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EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN THE TAX BASE AND GOVERNMENT SPENDING: EVIDENCE FROM STATE PANEL DATA, 1977-1992

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ABSTRACT OF DISSERTATION

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ABSTRACT OF DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Business and Economics
at the University of Kentucky

By
Barry Wayne Boardman

Lexington, Kentucky
Director: Dr. William Hoyt, Professor of Economics

Lexington, Kentucky

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Essentially, there are two competing propositions on tax base choices. The optimal tax theory on taxation asserts that the broader the tax base the better the tax. On the other hand, some public choice proponents have argued that, at the constitutional level, we should choose to restrict the power to tax and thus limit the available base. These theories assert fundamentally different views on the state and its citizens.

Within the traditional optimal tax framework, governments maximize resident's utility and tax base broadening lowers the tax rate, thus there is a revenue neutral response. When, however, governments do not choose to maximize resident's utility, then increases in the tax base can have an impact on government's revenues and spending.

In order to determine if tax bases influence government spending data on forty-eight states were compiled for the years 1977 through 1992. A state finance

system of equations was developed. Using three-stage least squares estimation in a fixed effects econometric model, the relationship between the broadness of a tax base and state government spending was estimated. The state sales tax base was the tax base used to study this relationship. The results of this estimation found that states with broader sales tax bases had higher spending, all else equal. This result suggest that governments do not act as if they maximize resident utility when making tax base and rate decisions, otherwise base broadness would have no impact on spending. An additional result from this empirical analysis, is that tax base and rates are inversely related, but the relationship does not lead to revenue-neutral adjustments.

KEYWORDS: Tax Base, Tax Rate, Optimal Tax, Government Spending, Revenue Maximization

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This Dissertation is dedicated to my father Earl Douglas Boardman

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The following dissertation could not have been completed without the patience, direction, and instruction of my Dissertation Chair, William Hoyt. Next, I wish to thank my Dissertation Committee who provided insight and instruction that has substantially improved the finished product.

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Table of Contents

List of Tables

List of Figures

List of Files

1. Boardman_Dissertation.pdf

Chapter 1: Introduction

Considerable discussion has lately centered on the impact of an eroding sales tax base and the need to include internet sales into the base. Currently, efforts are underway to streamline the states' sales tax systems in an effort to make it easier to tax e-commerce[1]. State governors and budget directors have been espousing the need to discover straightforward ways to tax these interactions[2]. Some state governors argue that internet sales are a needed part of a state's sales tax base in order to stabilize a shrinking base because the states are facing increasing demand for government expenditures. Additionally in an attempt to stabilize and increase revenues (Dye and Mcguire, 1991), states have tried to broaden the tax base by implementing a sales tax on services. Thus recent suggestions for expanding the sales tax base have included not only internet sales, but also services and mail order sales.

Firms and customers, on the other hand, are concerned with the potential impact of taxing internet sales and some described this base broaden efforts as a "revenue grab by government" (Wall Street Journal, November, 1996). Florida's implementation of taxation on services, for example, was met with strong opposition by both consumers and businesses as the difficulties in applying the tax consistently to services became apparent (Fox, 1992). Florida rescinded this broad base tax on services within the first year of its commencement. Thus, there is an ongoing debate over broadening the sales tax base with respect to the impact and motivation for broadening the base.

[1] The project is currently being pilot tested in four states. This streamlined approach to sales taxation is currently supported by 27 states. Information regarding this project can be viewed at www.streamlinedsalestax.org

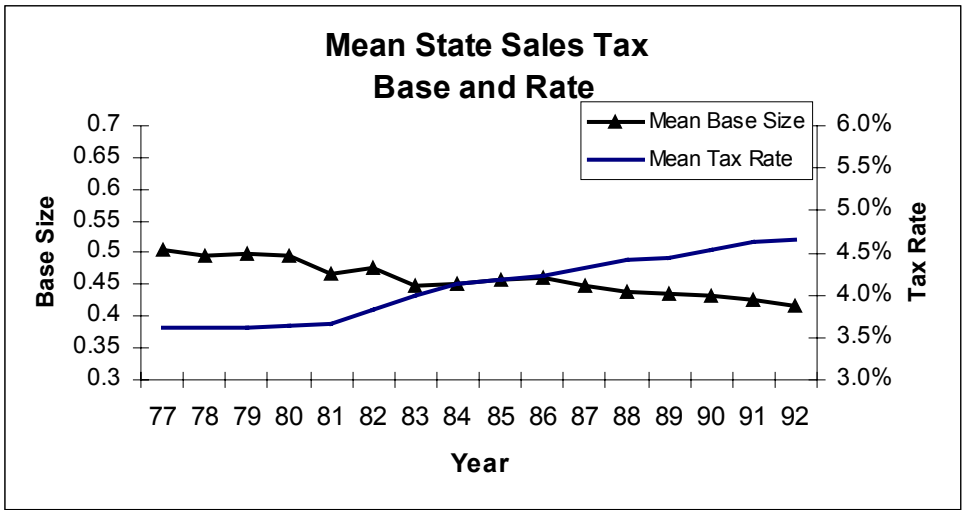
[2] On May 17, 2001 the *Washington Times* reported only four governors support U.S. congressional legislation to continue a moratorium on internet taxation.

The Changing Sales Tax Base

Using state data from 1977 to 1992, the graph at the end of this section shows how the size of the sales tax base has steadily decreased. During this time, nearly 32 percent of all state tax revenues came from the sales tax. In 1977, 30.5 percent of all tax revenue was generated by the general sales tax. By 1992, this had increased to 32.8 percent, peaking at 33.2 percent in 1991. Clearly the ability for states to tax e-commerce or find ways to tax services is a legitimate concern of state policy makers given the erosion of the tax base over time and the states' reliance on the sales tax. Also during this period, states responded to the shrinking tax base by increasing the sales tax rate. The graph below shows how the mean sales tax rate has increased by approximately one percentage point, from 3.6 percent to nearly 4.7 percent, an increase of 30.5 percent.

Since states rely on the sales tax as a major source of revenue, the ability to understand the relationships between the tax base, tax rate and the resulting expenditures fed by these revenues is important. Currently the trend is toward narrower bases and higher rates, if the efforts to broaden the sales tax base are realized what might that portend for the sales tax rate and government spending?

Figure 1.1 State Mean Tax Base and Tax Rate



The Political Economy of Tax Rates and Bases

This study assists our understanding of the relationships between tax base broadness, tax rates, and expenditures. This understanding will allow one to answer the question, does a more comprehensive sales tax base lead to revenue neutral adjustments in tax rates? Knowing what influence base broadening has on government spending will represent an important contribution to the ongoing fiscal policy debate concerning the taxation of e-commerce and services.

The focus of this study, therefore, will be on the state sales tax and the influence tax base choices have on state government expenditures. The study will be an empirical examination of the relationship between tax rates, bases, and expenditures. It will provide insight into the appropriate setting for government revenue objectives. The empirical test will be conducted using the percentage of the available sales tax base taxed by a state and determining what, if any, impact that choice of tax base has on expenditures, holding constant other determinants of state spending.

This study offers contributions to our understanding of state sales tax systems and indirectly government behavior. It will contribute in two distinct ways. First, it will contribute towards building a positive model of government behavior by examining the impact tax base choices have on government spending. Secondly, it provides an understanding about the behavior of governments. Specifically, this study will determine whether broadening the sales tax base positively impacts a state's per capita expenditures.

Since this essay will address the political economy of tax base choices as they are related to expenditure outcomes, it will not only add to our understanding of this relationship, but it will also help inform the broader question: What is the appropriate setting within which to study government activity? One political economy approach to the appropriate setting for government behavior would suggest that if government's behavior is to maximize voters welfare and the voter acts as a constraint on government excesses, then the need to constrain the tax rates and bases made available to government would needlessly lead to a inefficient tax system. Historically, however, this model of constrained government behavior is called into question. For example, the tax limitation movements suggest that the constraint of the voter may not always be sufficient to constrain government. In fact, another political economy approach to the appropriate setting for government activity would suggest that an inefficient tax system is desirable so as to more fully constrain government revenue raising power. It is the purpose of this empirical research to contribute to the debate on the appropriate setting with which to study government.

Two Views of Government and the "Optimal Tax Base"

Taxpayers have, from time to time, voted to impose restrictions on a state's taxing power. Proposition 13 in California, over twenty years ago, was one of the most notable cases of voters choosing to impose such restrictions. Recently, such voter impositions have occurred in Virginia and Washington regarding the application of an automobile excise tax. This led to the election of a new governor promising to overturn the tax, and a referendum to abolish the tax, respectively. In Colorado since 1992, tax and fee increases must pass voter approval before they can be enacted. Larry Kallenberger, the executive director of Colorado Counties Inc., who originally opposed the initiative concludes that tax increases have not been difficult to pass if the purpose is clear. He says elected officials can't "keep acting like citizens are our enemies and we have to fight with them all the time."

The interpretations of these actions taken by voters in the state depend in part on your view of the roles played by the government and its citizens. The public choice literature offers different concepts on the state (Mueller, 1996) and different views on the size of government which are derived from these concepts. Depending on which view is accepted, the actions by a government and the use of its taxing power will have different interpretations. One conceptualization of the state is drawn from the classical theory of the democratic state, where ultimate authority rests with the voter/taxpayer. One such classical public choice theory is the frequently espoused median voter theorem where the outcome of majority voting reflects the preferences of the median voter.

Under this view, the change in voter preferences, for example, would be a viable explanation for tax limitation referendums. Similarly, complaints lodged against the use of certain tax bases may stem from voter/taxpayers that do not,

within the distribution of all voter/taxpayers, represents the views held by the median voter/taxpayer.

Another conceptualization of the state places the state and its government above the citizens. It is the preferences of the state, or the individuals in the government, that are deterministic. This view is characterized in the work by Niskanen (1971, 1975) and Brennan and Buchanan (1977, 1978, 1980).

Under this view of the state, for example, the tax limitation movements and voices raised against the use of certain tax bases may represent a true divergence in preferences between the taxing authority and the voter/taxpayer. Both of these views, may to some degree be correct. Government officials and bureaucrats can seek to advance their own preferences similar to the revenue maximizing or bureaucratic model, while the voter/taxpayer through its voting power represents some constraint similar to the median voter model.

In the study of governments, the standard approach often is to treat voters/taxpayers as rational, self interested individuals and government decision makers as seeking only to promote the general welfare. This according to Buchanan (1972) does not represent a closed behavioral loop. Closing the behavioral loop requires that the same rational, self interested decision calculus that motivates the voter/taxpayer apply to decision making in the public sector.

Within this context, the degree to which the state exists to "carry out the will of the people" and the degree to which government official and bureaucrats have discretionary power could matter with respect to tax base choices and the constraint imposed through tax base limitations. It is the purpose of this essay to help inform this debate and to provide some understanding of how governments respond to the availability of broad based taxes.

Referendums, constitutional amendments, and election of representatives promising to repeal taxes provide evidence there exist a perception among at least

some voter/taxpayers that political constraints are not always sufficient in constraining the powers of government. There appears to be a divergence of motives for the taxing authority and the voter/taxpayer. This perceived divergence can help explain some of the tax limitation movements occurring over the last twenty plus years. James Madison in The Federalist Papers writes, "In forming a government which is to be administered by men over men, the great difficulty lies in this: you must first enable the government to control the governed; and in the next place oblige it to control itself."

