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FISCAL DECENTRALIZATION AND STATE-LEVEL TAX COMPETITION:
A LEVIATHAN PERSPECTIVE

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Analyses of interjurisdictional competition have extensively proved the presence of competition between local governments and the constraining effect of federalism or fiscal decentralization on government size. Few papers have applied local-level theories to the state level, despite the applicability of such theories to larger subnational governments. I apply several different local-level analyses from the literature on Leviathan governments and tax competition to a state-level analysis to examine the degree of inter-state and intra-state competition across the United States. Using state-level sales and income taxes, I compare average tax rates to revenue-maximizing rates and find that states set tax rates well below Leviathan revenue-maximizing rates. Using a spatial autoregressive model I also estimate the degree of interstate tax competition and find some evidence of strategic interaction among states. Lastly, I compare tax rates, the degree of competition between states, and a measure of fiscal decentralization using a panel model to tie the analysis back in to the underlying assumptions of the Leviathan hypothesis: can interjurisdictional competition and fiscal decentralization constrain government from maximizing its size?

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I. Introduction

At any level of government, capturing consumer preferences for public goods is often a difficult, complex process that has become a subject of much analysis in the public choice literature. In his work on government structure and liberty, *The Spirit of Laws*, Montesquieu writes “regard should be had both to the necessities of the state and to those of the subject. The real wants of the people ought never to give way to the imaginary wants of the state” (1748, Book XIII). His words are particular import for those who espouse the benefits of federalism and fiscal decentralization. A more equal distribution of government power through subnational governments (federalism) and granting low-tier governments more spending autonomy (fiscal decentralization) is often believed to be a good way of providing local public goods and limiting the government’s ability to extract rents from its constituents. Both federalism and fiscal decentralization have been studied extensively since Tiebout’s (1956) seminal work on local public expenditures. Of contention is the most efficient way to capture consumer preferences given a certain level of mobility. Instead of viewing the traditional political mechanism as an ideal method, Tiebout argues that consumers “vote with their feet”, effectively sorting themselves into surrounding jurisdictions to satisfy their preferences for public goods.¹ These results have many economic implications, of which the most relevant is the significance of interjurisdictional competition.

The literature on jurisdictional competition for capital given the reality of mobility has evolved into studies on certain types of competition such as tax, expenditure and political

¹ From Tiebout (1956, 424): “If consumer-voters are fully mobile, the appropriate local governments, whose revenue-expenditure patterns are set, are adopted by the consumer-voters.”

competition (Case and Rosen, 1993; Brueckner, 1997; Epple and Zelenitz, 1981). A necessary byproduct of these analyses is the examination of public finance in terms of fiscal decentralization and revenue maximization. There are many models of government structure and each varies in its assumptions about governmental objectives (Goel and Nelson, 1998; Marlow, 1991). This analysis draws from Brennan and Buchanan's (1977) Leviathan model of government in which the government's goal is to maximize its size and will do so in the absence of constitutional constraints or intergovernmental competition. The Leviathan model purports that a Leviathan government will set tax rates that maximize tax revenues which encompasses the relationship between tax rates and tax revenues depicted by the Laffer curve.² Similar to Tiebout's conclusions, competition among governments limits the ability of the Leviathan government to extract resources from its tax base into the public sector. One of the most extensive analyses of the Leviathan government and fiscal decentralization is Crowley and Sobel's (2011) paper on government constraints at the local level within Pennsylvania. The authors develop a "Leviathan ratio" which compares average tax rates to revenue-maximizing rates. It is a way to measure the consequence of jurisdictional competition and offers a unique perspective on whether fiscal decentralization can constrain Leviathan governments.

The goal of this analysis is to emulate the Crowley and Sobel's (2011) Leviathan ratio analysis at the state level in its relation to intra-state and inter-state tax competition in the United States. I begin by estimating Leviathan ratios for state-level sales and combined sales and personal income taxes. I then estimate the level of competition across states with a spatial dependence model. The estimates of competition across states derived from the spatial model

² The Laffer curve is attributed to Arthur Laffer in 1974. It is commonly portrayed as a single-peaked curve where tax revenue approaches zero when the tax rate is either zero or close to 100%, and at some point in between revenue is maximized at the peak (Spiegel and Templeman, 2004).

and a measure of fiscal decentralization are then regressed on the Leviathan ratios in a panel model to examine the change in competition within states over time. This analysis is unique in the sense that it applies local-level theories at the state-level to gain insight into whether interstate competition constrains state government spending.

II. Literature Review

An analysis of governmental activity must choose the angle with which it approaches specific governmental goals. These concepts range from the benevolent dictator models of government which aim to maximize social welfare, to the Leviathan models of government, first postulated by Brennan and Buchanan (1977, 1978, 1980), which aim to maximize tax revenue. A Leviathan government will choose to set tax rates at the peak of the Laffer curve only to be limited by constitutional constraints or interjurisdictional competition. Because consumers are mobile across jurisdictions, a Leviathan government is faced with a serious restriction on its ability to exploit taxes. In other words, fiscal decentralization and federalism should constrain a Leviathan government through increased competition. Brennan and Buchanan (1980) succinctly argue that “total government intrusion into the economy should be smaller, *ceteris paribus*, the greater the extent to which taxes and expenditures are decentralized” (pg. 185). Fiscal decentralization forces governments to engage in tax competition, inhibiting a Leviathan government’s monopoly on taxation while also matching government spending with the preferences of the people (Rodden, 2003).

