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Local Intergovernmental Competition and the Law of 1/*n*

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This article proposes an empirical framework based on a synthesis of the seminal "Law of 1/*n*" and "Leviathan" theories, which models the relationship between government spending and the number of jurisdictions in a federal system as determined by the interplay of the costs related to centralized government (which fall as the number of jurisdictions increases) and the costs of distributive politics (which rise as the number of jurisdictions increases). Using a panel of U.S. state and local government spending data, empirical tests based on this combined framework show that the effect of intergovernmental competition predicted by the Leviathan model is partially offset by the Law of 1/*n*. This result helps explain the inconsistent findings in the previous empirical literature.

JEL Classification: H77, H72, H11

1. Introduction

In their seminal article on distributive politics, Weingast, Shepsle and Johnsen (1981) posit the "Law of 1/*n*" which states that as the number of legislative districts (*n*) increases, the tax share of public expenditures borne by each (1/*n*) falls. This in turn leads to an increase in the number of inefficient projects passed by the legislature and, ceteris paribus, an increase in total government expenditure. In a similarly important contribution, Brennan and Buchanan (1977, 1978, 1980) present a "Leviathan" model of government, which assumes government's objective is to maximize its size. In the context of this model, government can be constrained by intergovernmental competition resulting from fiscal decentralization. In other words, according the Law of 1/*n*, the number of legislative districts is positively related to the size of government, while the Leviathan model proposes a negative relationship between the number of governments and government size.

This article is the first to synthesize these theories. While a voluminous literature has concerned itself with the extension and empirical testing of these models separately, a unified model has thus far not been developed. While it may seem natural to assume a standard, relatively constant relationship between administrative districts (the lower level governments such as counties on which the Leviathan model is based) and legislative districts (which the Law of 1/*n* model deals with) exists across states, this is an unsafe assumption. In fact, the degree of "overlap" between legislative and administrative districts varies widely across the U.S. states. In this article, I capitalize on this exogenous variation to empirically test the degree to which the intergovernmental competition inherent in the Leviathan model is partially offset by the Law of 1/*n*.

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I present a model where government spending is dependent on both the number of lower level governments (as in the Leviathan literature) and the size of the legislature (as in the 1/*n* literature). When analyzed separately, each of the above theories holds as predicted by their respective models. The main prediction of the unified model, however, is that the negative effect on government size associated with increases in intergovernmental competition is lessened by related increases in legislature size. The extent of this effect is determined by the degree to which legislature size is linked to the number of lower level governments. In other words, if an increase in the number of substate governments (and associated increase in the level of competition) implies an increase in the number of legislative districts as well (in other words, the link between legislature size and the number of lower-level governments is strong) the constraining effect predicted by the Leviathan hypothesis is lessened. This lessening effect is caused by the positive relationship between legislature size and total spending. In the extreme case where the link is very strong, increases in the number of substate governments may actually lead to increases in spending as the associated increase in legislature size more than offsets the effects of intergovernmental competition.

This unified analysis has serious implications for past empirical tests of the Law of 1/*n* or Leviathan hypotheses. Studies of the Leviathan hypothesis which do not include the size of the legislature are failing to account for associated increases in spending attributable to distributive politics; this will lead to results which underestimate the constraining effects of intergovernmental competition on spending. Similarly, studies of legislature size which do not account for the number of substate governments are likely underestimating the 1/*n* effect. The theoretical model presented below demonstrates that by focusing only on the partial effect, these studies are assuming away the relationship between legislative and administrative jurisdictions. The extent of the associated biases is a function of the strength of the link between the two types of districts.

This article proceeds in the following manner. Section 2 provides a summary of the previous theoretical and empirical work following the Weingast, Shepsle, and Johnsen (1981) and Brennan and Buchanan (1977, 1978, 1980) contributions. Section 3 presents a model which unifies these two approaches. Section 4 discusses the data and empirical approach used to test the model's implications. Section 5 presents and discusses the empirical results, while the last section offers concluding remarks and policy implications.

2. Previous Literature

The Weingast, Shepsle, and Johnsen (1981) Law of 1/*n* is essentially a common pool model. Legislators seek projects for their districts (generally assumed to be geographically based) as long as the costs associated with the projects are exceeded at the margin by the related benefits.[1] If one assumes that district tax shares for projects approved by the legislature are inversely related to the number of districts (e.g., a regime where each district pays an equal share) the tax burden borne by each district falls as the number of districts increases. Ceteris paribus, the number of inefficient projects (and thus government expenditure) will increase as a result of each legislator systematically underestimating the project's cost.

[1] Most of the work following Weingast, Shepsle, and Johnsen (1981) is based on this conception of legislatures being geographically based. See Bradbury and Crain (2001) for a discussion of the interaction of bicameral legislatures based on different constituent populations and its implications for the Law of 1/n.

Numerous empirical studies have tested this straightforward implication. Studies using the U.S. states as the unit of analysis are most common [e.g., Gilligan and Matsusaka (1995, 2001), Primo (2006), and Chen and Malhotra (2007)]. Other jurisdictions examined include U.S. cities (Baqir 2002), counties in the state of Georgia (Bradbury and Stephenson 2003), and an international sample of countries (Bradbury and Crain 2001). These studies generally find evidence of the Law of $1/n$ in unicameral legislatures and the upper chamber (senate) of bicameral legislatures. While Gilligan and Matsusaka (1995, 2001) find no such relationship for lower chambers (house), Primo (2006) and Chen and Malhotra (2007) find a negative relationship between lower chamber size and spending, indicating lower chambers may be uniquely immune to the Law of $1/n$.[2]

Chen and Malhotra (2007) use this discrepancy between upper and lower chamber results as the basis of their theoretical extension which explicitly models bicameral legislatures. Their model posits, and the results of their empirical specification support, a negative relationship between the ratio of lower to upper chamber size (k) and spending. The authors refer to this as the "Law of k/n" since the forces work on spending in opposite directions. Other extensions include Crain (1999) (who shows that constituent diversity within and between districts affects the Law of $1/n$), Bradbury and Crain (2001) (who empirically test the interaction between bicameral legislatures), and Primo and Snyder (2008) (who show the Law of $1/n$ is dependent on a number of factors including the cost-sharing regime in place and the project's size and type). Looking at local governments, MacDonald (2008) provides evidence that the positive relationship between city council size and public expenditures observed in cross-sectional studies may be due to omitted variable bias, while Egger and Koethenbuerger (2010) find the expected positive relationship looking at German municipalities over a 21-year period. Importantly in the context of this article, Egger and Koethenbuerger (2010) conclude that fiscal competition may constrain "legislators' incentive to unhesitatingly approve each other's spending proposals."

The Brennan and Buchanan (1977, 1978, 1980) Leviathan model is based on the assumption that governments, left unchecked, seek to maximize their size. Within the model, the only possible constraints on the Leviathan government are a strict fiscal constitution or the presence of intergovernmental competition. While a great deal of the theoretical work by Brennan and Buchanan focuses on the strict fiscal constraints, empirical examination of the Leviathan model has been based almost exclusively on the proposed relationship between the degree of fiscal decentralization and government size.

That competition between governments constrains Leviathan is based on a model of government as a monopoly. As the number of competing governments is increased, the monopoly power achieved by any one is weakened. In the words of Brennan and Buchanan (1980), "Total government intrusion into the economy should be smaller, ceteris paribus, the greater the extent to which taxes and expenditures are decentralized." In later work, Buchanan (1995) refers to fiscal decentralization as an "ideal political order." In the extreme, competition between governments may approximate market outcomes (Dowding, John, and Biggs 1994). This efficiency-enhancing competition between jurisdictions is clearly influenced by the work of Tiebout (1956). Related research by Sobel (1997) and Berry (2008) identifies problems associated with multiple governments sharing taxing power over the same geographic area.

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[2] This lack of a "$1/n$ effect" in the lower chamber has been a consistent finding in the empirical literature. For possible explanations, see Chen and Malhotra (2007) who model legislature chambers in a game-theoretic bargaining framework and Bradbury and Crain (2001) who discuss a possible constitutional basis. Further examination of this issue is clearly an area ripe for future research.

A voluminous empirical literature has been devoted to testing the link between decentralization and spending, which is often dubbed the "Leviathan hypothesis." This previous literature has returned mixed results. Many studies find no relationship between decentralization and government size [see Oates (1985, 1989), Forbes and Zampelli (1989), Heil (1991), and Anderson and van den Berg (1998), e.g.] while many others provide evidence of the Leviathan hypothesis's validity [examples include Nelson (1986, 1987), Eberts and Gronberg (1988), Marlow (1988), Grossman (1989), Zax (1989), Joulfaian and Marlow (1990), Shadbegian (1999), Rodden (2003), Stansel (2006), and Crowley and Sobel (2011)]. This divergence in findings is striking given the variety of methodologies, units of analysis, and definitions of decentralization considered.