One result of the efforts to obligate government to control itself is the enactment by twenty-four states of constitutional or statutory state tax and/or expenditure limits (TELs). The passage of these limits can reflect changes in voter preferences about the size of government, the tax structure, or both. The success at the ballot box of referendums limiting government taxing activities suggest political constraints can be perceived by the voter/taxpayer as only partially effective in delivering the desired level of government and/or the appropriate tax structure to obtain the desired level. Thus, voters turn to these constitutional constraints as a possible way to control the taxing powers granted to government.

Cutler, et al (1999) found that people supported tax limitations for two primary reasons: because their government was perceived to raise revenue for projects not valued by the people; because they believed government goods were produced inefficiently. Again, these perceptions imply that political constraints have been ineffective in constraining government taxing activity and the populace sought constitutional constraints.

All this on tax limitations points to the fact that recent tax history of states implies that a purely symbiotic relationship between government and the voter/taxpayer may not at all times exist. The voter without constitutional

protection may not think that through her vote alone she is able to constrain government activity and thus chooses constitutional constraints.

Within the context of tax limitation movements, there often exists an attitude among constituents of a state that broadening of the tax base is an attempt at maximizing revenues[3]. As noted, considerable discussion lately has centered around the impact of an eroding sales tax base and the desire to include internet sales into a state's sales tax base.

The anecdotal evidence presented indicates government is sometimes perceived by voter/taxpayers as something other than a benevolent equi-revenue provider of public goods and services. The equi-revenue government, as defined by Brennan and Buchanan (1980) is one where the government obtains revenues just equal to the cost required to meet the demand for government goods and services. The equi-revenue government is analogous to the firm under perfect competition where the price of the good is equal to the marginal cost to produce the good which is equal to the quantity demanded in equilibrium. While this study will not explicitly offer insight into the conceptual relationship between the state and its citizens, it will provide insight into what represents the appropriate objective function to assign governments.

Essentially, there are two competing propositions on tax base choices. The optimal tax theory on taxation asserts that the broader the tax base the better the tax. On the other hand, some public choice proponents have argued that, at the constitutional level, we should choose to restrict the power to tax and thus limit the available base. These theories assert fundamentally different views on the state and its citizens, as mentioned above.

[3] A *Wall Street Journal* article published Tuesday, May 26, 1998 comments on the recent success of a Virginia political candidate whose primary initiative was the repeal of the automobile property tax and how other State politicians are seeking to capitalize on this voter sentiment concerning the automobile property tax and its perception that "much of it is a revenue grab" by the state governments.

The purpose of this study, however, is to move the discussion of policy outcomes away from purely normative assertions and place the focus on a positive analysis of how public institutions actually function. The positive model would say that government officials are fully constrained in their ability to gain a surplus from revenues, they are not constrained, or they are partially constrained. Regardless of the degree of constraint, the assumption of the analysis is that the taxpayer/voter and the government official are both acting rationally in their own self-interest.

It is hoped that this study will contribute to those bodies of literature that explore the fiscal policy effects on government expenditures and possible normative implications for policy makers. The contribution is to both the public finance and public choice literature by integrating the two for an empirical examination on the relationship between the tax base and government spending. Thus, the major hypothesis to be tested in this study is " do broad base taxes lead to higher expenditures?" Given the current debate on the taxation of internet sales and broadening of the tax base by adding services to the base, this study will provide some insight into the potential benefits and costs to be considered by voters and policymakers.

Outline of Dissertation

The balance of the study will be divided into five chapters, chapter two consists of a literature review of the two contrasting theories on the appropriate tax base; the public finance optimal tax literature and the public choice Leviathan literature. An overview of the optimal tax theory will be provided and juxtaposed with the constitutional approach to taxation found in the Leviathan model of government behavior. The final parts of this chapter will explore the literature which has undertaken a search of Leviathan motives in government behavior and

the literature involved in analyzing whether revenue causes expenditures or vice versa.

The third chapter will be a simple tax model. It will show how this model can yield the exact same results whether optimal tax policy is prescribed or revenue maximizing objectives are imposed on the model. This will lead into a discussion of the comparative static outcomes possible from changes on the commodity tax base.

The fourth chapter begins with the development of the econometric model and estimation procedure. The estimation will encompass a system of equations that model government fiscal activities. The estimation procedure will be one that accounts for the longitudinal characteristics of the state data, as well as the simultaneity inherent in a state finance system. The fourth chapter concludes with a discussion of the data used to estimate the structural equations of interest in the state finance model. Additional literature supporting the use of variables and structural equations in the model will be presented. A variable list and description along with summary statistics of the variables, as constructed for the estimation, will be included in this section.

The fifth chapter will present the results of the econometric model estimation. In this section a complete report on the parameter estimates for the various specifications will be presented. The sign, magnitude, and statistical significance of the estimated equation's parameters will be investigated for consistency with theory and other empirical works.

The final chapter reports on the results of the empirical test performed in Chapter Five. The results of the research finds that tax base broadening will lead to higher government spending. Also, the sales tax base and rate are inversely related, but they do adjust in a revenue neutral manner. The chapters discusses the appropriate setting for government fiscal activity based on these findings, what this

empirical study portends for future research, as well as, what impact it will have on the development of a positive model for government will be presented.

Contribution

In summary, this study advances both the public finance and public choice literature by integrating the two strains and empirically examining the relationship between the tax base and government spending. It addresses the fundamental question " do broad base taxes lead to higher expenditures, *ceteris paribus*?"

The research offers two important contributions: understanding the impact the tax base size has on government spending, and the relationship between the tax base and rate; and advancing our understanding of government behavior.

Finally, the relationships that will be developed in this study can be used in future research examining different levels of government and different taxes available to government.

Chapter 2: Literature Review

Since Tiebout's (1956) response to Samuelson's (1954) treatise on public goods, research has focused on local fiscal policies and public good provision. Tiebout suggested that the provision of local public goods in a federal system of numerous jurisdictions is analogous to a competitive market for private goods. The Tiebout model is filled with many rigid assumptions which lead to efficient equilibrium. The efficient equilibrium derived from a heterogeneous population that costlessly divides into jurisdictions that are homogeneous in the demand for public services is a Pareto equilibrium in this setting. For this global optimality to exist the following conditions must be met: full mobility of all citizens; full knowledge of each communities characteristics, fiscal and otherwise; an absence of scale economies in public good production or an optimum scale of production achieved at small levels of output; no spillover effects across communities; an absence of geographical private good price differences or differences with respect to earnings. The existence of an efficient equilibrium is called into question however, when any one of these assumptions of the Tiebout model is relaxed.

In local public finance, efficiency or optimality in the provision of public goods applies to both the intrajurisdicitional efficiency and the interjurisdictional efficiency (Rubinfeld, 1987). Intrajurisdictional efficiency is given by the condition that the sum of all individuals within the jurisdiction net-of-costs willingness to pay for the public good is maximized. The interjurisdictional efficiency involves a system of jurisdictions where migration is possible. Efficiency is obtained when the number of existing jurisdictions results in the sufficient level of provision of the public good at the lowest cost. This notion of jurisdictional optimality not only is concerned with the efficient provision of the

public good, but the optimal size of the jurisdiction (or club) is now relevant. The Tiebout model focuses primarily on the interjurisdictional efficiency and is an analysis of the efficient provision of public goods in a series of clubs or jurisdictions. This study will look at state tax systems, but will not specifically consider the intrajurisdictional efficiencies. It will, however, provide insight into interjurisdictional efficiencies within a federalist system.

I am interested in determining a positive model of government behavior by gaining an understanding of the relationship between tax bases, rates and debt instruments available to governments and government spending. Of particular interest is the work of Brennan and Buchanan (1977, 1978, 1980, and 1985) on government as a Leviathan. Their work on public finance has generated a body of literature that explores the theoretical and empirical implications of fiscal policy in a federalist constitutional system. According to Brennan and Buchanan (1980) efficiency conditions are typically derived under a simplistic view of government. They go on to argue that a more complete analysis distinguishes different behavioral models that may result in non-optimal public expenditures.

One model developed by Niskanen (1971) shows, in a non-federalist system, how the level of public expenditures may be greater than that desired by the median voter. This occurs because policy makers have some bureaucratic power. This argument is a generalization of the Romer and Rosenthal (1978) agenda setting view of bureaucrats who desire larger governments output, but are not particularly concerned about higher wages for themselves or their employees.

Broad or Narrow Tax Base: Divergent Views

There are two divergent views of the appropriate tax base that should be made available to governments. The normative optimal tax prescription is for a

broad base that leads to a lower tax rate. This theory assumes that for a given level of revenue that a broad base minimizes the excess burden of the tax system since it will raise the necessary revenue at lower rates. If however a broader base does not lead to sufficiently lower rates, then broad base tax structures could contribute to higher government expenditures. Brennan and Buchanan (1978) argue that a reasonable tax system that accounts for a governments power to tax may look much different than the tax system which ignores the political setting which permits this taxing power.

Brennan and Buchanan (1980) state that in the absence of constraints on the tax base and tax rate, along with unconstrained debt issuance, greater government spending than desired by the voter/taxpayer can result. They conclude that the lack of constraints can have a positive impact on local government revenues. In contrast, the optimal tax theory argues for a broader base that leads to lower rates and burdens on the voter/taxpayer. Optimal tax theory does not directly comment on the revenue implications from broader bases and generally the broad base and low rate approach is treated as a revenue neutral prescription. In fact, much of the literature pertaining to tax theory presumes that government requires some exogenously determined amount of revenue, therefore governments are equi-revenue providers of goods and services. Thus, these strains of literature ignore possible feedback effects that a tax instrument may exert and therefore the influence it may have on the level of revenue government might seek to raise.

The appeal of the broad tax bases may change dramatically if the government was believed to be anything other than a benevolent equi-revenue provider. A benevolent equi-revenue providing government is one motivated to raise an exogenously determined level of revenue to meet the voter/taxpayer's demand for public goods and services. Brennan and Buchanan (1980) argue that the standard normative evaluation of an optimal tax structure depends upon this

equi-revenue provider assumption. The base and rate chosen by a voter/taxpayer at the constitutional level, therefore, may be more restrictive if the government was believed to be anything other this benevolent equi-revenue provider.

Essentially, traditional public finance assumes there is no reason to restrict the tax base in a constitution because a tax that does not contribute to the social welfare would never be utilized. The Leviathan view is that at the constitutional level the voter/taxpayer would choose an inefficient base when they can not choose tax rates along with the tax base.

Below I summarize two theories on the appropriate comprehensiveness of a tax base.

Optimal Tax Theory

Ramsey (1927) develops an inverse elasticity rule for commodity taxation that structures the tax rates in such a manner as to minimize the negative impacts of the tax on voter/taxpayer utility. This method of analysis concludes that it is appropriate to place the greatest tax burden on those goods for which supply is the most inelastic.

Diamond and Mirrlees (1971a, 1971b) contribution to the optimal tax literature is finding that utility is maximized when the resulting change in the marginal utility from a change in the price of a commodity is proportional to the change in tax revenue as a result of the change in the tax rate. With respect to the income tax the authors conclude that the optimal level of social welfare is obtained when the "social-marginal-utility weighted changes in taxation... are proportional to the changes in the total tax revenue."

Auerbach (1985) examines the burdens (dead-weight loss) created by taxation within the optimal tax framework. The author notes the important result

that the excess burden from taxation increases by the square of the tax. This result suggests the use of a small tax rate and a broad base over the higher rate applied to a narrower base reduces the excess burden of a tax system.

