare programs financed through greater tax system progressivity. Finally, more federal aid is associated with reduced progressivity.

The results for the top bracket personal income tax rate are reported in Table 3. Several findings are consistent with Fletcher and Murray (forthcoming), including the negative coefficients on the county income ratio and median income, and the positive

Table 3
Association between State Characteristics and Structural Provisions: Top Tax Bracket Cross-Sectional and Fixed-Effects Estimates

Outcome Sample	*Top Bracket Differences*	*Top Bracket 2002*	*Top Bracket 1995*
County Income Ratio	-1.762 (0.001)**	-0.914 (0.024)*	-0.708 (0.383)
Net Migration	-0.094 (0.088)+	-1.485 (0.225)	-0.113 (0.153)
Fed Aid	-0.158 (0.432)	0.005 (0.481)	0.001 (0.946)
% Black	-0.547 (0.298)	-0.088 (0.097)+	-0.035 (0.586)
% Poverty	-0.132 (0.337)	0.077 (0.712)	-0.147 (0.394)
PIT Adoption	-0.002 (0.814)	0.070 (0.000)**	0.066 (0.000)**
Sales Adoption	0.012 (0.273)	-0.010 (0.519)	-0.013 (0.480)
Median Income	-0.408 (0.639)	-0.343 (0.799)	-2.680 (0.085)+
Constant		4.980 (0.506)	14.467 (0.054)+
Observations	48	48	48
R-squared	0.376	0.690	0.655

Robust p-values in parentheses. **1% percent *5 percent, +10 percent levels of significance. Additional controls include voter participation, democrat share, proportion of itemizers, and welfare benefits (which are never significant).

effect of years since income tax adoption. The results for the income variables suggest that states with skewed regional distributions of income and high overall average income resist increases in the top bracket rate. There is virtually no story to tell for the changes' model. The coefficient of net migration is negative and significant.

DISCUSSION

This paper has extended Fletcher and Murray (forthcoing) in a number of ways. We include composite progressivity indexes in addition to structural income tax provisions, consider multiple cross sections, and examine policy changes over time. In addition, we apply SAR and GWR regression techniques to the progressivity indexes in an effort to clarify the role of tax competition in affecting state tax progressivity.

Our results indicate that demographic characteristics of the population and political measures have little influence on progressivity. Fletcher and Murray (forthcoming) consider somewhat richer model specifications in their examination of specific income tax provisions. But many of their findings, like the negative relationship between the share of the youth population and the child exemption, are quite unintuitive. One possible explanation is that those who might benefit most from certain tax provisions cannot vote (children) or have low voting propensities (blacks and low-income individuals). Of course, other residents could vote on their behalf if there were tastes for tax redistribution, but that does not seem to be the case based on the models we employ.

Purely cross-sectional analysis might be criticized for not adequately capturing the various factors that prevailed when specific policy decisions regarding tax system progressivity were made. Yet the analysis presented here on changes in progressivity and changes in structural provisions yields little or no improvement in empirical results. Finally, we find no evidence of tax competition in the analysis of progressivity indexes using SAR techniques.

The point of departure for our inquiry was the presumption that progressivity reflected the intent to pursue the equity objectives of the electorate. Perhaps this is not the case. For example, there may be a bureaucratic rent seeking or Leviathan story at play. Holsey and Borcherding (1997) discuss Oates' review of the fiscal illusion literature and note there is some evidence that tax system complexity leads to greater tax system elasticity. Progressive tax systems are one means of creating tax system complexity. But Feenberg and Rosen (1987) find no evidence that state tax structures and elasticities influence spending.[6]

Finally, it is possible that the progressivity of state tax systems today is largely a reflection of the tax policy choices made by the states when income taxes were first introduced. Thirty-two states adopted income taxes prior to World War II, including 16 states in the 1930s. The states may have simply mimicked the progressive structure of the federal income tax. Alternatively these early choices may have reflected prevailing attitudes toward tax-based redistribution. In the intervening years the population has sorted itself across the states based in part on state-specific tax systems and own-tastes for redistribution. If this is the case, then it is perhaps no surprise that typical demographic characteristics and political factors have a mixed influence in explaining differences in state tax progressivity. Our results for the time-since-income-tax adoption variable adds weight to this long-term inertia argument.

Notes

[1] Fletcher and Murray (2006, forthcoming) discuss more generally the potentially important role of *economic* neighbors in the analysis of strategic tax competition. For example, in the current context one might alternatively define neighbors based on similar distributions of income of share of poverty households.

[2] A bandwidth parameter must be specified that dictates how far neighbors can be from one another and still affect each other. This parameter can be specified or estimated within a designated range. And a weighting function must be used that assigns the importance (or weight) for each neighbor within the bandwidth of the observation in question.

[3] Lesage (1999) notes several potential problems with GWR. First, the estimates for each data point (state) are not independent from the estimates of its neighbors. This results in conventional measures of dispersion (standard errors) that are likely incorrect. Second, GWR results can be driven by outliers, which is problematic. Finally, some GWR results can suffer from "weak data" if observations do not have many neighbors (e.g., Alaska, Hawaii).

[4] See http://www.itepnet.org/wp2000/text.pdf and http://www.ctj.org/whop/whop_txt.pdf.

[5] See LeSage and Pace (2004) for methods of producing maps from geographic data.

[6] Rob Wassmer (direct conversation) suggested that progressive rate structures—in particular the top bracket rate—are used to overcome supermajority requirements for raising taxes. We have explored this question empirically and find no evidence that this is the case.

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