Definitions and opinions of federalism and decentralization vary across studies. Much attention has been given to decentralization as a policy instrument to restrict central governments

from taking advantage of its constituents, offering greater monitoring and accountability of government. The concept of “bringing the government closer to the people” aims to enhance the information available to voters about government activities so they may be better equipped to vote against poor performance or rent-seeking (Stansel 2006). Some cross-national studies show evidence that a trend toward fiscal decentralization is connected with transitions to democracy and that average state and local expenditure as a share of the total government sector has increased over time.³ Rodden (2004) summarizes the various ways of measuring and defining decentralization, which he personally defines as a shift of authority toward local governments (pg. 482). He differentiates between three types of decentralization: fiscal, policy, and political. Fiscal decentralization encompasses the balance of expenditures and revenues between governments in which local governments are given more autonomy while simultaneously depressing the central government’s ability to control local-level decisions. The most common way of measuring fiscal decentralization is the ratio of local government expenditures to total state-local expenditures. Rodden argues this specific measure may not accurately reflect true decentralization in which some jurisdictions, like Denmark, could seem highly decentralized but the central government may have much control over local government finance (pg. 483). Therefore this measure does not necessarily describe the *source* of governmental authority, yet Rodden’s arguments are primarily focused on international studies of decentralization and may not hold for intranational studies.

Analyses of federalism and fiscal decentralization are born primarily from Tiebout’s (1956) theory of public expenditure choices and interjurisdictional competition. He posits the question as to whether a market-based solution can help determine the level of expenditures on

³ See Panizza (1999); Bardhan and Mookherjee (2006); Goldfrank (2007)

public goods in which he focuses specifically on the mobility of consumers and competition between jurisdictions. As the number of jurisdictions increases, and the greater the variance among them, the better off the consumer will be in which he may choose the community with the best mix of public goods and services to suit his preferences. Borrowing from Tiebout's theories, an analysis by Oates (1985) goes a step further in developing connections between fiscal decentralization and the Leviathan hypothesis. Historically, local governments grow under fiscal decentralization because citizens wish to grant the public sector with more responsibilities. As a result, over time and across states, the state-local sector has tended to be *larger* in conjunction with more fiscal decentralization (pg. 749). Earlier work done by Oates (1972) did not support the Leviathan hypothesis (especially after controlling for the effects of income on government size) in which he finds a strong and statistically significant negative relationship between fiscal decentralization and government size. These results match his later work in which he examines the state-local sector within the United States. Overall, Oates finds there is little support for the idea that fiscal decentralization constrains the size of the public sector, even accounting for alternative ways to measure fiscal decentralization.

Conclusions as to whether the Leviathan hypothesis holds empirically are far from unanimous. Analyses linking fiscal decentralization and certain characteristics of government like size, spending, and competitiveness are numerous. Studies that support the hypothesis by Rodden (2003), Fiva (2006), and Stansel (2006) take different approaches yet all arrive at similar results. The size of the public sector is expected to vary inversely with the degree of fiscal decentralization in which the government may find it difficult to act in the best interest of all constituents thus fiscal competition may constrain government. However, this relationship only holds for certain types and funding of decentralization. Tax revenue decentralization is

associated with a smaller public sector (in accordance with fiscal competition theories) while expenditure decentralization is associated with a larger public sector which may be due to vertical fiscal imbalance (Fiva 2006).⁴ Rodden (2003) distinguishes between decentralization funded by intergovernmental grants opposed to local resources and notes that decentralization funded by grants may actually increase government spending and size- a result in direct contradiction to the Leviathan hypothesis. There may be a moral hazard problem related to an increased dependence on intergovernmental grants, which encourages local governments to borrow rather than alternate spending behavior when faced with fiscal shortages (pg 716). The results seem to show that it is through decentralization funded by autonomous local taxation that is more likely to decrease government size.

Crowley and Sobel (2011) explain what might cause the lack of agreement between the various studies in the literature on intergovernmental competition and government. The core of the Leviathan hypothesis names two constraints that limit government's ability to maximize tax revenues: constitutional constraints and competition. Few studies actually control for differences in constitutional constraints, especially cross-national studies where governments are expected to be much more heterogeneous compared to governments within a country. Even studies of the United States or Canadian provinces face similar problems. A second possible problem is related to Rodden's (2004) argument which doubts the efficacy of using total government size as a proxy for competition faced by jurisdictions. Crowley and Sobel (2011) argue that specific tax rates and how they differ across jurisdictions is a much more accurate representation of competitive activity between governments.

⁴ Vertical fiscal imbalance (VFI) has interesting implications in analyses on federalism and fiscal decentralization. It describes an asymmetry in public sector financing and performance which allows public officials to ignore financial consequences of competition for mobile capital and inefficient use of public resources (pg. 263).