Finally, and most importantly with respect to this study is Samuelson's (1986) prescription for an optimal tax structure. He offers what he describes as "tentative conclusions" for tax policy. The fundamental premise upon which these conclusions are built is the notion that when taxing goods and services policy should seek to minimize the excess burden or deadweight loss of the tax. In order to minimize the burden of the tax, Samuelson calls for taxes which people can not avoid by changing behavior because this leads to the maximum level of loss from the tax. Thus, optimal tax theory calls for a broad base tax structure in order to minimize the excess burdens of the tax.

The optimal tax literature, therefore, emphasizes the need for a non-uniform tax rate applied to a broad tax base. Wilson (1989) summarizes the issue of taxed and untaxed commodities by noting that when all goods (i.e. leisure) are not subject to taxation, then voter/taxpayers will shift consumption away from taxed commodities, thus increasing distortions from taxation. He finds as this substitution between goods becomes more elastic that a broader tax base with low rates is preferable. This reaffirms the conclusions of the optimal tax theorists that preceded this study. It is also important to note Wilson (1989) recognizes that administrative cost may make non-uniformity of tax rates an impossibility and the cost of collecting may result in a narrower base and higher rate than optimal tax theory would prescribe.

Constitutional Approach to Taxation

The constitutional approach as developed by Brennan and Buchanan (1980) substitutes the "passive benevolent despot" with a revenue seeking Leviathan. This

idea of the non-passive provider of public goods is also similarly developed by Niskanen (1971, 1975) which states that the politician/bureaucrat acts as a budget maximizer.

Within the framework of governments engaging in maximizing behavior it is postulated that base taxation is analogous to market price theory. Thus, the power to tax a good is the same as providing monopoly power pricing in the sale of a good. The optimal tax orthodoxy is challenged by Brennan and Buchanan (1977, 1978, 1980) by arguing for a limited or restricted tax base and rates in order to reign in the government's power to tax. Thus, with income and commodity taxation available to the taxing authority the question arises: What fiscal policy constraints at the constitutional level will successfully constrain a Leviathan government's revenue maximization?

The work of Geoffrey Brennan and James M. Buchanan's (1980) *The Power To Tax* provides a framework for a tax system which would limit the power of a taxing authority. The approach used by Brennan and Buchanan is rooted in the late nineteenth century fiscal exchange literature of Wicksell and others (Hettich and Winer, 1985). The authors expound on this philosophical base for tax system design by developing an "outcome-oriented" approach.

In Brennan and Buchanan's (1978, 1980) discourse on taxation and fiscal constitutions they discuss the implications of constitutional constraints on tax bases and rates and government's power to tax. They argue that at the constitutional level the power to tax and the fiscal arrangements are important in constraining the revenue generating power of governments. When the taxing authority is not an equi-revenue provider of government services, then the tax base and rate that would reign in the power of the government's taxing authority would be different than that prescribed by optimal tax theory. The tax revolts of the late 70's and 80's could be viewed as an attempt by the voter/taxpayer to impose constitutional

constraints on the local taxing authorities when political constraints were insufficient in restraining government revenue raising power. This would suggest that there are specific implications that can be drawn from differences in tax base and rate choices and their constraint on the governments' ability to increase spending.

Additionally, Brennan and Buchanan (1980) suggest that federalism can be a constraint on the government's revenue generating power. They argue "total government intrusion into the economy should be smaller, ceteris paribus, the greater the extent which taxes and expenditures are decentralized, the more homogenous are the separate units, the smaller the jurisdictions and the lower the net locational rents" (p.180).

Thus, the optimal tax model prescribes the broad comprehensive base that allows for lower rates and minimizes the excess burdens from taxation, while the constitutional, Leviathan tax model calls for restricting the tax base, and therefore, the power to tax.

In Search of Leviathan

Research focusing on the existence of Leviathan government behavior has centered primarily on the notion of "market" structure and the impact of multi-jurisdictional competition. As noted earlier, Brennan and Buchanan (1980) argue "total government intrusion into the economy should be smaller, ceteris paribus, the greater the extent to which taxes and expenditures are decentralized." Oates (1985) was the first empirical study to examine the relationship between revenues and the number of taxing jurisdictions, suggesting a negative relationship supported the presence of a Leviathan government. This research found no conclusive evidence of this negative relationship. Subsequent attempts by Bell

(1988), Zax (1989), Forbes and Zampelli (1989) and Eberts and Gronberg (1989) using different empirical parameters have tried to improve upon the work by Oates. The results are mixed in their conclusions about government as a revenue maximizer, where: Forbes and Zampelli (1989) find no evidence of Leviathan and Bell (1988), Zax (1989), and Eberts and Gronberg (1989) do find evidence.

Epple and Zelenitz (1981) specifically developed a theoretical model to examine the effects from government decentralization. In their model they assign the government a profit maximization motive and demonstrate that there exists a negative relationship between government expenditures and the number of localities. A similar approach will be employed to develop a model of the government's objective later in this essay. Hoyt (1998) has argued that other government objectives, such as maximizing residents' utility are consistent with the negative relationship between the number of competing jurisdictions and the expenditure level.

Nelson (1986) provides some insight that has been missing from previous empirical and theoretical examination of the existence of Leviathan by relating a state's tax structures to its revenues. Nelson examines the impact on state revenue in a single year from constraints on base and rate, as well as, the degree of decentralization. He finds evidence of Leviathan behavior in this empirical study.

The literature regarding raising revenues to provide government goods and services differs essentially with respect to the motivation of those taxing authorities. When the equi-revenue taxing authority is assumed, then the broad base-low rate approach is optimal. When a Leviathan taxing authority is assumed, then it is preferred to constitutionally constrain the tax base available and size of the tax rate.

In developing a positive model of a local public sector's tax structure, the impact of the tax base, ceteris paribus, on expenditures becomes an important

policy consideration. The two views presented on government behavior represent polar cases of how governments perceive the value of revenues and the motivation for generating revenue. This essay will explore the impact of tax base comprehensiveness for revenue generating powers of local governments. Government activity will, therefore be modeled under the premise that governments are potentially in possession of some market power. Likewise, governments will be able to respond to voter/taxpayer's wishes as estimated by median voter demand. This paper will help us better understand what role tax base constraints have on government expenditure activity in the fiscal arena and contribute to the development of a positive model of government fiscal activity.

To determine the appropriate, positive model of government behavior an approach similar to Nelson's will be utilized. I will, however, differ in several important aspects. First, a panel data set of state fiscal activity and characteristics from 1977-1992 will be used. This allows for changes in tax structure across states and within states that should lead to a more robust analysis. Secondly, the potential impact on expenditure levels from sales tax base comprehensiveness will be the focus of this empirical study. The analysis will utilize structural equations derived from the functional determinants of expenditures, base and rate choices, and government expenditures.

Tax and Spend Causality

Before development of an empirically sound fiscal model for states, the fundamental relationship between spending and revenues needed to be understood. There have been a number of studies conducted to test whether revenues cause spending or vice versa. In considering the appropriate way to model state fiscal relationships, determining whether there might be, for example, a recursive or

simultaneous relationship between revenues and expenditures is important. The tax-spend hypothesis for state and local governments has yielded mixed results on this account. Marlow and Manage (1987, 1988), and Joulfaian and Mookerjee (1990) find a unidirectional relationship where revenues cause expenditures. Ram (1988) on the contrary finds the relationship runs the other direction. Miller and Rusek (1989) and Chowdbury (1988) both find bi-directional causality runs between revenues and expenditures. Payne (1998) finds that the revenue drives expenditure hypothesis is supported by twenty four states, eleven states causation runs in the opposite direction, eight states support the fiscal synchronization hypothesis and five states failed to yield results. Darrat (1998) finds that taxes unidirectionally Granger-cause negative changes in spending consistent with the Buchanan-Wagner hypothesis (1977, 1978). Since it remains inconclusive as to the specific relationship between revenues and expenditures it appears appropriate to model the revenue-expenditure decision as a simultaneous decision.

This decision to treat the revenue and expenditure decisions as a simultaneous decision is consistent with first hand observation of the Kentucky General Assembly. Kentucky's General Assembly determines the appropriation of state revenues and the development of tax law to obtain those revenues by considering the consequences of each decision before final passage of the State's budget. Each biennium the legislature sets the budget and revenue priorities for the state for the following two years. During this time negotiations take place between the executive branch, the legislature, and among legislators. While bills pertaining to appropriations and revenue are presented separately for vote, the process of crafting both pieces of legislation and determining what legislation will be brought to a vote are determined simultaneously.

Peacock and Wiseman (1961, 1979) have observed spending tends to expand to use up the available revenue, but recent causality test do not universally

confirm those conclusions. Moreover, experience with the Kentucky budget process suggest that these outcomes are simultaneously determined and neither spending nor revenue necessarily proceeds the other.

Chapter 3: State Tax Model and Government Budget Model

This chapter will present two separate models. The first model develops the basis for empirically testable hypotheses. The state tax model generates these hypotheses by contrasting the predictions of two alternative models of government behavior. Therefore, the state tax model will allow me to highlight the implications that arise from an increase in the tax base. These implications are dependent upon the objective of government, utility maximization or revenue maximization.

The primary purpose of the state tax model, therefore, is to illustrate how Leviathan objectives can arise in a conventional optimal tax framework and to develop a basis from which to test empirically the presumptions on the government objective functions. As noted earlier, these objectives follow from two different views of government. In the Leviathan model of government an inefficient tax base would be chosen by the governed if they can not choose the rates along with the base . In the traditional public finance literature there is no reason to place restrictions on the tax base because a tax which does not maximize social welfare would never be utilized.

The second model, the government budget model, generates the framework for the econometric model developed in Chapter 4. The government budget model sets the framework from which the system equations that are necessary to empirically examine the impact the tax base has on expenditures.

A Simple State Tax Model

Following, Hoyt (2001), I consider a model with a single state government and *n* local governments. Each locality has a single (representative) resident. The residents are identical and therefore, in equilibrium, each locality will choose the

same policies. Each government finances a public service to provide to its residents with g_s being the level provided by the state government. The public services are produced with constant costs with the cost function for the state government service $c_f(g_s) = ng_s$.

In addition to the public services the residents consume, they also consume private commodities. Following, Wilson (1989), I consider a continuum of these private commodities identified on the interval *[0,1]*. We denote the gross of tax price of commodity *i* by *q(i)* with the net price of all commodities being unity. I assume identical demand functions over the set of commodities. That is, when prices are identical, the quantity demanded is the same for the commodities.

The set taxed by the state government is denoted by B_s and are the commodities in the interval $[0, \bar{k}_s]$. I denote the lengths of this interval by k_s.

When the state can only set a single tax rate, then

$$q(i) = \begin{matrix} 1 & i \notin B_s \\ 1+\tau_s & i \in B_s \end{matrix} \qquad (3.1)$$

One example of a utility function that would generate the demand functions I desire is the *CES* utility function,

$$U_j = \frac{\sigma}{\sigma-1}\ln\left\{\int_0^1 [x(i)]^{(\sigma-1)/\sigma} di\right\} + V_s(g_s). \qquad (3.2)$$

where σ is the elasticity of substitution and we assume $\frac{\partial V_s}{\partial g_s} \equiv V_{g_s} > 0$ *and* $\frac{\partial^2 V_s}{\partial g_s^2} \equiv V_{g_s^2} < 0,$. Then given income of *y*, the demand for commodity *i* is given by

$$q(i)x(i) = \frac{q(i)^{1-\sigma}}{\int_0^1 q(k)^{1-\sigma}\,dk} y \qquad (3.3)$$

I denote the derivatives of the demand with respect to price by

$x_{11} \equiv \dfrac{\partial x(k)}{\partial q(k)}$ and $x_{21} \equiv \dfrac{\partial x(k)}{\partial q(i)}$, $k, i \neq k$. Then the associated indirect utility function is

$$V\left[q, g_s\right] = \frac{\sigma}{\sigma - 1} \int_0^1 \left[\ln \frac{q(i)^{-\sigma}}{\int_0^1 q(k)^{1-\sigma}\, dk} \right]^{\frac{\sigma-1}{\sigma}} di + \quad V_s(g_s) \tag{3.4}$$

Let the first term of $V[q, g_s]$, the sub-utility function with respect to prices, be denoted by $\int_0^1 V(q(k))dk$.