One explanation for the inconsistent findings not previously considered in the Leviathan literature is the role of the legislature. If increased competition (as measured by the number of substate governments) is accompanied by an increasingly large legislature, which in turn is characterized by a "$1/n$ effect" of increased spending, total spending, on net, may increase. Brennan and Buchanan (1980) discuss a related concern of a type of "collusion" among local governments whereby the constraining effects of intergovernmental competition are circumvented, specifically referring to cases where "the central government collects and administers taxes on behalf of the subordinate units" thereby effectively removing policy variables on which to compete. In the context of this article, substate governments may be able to partially escape the forces of intergovernmental competition through the use of the state government's (and here specifically the legislature's) ability to levy taxes and distribute revenue (or engage in direct expenditure) across all substate jurisdictions. This ability to collude (at least to some extent) through the legislature combined with the legislature's expected $1/n$ effect, which itself is based in part on using state funding to finance local projects, once again makes the effects of increased fiscal decentralization ambiguous. These issues are especially relevant as many previous studies use total state and local spending as the dependent variable, meaning that factors influencing multiple levels of government are relevant.[3]

Given the complexities outlined above, and as the relationship between lower level governments and legislative districts varies across jurisdictions, it is perhaps unsurprising that the Leviathan hypothesis has not been convincingly confirmed or refuted in the empirical literature. Clearly, a model of the counterbalancing forces of the Leviathan hypothesis and the Law of $1/n$ is required to better address these questions.

3. A Synthesis of the "Law of 1/*n*" and "Leviathan" Models

A central implication of the Weingast, Shepsle, and Johnsen (1981) and Brennan and Buchanan (1977, 1978, 1980) models is that total government spending is a function of the number of relevant jurisdictions (legislative districts in the case of the Law of $1/n$ and administrative districts in the case of the Leviathan model) comprising the government. Thus, a basic model of total government spending in state i which takes into account both effects can be expressed as

[3] The use of state and local government spending as the dependent variable is consistent with empirical studies in both the Leviathan [see Nelson (1987) and Wallis and Oates (1988), e.g.] and Law of $1/n$ [see Gilligan and Matsusaka (1995, 2001) and Primo (2006), e.g.] literatures. The empirical analysis conducted here uses local government spending and state government spending separately as additional dependent variables.

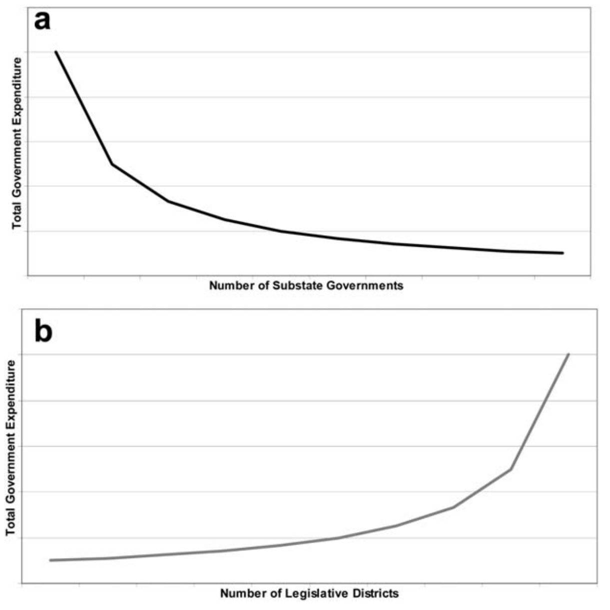

Figure 1. Leviathan, 1/*n*, and Government Size. (a) Leviathan Model, (b) Law of 1/*n* Model.

$$G_i = G(c_i, n_i, X_i) \tag{1}$$

where G_i is total government spending, c_i is the number of substate governments (such as counties), n_i is the number of seats in the state legislature, and X_i is a collection of other political and demographic factors which influence spending but are not affected by legislature size or the number of substate governments.

In keeping with several studies in the previous empirical literature, here G_i can be thought of generally as total state and local expenditure which would be affected by changes in the number of both types of districts with the Law of 1/*n* affecting primarily state-level spending and the Leviathan hypothesis applying primarily to local-level spending. When looking at total expenditures, however, it would not be entirely surprising to observe a 1/*n* result in local spending or a Leviathan effect at the state level as many local projects are funded by local governments through transfers from the state level.[4] As such, several levels of spending are considered in the empirical exercise below.

As discussed above, the Brennan and Buchanan (1977, 1978, 1980) model predicts that intergovernmental competition, a byproduct of fiscal decentralization, will help to constrain Leviathan government. Further, the degree of fiscal decentralization will increase as the number of substate governments increases, ceteris paribus (Tiebout 1956). In the context of Equation 1, the Leviathan model implies

$$\partial G_i / \partial c_i < 0 \tag{2}$$

indicating that total government spending is inversely related to the number of substate governments in the state. Figure 1a shows a hypothetical illustration of this relationship.

[4] This issue of the intergovernmental relationship between state and local governments is explored more thoroughly in the empirical exercise described in the following section.

The Weingast, Shepsle, and Johnsen (1981) Law of 1/*n* predicts that legislators will endorse spending programs in their districts up to the point where the marginal benefit of such programs is just equal to the marginal cost such that

$$b' = t' \tag{3}$$

where *b* is the benefit associated with the program and *t* is the cost associated with it. Through the legislature, however, the costs of local projects can be partially passed off to other districts. Assuming taxes are evenly spread across districts, the optimal (again, from the point of view of the legislator and his or her district) level of spending in the district becomes

$$b' = (1/n)t' \tag{4}$$

where *n* is the number of legislative districts within the state.[5]

Thus, the Law of 1/*n* implies that the optimal level of spending for each legislator is increasing in n. Assuming a traditional logrolling framework where legislators are able to bargain with one another for district-specific spending programs, total government spending is also positively related to the number of legislative districts. Specifically, in terms of Equation 1

$$\partial G_i/\partial n_i > 0. \tag{5}$$

Graphically, the relationship takes a form similar to Figure 1b.

In the unified model described by Equation 1, total government spending is positively related to the number of legislative districts, but negatively related to the number of substate governments. While this result can be tested straightforwardly as a baseline, the more interesting relationship between these counteracting forces requires knowledge of how the two types of jurisdictions relate to one another. This relationship can be expressed as

$$n_i = f(c_i, Y_i) \tag{6}$$

where Y_i is a collection of other exogenous variables affecting legislature size. For the empirical exercise described below, the relationship between legislative and administrative districts in each state may be safely considered to be exogenously determined as states typically define the makeup of their legislatures within their constitutions. For example, Section 50 of Alabama's constitution states, "The legislature shall consist of not more than thirty-five senators, and not more than one hundred and five members of the house of representatives, to be apportioned among the several districts and counties, as prescribed in this Constitution; provided that in addition to the above number of representatives, each new county hereafter created shall be entitled to one representative." Article VI, Section 4 of West Virginia's constitution provides for legislative districts which are "compact, formed of contiguous territory, bounded by county lines, and, as nearly as practicable, equal in population" with Section 5 explicitly defining the initial relationship between such districts and county governments: "Until the senatorial districts shall be altered by the Legislature as herein prescribed, the counties of Hancock, Brooke and Ohio, shall constitute the first

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[5] Importantly, the key conclusions of the model hold for any regime where individual district tax shares are decreasing in "*n*." The assumption of evenly split tax burden simplifies the model and yields the classic "1/*n*" version of the conclusion.

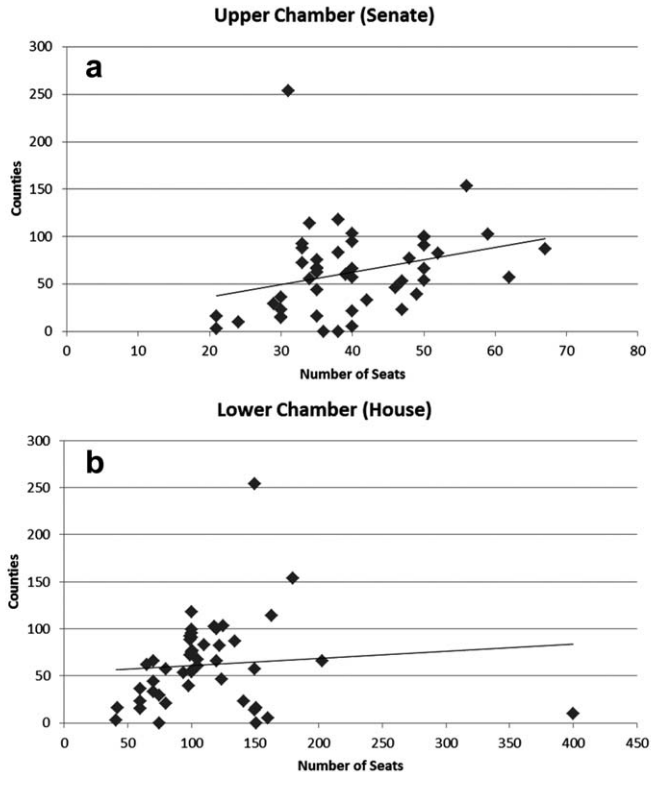

Figure 2. Number of Counties and Chamber Size (2010). (a) Upper Chamber (Senate), (b) Lower Chamber (House).

senatorial district; Marshall, Wetzel and Marion, the second; Ritchie, Doddridge, Harrison, Gilmer and Calhoun, the third..."