The most widely examined source of competition in relation to fiscal decentralization is local property tax competition. Brueckner and Saavedra (2001) use spatial econometric models to determine the degree of property tax competition among local governments within the Boston metropolitan area for the years 1980 and 1990. Of concern is whether jurisdictions strategically interact when setting local property tax rates. Such interaction may be caused by interjurisdictional mobility of the tax base or the result of “benefit spillovers” where residents of one jurisdiction gain access to the public goods provided by neighboring jurisdictions. The authors develop a spatial autoregressive, or spatial lag, model in which community *i*’s property tax rate is a function of tax rates in other communities, its own preferences, and the distribution of population.⁵ The results for the year 1980 suggest the presence of strategic property tax competition in which a given community’s best response to an increase in the property tax rates of competing communities was to increase its own rates. The results for 1990 are similar but to a lesser extent due to constitutional changes in the tax code.⁶

In a similar manner, Crowley and Sobel (2011) analyze whether fiscal decentralization can limit the revenue-maximizing behavior of a Leviathan government by first developing their own unique measure of the level of decentralization inspired by the Leviathan hypothesis. They begin with a theoretical model to determine the revenue-maximizing tax rate which is a function of the tax rate and the tax base. They then compare the current tax rate to the Leviathan rate and call this proportion the “Leviathan ratio” where higher values indicate less competitive behavior. Using panel data on property tax rates and tax revenue for all levels of local governments in

⁵ The authors use per capita income, per capita state aid, the African-American proportion of the population, the proportion of the adult population with at least a college education, public sector earnings per capita, and the annual rate of population growth to proxy consumer preferences. These variables are similar to the ones used by Crowley and Sobel (2011) and Case and Rosen (1993).

⁶ Proposition 2 ½ was a tax limitation measure set by Massachusetts in 1981 which changed the way property-value was assessed. Analysis before and after Proposition 2 ½ offered a unique look at jurisdictional competition under two different tax regimes.

Pennsylvania from 1995 to 2005, they estimate a number of models to examine taxes in three distinct levels of government: municipalities, school districts, and counties. Their results show that local Pennsylvania jurisdictions do set tax rates below the Leviathan revenue-maximizing levels. Municipalities are found to be more competitive with tax rates set further below county rates, which are found to be less competitive. They conclude that fiscal decentralization, measured by a larger number of governments in a given geographic area, does seem to constrain Leviathan and lead to overall lower tax rates.

The tax competition literature distinguishes between the sizes of jurisdictions in which larger individual jurisdictions relative to the economy are able to alter capital's net return by changing tax rates. Strategic behavior arises when the tax rate in other jurisdictions is first considered by a given jurisdiction before setting rates. Fuest (1995) distinguishes between the positive and negative consequences of jurisdictional competition. Competitive pressures should increase the efficiency of public policies and restrict the government's ability to extract rents from citizens. An important consequence of competition, found in many local property tax competition analyses, is that public goods are usually underprovided (rates are too low) in order to preserve the tax base.⁷ The inherent inverse relationship between tax rates and the tax base lowers the incentive to raise tax rates.

A unique study at the state level that maintains the framework of jurisdictional interdependence done by Case and Rosen (1993) tests whether states' expenditures depend on the spending of "similarly situated" states. In older models of government expenditure choices, a government concerned with the welfare of its citizens chooses expenditure levels found in an equilibrium between marginal benefits from public services and marginal costs of providing

⁷ See Nechyba (1997) for an analysis of strategic property tax coordination.

those services.⁸ Accounting for strategic interaction between states' expenditure levels creates a more dynamic model of government decision-making. As with Brueckner and Saavedra (2001) and Brueckner (2000), Case and Rosen include geographic proximity as a weight specification for their spatial model however they argue the concept of "neighbor" does not necessarily imply geographic proximity. States that are economically and demographically similar may have more of an effect on each other than two dissimilar states that share a border (pg. 287). The authors then develop three alternate weighting schemes to proxy "neighborliness": geographic proximity, level of income, and proportion of the population that is African American. The results for all three weighting schemes indicate states' expenditures are significantly influenced by their neighbors, of which the best measure of "neighborliness" is the proportion of African Americans within a state. The results of the three different weighting schemes seem to indicate some degree of arbitrariness which calls into question the viability of spatial dependence models. The authors test the potentially capricious results by using an extreme weighting scheme based on alphabetical order. Re-estimating the model, where the weight equals one if state *i* follows state *j* in the alphabet and a zero otherwise, resulted in a significantly smaller degree of competition. These results lend credence to the use of spatial dependence models in the context of tax and expenditure competition.

III. Methodology

A. Leviathan Ratio

⁸ See Samuelson (1954). Social welfare functions of government are primarily used in "benevolent dictator" models where the government's objective is to maximize the utilities of all individuals.