When the state can only set a single tax rate the state tax base is given by

$$\tau_s \int_{B_s} x(i)di = \tau_s X_s = \tau_S \underbrace{\left(k_S (1+\tau_S)^{-\sigma} \right)}_{(a)} A = n g_s \tag{3.5}$$

where X_s denotes the state tax base and for *CES* demand function is given by expression (a) where A = $\left((K_l - k_s) + k_s (1+\tau_s)^{1-\sigma} \right)^{-1}$.

Policy Choice with a Single Government and Public Service

To make the nature of expanding tax bases more apparent my analysis considers the decisions of a single level of government providing a single public service. For our purposes, think of this as the state government providing only a state public service. I consider two alternative objectives of the government, utility maximization and revenue maximization.

Utility Maximization

If the state government seeks to maximize resident's utility then the problem is to

$$\underset{\tau}{Maximize} \int_0^1 V(q)dk + V^s(g_s) \tag{3.6}$$

where g_s is defined by the balance budget constraint defined in (3.5).

The first order condition is

$$V_{\tau} = \int_0^{k_s} \frac{\partial V(q(k))}{\partial q(k)} dk + \frac{\partial V}{\partial g_s}\left[\int_0^{k_s} x(i) + \tau_s\left(\int_0^{k_s} \frac{\partial x(k)}{\partial q(i)} di + \int_0^{k_s}\left(\frac{\partial x(i)}{\partial q(k)}\right) dk\right) di\right] d\tau = 0$$

$$= -V_y k_s x + V_{g_s}\left[k_s x + \tau_s\left(k_s x_{11} + k^2{}_s x_{21}\right)\right] = 0 \qquad (3.7)$$

or

$$V_y k_s\left[-x + MRS_s\left\{k + \tau_s\left(x_{11} + x_{12}\right)\right\}\right] = 0$$

where $MRS_s = V_g/V_y$, the marginal rate of substitution between the public service and the private good. Alternatively we can express (3.7) as

$$MRS = \frac{x}{x + \tau_s\left(x_{11} + k_s x_{21}\right)} \qquad (3.7')$$

To find the impact of a change in the tax rate as a result of an increase in the tax base we differentiate (3.7) to get

$$\frac{d\tau}{dk_s} = -\frac{V_{\tau k_s}}{V_{\tau\tau}} \qquad (3.8)$$

where $V_{\tau\tau} < 0$ by the second-order condition, therefore

$$sign\left(\frac{d\tau}{dk_s}\right) = sign\left(V_{\tau k_s}\right) \qquad (3.9)$$

where

$$V_{\tau K_s} = V_y k_s\left[MRS_s x_{21} + \frac{\partial MRS_s}{\partial g_s}\frac{\partial g_s}{\partial k_s}\left(x + t_s(x_{11} + k_s x_{21})\right)\right] \qquad (3.10)$$

from the first order conditions,

$$x + t_s(x_{11} + k_s x_{21}) = \frac{x}{MRS_s}$$

so

$$V_{tk} = V_y k_s \left[MRS_s t_s x_{21} + \frac{g_s}{MRS_s} \frac{\partial MRS_s}{\partial g_s} \frac{1}{k_s} \right]$$

$$= V_y k_s \left[MRS_s t_s x_{21} + E_{mrs} \right]$$

where

$$E_{mrs} < 0 \qquad (3.11)$$

In (3.11), whether there is a tax rate reduction as a result of a base increase depends whether those private commodities not in the tax base are gross substitutes or complements with those commodities in the tax base. The assumption of gross substitution with the tax base may not hold as the base begins to include most of the consumer goods, rather the untaxed base may become more complementary. Thus, when government chooses the base and rates to maximize utility, then depending on whether private goods not in the base remain gross substitutes, the base increase may lead to lower tax rates or higher rates.

Revenue maximization

Now consider the case in which the government is a "Leviathan", that is, it is choosing its tax policy to maximize tax revenue. In this case its objective is

$$\underset{\tau}{Maximize}\ \tau \int_0^{k_s} x(k)dk$$

$$s.t.\ \tau \int_0^{k_s} x(k)dk = ng_s \qquad (3.13)$$

The first order condition for (3.13) is

$$= \int_0^{k_s} x(k)dk + \tau_s \left(\left[\int_0^{k_s} \frac{\partial x(k)}{\partial q(k)} + \frac{\partial x(i)}{\partial q(k)} dk \right] di \right)$$

$$= k_s x + \tau_s \left(k_s x_{11} + k^2{}_s x_{12} \right) = 0 \qquad (3.14)$$

Which gives

$$\tau_s = \frac{x}{x_{11} + k_s x_{12}} \qquad (3.15)$$

Analagous to the utility maximizing case, by totally differentiating (3.14) with respect to k_s gives

$$\frac{d\tau}{dk_s} = -\frac{V_{\tau k_s}}{V_{\tau\tau}} = \frac{x_{12}}{V_{\tau\tau}} \qquad (3.16)$$

Since $V_{\tau\tau}<0$ by the second order condition we have

$$sign\left\{ \frac{\partial \tau_s}{\partial k_s} \right\} = sign(x_{12}) \qquad (3.17)$$

If commodities are gross substitutes, then expanding the base increase the tax rate. With gross complements the tax rate decreases. The impact on total revenue is again given by (3.12). However, in this case, the second term of (3.12) is equal to zero by the envelope theorem (the tax rate chosen to maximize revenue), therefore making

$$\frac{d\left(\tau \int_0^{k_s} x(k)dk \right)}{dk_s} = x(k_s) > 0 \qquad (3.18)$$

Note that while with utility maximization the tax rate could increase and revenue will increase with expansion of the tax base, these increases are always less than the expansion occurring when government maximizes revenue.

Equations (3.16) and (3.18) generate the predictions to be tested. First, in (3.16) when government chooses the base and rates to maximize utility, then depending on whether private commodities not in the base remain gross

substitutes, the base increase will lead to lower tax rates. Secondly, in (3.18), if revenue maximization is the objective, then we get no change in rates and an increase in revenues from a tax base increase. Therefore, the following hypotheses to be tested are

Hypothesis 1: Tax bases and rates are inversely related.
Hypothesis 2: Tax base expansion leads to higher expenditures.

The first hypothesis relates to the standard optimal tax formula of broader bases and lower tax rates. Generally, this base-rate adjustment would be considered revenue neutral and serves to reduce the excess burden of the tax. The second hypothesis generated by the model relates directly to whether tax base broadness allows government the opportunity to increase spending through revenue expansion. The next step towards testing these hypotheses is to develop a model that describes the system within which, tax rates, bases and expenditures are determined.

A General Government Budget Model

In order to test the hypotheses generated from the tax model above, a framework must be established for the development of an econometric model. What follows is a general derivation of a government budget model. In order to consider the different possible objectives that exist for government, I use an approach similar to one used by Brennan and Buchanan (1980). This approach does not necessarily presuppose a specific objective function for government. They simply define any difference between the revenue raised and the demand for public goods as surplus, S and note that government decision makers are constrained in

the surplus available since some of the total revenue generated must go to meet the demand for public goods and services, G. Thus,

$$S = R - G \quad \text{and} \quad G = \alpha R \qquad (3.19)$$

If α equals 1 then the government is acting, or at least is constrained sufficiently so as to act, as an equi-revenue provider or utility maximizing government. Otherwise, some surplus is accruing to government.

$$S = (1 - \alpha)R \quad \text{for } \alpha \in (0,1] \qquad (3.19')$$

This concept of surplus revenues could manifest itself in various forms. One possible explanation is developed as a principal-agent problem similar to what can be found in the industrial organization literature.

The principal-agent problem arises when the purchaser of services (the principal) does not have full information about the circumstances faced by the provider of those services (the agent). As a result the agent is able to serve it's own end rather than the principal's. The principal-agent problem for government can result in, for example, rent-seeking behavior by bureaucrats or a loss in operational efficiency.

The model above implies increases in the tax base may make available more surplus to government. If, however, the surplus available to government is fixed, then an increase in the tax base would find as Brennan and Buchanan (1980) assert that "such a broadening would lead to a higher level of tax revenues and of public goods supply than the citizen-taxpayer desires."

Surplus could be thought of as fixed, since typically beyond some level of surplus political pressure could supplant the current bureaucratic system, thus

constraining the ability of government to increase its surplus. The increase in the base is analogous to a price increase, thus motivating the producer (government) to increase output. Since, the power to tax affords the government the ability to provide to the market more than would be demanded if price was constrained to short run marginal cost, then base broadening beyond some desirable level would lead to a higher supply of government goods and services, thus higher total expenditures.

Therefore, the relationship between the tax base and government expenditures must be incorporated into a state government budget model. While the surplus available to government can not be explicitly determined within a budget model, the financing of government expenditures and the demand for government goods and services can be modeled.

This model is developed from previous work, as noted in this and previous chapters. The maximizing behavior framework of governments requires that revenues be maximized subject to constraints on base, rate and taxing power. Therefore, to provide a given level of the public good revenue, R*, must be raised, such that:

$$R^* = R(b, r, c) \qquad (3.20)$$

Budget Model System of Equations

Equation (3.20) says a government raises revenue subject to the constraints on tax base (including debt issuance), b, tax rates and limits, r, and the degree of competitiveness (or degree of centralization) facing each taxing jurisdiction, c. Equation (3.20) suggests, that revenue maximizing occurs independent of public good demand and is consistent with a pure Leviathan model of government

ignoring the demand for government expenditures. There exist a demand for the public good, however, where,

$$G^* = G(Y,z) \qquad (3.21)$$

Equation (3.21) says that the demand for public goods is a function of income, Y, and characteristics of the population, z. This relationship can be expressed as an augmentation of the median voter models introduced by Borcherding and Deacon (1972) and, Bergstrom and Goodman (1973). Equations (3.20) and (3.21) represent a system of equations which must be considered in testing the hypothesis on tax base size and government spending.

Additionally, states have been subject to voter imposed base and rate limitations. Empirical evidence on the effects of these constraints have been inconclusive. The difficulty with these studies is in characterizing government behavior in the absence of the limitations (Dye and McGuire, 1992). In developing equation (3.20) inclusion of a state tax and rate limitation indicator variable needs to be included. Federal transfers also need to be included to control for additional revenue available to the states and expenditure incentives created by these transfers.

In addition to equation (3.20) and (3.21) there are the budget identity and revenue identity. The budget identity is where total expenditures equal sales revenue, other revenue, federal transfers, and borrowing.

$$\text{Expenditures} = \text{Sales Revenue} + \text{Other Revenue} + \text{Federal Transfers} + \text{Borrowing} \qquad (3.22)$$

The revenue identity is just the product of the tax base and tax rate.

$$\text{Tax Revenue} = \text{tax rate} \bullet \text{tax base} \qquad (3.23)$$

Equations (3.21) - (3.23) must be augmented by tax base and rate equations since they are endogenously determined in the budget. As noted by Wilson (1989), base and rate decisions are jointly determined. The issue of endogeneity is enhanced by the fact that the sample data will encompass a 16 year time period. In a one year sample it could be argued that bases and rates can be treated as exogenous when spending based on revenue forecasts are considered, this clearly is not the case when considering longitudinal data (in chapter five a test for the endogeneity of the tax base in the government expenditure equation will be performed). Therefore, one solution is to model the determinants of the base and rate choices in a given year. These base and rate choices become part of the model and are endogenous.