Given that the linkage between substate governments and legislative districts is codified within state constitutions, changes are infrequent. Over the sample period described below, the correlation coefficient between observations across states from the first year (1992) and last year (2010) is 0.9848 for the upper legislative chamber, 0.9978 for the lower chamber, and 0.9997 for the number of counties. While some variation did occur, the vast majority of states experienced no changes in the size of their legislatures or number of counties over this period.

The relationship between legislature size and substate governments (e.g., counties) varies widely across states. Figure 2 plots the number of counties against the number of seats in the legislator for the 47 contiguous U.S. states featuring bicameral legislatures in 2010. Panel a depicts the relationship for the upper chamber (or senate), while panel b shows the lower chamber (or house). The correlation coefficient across the sample between counties and legislature size is 0.289 for the upper chamber and 0.091 for the lower chamber. Further, the R^2 value of the trends depicted in Figure 2 is 0.08 for the upper chamber and 0.01 for the lower chamber. Thus, while the relationship between counties and upper chamber seats is stronger than the relationship with lower chamber seats, it is still far from constant across states. For example, Texas is made up of 254 county governments but has an upper chamber of only 31 seats (a ratio of 0.122 legislative districts per county government) while Massachusetts has an upper chamber of 40 seats, and only five county

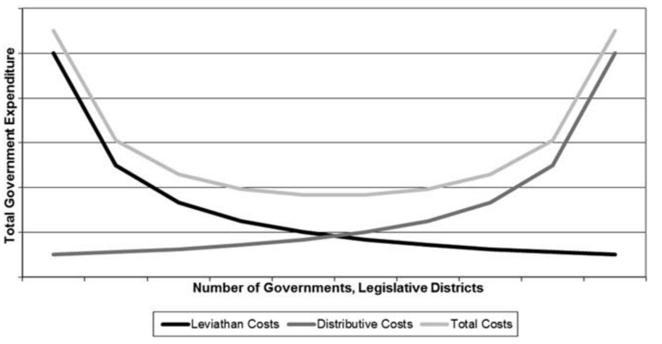

Figure 3. Combined Model for a Hypothetical State with the Number of Legislators Equal to the Number of Substate Governments.

governments (a ratio of eight legislative districts per county). The correlation coefficient between upper and lower chamber seats in 2010 is 0.119.

From a theoretical standpoint, the relationship defined in Equation 6 is important because it indicates the partial derivative in Equation 2 does not adequately reflect the total effect of an increase in the number of substate governments on total government spending. Instead, a total derivative of Equation 1 with respect to c is required:

$$dG_i/dc_i = G_1 + G_2(\partial n_i/\partial c_i) \tag{7}$$

with $G_1 = \partial G_i/\partial c_i$ and $G_2 = \partial G/\partial n$, and given $\partial X_i/\partial c_i = 0$ by assumption. Given the positive relationship between the number of seats in the legislature and total government spending described in Equation 5, the total effect of an increase in c is less than (in absolute terms) the partial derivative $\partial G_i/\partial c_i$ would suggest. Specifically, the impact of an increase in intergovernmental competition is lessened by the interaction of the $1/n$ effect, $\partial G_i/\partial n_i$, and the relationship between legislative districts and substate governments $\partial n_i/\partial c_i$. In other words, the effect of an increase in the level of intergovernmental competition (as measured by the number of substate governments) is partially offset by associated increases in legislature size (as the Law of $1/n$ posits an opposite, positive relationship).

To more clearly express this idea, Figure 3 presents a hypothetical case illustrative of a state where the number of substate governments is identical to the number of legislative jurisdictions. This diagram combines both panels of Figure 1, with the increases in government expenditure associated with increased legislature size referred to as "Distributive Costs" and the increases in spending associated with decreased fiscal decentralization referred to as "Leviathan Costs." That is, Distributive Costs increase as the number of jurisdictions increase while Leviathan Costs fall as the number of districts increase. This representation is clearly inspired by Buchanan and Tullock's (1962) discussion of the costs associated with various voting rules.

Following the approach of Buchanan and Tullock (1962), I define Total Costs as the sum of these two costs. Total Costs are highest at either extreme (zero or some maximum number of jurisdictions) and minimized at some point in between. At this point where Total Costs are minimized, the portion of government spending which is determined by the number of jurisdictions will also be minimized. In the simple case depicted in Figure 3 where the rate at which the costs increase/decrease is identical by construction, this happens to be at the intersection of the two costs.

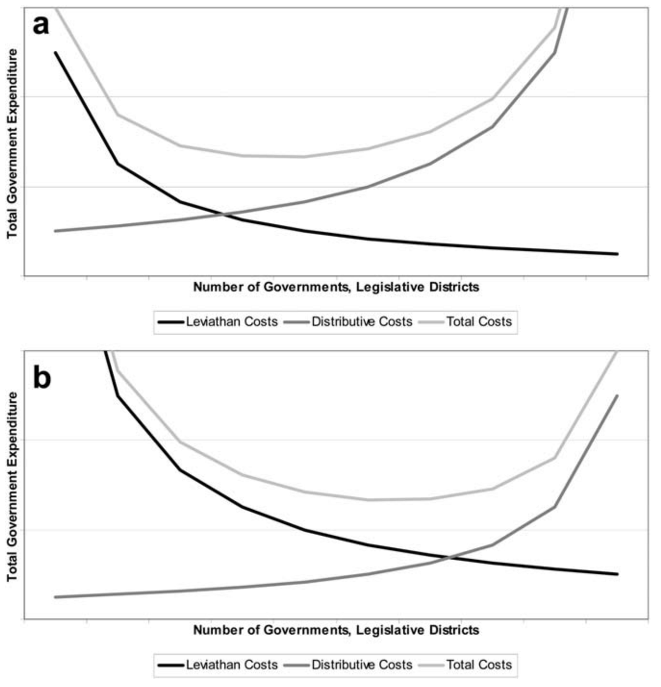

Figure 4. The Relationship Between the Number of Districts and Government Expenditure. (a) Hypothetical State with 1 Substate Government per 2 Legislative Districts, (b) Hypothetical State with 2 Substate Governments per 1 Legislative District.
Note: For simplicity, the above figure assumes the rate at which an increase in the number of governments or legislators affects Leviathan and distributive costs is the same.

In this example, the Leviathan hypothesis holds for smaller numbers of jurisdictions, with increases in the number of jurisdictions leading to decreases in government spending. This is depicted in the figure as the area to the left of the minimum point, and it is here that the partial derivative $\partial G_i/\partial c_i$ is large enough (in absolute terms) to overcome the upward pressure of the $1/n$ effect $\partial G_i/\partial n_i$. Given $\partial G_i/\partial n_i > 0$, the sign and magnitude of $\partial n_i/\partial c_i$ determines the degree to which the $1/n$ effect offsets the constraining effects intergovernmental competition. If $\partial n_i/\partial c_i > 0$ and sufficiently large (i.e., increases in substate governments necessarily lead to relatively large increases in the size of the legislature) increases in the number of substate governments will actually lead to increases in total government size as the intergovernmental competition between administrative districts is more than offset by associated increases in the size of the legislature and a growing $1/n$ effect.

As the relationship between substate governments and legislative districts changes, the curves depicted in Figure 3 shift. Figure 4 depicts an example of this. Panel a presents a hypothetical linear relationship characterized as two legislative districts for each substate government. This is depicted in the figure as a leftward shift of the Distributive Costs curve, as well as a leftward shift of the minimum point on the Total Cost curve, and indicates that the costs associated with the $1/n$ effect dominate the cost-savings associated by intergovernmental competition at a much lower number of jurisdictions than in the baseline case depicted in Figure 3. Panel b presents the opposite scenario, where the linear relationship is characterized as two local governments for each legislative district, shifting the Leviathan cost curve to the right, and shows that total costs are

Table 1. Summary Statistics

48 Contiguous U.S. States (Excluding Nebraska), Years: 1992–2010

Variable Name	Mean	SD
Upper chamber seats	40.099	10.096
Lower chamber seats	113.554	59.946
Counties	62.320	45.571
Real state and local government expenditure per capita	3598.763	734.903
Real state government expenditure per capita	2362.680	557.276
Real local government expenditure per capita	1843.934	489.956
Democrat governor	0.458	0.499
Percent democrat prev. presidential election	45.693	7.762
Population growth rate (average percentage over 5 years)	1.158	0.981
State population (millions)	5.944	6.296
Real federal aid per capita	675.113	254.488
Real personal income per capita	16338.177	2799.868
Percent young (age 5-17)	18.174	1.423
Percent below poverty line	12.721	3.550
Population density (pop/sq mi)	246.214	788.303
Percent white	83.552	11.463
Ratio of local to state total expenditure	0.802	0.203
Real local intergovernmental revenue from state per capita	579.923	187.917
Distance from state capital to population centroid (miles)	53.414	57.448

Note: All fiscal variables are adjusted for inflation using the Consumer Price Index with a base year of 1982–1984.

minimized at a much higher number of jurisdictions than in the baseline case. In this case, intergovernmental competition overwhelms the $1/n$ effect, except at the highest number of jurisdictions. Importantly, the full effect of increases in the number of legislative or administrative districts cannot be considered separately, regardless of the specific functional form of the relationship between the types of jurisdictions.