Crowley and Sobel (2011) develop the Leviathan ratio in accordance with the Laffer curve, in which an inverted U-shaped relationship exists between the tax rates the government sets and the tax revenue it receives. Tax revenues are minimized at either very low or very high tax rates and are maximized at a rate somewhere in between. The Leviathan hypothesis predicts the tax rate that maximizes revenues is the rate a Leviathan government would set in the absence of constitutional constraints or intergovernmental competition (pg. 9). The Leviathan ratio compares the revenue maximizing rate to the actual tax rate as a measure of the extent a government is acting like a Leviathan. Crowley and Sobel specifically follow Garrett (2001) and Sobel's (1999) models to develop the Leviathan model in which total tax revenue is given by the product of the tax rate and the level of the tax base. The tax base is a function of the tax rate in which higher rates diminish the tax base because of reduced incentive to partake in taxable activities. Empirically, the model to estimate total tax revenue for government i at time t is given by:

$$R_{it} = \alpha\tau_{it} + \beta\tau_{it}^2 + \gamma_1 Y_i + \gamma_2 Z_t + \varepsilon_{it} \quad (1)$$

where R_{it} is defined as real per capita tax revenue for state i at time t , τ_{it} is defined as the effective average tax rate for state i at time t , Y_i and Z_t are cross-section and time-period fixed effects respectively, and ε_{it} is a panel-specific error term.⁹ The tax rate that maximizes tax revenue τ_{it}^* is given by:

$$\tau_{it}^* = -\frac{\alpha}{2\beta} \quad (2)$$

⁹ (1) is estimated without a constant because it first assumes that tax revenues are only a function of the tax base and tax rates. There should not be any tax revenue without a tax rate or tax base.

The Leviathan ratio is thus:¹⁰

$$\frac{\tau_{it}}{\tau_{it}^*} \quad (3)$$

Theoretically, the ratio should take on values between zero and one, in which higher values closer to one indicate that the government's actual tax rate approaches the revenue-maximizing rate. Higher values for the Leviathan ratio could be indicative of a preference for more government spending and income redistribution as well as lower intergovernmental competition.

Crowley and Sobel's empirical model focuses solely on effective property tax rates and revenue for municipalities, counties, and school districts within Pennsylvania for the years 1995 to 2005. By focusing on taxes within one state, certain problems concerning heterogeneity of state or national constitutional constraints may be avoided, yet even local property tax laws can be set on a state-wide basis. Taking into consideration the idea that state-level taxes may face more heterogeneous constraints than local-level taxes, I estimate Leviathan ratios at the state level using a longitudinal panel of annual tax revenues and effective average tax rates for the years 1970 to 2010 for the 50 U.S. states.¹¹ I estimate two Leviathan ratios, one using the sales tax and another using the combined sales and personal income taxes as these taxes are shown to account for a majority of state tax revenues. To estimate (1), R_{it} is either real total sales or real total personal tax revenue per capita and τ_{it} is either effective average sales or combined sales and income tax rates. Data for total and specific tax revenues are obtained from the U.S. Census Bureau's State Government Tax Collection reports. To calculate effective average tax rates I use

¹⁰ See Crowley and Sobel (2011) pg. 9-10 for a full derivation of the Leviathan ratio.

¹¹ For example, the effective average sales tax rate is found by taking total sales tax revenue divided by state GDP for that year.

annual state GDP obtained from the Bureau of Economic Analysis. The results are shown in Table 1 and summary statistics of the resulting Leviathan ratios are shown in Table 2.

Table 1: Leviathan Ratio Results

	Sales Tax	Sales and Income Tax
Effective Tax Rate (α)	43349.28*** (2382.95)	43112.07*** (2513.26)
Effective Tax Rate Squared (β)	-282465.10*** (38609.55)	-125411.20*** (28578.53)
Revenue-Maximizing Rate ($-\alpha / 2\beta$)	0.077	0.172
Number of Observations	2050	2050
R-squared	0.75	0.72

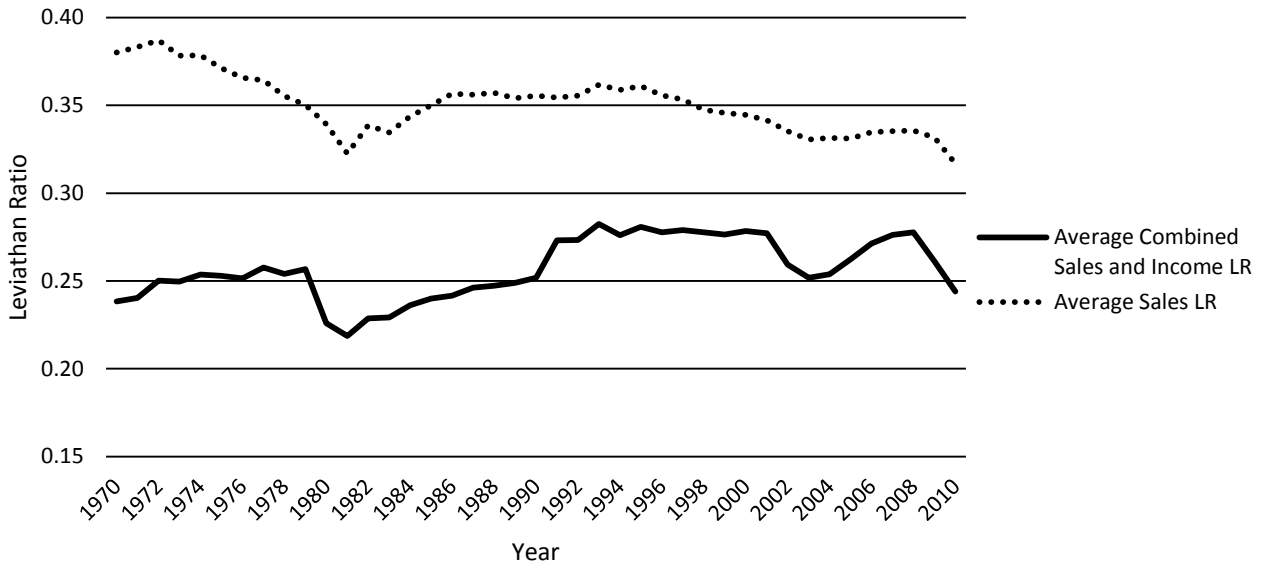
Note: Both models are estimated using cross-section and time period fixed effects, standard errors in parentheses, *** indicates significance at the 1% level.