Since it can be argued that the base and rate are both endogenous variables, it is appropriate to consider what exogenous factors influence these variables. The tax base can be characterized as a function of government spending, G, tax rate, r, political factors, p, socioeconomic factors, z, and tax and expenditure limits, tel.

Thus it follows that,

$$b^* = b(G^*, r^*, p, z, tel) \qquad (3.24)$$

Similarly, arguments can be made for the tax rate such that tax rate decisions are a function of government spending, tax base, political factors and tax and expenditure limits

$$r^* = r(G^*, b^*, p, z, tel) \qquad (3.25)$$

Since equations (3.21) - (3.25) represent a system of equation where government expenditures, tax base, and tax rate are simultaneously determined, then the relationships in this system of equations can be estimated. Chapter Four

employs this general equation framework to construct an econometric model in order to test the hypotheses formulated in the first part of this chapter.

Chapter 4: Econometric Model and Estimation Procedure

Many studies have estimated the demand for state and local expenditures, including Borcherding and Deacon (1972) and Bergstrom and Goodman (1973). While no consensus on the variables that determine government spending seems to exist, recent studies including Abrams and Dougan (1986) and Alm and Evers (1991) provide some assistance in determining what explanatory variables are appropriate to consider. Therefore, following previous work and the relationships suggested in Chapter Three, a simultaneous equations econometric model of government finances is developed.

Model of State Finance

The state budget model consist of five structural equations and two identities. By structural equation, I mean an equation that, in addition to an endogenous variable, has a predetermined component, a stochastic component, and characterizes underlying economic theory.

The equations in the econometric model are presented in log-linear functional form. The subscript *it* denotes the state, *i*, and the year, *t*. For example, $\text{Sales Revenue}_{it}$ represents the natural log of a State's sales revenues in time *t*. The first two equations are the two identities, the sales tax revenue identity and the budget identity. The identities do not contain a stochastic component, they are simply an additive or multiplicative relationship. Moreover, there are no variable coefficients associated with these identities

$$\text{Sales Revenue}_{it} = \text{Sales Tax Base}_{it} + \text{Sales Tax Rate}_{it} \qquad (4.1)$$

The sales revenue identity simply implies that revenue from the general sales tax is a function of the size of the tax base chosen and the sales tax rate, where the tax rate times the tax base equals sales revenue. The sales tax base is a ratio of the base taxed to the size of the base available for taxation. Both the sales tax rate and base are simultaneously determined in the model.

The Budget Identity equates expenditures and revenues including the current period issuance of debt.

$$\text{Expenditures}_{it} = \text{Sales Tax Revenue}_{it} + \text{Other Revenue}_{it} + \text{Federal Transfers}_{it} + \text{Borrow}_{it} \qquad \textit{(4.2)}$$

Other revenue is a state's own revenue less the revenues generated from the general sales tax. Other revenues are exogenous in this model. *Borrow* is the change in a state's short-term debt and the amount of long-term debt issued. All the states except for Vermont have a balanced budget requirement, but there are few occasions during the time period that states do not issue either short or long term debt, or both.

The Expenditure demand equation is an augmented demand for government spending equation. The traditional median voter demand equation is augmented to include variables that describe the state fiscal environment similar to recent studies by Abrams and Dougan (1986), Holtz-Eakin (1988), Alms and Evers (1991) and Poterba (1995).

$$\text{Expenditures}_{it} = \beta_0 + \beta_1 \text{Federal Transfers}_{it} + \beta_2 \text{TEL}_{it} + \beta_3 X_{it}^{E} + \beta_4 Z_{it} + \beta_5 \text{Sales Tax Base}_{it} + \varepsilon^{e} \qquad \textit{(4.3)}$$

The Expenditure equation includes the endogenous variables Federal Transfers, TEL, and the Sales Tax Base. States with higher relative transfers are expected to have higher government spending levels. Tax and expenditure limits, TEL, while arguably may or may not effect spending outcomes, they do reflect voter and legislative intent with respect to spending activity. The Sales Tax Base is simultaneously determined in the budget process and is hypothesized to have a positive impact on expenditure outcomes. Additionally, political-socioeconomic variables, as summarized by the notation X_{it}^{E} and Z_{it}, are included in the spending decision.

The Sales Tax Base equation includes determinants that explain the choice of the base size for a state.

$$\text{Sales Tax Base}_{it} = \delta_0 + \delta_1 \text{Sales Tax Rate}_{it} + \delta_2 \text{Expenditures}_{it} + \delta_3 \text{Number Legislature}_{it} + \delta_4 X_{it}^{SB} + \delta_5 Z_{it} + \varepsilon^{b} \qquad (4.4)$$

This choice of base size, the percent of the available sales base that is taxed, is a function of the state's economic stability, revenue from other sources, the sales tax rate, current expenditures, number of elected legislators (Campbell, 1994), border states base sizes as measured by the weighted average of adjoining state tax bases, and other political-socioeconomic state characteristics.

The Sales Tax Rate equation includes determinants that explain the choice of the tax rate.

$$\text{SalesTax Rate}_{it} = \phi_0 + \phi_1 X_{it}^{SLR} + \phi_2 \text{Sales Tax Base}_{it} + \phi_3 E_{it} + \phi_3 Z_{it} + \phi_4 \text{TEL}_{it} + \varepsilon^{slr} \qquad (4.5)$$

The sales tax rate is a function of cross border tax competition as measured by the weighted average of adjoining state tax rates, other revenue, rate of total taxation as measured by total tax revenue divided by personal income , forecasted change in revenue needs, expenditures, political-socioeconomic characteristics, the relative sales tax base chosen, and the presence of a TEL.

The final two structural equations indirectly influence the budget process, but are very much endogenous to that process. This is particularly true when examining the process over a period of time. Where and when TEL's are binding, the budget process may be constrained. The existence of a TEL at the state level can suggest, as well, that the budget process was perceived to need some constraint or additional oversight.

The federal transfers a state receives are often directly tied to budgetary spending decisions of the state. Thus, both TEL's and federal transfers exhibit endogenous characteristics and as such are included as structural equations in the state budget model. Following work by Shedbagian (1999) these variables will be estimated using the separate structural equations below and the predicted values will be used as instruments in the other structural equations.

$$TEL_{it} = \mu_0 + \mu_1 Direct_{it} + \mu_2 Federal\ Transfers_{it} + \mu_3 Z_{it} + \varepsilon^{tel} \qquad (4.6)$$

$$Federal\ Transfers_{it} = \xi_0 + \xi_1 Expenditures_{it} + \xi_2 Local\ Expenditures_{it} + \xi_3 Povrate_{it-1} + \xi_4 Unemp_{it-1} + \xi_5 Z_{it} + \varepsilon^{f} \qquad (4.7)$$

Table 4.1 on the following page list the five structural equations and the independent variables found in each equation.

Table 4.1 Structural Equation Variables

Expenditure Equation	Sales Tax Base Equation	Sales Tax Rate Equation	Per Capita Federal Transfers	Tax and Expenditure Limits
Sales Tax Base	Sales Tax Rate	Sales Tax Base	Expenditures	Direct
Per Capita Federal Transfers	Taxation of Personal Income	Number of Legislators	Per Capita Local Expenditures	Per Capita Federal Transfers
TEL	Per Capita Expenditures	Per Capita Expenditures	Unemployment Rate (t-1)	Percent under 18
Per Capita Private Income	Per Capita Private Income	TEL	Poverty Rate (t-1)	Percent 65 and over
Unemployment Rate	Per Capita Other Revenue	Border Rate	Percent under 18	Population Density
Per Capita Local Transfers	Border Base	Change Total Revenue(t-1)	Percent 65 and over	Population Growth
Per Capita Local Expenditures	Change in Income (t-2)	Taxation of Personal Income	Population Density	Poverty Rate
Per Capita Borrowing	Change in Revenue (t-2)	Per Capita Private Income	Population Growth	
Upper Distance	Number of Legislators	Per Capita Other Revenue	Poverty Rate	
Lower Distance	Per Capita Private GSP	Per Capita Private GSP		
Governor	Percent under 18	Percent under 18		
Per Capita Private GSP	Percent 65 and over	Percent 65 and over		
Percent under 18	Population Density	Population Density		
Percent 65 and over	Population Growth	Population Growth		
Population Density	Poverty Rate	Poverty Rate		
Population Growth				
Poverty Rate				
constant	constant	constant	constant	constant
state indicators	state indicators	state indicators	state indicators	state indicators
year indicators	year indicators		year indicators	year indicators

Estimation of the State Budget Model

The data consists of a sample of 748 observations that includes all the states except Alaska and Nebraska for the years 1977 -1992. Alaska was excluded because of its unique fiscal structure where the primary tax base is its natural resources. Thus, there is a significant amount of tax exporting, as well as a high degree of federal intergovernmental transfers into that state. Nebraska was excluded because of its unique unicameral legislative body. Because party strength can be an important determinant of budgetary outcomes, rather than construct a separate model to describe Nebraska's legislative characteristics, it was omitted from the sample. Inclusion of Nebraska, otherwise, would require the undesirable omission of party strength variables from the model.

The observations represent a panel data set with both cross-sectional and time series characteristics and the model is a multiple equations model representing a system of simultaneous equations. Both of these conditions suggest ordinary least squares estimation of the equations would lead to inconsistent and inefficient parameter estimates.

Two methods for estimating longitudinal data sets of this nature are fixed effects and random effects procedures. A common formulation for state longitudinal data is to assume that differences across states can be captured in differences in the constant term (Greene, 1993). Thus, the fixed effects estimation will be employed. Because the unit sample size and the number of states is small, a least squares dummy variable model is used where an nT x n matrix of dummies, **D**, is included in the estimation. Additional specifications will explore the importance of time fixed effects in addition to the state fixed effects. Thus, the model , with time effects, can be expressed by

$$Y_{it} = \mathbf{D_i}\gamma + \mathbf{D_t}\alpha + X_{it}\beta + \varepsilon_{it}$$

This model is referred to as the least squares dummy variable model, where $\mathbf{D_i}$ and $\mathbf{D_t}$ are state and time dummy variables. This is a classical regression model with all the usual properties and can be estimated with ordinary least squares.

The simultaneity inherent in the system creates an additional problem because the explanatory variables are correlated with the error terms of the structural equations, thus ordinary least squares delivers biased estimates of the structural coefficients. As a result, an alternative instrumental variable approach is needed to estimate these equations.

The issue of endogeneity is enhanced by the fact that the sample data will encompass a 16 year time period. In a one year sample it could be argued that bases, rates, TEL's, and federal transfers may be exogenous to spending decisions based on revenue forecasts. That assumption is debatable for a single year estimation, but clearly is not the case when considering longitudinal data. Also, as noted by Wilson (1989) base and rate decisions are jointly determined. This simultaneity would need to be corrected for in the final estimation of the structural equations regardless of the time frame.

Before an instrumental variable approach can be successful, the structural equations must be identified. An under-identified structural equation cannot be estimated. One test of the identification of a structural equation is the *Order Condition* (Greene, 1993).

The state budget model meet this necessary condition for identification, therefore, the structural equations of interest will be estimable using the instrumental variable approach. To assure identification of the endogenous variables, in Chapter Five an additional test will be performed to confirm identification of each equation.