4. Data and Empirical Approach

I test the combined model on a panel of U.S. state data. The data span the years 1992–2010 and cover 47 of the 48 contiguous states. As is standard in the empirical literature on state legislatures, Nebraska is excluded from the analysis due to its unique unicameral legislature. Table 1 reports summary statistics for all variables used in the analysis.

The number of county governments is constructed from data available from the U.S. Census of Governments. These data are available in five-year increments, and I extrapolate for the missing years using an average annual growth rate, though the vast majority of states experienced no changes in the number of counties over the sample period. The number of seats in the upper and lower legislative chambers is taken from various volumes of the Council of State Government's *The Book of the States*. State and local government expenditure is total state and local expenditure and is taken from the Census Bureau's State and Local Government Finance data. I also use state expenditure and local expenditure separately as additional dependent variables. These variables are not available for the years 2001 or 2003 so these years are excluded. All fiscal variables are adjusted for inflation using the Consumer Price Index with a base year of 1982–1984, and expressed in per capita terms using state population.

Information on the governor's political party is taken from *The Book of the States*, and is included to control for party-specific fiscal policy. Also included is the percentage of votes cast for the Democrat candidate in the previous Presidential election to control for political ideology amongst the residents in each state. State population is taken from the Bureau of Economic Analysis, and the population growth rate is the average annual percentage change over the previous 5 years. Experiments with the use of other growth rates, including difference in logs, total changes instead of average annual changes, and different time periods yielded nearly identical results. Personal income data come from the Bureau of Economic Analysis and Federal aid comes from annual issues of the *Federal Aid to States* report. Both are adjusted for inflation and population in the same manner discussed above, and also lagged by 1 year to avoid issues of simultaneity.[6] Finally, the percentage of the population that is young (between ages 5 and 17), the percentage of the population that is white, and state population density all come from the *Statistical Abstract*, while the percentage of individuals below the poverty line comes from the Census Bureau's Current Population Survey data. These variables are included to control for differences in fiscal policy owing to differences in demographics. For instance, a larger share of the population aged 5–17 would likely be associated with higher spending on education, while a greater population density or larger portion of the population below the poverty line could be expected to lead to differences in spending associated with urban infrastructure or welfare programs.

To test the effects of local governments and legislative chamber size on government spending, I use the following fixed effect panel model:

$$G_{it} = \alpha + \beta_1 n_{it}^{U} + \beta_2 n_{it}^{L} + \beta_3 c_{it} + \delta X_{it} + \mu_t + \varphi_i + \epsilon_{it} \tag{8}$$

where G_{it} represents total government expenditure, n_{it}^{U} represents the number of seats in the upper chamber, n_{it}^{L} represents the number of seats in the lower chamber, and c_{it} represents the number of county governments in state i during year t. X_{it} is a matrix of demographic and political factors which may affect government spending, and μ_t and φ_i represent year and state fixed effects. As described above, there is a high degree of correlation among legislature sizes and the number of counties from year to year; as such the models are estimated both with and without state fixed effects. The variables which enter the X_{it} matrix include those listed above: an indicator for the governor's political party, the percentage of the state voting for Democrat in the previous Presidential election, the state's population growth rate, the level of population, real per capita federal aid to the state in the prior year, real per capita state personal income for the prior year, population density, and variables representing the percentages of the population that is age 5–17, living below the poverty line, and white. The error term, ϵ_{it}, is clustered at the state level.

Equation 8 can be estimated without the chamber size variables to test a traditional Leviathan hypothesis model. Similarly, the counties variable can be dropped to test a $1/n$ model. When Equation 8 is estimated with both the chamber size and county variables included, the model described above would predict a negative and significant coefficient on the number of county governments with a positive and significant coefficient on the upper chamber size. Past empirical studies have typically found either an insignificant or negative coefficient on the lower chamber size variable.

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[6] While the data cover the years 1992-2010, including these 1-year lagged variables, coupled with the lack of data for years 2001 and 2003, means the sample size is 658 observations (14 years × 47 states) since the years 1992, 2002, and 2004 must be excluded as well due to a lack of observations for these lagged variables.

While the previous empirical specification is useful for testing the partial effects of chamber size and the number of substate governments, it does not adequately model the relationship between the counterbalancing forces detailed above. To test the effect of the relationship between the number of county governments and legislature size on the size of government, I specify two additional models. The first [Eqn. 9 below] includes ratios of each chamber size variable to the county governments variable to estimate how relative changes in the number of each type of jurisdiction affect spending. As constructed, these ratios increase when either the number of seats in the legislature increases relative to the number of counties, or when the number of county governments decreases in relative magnitude. Thus, the expected effect of an increase in the ratio is an increase in expenditure.

$$G_{it} = \alpha + \beta_1 (n_{it}^{\mathrm{U}} / c_{it}) + \beta_2 (n_{it}^{\mathrm{L}} / c_{it}) + \delta X_{it} + \mu_t + \varphi_i + \epsilon_{it} \tag{9}$$

A second approach to modeling the interplay of legislative and administrative jurisdictions is to include variables which interact the number of county governments with the chamber sizes. These provide a test of the change of the marginal effect of an increase in governments or chamber sizes due to an increase in the *other* type of district. With these inclusions, the empirical model becomes

$$G_{it} = \alpha + \beta_1 n_{it}^{\mathrm{U}} + \beta_2 n_{it}^{\mathrm{L}} + \beta_3 c_{it} + \beta_4 (n_{it}^{\mathrm{U}} \times c_{it}) + \beta_5 (n_{it}^{\mathrm{L}} \times c_{it}) + \delta X_{it} + \mu_t + \epsilon_{it}. \tag{10}$$

As before, the above model predicts a positive and significant coefficient on the upper chamber size variable, and a negative and significant coefficient on the total governments variable. The inclusion of the interaction terms, however, modifies the interpretation of the marginal effect. For the upper chamber size variable, for instance, the marginal effect becomes

$$\partial G_{it} / \partial n_{it}^{\mathrm{U}} = \beta_1 + \beta_4 c_{it}, \tag{11}$$

and is dependent in part on the number of substate governments. The marginal effects for the lower chamber and total substate governments variables are derived similarly. The full marginal effects can then be evaluated at the sample mean to yield a more complete understanding of the effect of jurisdictions on total government size.

Importantly, the previous specifications ignore the substitutability between state and local government spending; that is, state and local spending are considered to be independently determined. However, it is likely the case that spending at the state and local level are inextricably linked. For example, increases in state spending may lead to decreases in local spending as local governments opt to accept intergovernmental transfers or direct provision of some services from the state rather than spending own-source revenue. Further, the prospect of collusion amongst substate governments via the state government, as discussed by Brennan and Buchanan (1980), provides an additional theoretical justification for considering the substitutability of state and local expenditure. Using total state and local expenditure as the dependent variable may conflate these effects. At the same time, using only either state or local expenditure, without explicitly controlling for the substitutability of spending or intergovernmental transfers is insufficient. Only by adequately controlling for the intergovernmental relationship between state and local government expenditure can the true effects of increases in legislative and administrative districts on the size of government be determined.

Without question, this fiscal relationship between state and local government is endogenous to the model, in that the number of substate governments should primarily affect local expenditure while the size of the legislature affects state spending. Thus, a two-stage approach is required which explicitly estimates this endogenous "federalism" variable before including it as an additional explanatory variable in Equation 8. The first stage equation takes the form

$$F_{it} = \alpha + \beta_1 n_{it}^{U} + \beta_2 n_{it}^{L} + \beta_3 c_{it} + \delta X_{it} + \gamma Z_{it} + \mu_t + \varphi_i + \epsilon_{it} \tag{12}$$

where F_{it} is a variable measuring the federalism effect described above, which is then included as an additional explanatory variable in Equation 8, and Z_{it} a set of additional exogenous (instrumental) variables used to identify the system of equations. Empirically, F_{it} can be defined as the ratio of local to state total expenditure, in which case the coefficients on both the number of substate governments variable as well as the chamber size variables are expected to take negative signs (as an increase in counties is expected to lead to lower local expenditure, while an increase in chamber size is expected to lead to higher state expenditure). Alternatively, F_{it} can be defined as per capita local revenue coming from intergovernmental transfers from state government, which directly measures the degree to which local spending is driven by state government action. With this dependent variable, the chamber size variable is once again expected to take a positive sign (as the local projects driving the $1/n$ effect likely require transfers from state to local government). If the number of county governments variable takes a positive sign it may provide evidence of the type of collusion discussed by Brennan and Buchanan (1980). Two additional exogenous instrumental variables are included in each specification of Equation 12 (and excluded from the second stage estimation): the distance, in miles, from the state capital to the population centroid of each state and the lagged value of the endogenous variable. Equations 12 and 8 are estimated together using two-stage-least squares (2SLS).