Table 2: Summary Statistics

Leviathan Ratio:	Sales Tax	Sales and Income Tax
Mean	0.3508	0.2568
Standard Deviation	0.1195	0.0653
Min	0.0318	0.0161
Max	0.6691	0.4729
Observations	2050	2050

The Leviathan ratio estimates seem to show some presence of competition among states since the rates are set well below the revenue-maximizing level where the Leviathan ratio equals to one. Figure 1 plots the average sales and combined sales and income Leviathan ratios for each year from 1970 to 2010.

Figure 1: Average Sales and Combined Sales and Income Tax Leviathan Ratios



The sales tax Leviathan ratios are higher than the combined sales and income tax ratios, indicating that governments face a higher degree of competition for combined sales and income tax rates. The results also show that states face more competition when setting personal income tax rates than sales tax rates as the combined sales and income tax ratios are much lower than the sales tax ratios alone. The recent downward trend in both ratios is interesting and may reflect changes in government spending levels across states or changes in demand for local public goods from consumers.

Comparing effective average tax rates to revenue-maximizing tax rates for both sales and combined sales and income taxes suggests that state governments consistently set tax rates well below rates set by a Leviathan government. Crowley and Sobel (2011) find similar results and conclude that interjurisdictional competition, as predicted by Tiebout (1956), can constrain Leviathan governments from maximizing tax revenues.

B. Data

To further explore the nature of competition faced by states, I develop a state-level spatial dependence model similar to the ones used by Crowley and Sobel (2011) and Case and Rosen (1993). Most spatial empirical models are based on response or reaction functions derived from theoretical models assuming some level of human/labor capital mobility.¹² Since a consumer can choose the jurisdiction that suits his preferences for public goods, where he compares policies of surrounding jurisdictions, the reaction function of a given jurisdiction depends on surrounding jurisdictions' policies as well as its own. The variables found to be the most helpful in determining the demographics of and policy mix demanded by consumers are shown in Appendix A. These data are socioeconomic variables that are expected to have some influence on the demand for public spending and as a result, the tax rates within a jurisdiction.

General expenditure is expected to positively affect tax rates as jurisdictions will typically set higher rates when expenditure activities increase. Higher levels of income are expected to positively affect income tax rates and should have the same effect on sales tax rates. An increase in federal grants is expected to decrease tax rates through an increase in the resources available to a city. The proportion of the population that is African American is included to not only measure preferences for policies that match minority demands but also measure poverty. The proportion of the student population is included to account for differences in age distribution. Population density should help to control for differences in tax policy resulting from the more rural or urban characteristics of each state. The liberal ideology index developed by Berry et al. (1998) is the revised version of the original index developed for the years 1960-1993. It ranges from zero to 100 where a higher score indicates more liberal views. The proportion of tax revenue generated by severance taxes is expected to have a negative effect

¹² As in Brueckner (2000)

on sales and personal tax rates. All variables are collected for the 48 contiguous U.S. states for the years 1970-2010. Monetary values are adjusted for inflation, using the Consumer Price Index, and are expressed on a per capita basis.

C. Spatial Dependence Model

To examine the level of interstate competition, I follow Crowley and Sobel (2011) and Brueckner and Saavedra's (2001) model specification in estimating a state-level spatial autoregressive model (SAR) of the following form:

$$\tau_i = \rho \sum_{j \neq i} \omega_{ij} \tau_j + X_i \beta + \varepsilon_i \quad (4)$$

where τ_i is the effective average tax rate in state i , $\rho \sum_{j \neq i} \omega_{ij}$ is a spatial weight matrix that determines how surrounding states' tax rates (τ_j) influence state i 's tax rates, and ε_i is the error term. The matrix X_i contains the demographic and policy variables described in the data section. Policy variables capture influences on the choice of τ_i and the demographic variables account for state population's preferences. The weighting scheme used in this analysis is based on geographic proximity in which a row-standardized contiguity matrix determines the weight given to a state based on the number of bordering states. Specifically, $\omega_{ij} = \frac{1}{S_i}$ if i and j share a border and $\omega_{ij} = 0$ otherwise, where S_i is the number of borders state i shares.¹³

¹³ This is the same geographic weighting scheme used by Case and Rosen (1993) and Crowley and Sobel (2011)

The key variable of interest in my SAR model is ρ which measures the degree of spatial dependence between states. If governments are actually competing the sign for ρ should be positive: when one jurisdiction lowers its tax rates, surrounding jurisdictions should react by lowering rates to remain competitive. Using maximum likelihood methods, I estimate the model in equation (4) for each year from 1970 to 2010 separately to generate annual estimates of ρ for each of the two effective average tax rates (sales and combined sales and income). I also include regional dummies in this cross-sectional model (New England, Mid-Atlantic, Great Lakes, Plains, Southeast, Southwest, Rocky Mountains, and Far West) to account for some unobserved heterogeneity across states.¹⁴ The annual estimates for ρ are shown in Appendix B and are shown graphically in Appendix C. I find significant *negative* estimates for ρ which seems counterintuitive. However, Case and Rosen (1993) also obtain a negative estimate for ρ when using a geographic proximity weight matrix between states and attribute this to the idea that states may instead interact as neighbors in terms of demographic and economic similarity.