In order to mitigate problems from heteroschedastic disturbances within the model, the variables, where appropriate, will be expressed in per capita terms. A primary source for heteroschedasticity in studies of states is the differences in populations between the states. Per capita adjustments is a method to apply equal weights to the variables that enter the estimation. The adjustment by population is similar in approach to a weighted least squares estimation and is a standard approach for ridding government expenditure models of heteroschedasticity (Studenmund, 1997).

The fixed effects state budget model will be estimated using *STATA* statistical software. Three-stage least squares instrumental variable approach will be used to estimate the structural equations (tables in Chapter Five will report the estimation results for the expenditure, sales tax base, and sales tax rate equations). Three-stage least squares is a system method of estimation and thus is a technique used for joint estimation of an entire system of equations. It is essentially an equation by equation two-stage least square estimation. Two stage least squares is a method that systematically creates instrumental variables from the exogenous variables in the system to replace the endogenous variables.

Thus, three stage least square estimation involves the application of generalized least squares to a system of equations, each of which has been estimated using two stage least squares. The three stage least squares procedure can be shown to produce more efficient parameter estimates because it takes into account cross-equation correlations. This approach is used for two reasons. It is operationally efficient, and more importantly this approach provides consistent and asymptotically efficient parameter estimates.

Data and Variables

There are 748 observations on 48 states covering the years 1977 -1992. A table of all the variables , including variable name and sources, is at the end of this chapter. Since the data set covers 16 years, all nominal dollar values are adjusted by the CPI index, all dollar amounts are in 1982 dollars. Nominal dollars were adjusted using the U. S. Census Bureau CPI-U. All non-indicator variables will be in natural logarithms and the structural equations will be estimated using the log-linear functional form. Four states, Delaware, Montana, New Hampshire, and Oregon, do not have a general sales tax, their tax revenues, rates and base size are set to 1 $X10^{-9}$. Thus, the log of these variables for these states are equal to zero. Likewise, since Hawaii does not have any neighboring states, the weighted average of the neighboring states tax rate and tax base will be zero and the correction outlined above will be used.

Variables in the Structural Equations

Expenditure Equation

The expenditure equation adopts the often used median voter demand model for government spending as introduced by Borcherding and Deacon (1972) and Bergstrom and Goodman (1973). Three variables primarily influence the demand for government services: the State's personal income, federal transfers into the state, and the State's population.

Yousefi and Abizadeh (1992) argue that personal income is endogenous with government expenditures since these expenditures are part of personal income and should not, therefore, be treated as exogenous. They demonstrate that this problem can be avoided by subtracting government spending from personal

income to yield private income. That technique is employed here when constructing the personal income variables for this model.

The expenditure demand equation is augmented by including other political and socioeconomic variables, as well as other variables that influence state expenditure outcomes.

First, there are tax and expenditure limits (TEL) and federal transfers included in the expenditure equation. Since the presence of a TEL signals that the voting public believes revenues and/or expenditures may potentially exceed desired levels. The TEL, as noted earlier, is an endogenous indicator variable in the finance system, where a value of one indicates that a TEL effects the states financing decisions. TEL's that take on a value of one are actual limitations on state revenue and spending and should reduce the state revenue. Skidmore (1999) found that only those TEL's which are enacted with actual restrictions on state revenue and spending activity had significant impact. Some states have advisory restrictions, but these advisories were found to have no impact on state expenditures and revenues. TEL's can have a negative impact on expenditures, but states that have enacted TEL's may have higher expenditures, *ceteris paribus,* therefore the coefficient may be positive.

Federal transfers represents the total dollars transferred into a state from the federal government (determinants of federal transfers, as well as TEL's, will be discussed in more detail below). Federal transfers are formulaically tied to personal income and as such decline with increases in personal income. Because of the matching characteristics of many of the transfers, these transfers are often complementary with state expenditures. Thus, the federal government's use of grants with matching characteristics may tend to increase state expenditures. This effect is often referred to in the context of the "flypaper" effect, but conclusive findings of this effect have been called into question, Bailey and Connolly (1998).

Oates (1985) considers a state's share of total tax revenues a measure of the degree of centralized taxing authority in the state. Nelson (1987) argues that because states differ in the way they allocate services, the State's share of tax revenue may not measure centralized taxing power. He cites, as an example, states with a demand for higher elementary and secondary education will have lower state shares, but may not have any less centralization of taxing power from those states with a lower demand. He reasons that since these services are traditionally provided at the local level, those states will have lower state shares even though the division of taxing powers are the same for both states.

Since this analysis does not intend to directly measure the centralization effects on state spending, variables measuring local transfers and local expenditures will be included instead of the tax share measure employed by Nelson. These variables are intended to control for intrastate spending activity since they could influence the level of state expenditures.

Local transfers are the dollar amounts of intergovernmental transfer of state revenues to the local governments within the state. With respect to state expenditures, higher per capita transfers to local governments may increase the demand for spending at the state level.

If a state's overall tax structure is such that much of government spending is borne primarily at the local level then the need for greater expenditures at the state level will be lessened. If on the other hand, the demands on state spending are similar at the local level, then you would expect states with higher local government spending to also have higher state government spending levels.

Other variables that could be included as determinants of expenditures are fiscal policy constraints, such as the presence of a balanced budget requirement or line item veto. Holtz-Eakin (1988), Alm and Evers (1991) among others find that the line item veto has no impact on state spending. Similarly, while every state

except Vermont has a balanced budget requirement, the effectiveness has been limited to a state's ability to run a deficit. Because evidence from these studies suggest neither of these budget rules impact state expenditures, they are not included in the Expenditure equation.

In addition, Poterba (1995) finds little evidence that debt limitation requirements effect state debt. Additionally, Von Hagen (1991) finds state debt limits have no significant impact on per capita debt. Abrams and Dougan (1986) do not find that borrowing limits impact state spending levels. Poterba (1994) and Bohn and Inman (1996) find balance budget rules may matter with respect to deficits but, state borrowing constraints or debt limitations whether constitutional or statutory have little or no impact on a state's willingness to issue debt. For these reasons debt limitations are not included in the Expenditure equation.

As noted earlier, Brennan and Buchanan (1978, 1980) hypothesized that access to debt finance, ceteris paribus, positively influences the amount of Leviathan's revenue-maximizing power. In Nelson's study he found that debt limits significantly and negatively influenced per capita tax revenues. The variable *Borrow*, the sum of per capita long-term debt issued and the change in per capita short-term debt for the year, is a proxy for a state's willingness and ability to issue debt in the state's budget. The use of this variable is consistent with Von Hagen's findings that per capita debt is higher in states with weak budget rules. If states can defer current revenue needs through borrowing, then higher levels of per capita borrowing would lead to higher state expenditures.

The next variable is the state unemployment rate. This variable is a proxy for the current period business cycle. The business cycle can directly influence the revenue stream and expenditure demands within the state. Rather than using the national rate, the state rates will be used to distinguish between regional

differences in the business cycle. The unemployment rate was chosen because it is a good within period indicator of the business cycle.

Finally, the political environment of the state is included consistent with Holtz-Eakin (1988) and others in augmenting the expenditure demand equation. Three variables will be used to describe the political environment of budget decisions. The first variable, *Governor*, is a binary variable which equals one if the State's governor is a Democrat and zero otherwise. The next two variables are measures of the political strength in the upper and lower chambers of the state's legislature. Caplan (2001) shows how both parties tend to make government larger as the likelihood of electoral success increases. He proxies the likelihood of re-election success by the use of a "distance" variable. That approach is used here, where upper and lower chamber "distance" is measured as the absolute value of the percent of Democrats[4] less 0.5. This gives the absolute value of the distance between 50 percent and the percent of seats held by the party in power. The distance variable is a proxy measuring the degree of inter-party competition and because the variable is in absolute terms it represents party strength regardless of party.

This competition, as Caplan finds, may be associated with higher spending because representatives may use spending to assure their incumbency and retention of party strength. Also, as party strength or "distance" increases, special interest spending increases as fear of reprisal by voters decreases.

In addition to state and political variables, the socioeconomic characteristics (Z) are included. Those variables are: private personal income, discussed above; private Gross State Product, the state Gross State Product less government product; state population characteristics including, a one period change in population (this

[4] This could have been calculated as the percent of Republicans and obtained the same results. The distance measure would have yielded the same results.

variable is squared before taking logs, in a few instances states experienced negative annual growth); the population density; the percent of the population under 18; the percent over 65; and the states poverty rate.

Sales Tax Base Equation

There are 46 states that raise revenues with a general sales tax. Wilson (1989) notes that the tax base choice and the rate of taxation are jointly determined. Therefore, both the sales tax base choice and the sales tax rate are simultaneously determined within the state budget model.

In order to calculate the tax base size or coverage I follow the formula used by Metcalf (1993). The base choice is measured as the part of the base which is subject to the sales tax divided by the Gross State Product (GSP) as measured by the Bureau of Economic Analysis. The sales base variable therefore, is calculated by taking the actual base taxed divided by GSP. The numerator is constructed by dividing the general sales tax revenue by the sales tax rate. This ratio represents the fraction of the sales base that is taxed. This fraction of the tax base that is taxed is then divided by the private GSP. I differ from Metcalf by only using the private GSP, the total GSP less government product. The private GSP serves as a proxy for the tax base available for the application of a general sales tax and government activity is typically exempt from the general sales tax.

Ring (1999) has shown that only 59 percent of a state's sales tax revenues are from final consumption goods, the balance are from predominately intermediate goods. This indicates the sales tax is not a pure flat tax on final consumption. He notes the cascading effect created by the taxation of intermediate goods. A state's taxing of intermediate goods could alter the actual broadness of the tax base. In measuring the tax broadness, as noted, the GSP is used as the potential base, a "value-added" measure of state production, this should help

mitigate the problems in measuring base broadness when states rely on intermediate goods for part of their tax base. The GSP does, however, include the value of imputed rent from owner-occupied housing as well as rental income from housing, neither of which would be considered a potential part of the sales tax base. Because there is the potential of cascading effects and tax exporting, and the inclusion of rent values, the GSP is not a perfect measure of the available tax base, but it is a broader more comprehensive measure than the next best alternative, which is personal income.

The components of personal income include wages and salaries, rental income, dividends and interest, and transfer payments. This in many respects is similar to GSP, but is narrower in that it does not consider all business activity in the state. GSP, on the other hand, is the value added in production by the labor and property located in a state. Because GSP is calculated as the gross output minus intermediate inputs it could be considered as yet again to narrow a measure based on Ring's findings. The GSP does include any taxes paid by the business, however, therefore it seems the most appropriate and best measure to capture the potential tax base available to the state

Since the Bureau of Economic Analysis calculates the GSP for each state the dollar values are consistently measured for each state.

The sales tax rate is the general sales tax rate for the state. This variable, as noted, is endogenously determined.

The determinants of the tax base chosen by a state, includes the rate of taxation on the base as noted above. Also, of importance is the percent of personal income collected from all other tax sources within the state. This variable is a proxy for the dependence of the state on taxation of other source for its revenue. A greater percent of personal income going to other taxes in the state will reduce the size of the tax base.

The state budget process includes the simultaneous occurrence of setting the size of the budget and the bases and rates necessary to create revenues to equate expenditures. Thus in both the sales tax base and rate equations, expenditures can be an important determinant.