5. Results and Discussion

Before examining the effect of intergovernmental competition on the Law of $1/n$, I conduct an initial analysis to test both models separately. This serves two functions: first, it checks the robustness of previous empirical studies by using different data and second, it ensures that the primary findings are not an artifact of any characteristics of these data which are inconsistent with that used by others. Tables 2a (specifications including state fixed effects) and 2a (specifications without state fixed effects) present these baseline results.

The first column for each dependent variable in Table 2a presents results from a test of the $1/n$ hypothesis. Consistent with the previous theoretical and empirical literature, the relationship between the number of seats in the upper chamber and government spending is positive and statistically significant in the state and local government expenditure models, as well as in the state expenditure and local expenditure models. Also consistent with previous empirical work, the size of the lower chamber is negatively related to government spending in all models. The specification presented in the second column tests the Leviathan fiscal decentralization hypothesis. Again consistent with the previous literature, the results are mixed. While there appears to be a negative relationship between state and local government spending and the number of local governments in a state, the variable is statistically insignificant in each of the models.

Table 2a. Testing the Law of 1/*n* and Leviathan Theories

Dependent Variable: Real Per Capita Total Expenditure

	State and Local Government		State Government		Local Government	
Upper chamber seats	365.621***		255.208***		347.698***	
	(55.812)		(43.786)		(34.472)	
Lower chamber seats	−180.382***		−123.450***		−170.026***	
	(27.822)		(22.773)		(17.413)	
Counties		−3.199		7.519		3.863
		(15.073)		(13.518)		(8.866)
Democrat governor	−5.236	−5.106	−16.961	−15.058	−3.088	−1.879
	(25.069)	(24.633)	(37.479)	(36.124)	(15.632)	(15.997)
Percent democrat prev. presidential election	−1.255	−0.604	2.785	3.009	−2.305	−1.830
	(5.069)	(4.986)	(5.706)	(5.522)	(3.143)	(3.214)
Population growth rate	27.015	23.752	29.549	27.127	−2.241	−5.442
	(45.382)	(46.123)	(42.761)	(43.976)	(25.232)	(24.320)
Population (millions)	2.544	−2.753	−51.751*	−54.762*	36.987**	32.233*
	(36.821)	(36.031)	(30.695)	(29.679)	(17.926)	(17.663)
Real per capita federal aid (t-1)	0.457*	0.476*	0.441**	0.453**	0.155	0.172
	(0.258)	(0.265)	(0.212)	(0.217)	(0.138)	(0.142)
Real per capita personal income (t-1)	0.111***	0.116***	0.665***	0.071***	0.084***	0.090***
	(0.037)	(0.038)	(0.022)	(0.023)	(0.030)	(0.031)
Percent young (age 5-17)	−15.326	−6.868	−43.281	−35.776	17.003	26.264
	(26.685)	(28.124)	(26.646)	(28.016)	(16.831)	(19.047)
Percent below poverty line	−7.249	−8.392*	−11.302**	−11.851**	−0.910	−1.811
	(5.061)	(4.965)	(4.577)	(4.509)	(2.355)	(2.588)
Population density (pop/sq mi)	0.002	0.001	0.003	0.003	0.004	0.003
	(0.008)	(0.008)	(0.006)	(0.006)	(0.005)	(0.005)
Percent white	2.690**	2.773**	2.454***	2.478***	1.473*	1.527**
	(1.037)	(1.040)	(0.899)	(0.893)	(0.558)	(0.583)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	658	658	658	658	658	658
R^2	0.967	0.966	0.956	0.955	0.971	0.968

Note: All models include year fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.

* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level.

As discussed above, there is very little variation in the number of districts in each state over the sample period discussed, likely leading to multicollinearity when state fixed effects are included. Table 2b presents findings when the models are estimated without state effects. The upper chamber variable remains positively related to government expenditure, though it is now statistically significant in only the local government specification. The counties variable, however, is now negative in all three models and statistically significant in the state and local and state specifications. The lower chamber variable remains negative and statistically significant in all specifications.

Table 3 presents results for the first model attempting to estimate the effect of the relationship between legislative and administrative districts on government size. In place of the number of districts variables are two ratios: the number of upper chamber seats per county government, and the

Table 2b. Testing the Law of 1/*n* and Leviathan Theories

Dependent Variable: Real Per Capita Total Expenditure

	State and Local Government		State Government		Local Government	
Upper chamber seats	7.262		1.076		9.708**	
	(4.561)		(3.772)		(4.421)	
Lower chamber seats	−2.011***		−1.669***		−1.065**	
	(0.545)		(0.541)		(0.515)	
Counties		−2.546**		−2.888***		−0.157
		(1.078)		(0.893)		(1.448)
Democrat governor	42.137	55.690	18.709	38.817	47.256	41.240
	(53.817)	(61.980)	(47.607)	(52.823)	(45.426)	(52.949)
Percent democrat prev.	11.464**	6.723	16.513***	11.123**	−1.523	−1.805
presidential election	(5.165)	(5.755)	(4.831)	(4.797)	(6.462)	(6.510)
Population	26.975	13.888	−49.992*	−51.138**	106.737***	90.900**
growth rate	(33.991)	(27.859)	(29.138)	(22.441)	(31.656)	(34.480)
Population (millions)	20.031***	29.232***	−2.702	6.340	34.753***	37.079***
	(6.475)	(8.833)	(6.227)	(5.053)	(7.661)	(9.323)
Real per capita	1.456***	1.359***	1.340***	1.226***	0.579*	0.584*
federal aid (t-1)	(0.305)	(0.319)	(0.212)	(0.208)	(0.296)	(0.313)
Real per capita	0.124***	0.112***	0.042***	0.027**	0.092***	0.092***
personal income (t-1)	(0.021)	(0.024)	(0.013)	(0.012)	(0.026)	(0.031)
Percent young	39.856	47.657*	24.067	29.849	43.295**	48.045**
(age 5-17)	(28.015)	(24.237)	(26.486)	(24.885)	(18.241)	(18.302)
Percent below	−15.808	−4.682	−16.973*	−7.872	−4.843	0.673
poverty line	(10.554)	(11.611)	(9.048)	(8.850)	(10.739)	(12.290)
Population density	0.008	0.010	−0.003	0.000	0.009	0.010
(pop/sq mi)	(0.012)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)
Percent white	2.767	1.586	1.555	1.293	2.029	0.577
	(1.827)	(1.902)	(1.457)	(1.405)	(1.471)	(1.596)
State fixed effects	No	No	No	No	No	No
Number of observations	658	658	658	658	658	658
R^2	0.829	0.817	0.780	0.786	0.710	0.666

Note: All models include year fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.

* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level.

number of lower chamber seats per county government. Importantly, these ratios increase in magnitude when either the chamber size variable increases relative to the number of substate governments *or* the county government variable decreases relative to legislature size. For all levels of spending, the ratio of upper chamber seats to county governments is positive and statistically significant, as predicted by the 1/*n* and Leviathan theories. The lower chamber size ratio is negative and statistically significant in all specifications, providing further evidence of the lower chamber's uniqueness.

As discussed above, the relationship between substate governments and legislative districts varies across states, indicating models which include only chamber size or the number of governments largely ignore the effects of the excluded variable. Tables 4a and 4b present results for specifications which include both upper and lower legislative chamber size and the number of counties with (Table 4a) and without (Table 4b) state fixed effects. The first column for each dependent variable presents estimates for models including all three jurisdiction variables. In the models which include the state fixed effects, the upper chamber size variable is once again positive and statistically significant while the counties variable continues to exhibit mixed results. When the state fixed effects are dropped, the counties variable takes the expected negative sign in all specifications, and is statistically significant in the state and local and state models. The upper chamber variable remains positive without the state effects, and is statistically significant in the state and local and local expenditure models.

The second column for each dependent variable in Tables 4a and 4b includes coefficient estimates for the additional interaction terms. These terms interact the number of local governments with upper and lower chamber sizes. With and without state fixed effects, the county governments variable retains its negative, statistically significant sign in the state and local and state government specifications. The upper chamber coefficient is positive and statistically significant in the fixed effects models, but insignificant in those models without the state effects.

Importantly, the coefficient point estimates alone do not provide a complete understanding of the effects of jurisdictions on government spending. As individual statistical significance does not necessarily imply joint statistical significance, the standard errors for the "true" marginal effects must be computed using an alternative technique. Table 5 presents the estimated marginal effects, computed at the sample means, for all variables of interest.[7] Importantly, the size of the upper chamber is positively related to all measures of government expenditure, as predicted by the Law of 1/*n*, and statistically significant in all but one of six specifications. The marginal effect of the number of county governments is also negative and statistically significant in more than half of the models, providing support for the Leviathan hypothesis.