D. Panel Model

I expand on Crowley and Sobel's (2011) analysis by estimating the relationship between the Leviathan ratios in 50 states and the annual estimates of ρ to see if interstate competition constrains the size of government. I also include a measure of fiscal decentralization in the model

¹⁴ A two-way fixed effects panel would be warranted here, however this analysis is limited to a cross-sectional model for each year in order to obtain annual estimates of ρ for the use in the models of Leviathan ratios. Including regional dummies attempts to account for some unobserved heterogeneity across states.

to tie in the theoretical underpinning of the Leviathan hypothesis: can fiscal decentralization keep a Leviathan government from setting revenue-maximizing rates? A measure of political ideology is included to examine the equity-efficiency tradeoff between high and low tax rates on the Laffer curve. To analyze the relationship between tax rates, competition, and decentralization, I estimate the panel model:

$$LR_{it} = \alpha + \beta_1 \rho_t + \beta_2 FDEC_{it} + \beta_3 LIB_{it} + \varepsilon_{it} \quad (5)$$

where LR_{it} is either the sales or combined sales and personal income tax Leviathan ratio for state i at time t , ρ_t is the spatial estimate of competition between states for the corresponding tax rate (treated as a constant for all states within a given year) at time t , $FDEC_{it}$ is the fiscal decentralization ratio for state i at time t , LIB_{it} is the Berry et al. liberal ideology index for state i at time t , and ε_{it} is a panel-specific error term.¹⁵ The expected sign for β_1 is negative as higher levels of competition between states are expected to depress tax rates and limit a Leviathan government from setting the revenue-maximizing rates. The expected sign for β_2 is also negative as higher levels of local expenditure share indicate higher levels of fiscal decentralization which should constrain a Leviathan government according to the Leviathan hypothesis. The expected sign for β_3 is less certain. The Leviathan ratio is a Laffer curve-based estimate where rates set closer to the peak are considered to be more equitable and rates set closer to zero are more efficient. Thus, states with higher liberal ideology scores should have higher Leviathan ratios, *ceteris paribus*.

¹⁵ I define the fiscal decentralization ratio as $1 - (\text{state share of total state-local spending})$.

The Hausman test for both models fails to reject the null hypothesis (unobserved state effects are not correlated with regressors) and I estimate equation (5) using random effects. I test for and find first-order autocorrelation, heteroskedasticity, and contemporaneous correlation (Appendix C). To correct for this I use robust standard errors adjusted for clustering between groups. The results are shown in Tables 4 and 5.

Table 4: Sales Tax Model

Variable	Coefficient	Standard Error	P-value
ρ	-0.066***	0.016	0
<i>FDEC</i>	-0.066	0.064	0.303
<i>LIB</i>	-0.001***	0.000	0
Constant	0.379***	0.030	0
R^2	0.021	Wald Chi ² P-value	0

Note: Panel regression with random effects and robust standard errors, 1968 total observations. * indicates significance at 0.1, ** indicates significance at 0.05, *** indicates significance at 0.01

The results in Table 4 indicate the degree of competition between states has a significant negative effect on Leviathan ratios, as does the liberal ideology index. As expected, the sign for fiscal decentralization is negative but insignificant. Because the units of ρ and the Leviathan ratios are somewhat ambiguous, I calculate marginal effects of the regressors on the Leviathan ratio. All other things held constant, a 1% increase in the estimate of competition between states (ρ) is associated with a 0.13% decrease in the Leviathan ratio, and a 1% increase in the liberal ideology index is associated with a 0.14% decrease in the Leviathan ratio. The negative relationship between competition between states and the Leviathan ratios upholds the Leviathan hypothesis: interjurisdictional competition can constrain Leviathan governments from maximizing tax revenues. The negative relationship between the liberal ideology index and the

sales tax Leviathan ratios may represent a preference for higher income taxes instead of sales taxes.

Table 5: Combined Sales and Income Tax Model

Variable	Coefficient	Standard Error	P-value
ρ	-0.022**	0.009	0.016
<i>FDEC</i>	-0.283***	0.054	0
<i>LIB</i>	0.000	0.0002	0.777
Constant	0.349***	0.021	0
R^2	0.158	Wald χ^2 P-value	0

Note: Panel regression with random effects and robust standard errors, 1968 total observations. * indicates significance at 0.1, ** indicates significance at 0.05, *** indicates significance at 0.01

The results in Table 5 indicate that liberal ideology does not have the significant impact on tax rates found in the sales tax model (although it is positive which supports the idea that more liberal states prefer higher income taxes). In this model, fiscal decentralization has a significant negative impact on Leviathan ratios, as does the degree of competition between states. All other things held constant, a 1% increase in the estimate of competition between states (ρ) is associated with a 0.03% decrease in the Leviathan ratio and a 1% increase in the fiscal decentralization ratio is associated with a 0.4% decrease in the Leviathan ratio. These results also match the theoretical expectations of the Leviathan hypothesis which implies that competition and fiscal decentralization can constrain government from achieving Leviathan goals.