Private income and other state socioeconomic characteristics summarized as, Z, as well as the amount of tax competition from other states as proxied by the variable *Border Base*, a population weighted average of the surrounding states tax bases are included in the equation. The border base variable would be positive leading to larger base sizes, if states believe that base broadening will not have negative border effects for their state.

Campbell (1994), suggests that the number of state constitutionally elected legislatures could positively influence the base broadness probability, this variable will be included in the sales tax base equation.

Additionally, as discussed by Dye and McGuire (1992) and Holcombe and Sobel (1995), the choice of a tax base can be partially motivated by the need to smooth revenue flows across time. The need for a smoother flowing revenue stream is increased by rising demand for public goods and services. They argue that revenue stability is an important concern for expanding the tax base. Therefore, variables that measure the changes in not only revenue but, private income within a state can help explain the base structure chosen by the state. Since these variances may be negative, the square of the two-period lagged variance will be used. The larger the variance, from one period to the next, would suggest a greater probability in choosing a broad based sales tax.

Other revenue is included as a control for other sources of revenue available to the state from taxation and other sources. Other revenue is the total own source revenue less the sales tax revenue.

Sales Tax Rate Equation

The sales rate equation includes many of the same variables as the sales tax base equation. The sales tax base which is simultaneously determined would have a negative impact on the rate. As noted above, current expenditures are included in the sales tax rate equation since an increase in expenditures will place pressure on states to increase the base, the rate, or both. This pressure is assumed when holding other revenues constant and forcing a balanced budget with little or no borrowing. Similarly, forecasted changes in revenue as proxied by the actual revenue, R_{it}, less the previous years revenue, R_{it-1}, would impact the sales tax rate decision.

Another endogenous variable, TEL, is include in the structural equation. The presence of a TEL may provide a direct constraint on the tax rate chosen in any given year by a state.

The overall tax rate of personal income again will have a positive impact on the sales tax rate for the same reasons it positively impacts the sales tax base. The reliance on other revenue sources in the state will negatively influence the sales tax rate. Private income and other state socioeconomic characteristics summarized as, Z, are included.

The amount of sales tax rate competition from other states as proxied by the variable *Border Rate*, a population weighted average of the surrounding states tax rates is included in the equation. The border rate variable would be positive leading to larger state sales tax rates, this will occur if states believe that rate increases will not have negative border effects for their state.

Tax and Expenditure Limitations

Tax and expenditure limits are those limits which constrain the states growth in tax revenues or expenditures. As mentioned earlier only those state's which

passed actual limits are considered to have an effective limit. Actual limits must be overridden with a super majority vote or through a declaration of emergency by the governor. Those states with advisory limits are not considered as having an effective tax or expenditure limit. Advisory limits are often statutory limits that can be changed through a simple majority vote. Fifteen states have an actual tax or expenditure limit or both.

Early studies on TEL's found little effectiveness in reducing tax revenue or expenditures. These earlier studies considered the TEL to be an exogenous shock. The exogeneity of this shock has been challenged in recent literature. Recent works by Poterba (1995), Rueben (1995) and Shadbegian (1998, 1999) find that TEL's are endogenous to a state's finance structure. Since the endogeneity issue may have a significant impact on statistical inferences, this model treats TEL's as endogenous and the equation above will be used to create an instrument for the TEL dummy. In constructing the equation for a TEL the key, as with all the structural equations, is to find a variable that is correlated with the dependent variable, the probability of passing a TEL, but is otherwise uncorrelated with the sales tax base, rate, and expenditures of the budget system.

Rueben uses citizen direct legislation laws[5], *Direct*, which should be positively related to the passage of TEL's, but unrelated to current bases, rates, and expenditures. These direct legislation laws were passed early in the previous century and will not influence current budgetary outcomes, but would increase the probability of passing TEL legislation. Florida, Illinois, and Wyoming are excluded from the list of those states with direct legislation, as suggested by Rueben, since they passed direct legislation provisions recently (1978, 1970, and 1968, respectively).

Additional determinants used in assessing the probability of passing a TEL include state characteristics, Z, and federal transfers.

Federal Transfers

The federal intergovernmental transfers a state receives, as noted earlier, is not an exogenous outcome unrelated to state expenditures. The allocation of federal intergovernmental transfers depends not only on state socioeconomic characteristics, but also on the fiscal conditions and arrangements within the state. Shedbegian (1999) finds that federal transfers are endogenous and develops an instrument to use for the variable. His approach will be followed here.

The lagged unemployment rate and the lagged percent of families living in poverty are used as instruments. Both of these variables are expected to be positively related to federal intergovernmental transfers. Also, included are state and local expenditures since federal transfers are often directly linked to these expenditures in the form of matching funds. Finally, the states personal income is inversely related to the federal intergovernmental transfer decision and thus, a strong determinant of the level of transfers.

Data Sources

The data for this study is from the following sources: Advisory Commission on Intergovernmental Relations' Significant Features of Fiscal Federalism, which contains information on state tax rates, tax limitations on rates and bases and state tax base measures. State Government Finances (U.S. Bureau of Census) which has detailed expenditure and revenue data for each state. The U.S. Statistical Abstract which includes information on state expenditures and revenue, as well as

[5] States with historical provisions for direct legislation include Alaska, Arizona, Arkansas, California, Colorado, Idaho, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, South Dakota, Utah, and Washington.

individual state socioeconomic characteristics. The Bureau of Economic Analysis which has data on Gross State Product and personal income.

The following tables provide summary statistics on the variables and a list of the variables used in the state budget model.

Table 4.2 Summary Statistics

Variable	OBS.	Mean	Std. Dev.	Min	Max
Per Capita Expenditures	784	1526.206	367.482	861.546	3143.381
Per Capita Revenue	784	1.302157	0.352368	0.667424	2.702049
Per Capita Federal Transfers	784	0.353736	0.09902	0.161212	0.953961
Per Capita Borrowing	784	143.7829	133.1194	0	1273.527
Per Capita Local Expenditures	784	1.337972	0.388922	0.578907	3.0117
Per Capita Local Transfers	784	0.014033	0.020351	0.000106	0.186305
Per Capita Other Revenue	784	1.05381	0.330143	0.427975	2.474928
Sales Tax Base	784	0.459078	0.217753	0	1.260365
Sales Tax Rate	784	0.040961	0.016248	0	0.08
TEL	784	0.327806	0.469713	0	1
Per Capita Private Income	784	10351.66	1811.305	6822	17103
Per Capita Private GSP	784	12674.63	2548.25	8190.882	26239.29
Population	784	4822434	5040352	413000	3.09E+07
Percent Under 18	784	0.274143	0.027372	0.139121	0.374922
Percent 65 and Over	784	0.120235	0.021332	0.071513	0.201057
Population Density	784	163.385	227.1632	4.253	1049.9
Population Growth	735	0.009672	0.012962	-0.04421	0.081908
Poverty Rate	784	13.73074	4.281558	2.9	27.2

Variable	OBS.	Mean	Std. Dev.	Min	Max
Taxation of Personal Income	784	0.076254	0.0182	0.027863	0.164737
Unemployment Rate	784	6.669031	2.1477	2.2	18
Border Base	768	0.425975	0.110706	0	0.743
Border Rate	768	0.041176	0.011356	0	0.062
Direct	784	0.450255	0.497837	0	1
Number of Legislators	784	151.4324	59.28678	49	424
Upper Distance	768	0.188501	0.134543	0	0.5
Lower Distance	768	0.176325	0.127472	0	0.5
Governor	784	0.605867	0.488976	0	1
CPI	784	1.07	0.243517	0.63	1.45
Area	784	60528.67	46543.64	1045	261914.3

Table 4.3 Variable Description and Source

Variable	Description	Source
Per Capita Expenditures	Total state expenditures divided by total state population	Census of Government Finances
Per Capita Revenue	Per capita own source revenues ($000)	Census of Government Finances
Per Capita Federal Transfers	Per capita federal intergovernmental transfers ($000)	Census of Government Finances
Per Capita Borrowing	Per capita long-term debt issued during the year plus change in short-term debt for the year	Census of Government Finances
Per Capita Local Expenditure	Per capita local expenditures ($000)	Census of Government Finances
Per Capita Local Transfers	Per capita local transfers ($000)	Census of Government Finances
Per Capita Other Revenue	Per capita own source revenue less sales tax revenue ($000)	Census of Government Finances
Sales Tax Base	The sales tax revenue divided by the sales tax rate, this amount is then divided by private GSP	ACIR: SFFF, BEA
Sales Tax Rate	General sales tax rate	ACIR: SFFF
TEL	1 if there is a Statutory or Constitutional expenditure and/or revenue growth limitation, 0 otherwise	ACIR: SFFF
Per Capita Private Income	Per capita total personal income less income from government	BEA
Per Capita Private GSP	Per capita total Gross State Product (GSP) less government component of GSP	BEA
Population	US Census population estimates rounded to nearest thousand	US Census Bureau
Percent Under 18	Percent of people in state less than 18 years old	US Census Bureau
Percent 65 and Over	Percent of people in state 65 and older	US Census Bureau
Population Density	State population divided by area	US Census Bureau
Population Growth	One year percent change in population	US Census Bureau
Poverty Rate	US Census estimated poverty rates, substituting 1969 for 1971 rate and 1975 for 1977 rate.	US Census Bureau
Taxation of Personal Income	Total revenue less sales tax revenue divided by private personal income	US Census Bureau

Variable	Description	Source
Unemployment Rate	State unemployment rates	BLS
Border Base	Population weighted average of bordering states sales tax rate	ACIR: SFFF
Border Rate	Population weighted average of bordering states sales tax base	ACIR: SFFF
Direct	States with "long standing" direct legislation provisions	
Number of Legislators	Number of elected state legislators	Council of State Government
Upper Distance	Absolute value of the percent of democrats in the upper chamber minus 0.5	Council of State Government
Lower Distance	Absolute value of the percent of democrats in the lower chamber minus 0.5	Council of State Government
Governor	1 if governor is a democrat, 0 otherwise	Council of State Government
CPI	BLS reported CPI-U	US BLS
Area	State's square miles	US Census Geography

Chapter 5: Estimation Results

This chapter presents the results from estimating the state finance system of equations as developed in Chapter 4. Several different specifications and variations of the model will be presented. In total there are eight different specifications all of which are variations upon the model described in Chapter 4. The different specifications range from a simple ordinary least squares regression of the expenditures equation to the final three stage least squares fixed effects econometric model that includes both state and time effects. Table 5.1 at the end of this chapter briefly summarizes the different three stage least squares specifications and Table 5.2 presents the estimation results. The different specifications reported do not constitute a specification search, but rather will provide insight into relationships within the model, highlight the importance of applying the appropriate specification to the state finance system, and demonstrate the robustness of the final results.

The specifications range from an ordinary least squares estimation of an augmented expenditure equation to the three stage least squares fixed effects estimation of the state budget model. The ordinary least squares estimations are designed to provide insight into the basic relationships between the variables and how changes in the specifications effect these relationships. The ordinary least squares estimations ignore the endogeneity inherent in some of the variables. Several specifications are designed to provide an insight into how a specific group of variables in the equation impact the outcome of the estimation. These variable groups include: political economy variables, local economy variables, border effect variables state indicator variables, and time indicator variables. The final specification incorporates variables and procedures needed for a theoretically and econometrically sound estimation of the state budget model.

The results are analyzed according to the estimation approach, ordinary least squares or three stage least squares, and the effects of including various sets of variables into the model. Our primary interest is on how sensitive is the coefficient on the sales tax base in the expenditure equation to different specifications.