These results lend credence to the joint analysis of the counteracting forces of the Law of 1/*n* and "Leviathan" models, and generally support the previous findings of the empirical literature: the size of the upper legislative chamber is positively related to the size of government while the number of county governments is negatively related to government size, though with less consistent results. This finding is important and when coupled with the results in Tables 2 and 2b, provides evidence that previous empirical studies (in particular those testing the Leviathan hypothesis) which have focused on only one effect may be failing to find an effect due to an omitted variable.

Further, the results presented in Tables 3 and 4 show that the marginal effect of increases in the number of one type of jurisdiction depends in part on related changes in the number of the other type. The results from these models which explicitly allow for the interaction between the two effects indicate in that at the margin, increases in intergovernmental competition lead to lower government expenditures, while increases in upper chamber size lead to increased spending (in most specifications). Standalone tests of the Leviathan hypothesis which fail to account for the associated 1/*n* effect are underestimating this constraining effect.

Additional results of note include the across-the-board significance of upper chamber size and increased expenditure, regardless of the level of government. Also of note is the *lack* of a

[7] The standard errors for the marginal effects were calculated using the estimates from the variance-covariance matrices for each model. For example, as the marginal effect for upper chamber size is $\partial G_{it}/\partial n_{it}^{\mathrm{U}} = \beta_1 + \beta_4 c_{it}$ [see Eqn. 11], the associated standard error can be defined as the square root of the variance of the linear combination of two random variables, β_1 and β_4 such that $\hat{\sigma} = \sqrt{\mathrm{var}(\hat{\beta}_1) + c_{\mathrm{it}}^{-2} var(\hat{\beta}_4) + 2\bar{c}_{it}\mathrm{cov}(\hat{\beta}_1, \hat{\beta}_4)}$, where $\bar{c}_{it}$ is the sample mean for county governments.

Table 3. The Interaction of the "Law of 1/*n*" and "Leviathan" Theories, Ratio of Chamber Size to Counties

Dependent Variable: Real Per Capita Total Expenditure

	State and Local Government	State Government	Local Government
Ratio upper chamber seats to counties	19262.190***	13670.260***	13646.990***
	(2527.473)	(2406.458)	(3610.732)
Ratio lower chamber seats to counties	−4816.367***	−3423.757***	−3414.961***
	(633.510)	(601.478)	(903.765)
Democrat governor	−17.999	−26.873	−8.721
	(23.220)	(36.317)	(15.881)
Percent democrat prev. presidential election	1.122	4.977	−1.007
	(4.854)	(5.653)	(3.053)
Population growth rate	51.492	48.011	9.532
	(43.363)	(42.311)	(26.138)
Population (millions)	−10.970	−65.468**	28.514
	(36.431)	(31.212)	(17.516)
Real per capita federal aid (t-1)	0.428*	0.417**	0.137
	(0.245)	(0.204)	(0.124)
Real per capita personal income (t-1)	0.129***	0.084***	0.098***
	(0.038)	(0.023)	(0.031)
Percent young (age 5-17)	−12.091	−35.113	19.085
	(23.015)	(24.335)	(18.116)
Percent below poverty line	−7.271	−10.924**	−1.353
	(5.086)	(4.693)	(2.373)
Population density (pop/sq mi)	0.002	0.003	0.004
	(0.008)	(0.006)	(0.005)
Percent white	2.663**	2.349**	1.474**
	(1.045)	(0.899)	(0.588)
Number of observations	630	630	630
R^2	0.965	0.957	0.972

Note: All models include year and state fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.

* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level. Observations with 0 counties dropped.

statistically significant effect of the number of counties in the local government specifications, where the effect would likely be expected to be strongest, despite the fact that the expected constraining effect is observed in the state expenditure models. These puzzling results are perhaps indicative of a substitution of state for local expenditure and point to the need to explicitly control for the vertical relationship between state and local government expenditures with the two-stage approach detailed above.

Table 6a presents results for models which more directly estimate the role played by the linkage between legislative and administrative districts. These models include a first-stage estimation of the ratio of local to state expenditures, which is then included as an additional explanatory variable in the total expenditure equations. The first column of Table 6a presents results from the estimation of the first stage. As expected, both upper chamber size and the number of county governments have negative, statistically significant effects on the local to state spending ratio. Once this variable is then included in the total expenditure models, the upper chamber variable

Table 4a. The Interaction of the "Law of 1/n" and "Leviathan" Theories

Dependent Variable: Per Capita Expenditure

	State and Local Government		State Government		Local Government	
Upper chamber seats	369.887***	363.728***	252.809***	327.603***	348.000***	323.238***
	(59.549)	(117.366)	(47.355)	(118.788)	(37.708)	(72.912)
Lower chamber seats	−182.614***	−181.374***	−121.995***	−159.057***	−170.184***	−158.988***
	(29.969)	(57.399)	(24.794)	(57.848)	(19.020)	(35.345)
Counties	−8.421	−274.528***	4.735	−230.611**	−0.597	−91.768
	(15.454)	(77.403)	(13.952)	(87.105)	(8.233)	(65.585)
Upper chamber seats × counties		−0.237		−1.568		0.302
		(1.945)		(2.042)		(1.191)
Lower chamber seats × counties		1.751*		1.908*		0.499
		(0.902)		(1.005)		(0.650)
Democrat governor	−5.503	−13.561	−16.811	−22.092	−3.107	−6.389
	(25.229)	(24.818)	(37.467)	(36.937)	(15.653)	(16.052)
Percent democrat prev.	−1.188	−0.140	2.747	3.879	−2.300	−2.000
presidential election	(5.065)	(4.889)	(5.698)	(5.746)	(3.164)	(3.048)
Population growth rate	27.146	36.659	29.476	35.351	−2.232	1.744
	(45.165)	(43.256)	(43.017)	(40.892)	(25.224)	(26.924)
Population (millions)	3.346	5.789	−52.202	−50.526	37.044**	38.017**
	(37.337)	(36.908)	(31.183)	(30.392)	(18.134)	(18.340)
Real Per capita federal aid (t-1)	0.459*	0.442*	0.440**	0.429**	0.155	0.149
	(0.260)	(0.251)	(0.213)	(0.209)	(0.138)	(0.132)
Real per capita personal income (t-1)	0.110***	0.117***	0.067***	0.075***	0.084***	0.087***
	(0.039)	(0.038)	(0.024)	(0.022)	(0.031)	(0.032)
Percent young (age 5-17)	−17.365	−32.848	−42.135	−54.124*	16.858	11.072
	(27.037)	(27.333)	(27.340)	(27.940)	(17.048)	(19.099)
Percent below poverty line	−7.518	−7.130	−11.151**	−10.874**	−0.929	−0.778
	(4.995)	(4.832)	(4.569)	(4.535)	(2.380)	(2.369)
Population density (pop/sq mi)	0.002	0.003	0.003	0.004	0.004	0.004
	(0.008)	(0.008)	(0.006)	(0.006)	(0.005)	(0.005)
Percent white	2.723**	2.811***	2.435***	2.502***	1.475**	1.508**
	(1.035)	(1.032)	(0.889)	(0.891)	(0.566)	(0.568)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	658	658	658	658	658	658
R^2	0.967	0.968	0.956	0.957	0.967	0.971

Note: All models include year fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.
* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level.

Table 4b. The Interaction of the "Law of 1/n" and "Leviathan" Theories

Dependent Variable: Per Capita Expenditure

	State and Local Government		State Government		Local Government	
Upper chamber seats	9.620**	6.377	3.466	1.364	10.193**	3.511
	(4.584)	(9.030)	(3.791)	(6.985)	(4.823)	(9.095)
Lower chamber seats	−1.755***	−2.601***	−1.408***	−2.346***	−1.012**	−0.572
	(0.438)	(0.616)	(0.473)	(0.790)	(0.488)	(0.590)
Counties	−2.768***	−8.410**	−2.805***	−8.459*	−0.569	−0.974
	(0.910)	(3.554)	(0.926)	(4.659)	(1.089)	(3.700)
Upper chamber seats × counties		0.040		0.024		0.094
		(0.090)		(0.081)		(0.087)
Lower chamber seats × counties		0.029		0.033		−0.021
		(0.018)		(0.022)		(0.015)
Democrat governor	68.830	73.449	45.765	52.090	52.748	43.545
	(53.841)	(55.886)	(49.779)	(51.048)	(47.034)	(45.414)
Percent democrat prev.	6.342	4.433	11.322**	9.266*	−2.576	−1.907
presidential election	(5.587)	(5.730)	(4.976)	(4.905)	(6.443)	(6.380)
Population growth rate	13.328	−15.058	−63.825**	−92.820**	103.929***	104.979***
	(34.055)	(41.280)	(29.348)	(40.843)	(31.524)	(34.255)
Population (millions)	28.360***	29.171***	5.741	6.343	36.466***	37.705***
	(8.285)	(8.138)	(4.816)	(4.938)	(8.373)	(9.551)
Real per capita federal aid (t-1)	1.302***	1.238***	1.185***	1.110***	0.548*	0.601**
	(0.308)	(0.321)	(0.210)	(0.232)	(0.301)	(0.290)
Real per capita personal income (t–1)	0.111***	0.110***	0.029**	0.027**	0.090***	0.093***
	(0.021)	(0.021)	(0.013)	(0.013)	(0.027)	(0.026)
Percent young (age 5-17)	41.797*	39.471*	26.034	23.707	43.694**	43.508**
	(23.945)	(23.175)	(24.068)	(23.871)	(18.186)	(17.189)
Percent below poverty line	−10.729	−9.397	−11.825	−10.812	−3.798	−1.899
	(9.971)	(10.515)	(8.516)	(8.876)	(10.958)	(10.310)
Population density (pop/sq mi)	0.010	0.006	−0.001	−0.004	0.010	0.010
	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.011)
Percent white	2.919*	3.497*	1.709	2.315*	2.060	1.948
	(1.714)	(1.794)	(1.337)	(1.359)	(1.465)	(1.271)
State fixed effects	No	No	No	No	No	No
Number of observations	658	658	658	658	658	658
R^2	0.844	0.848	0.804	0.813	0.711	0.720

Note: All models include year fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.
* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level.