The implications of not only the presence of state-level tax competition but the ability of fiscal decentralization and interjurisdictional competition to constrain government from setting revenue-maximizing tax rates are especially important from a public finance perspective. What is the most efficient way to keep government spending in check? How can a nation prevent its government from becoming a Leviathan when the government has a monopoly on certain public

goods and services? The results shown in Tables 4 and 5 indicate that competition between subnational governments can keep governments from operating at the peak of the Laffer curve.

VI. Extensions for Future Research

Many analyses of fiscal decentralization and competition have been extended to examine the positive impact increased subnational fiscal autonomy can have on political corruption.¹⁶ In theory, political competition (similar to jurisdictional competition) should reduce the ability of bureaucrats to extract rents in exchange for public services. Goel and Nelson's (2011) analysis on decentralization and corruption describes decentralization as a tool to promote interjurisdictional competition and transparency between citizens and government officials. The interesting link between decentralization, competition, and corruption should be examined in future research where the Leviathan ratios developed in this analysis could be substituted for measures of fiscal decentralization as a measure of the *consequence* of competition rather than competition itself. Results similar to the previous literature on decentralization and corruption would indicate a robust relationship between competition and transparency.

The use of a spatial dependence model within the framework of interjurisdictional competition allows for flexibility in the specification of the weighting scheme. Case and Rosen (1993) use income and proportion of the population that is African American as well as geographic proximity. Other considerations should be given to factors that might define demographic and economic similarity such as expenditures on public services like health care or political ideology. Spending patterns that reflect preferences on public services could portray

¹⁶ See Fisman and Gatti (2002); Ahmad (2004); Arikan (2004)

more underlying similarities between states that better explain the competitive nature between states rather than shared borders.

V. Conclusion

The results from the combined analyses of state-level tax competition: the Leviathan ratios, the estimates of ρ from the spatial dependence model, and the results from the panel model, all seem to indicate some presence of interjurisdictional competition that ultimately constrains tax rates. Crowley and Sobel (2011) attribute these results to fiscal decentralization where (according to their analysis at the local level), the more prevalent and thus more competitive municipalities set tax rates much lower than revenue-maximizing rates. A state-level analysis is limited due to a fixed number of competing jurisdictions across the United States. However, despite the somewhat muted effects of capital mobility or heterogeneity of constitutional constraints, the results of this analysis support Tiebout (1956) and Brennan and Buchanan's (1977) theories of government decision-making and interjurisdictional competition. For modern developing economies with less decentralized governments, these results imply that enabling interjurisdictional competition through federalism or fiscal decentralization can limit the government's ability to extract rents from its constituents and offer a better "mix" of public goods to suit consumer-voter preferences.

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Appendix A: Data and Summary Statistics

Abbreviation	Description	Source	Mean	St. Dev.
<i>SalesTax</i>	Effective average sales tax rate for state i at time t	U.S. Census Bureau	0.03	0.01
<i>CombinedTax</i>	Effective average sales and personal income tax rate for state i at time t	U.S. Census Bureau	0.04	0.01
<i>EXPEND</i>	Real per-capita general expenditure	U.S. Census Bureau	366.78	1287.75
<i>INCOME</i>	Real per-capita personal income	U.S. Bureau of Economic Analysis	31055.93	7103.04
<i>PropAA</i>	Proportion of the population that is African American	U.S. Census Bureau	0.10	0.09
<i>PropSTUDENT</i>	Proportion of the population enrolled in public school in the years K-12	U.S. Census Bureau	0.18	0.03
<i>FEDTrans</i>	Real per-capita state-level intergovernmental revenue from the federal government	U.S. Census Bureau	1038.99	471.33
<i>POP</i>	Annual population level	U.S. Bureau of Economic Analysis	5243675	5580777
<i>POPDens</i>	Annual population density per square mile	U.S. Bureau of Economic Analysis & U.S. Census Bureau	172.94	241.59
<i>SEVTAX</i>	Proportion of tax revenue generated by severance taxes	U.S. Census Bureau	0.03	0.07
<i>LIB</i>	Index of state liberal ideology	Berry et al. (1998)	47.80	15.81

Appendix B: SAR Results

Table 4: Spatial Autoregressive Model Results

Year	Sales Tax ρ	Robust St. Error	Combined Sales and Income Tax ρ	Robust St. Error
1970	-0.699**	0.224	-0.122	0.162
1975	-0.679**	0.226	-0.198	0.136
1980	-0.709**	0.208	-0.409**	0.148
1985	-0.694**	0.204	-0.271*	0.144
1990	-0.745**	0.193	-0.414**	0.147
1995	-0.755**	0.210	-0.204	0.171
2000	-0.519**	0.199	-0.461*	0.183
2005	-0.625**	0.231	-0.404**	0.152
2010	-0.654**	0.199	-0.506*	0.201
Observations	48		48	

Note: Values reported in 5-year intervals (estimates remain relatively constant over the 42-year period). * indicates significance at 0.05 and ** indicates significance at the 0.01 level

Appendix C:

Figure 2: Combined Sales and Income Tax Rho Estimates

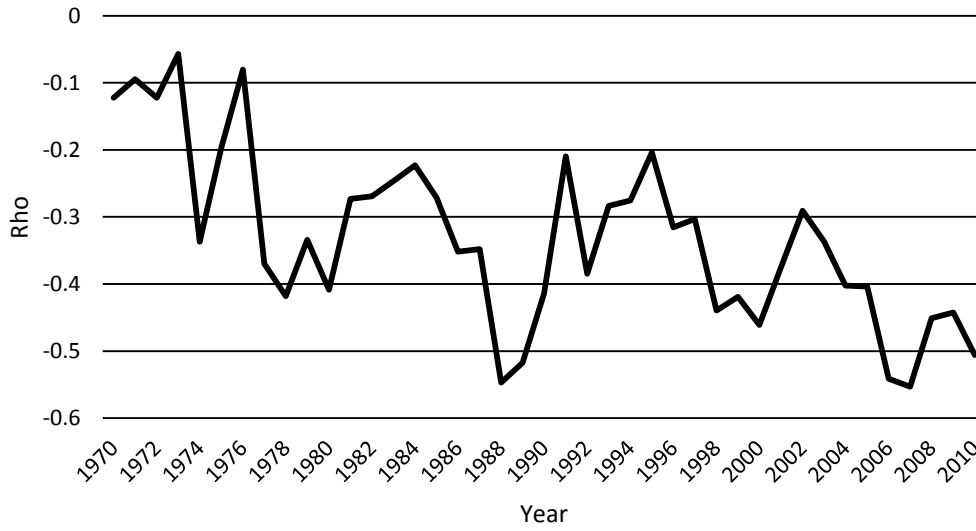
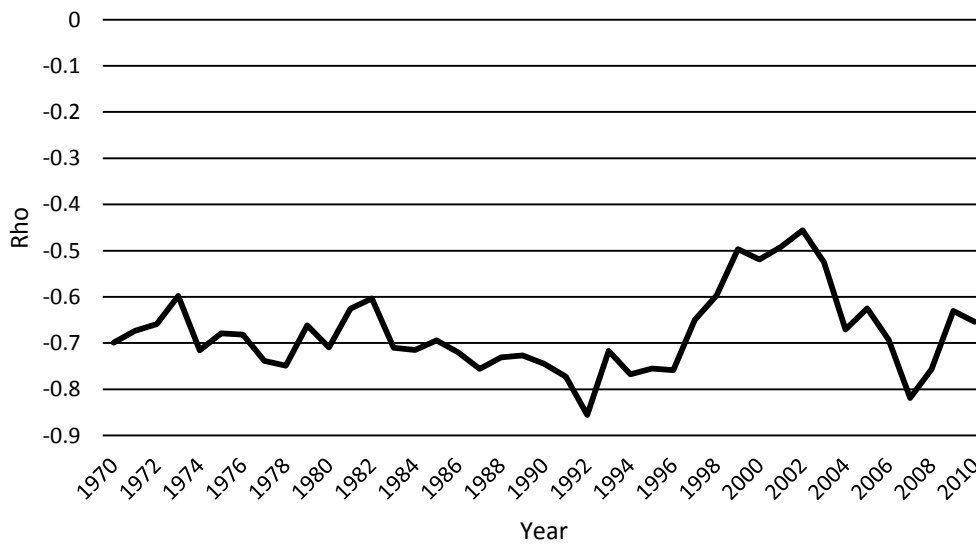


Figure 3: Sales Tax Rho Estimates



Appendix D: Anomaly Testing

Hausman Test:

H_0 : Unobserved effects are uncorrelated with regressors (RE is appropriate)

Sales Tax Model: Prob > $\text{Chi}^2 = 0.8650$

Combined Sales and Income Tax Model: Prob > $\text{Chi}^2 = 0.2896$

Both models fail to reject the null of the Hausman test which verifies the use of a random effects model for both sales and combined sales and income tax models.

The following tests indicate the presence of heteroskedasticity, an AR(1) process, and contemporaneous correlation in both panel models:

Breusch-Pagan/ Cook-Weisberg Test for Heteroskedasticity (of standard OLS regression)

H_0 : Constant variance

Sales Tax Model: Prob > $\text{Chi}^2 = 0.0041$

Combined Sales and Income Tax Model: Prob > $\text{Chi}^2 = 0.0000$

Significant p-values for both models indicate heteroskedasticity.

Wooldridge Test for Autocorrelation in Panel Data:

H_0 : No first-order autocorrelation

Sales Tax Model:

$F(1, 47) = 240.364$

Prob > F = 0.000

Combined Sales and Income Tax Model:

$F(1, 47) = 256.797$

Prob > F = 0.000

Significant p-values for both models indicate serial correlation.

Pesaran's Test for Contemporaneous Correlation

H_0 : Cross sectional independence

Sales Tax Model:

= 41.218, Pr = 0.0000

Average absolute value of the off-diagonal elements = 0.347

Combined Sales and Income Tax Model:

= 66.984, Pr = 0.0000

Average absolute value of the off-diagonal elements = 0.403

Significant p-values for both models indicates contemporaneous correlation.