Table 5. The Interaction of the "Law of 1/*n*" and "Leviathan" Theories, Marginal Effects

Dependent Variable: Per Capita Expenditure

	State and Local Government		State Government		Local Government	
Upper chamber seats	348.950***	8.846*	229.898***	2.829	342.067***	9.361*
	(54.137)	(4.978)	(46.482)	(3.772)	(37.457)	(5.096)
Lower chamber seats	−72.229*	−0.823	−40.142	−0.313	−127.913***	−1.854**
	(40.603)	(0.894)	(35.567)	(0.924)	(34.777)	(0.758)
Counties	−85.185**	−3.581**	−76.819*	−3.813***	−23.040	0.453
	(40.603)	(1.416)	(46.445)	(1.360)	(28.053)	(1.101)
State fixed effects	Yes	No	Yes	No	Yes	No

Note: Marginal effects evaluated at the sample means for each variable.

remains positive and statistically significant for all levels of spending. The counties variable, however, loses its statistical significance.

Table 6b presents an additional set of two-stage results, this time using a more direct measure of the relationship between state and local government expenditure: per capita local government revenue from state intergovernmental grants. The first stage results show that upper chamber size is positively related to state-to-local grants. The total number of counties is also *positively* related to the level of local revenue due to state funding. The local revenue from state sources variable is in turn positive and statistically significant in all second stage total expenditure models, as is the upper chamber measure, while the total number of counties variable remains negative but statistically insignificant.

Finally, Table 7 presents an alternative specification which includes both endogenous measures of the relationship between state and local governments in separate first-stage regressions before including both as explanatory variables in the total expenditure models. The results are largely identical to those presented in Tables 6a and 6b, with the upper chamber and total number of county governments variables negative and statistically significant in the local-to-state expenditure ratio equation, and positive and significant in the local revenue from state government equation. The upper chamber variable is positive and significant in the total expenditure models, while the number of counties variable remains negative, but insignificant.

Taken together, these results shed light on the complexities in estimating the relationship between the different types of jurisdictions in a federal system and government size. The first stage results reported in Tables 6a and 7 provide straightforward support for both the 1/*n* and Leviathan models: the ratio of local to state total expenditure decreases as the number of county governments and the size of the upper legislative chamber increase. The second stage results also support the 1/*n* hypothesis for the upper chamber, but the county governments variable is statistically insignificant. These results suggest that while the 1/*n* effect is easily observed both through its impact on the spending ratio and its direct effect on the size of government, the intergovernmental competition at the heart of the Leviathan hypothesis has only a secondary effect on the level of expenditure: the ratio of local to state spending is affected, but once this effect is controlled for, the level of intergovernmental competition is no longer an important determinant of spending. Importantly, the ratio of local to state expenditure is itself statistically significant in the local (where it is positive) and state (where it is negative) specifications. In other words, the level of competition among substate governments is a significant determinant of the relative size of local government, which in

Table 6a. The Interaction of the "Law of 1/*n*" and "Leviathan" Theories, 2SLS Approach

	1st Stage	2nd Stage: Real Per Capita Total Expenditure		
	Local to State Spending Ratio	State and Local Government	State Government	Local Government
Upper chamber seats	−0.017***	355.520***	181.886***	396.476***
	(0.006)	(51.317)	(38.628)	(27.251)
Lower chamber seats	0.007*	−176.638***	−92.494***	−190.348***
	(0.003)	(25.614)	(19.831)	(13.873)
Counties	−0.004**	−9.678	−1.472	3.646
	(0.002)	(14.829)	(10.852)	(8.937)
Democrat governor	−0.006*	−9.031	−34.227	8.796
	(0.003)	(−1.228)	(32.049)	(14.087)
Percent democrat prev. presidential election	0.000	−1.228	2.551	−2.166
	(0.000)	(4.665)	(4.807)	(2.721)
Population growth rate	0.011*	25.926	23.452	1.885
	(0.006)	(41.040)	(27.430)	(22.330)
Population (millions)	0.007**	4.881	−44.625*	31.865
	(0.003)	(34.159)	(24.633)	(20.274)
Real per capita federal aid (t-1)	−0.000	0.449*	0.392**	0.189
	(0.000)	(0.250)	(0.198)	(0.121)
Real per capita personal Income (t-1)	0.000	0.112***	0.078***	0.077***
	(0.000)	(0.035)	(0.023)	(0.023)
Percent young (age 5–17)	0.004	−12.886	−20.024	1.746
	(0.003)	(26.753)	(20.547)	(16.605)
Percent below poverty line	−0.001	−7.740*	−12.248***	−0.180
	(0.001)	(4.653)	(3.944)	(2.250)
Population density (pop/sq mi)	−0.000	0.001	0.001	0.005
	(0.000)	(0.008)	(0.005)	(0.004)
Percent White	−0.000	2.709***	2.365***	1.523***
	(0.000)	(0.956)	(0.684)	(0.487)
Endogenous variable				
Ratio of local to state total expenditure		−330.332	−1630.683***	1114.567***
		(598.598)	(408.358)	(367.529)
Excluded exogenous variables				
Distance from capital to pop centroid	0.002*			
	(0.001)			
Ratio of local to state total expend (t-1)	0.541***			
	(0.042)			
Number of observations	658	658	658	658
R^2	0.595	0.931	0.921	0.971
F-statistic (p-value)	127.96	320.97	419.72	381.70
	(0.00)	(0.00)	(0.00)	(0.00)
Underidentification test (p-value)		20.733	20.733	20.733
		(0.00)	(0.00)	(0.00)
Overidentification test (p-value)		1.097	0.154	0.567
		(0.30)	(0.70)	(0.45)

Note: All models include year and state fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.

* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level.

turn is a significant determinant of total government size in terms of per capita expenditure. Specifically, as the level of intergovernmental competition increases, the ratio of local to state expenditure falls, leading to lower levels of local expenditure per capita and higher state spending, ceteris paribus.

Table 6b. The Interaction of the "Law of 1/*n*" and "Leviathan" Theories, 2SLS Approach

	1st Stage	2nd Stage: Real Per Capita Total Expenditure		
	Real Per Capita Local Intergovernmental Revenue From State	State and Local Government	State Government	Local Government
Upper chamber seats	23.326***	293.522***	164.095***	295.668***
	(5.820)	(59.933)	(45.576)	(40.217)
Lower chamber seats	−10.897***	−147.051***	−80.682***	−145.814***
	(3.101)	(30.252)	(23.556)	(20.126)
Counties	3.932**	−14.432	−2.247	−4.716
	(1.835)	(13.576)	(11.977)	(5.549)
Democrat governor	−4.936	15.440	7.518	11.245
	(5.107)	(23.295)	(17.894)	(16.062)
Percent democrat prev.	0.260	−4.791	−1.439	−4.769
presidential election	(0.774)	(5.256)	(3.118)	(3.473)
Population growth rate	5.322	26.380	28.586	−2.757
	(4.834)	(40.352)	(41.231)	(19.323)
Population (millions)	−6.299**	27.937	−23.634	53.895***
	(2.507)	(29.418)	(19.859)	(13.831)
Real per capita	0.016	0.332*	0.293**	0.068
federal aid (t-1)	(0.013)	(0.186)	(0.138)	(0.078)
Real per capita	0.018***	0.069***	0.020	0.056***
personal income (t-1)	(0.005)	(0.024)	(0.019)	(0.018)
Percent young (age 5-17)	−3.352	−9.251	−32.709*	22.418*
	(3.999)	(22.006)	(19.410)	(12.103)
Percent below poverty line	−0.438	−3.406	−6.374*	1.888
	(0.909)	(4.598)	(3.642)	(2.405)
Population density	0.002**	−0.001	0.000	0.002
(pop/sq mi)	(0.001)	(0.006)	(0.005)	(0.003)
Percent white	0.500***	1.771**	1.329*	0.823*
	(0.172)	(0.880)	(0.747)	(0.498)
Endogenous variable				
Local intergovernmental		1.079***	1.254***	0.740**
revenue from state		(0.341)	(0.155)	(0.305)
Excluded exogenous variables				
Distance from capital to	0.471			
pop centroid	(0.324)			
Local intergovernmental	0.810***			
revenue from state (t-1)	(0.048)			
Number of observations	658	658	658	658
R^2	0.868	0.941	0.931	0.901
F-statistic (p-value)	15716.87	645.36	1559.23	1374.93
	(0.00)	(0.00)	(0.00)	(0.00)
Underidentification test		8.989	8.989	8.989
(p-value)		(0.01)	(0.01)	(0.01)
Overidentification test		2.032	2.622	0.673
(p-value)		(0.15)	(0.11)	(0.41)

Note: All models include year and state fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.

* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level.

Table 7. The Interaction of the "Law of 1/n" and "Leviathan" Theories, 2SLS Approach (Both Variables)

	1st Stage		2nd Stage: Real Per Capita Total Expenditure		
	Local to State Spending Ratio	Real Per Capita Local Intergovernmental Revenue From State	State and Local Government	State Government	Local Government
Upper chamber seats	−0.017***	25.700***	272.131***	84.985**	339.918***
	(0.006)	(6.157)	(58.416)	(34.557)	(32.755)
Lower chamber seats	0.007**	−11.829***	−138.120***	−47.734***	−164.224***
	(0.003)	(3.216)	(29.354)	(17.427)	(16.531)
Counties	−0.004**	4.310**	−16.298	−9.163	−0.844
	(0.002)	(1.887)	(13.250)	(8.812)	(6.754)
Democrat governor	−0.006*	−4.801	10.538	−11.480	22.070
	(0.003)	(5.124)	(25.141)	(12.795)	(15.738)
Percent democrat prev. presidential election	0.000	0.207	−4.880	−1.694	−4.644
	(0.000)	(0.780)	(5.267)	(2.763)	(3.176)
Population growth rate	0.011*	5.532	24.614	21.928	0.995
	(0.006)	(4.902)	(37.001)	(22.618)	(19.511)
Population (millions)	0.007**	−6.513**	30.367	−15.006	49.152***
	(0.003)	(2.482)	(27.956)	(15.482)	(16.000)
Real per capita federal aid (t-1)	−0.000	0.018	0.317*	0.238*	0.099
	(0.000)	(0.013)	(0.188)	(0.126)	(0.073)
Real per capita personal income (t-1)	0.000	0.018***	0.072***	0.031**	0.050***
	(0.000)	(0.005)	(0.023)	(0.013)	(0.014)
Percent young (age 5-17)	0.003	−4.073	−2.721	−8.216	8.639
	(0.003)	(4.014)	(21.998)	(13.422)	(11.698)
Percent below poverty line	−0.001	−0.466	−3.690	−7.541**	2.567
	(0.001)	(0.895)	(4.631)	(3.317)	(2.234)
Population density (pop/sq mi)	−0.000	0.003***	−0.002	−0.003	0.003
	(0.000)	(0.001)	(0.006)	(0.004)	(0.003)
Percent white	−0.000	0.496***	1.742**	1.242**	0.867**
	(0.000)	(0.174)	(0.865)	(0.548)	(0.433)

Table 7. (*Continued*)

	1st Stage		2nd Stage: Real Per Capita Total Expenditure		
	Local to State Spending Ratio	Real Per Capita Local Intergovernmental Revenue From State	State and Local Government	State Government	Local Government
Endogenous variables					
Ratio of local to state total expenditure			−476.338	−1800.040***	1015.625***
			(479.718)	(244.281)	(294.766)
Local intergovernmental revenue from state			1.089***	1.266***	0.739***
			(0.362)	(0.127)	(0.251)
Excluded exogenous variables					
Distance from capital to pop centroid	0.002*	0.219			
	(0.001)	(0.355)			
Ratio of local to state total expend (t-1)	0.541***	63.342			
	(0.043)	(47.776)			
Local Intergovernmental Revenue from state (t-1)	−0.000	0.811***			
	(0.000)	(0.050)			
Number of observations	658	658	658	658	658
R^2	0.595	0.869	0.941	0.951	0.929
F-statistic (p-value)	137.07	13701.09	629.14	3539.74	1047.55
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Underidentification test (p-value)			22.005	22.005	22.005
			(0.00)	(0.00)	(0.00)
Overidentification test (p-value)			2.328	1.575	1.633
			(0.13)	(0.21)	(0.20)

Note: All models include year and state fixed effects. Constant and fixed effect coefficient estimates not shown. Robust standard errors (clustered at the state level) in parentheses.

* indicates statistical significance at the 10% level; ** at the 5% level; and *** at the 1% level.

The models including the endogenous local intergovernmental revenue from the state government provide evidence of the interplay between substate governments and legislative districts (Tables 6b and 7). Predictably, the size of the upper legislative chamber is positively related to this measure, as intergovernmental transfers from state to local government are likely the main mechanism through which the state-financed local projects central to the Law of 1/*n* theory are funded. The first stage results may also offer support the Brennan and Buchanan (1980) argument of local governments colluding via central state government administration of taxes and spending in that the number of county governments is positively related to the level of per capita local intergovernmental revenue from state government. An alternative explanation is that increases in the number of local government jurisdictions may in turn increase the number of local projects supported by each state legislator and thus increase the level of transfers from the state government. In either case, this variable is positive and statistically significant in all three total expenditure specifications, indicating that more transfers from state to local government lead to larger overall government size. All told, these results further support the key hypothesis of this article: measures of intergovernmental competition by themselves, without regard for the relationship between substate governments and the size of the state legislature, are insufficient and likely fail to provide a true accounting of the constraining effect predicted by the Leviathan hypothesis.

6. Conclusion

The influential work of Weingast, Shepsle, and Johnsen (1981) predicts a positive relationship between legislative chamber size and government spending due to decreasing district tax shares and the associated increase in inefficient projects. At the same time, the work of Brennan and Buchanan (1977, 1978, 1980) posits a negative relationship between the number of substate governments and total spending due to increases in intergovernmental competition. While extensive work has been devoted to testing these theories independently, a model unifying these effects has not yet been developed. Further, while the findings of the empirical literature following the Law of 1/*n* are fairly robust, the Leviathan hypothesis has been tested extensively with very mixed results. This article presents and empirically tests a framework for considering the interplay of these two effects.

The extent to which an increase in the level of intergovernmental competition affects government spending is a function of the relationship between legislature size and the number of substate governments. If an increase in the number of substate governments implies an increase in the number of legislative districts as well (in other words, the link between legislature size and the number of counties is strong) the effect predicted by the Leviathan hypothesis is lessened as a result of the positive relationship between legislature size and total spending. In cases where the link between districts is particularly strong, apparent increases in the intergovernmental competition may actually lead to increases in spending as the associated increase in legislature size more than offsets the effects predicted by the Leviathan hypothesis. Further, to the extent local governments are able to circumvent the constraining effects of intergovernmental competition through a type of collusion in the form of centralized state tax and expenditure policy carried out by a legislature affected by the Law of 1/*n*, increases in fiscal decentralization may not have the expected effect.

The empirical findings presented here support the unified model. The size of the upper legislative chamber unambiguously increases the size of government. Further, while the effect of an increase in intergovernmental competition appears inconsistent when tested separately, once the interaction between legislature size and the number of county governments is included the constraining marginal effect becomes clearer. The two-stage approach which more explicitly models the substitutability of state and local expenditures shows that intergovernmental competition, as measured by the number of county governments, leads to lower local spending relative to state expenditure (which in turn constrains total local expenditure), but that increases in the number of substate jurisdictions correspond to increases in transfers from the state government (which in turn lead to increases in expenditure) likely due once again to the interaction with the $1/n$ effect in the state legislature.

These results have serious implications for the study of the effects of legislature size and fiscal decentralization on government size. By ignoring the interplay between the Law of $1/n$ and intergovernmental competition effects, previous studies have likely underestimated the positive relationship between legislature size and spending as well as the negative relationship between the number of substate governments and total expenditure. At the very least, this article provides a plausible explanation for the rather inconsistent results of previous tests of the Leviathan hypothesis.

Finally, this article has important policy implications. Any attempts to reform government which target total expenditure need to consider the effects of the structure of both the lower level governments as well as the legislature. While fiscal decentralization may be an "objective for constitutional reform," as in Buchanan (1995), it may not necessarily lead to smaller government in cases where it corresponds to a larger upper chamber in the legislature or additional opportunities to substitute state for local administration of fiscal policy. At the same time, the increased distributive politics which characterize larger legislatures may not be as problematic in states exhibiting a high degree of intergovernmental competition. Future work on "optimal" government structure will do well to consider the counterbalancing effects of the Law of $1/n$ and Leviathan theories.

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