The results of the specification estimations report the estimated coefficient, t-statistic, and the p-statistic. The p-statistic is interpreted as the minimum confidence level that the null hypothesis for statistical significance would be rejected. Where applicable an R-square statistic and F-statistic are reported. For the three stage least squares estimation only a "quasi" R-square statistic along with a chi-square statistic are reported.

It should be stated that the estimation of the structural equations using three stage least squares is to discover the parameter values and not to develop projections of the dependent variable. Thus, the "quasi" R-squared statistic reported is not an overly important, meaningful statistic when evaluating the structural model estimation.

Ordinary Least Squares Estimates

The ordinary least squares estimates (see Appendix A) were performed to provide some insight into the relationships between the variables and to assist in determining the robustness of the final specifications estimation. It is abundantly clear from these OLS estimates that the use of the state and time fixed effects are necessary to accurately portray the relationships established in the state finance model.

The results of the OLS specifications do not control for the endogeneity inherent in the state finance model. Because the structural equations represent a series of simultaneous interdependent equations ordinary least squares estimates will tend to exhibit biased and inconsistent parameter estimates.

These OLS specifications were primarily instructive regarding the need to control for fixed effects in the model. Previous work on state panel data indicated the need to develop state specific effects, but little information was available regarding the use of time effects in a state finance model. The OLS estimates suggest the tax base and expenditures are positively and significantly related. These, results held for all of the estimations and seem robust to different specifications. Whether this relationship holds once you control for endogeneity will be investigated next.

Three Stage Least Squares Estimation

Specification Test for Endogeneity of Tax Base Size

Before estimating the expenditure equation using the three stage least squares procedure, the hypothesized endogeneity of the tax base size should be confirmed. Davidson and MacKinnon (1993) suggest the Durbin-Wu-Hausman (DWH) test for endogeneity. The augmented regression test is formed by including the residual of the endogenous right-hand-side variable as a function of all exogenous variables in a regression of the original equation. In this case, the residual of the instrumented tax base variable will be included in the estimation of the expenditure equation. The test is of the following form where the simultaneous equations are

$$Z = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + \varepsilon_1$$
$$Y = \beta_0 + \beta_1 Z + \beta_2 x_3 + \varepsilon_2$$

You first perform the regression,

$$Z = \phi_0 + \phi_1 x_1 + \phi_2 x_2 + \phi_3 x_3 + \varepsilon_3$$

then get the residual from this regression and perform the following augmented regression

$$Y = \delta_0 + \delta_1 Z + \delta_2 x_3 + \delta_3 residual + \varepsilon_4$$

if δ_3 is statistically significant, then the ordinary least squares estimate would not be consistent.

For the expenditure equation, the critical value of the F-statistic (1,593) at the 95 percent confidence level is 3.84. The F-statistic on the residual is 15.91, thus we reject the hypothesis of no endogeneity of the tax base.

Identification of the System

The state finance system contains five endogenous variables. These variables must be uniquely identified by instrumental variables in the structural equation within which they are endogenous. Two of these endogenous variables, tax and expenditure limits (TELs) and federal intergovernmental transfers, are instrumented as per previous work documented in Shedbagian (1999), Skidmore (1998), and Rueben (1995). The variables that identify TELS and federal transfers are direct legislation; and lagged unemployment and lagged poverty rates, respectively.

Thus before presenting the final specification, the per capita expenditures, sales tax base, and sales tax rate need to be explicitly examined in order to determine if they are appropriately identified in each of the equations for which they appear as an endogenous determinant. If these endogenous variables are not fully identified, then the robustness of the results of the estimation could be brought into question. It certainly would weaken the conclusions that could be drawn from this estimation.

In order to test whether each variable is uniquely identified, two stage least squares will be utilized. Consider the following system where Y1 and Y2 occur simultaneously:

$$Y1 = X1*b1 + X2*b2 + X3*b3 + Y2*b4 + u1$$
$$Y2 = X3*a1 + x4*a2 + x5*a3 + Y1*a4 + u2$$

To do 2SLS we need X1, X2 and X3 to be uncorrelated with u2, and X4 and X5 to be uncorrelated with u1. In other words, if we include X1 and X2 in the equation for Y2 (with Y1) their coefficients need to be zero if they are to be used as instruments. This leads to the test: do 2SLS on the system, but include X1 in the equation for Y2 and if it is significant, it fails the test.

The first test is on the tax base variable in the expenditure structural equation. There are three variables that should be good instruments for the tax base. They are the number of elected legislators, the previous years change in personal income, and the previous years change in revenue. While the number of legislators influences policy regarding tax base and rate choices, there is no compelling argument that the number will influence per capita expenditures. When the number of legislators was included in the two stage least square estimation on expenditures its t-statistics was 0.534 and it passes the test and is a suitable instrument.

The two variables accounting for a states income and revenue volatility, the previous years change in personal income and the previous years change in revenue, are factors which may influence a state's desire for broader bases, but should have no bearing on the state's expenditures. When these variables were inserted individually into the expenditure equation their respective t-statistics were, 0.414 and –0.311. Thus, these variables make for suitable instruments as well. Moreover, it can be concluded that the tax base is identified in the expenditure structural equation.

The next equation, the sales tax base, contains two endogenous variables, tax rates and expenditures. These variables must be tested for identification. There are

three variables that should uniquely define expenditures in the tax base equation; state unemployment rates, and the political economy variables upper and lower distance. State unemployment rates, an important business cycle variable, should have little impact on a state's choice for its sales tax base. When the unemployment rate was inserted into the tax base equation its t-statistic was –1.350 and it passes the test, therefore, it is a good instrument.

The two political economy variables are designed to gauge incumbency strength of a political party that effect appropriations by the legislature, therefore, base choices should not be influenced by these variables on theoretical grounds. Nonetheless, each variable was tested and found to be statistically insignificant with t-statistics of 0.140 for upper distance and 0.752 for lower distance. It can be concluded that per capita expenditures are uniquely identified.

The next variable in the tax base equation that must be identified is the sales tax rate. Two variables, the weighted average of the bordering states' tax rates, and the forecasted change in the state's revenue, should impact state tax rate decisions, but not tax base decisions. The test confirmed that both would be good instruments with respective t-statistics of, 0.479 and -.403. Therefore, the sales tax rate is uniquely identified in the sales tax base equation.

The final tests are on the endogenous per capita expenditures variable and the sales tax base variable in the sales tax rate equation. There are three variables that should uniquely define expenditures in the tax rate equation; state borrowing, local expenditures, and local transfers. State borrowing should have no impact on a state's choice for its sales tax rate. When borrowing was inserted into the tax rate equation its t-statistic was –1.453 and it is a good instrument.

The two local economy variables are designed to measure the degree of centralization of government and control for local government involvement. Therefore, neither variable should impact state tax rates. This was confirmed by

the tests where each variable was found to be statistically insignificant with t-statistics of –1.200 for local state transfers and 1.158 for local expenditures. It can be concluded that per capita expenditures are uniquely identified.

The next variable in the tax rate equation that must be identified is the sales tax base. Two variables, the weighted average of bordering states' tax bases and the number of state elected legislators, should impact state tax base decisions, but not tax rate decisions. The test confirmed that the border base variable is a good instrument with a t-statistics of 1.674. The number of legislators, however, was statistically significant at the 5 percent level of significance, t = 1.970. Therefore, the sales tax base is identified by the border base variable, but the number of legislators variables does not pass the test.

This finding on the number of legislators suggest that it should be included as a determinant of tax rates. The final specification was changed to include this variable.

Another candidate for a tax base instrument are the time indicator variables. A discussion of Specification IV develops the justification for including the time effects in the expenditure and tax base structural equations, but no compelling reason could be established for their presence in the tax rate equation. Thus, an effort to determine if the tax base is identified by the time effects would also confirm that they do not belong in the tax rate equation.

In order to test whether these variables are significant to the tax rate equation an F-test is preformed. The F-test indirectly employs the Wald test statistic (Greene, 1993) where Rb=r denotes the set of q linear hypotheses to be tested jointly. Let the estimated coefficient vector be b and the estimated variance-covariance matrix be V. Then the Wald statistic is given by

$$W = (\mathbf{Rb-r})'(\mathbf{RVR})'^{-1}(\mathbf{Rb-r})$$

And the F statistic computed with q numerator degrees of freedom and d denominator degrees of freedom is given by

$$F= (1/q)W$$

The test for the time effects in the tax rate equation is tested against the critical value, F(13, 593) = 1.73. The generated F statistic is 0.503, therefore, we cannot reject the hypothesis that the time variables do not effect tax rates. The findings from this test and the test on the border base variable results in the conclusion that the sales tax base is identified in the tax rate equation.

This inquiry into the identification of the state finance system has found that the endogenous variables are identified, thus confirming the robustness of the results from the estimation of the system.

Three Stage Least Squares Estimation

Specification I – V, reported at the end of this chapter, are estimated using the three stage least squares estimation procedure. The estimation procedure controls for endogeneity in the state finance model. The Durbin-Wu-Hausman test for endogeneity confirmed the hypothesized endogenous relationship between the tax base and expenditures and the need for controlling for endogeneity in estimating their relationship. Strong theoretical evidence has been presented to support the endogeneity of the other endogenous variables in the model.

In the OLS specifications the fixed effects problem created by the use of pooled state data was addressed. It showed the least squares procedures of assuming a constant intercept across states and time was incorrect. The

introduction of state and time indicator variables removes this restriction on the model. An objection to using state and time indicators is that their use implies that there is important missing information. Because this essay is focused on determining the impact tax base choices have on expenditures and not the development of a comprehensive description of all matters effecting state fiscal outcomes across time, the fixed effects indicator variable approach is appropriate in the 3SLS specifications.

Specification I begins the process of exploring the importance of a set of variables that include the political economy, local economy and border effect variables. The omission of these variables allows us to explore the sensitivity of the model specification to the exclusion of these variables while controlling for endogeneity and fixed effects. Specification I omits all three sets of variables.

Omitting these three sets of variables from the model seems to create an upward bias in the estimated equations for all three variables of interest. The response of expenditures to changes in the tax base size is quite elastic with the coefficient being 1.293. The tax rate variable in the tax base equation is not statistically significant. The tax rate equation finds the sign and significance of the tax base coefficient is as expected.

Specification II returns to the estimation the local economy variables: local expenditures, and state transfers to the local governments. There does not appear to be any significant effect from the inclusion of these variables on the estimation results. In fact, both variables are statistically insignificant in the expenditure equation.

Specification III returns the border effects, border base and border rate, to the estimated model. These variables enter the tax base and tax rate equations, respectively. The border base variable is not statistically significant, but the border rate variable is significant and of the expected sign, positive.

The coefficient on tax base in the expenditure equation is now 2.742 suggesting a very elastic response to an increase in the size of the tax base by expenditures. The coefficient on the tax rate in the tax base equation is now negative and significant at the 10 percent level of confidence. Also, the coefficient on the tax base variable in the tax rate equation remains statistically significant and of the proper sign. It, therefore, can be concluded that border effects are important determinants in the state budget model.

Before including the political economy variables, Specification IV examines the sensitivity of the model to the inclusion of the time effects indicator variables in the tax rate equation. There was no compelling reason to expect time effects to influence tax rate choices, and this specification confirms that hypothesis. Including time effects into the estimation would imply there are yearly differences that influence the dependent variables in the structural equations. For example, this model does not contain changes in federal policy that may effect state expenditure decisions and outcomes. An increase in unfunded mandates from the federal government could have just such an effect. Likewise, changes in the nation's economic growth could effect tax bases in the states. State unemployment is included in the model to proxy business cycle fluctuations, but changes in the nations wealth or resources may not be fully proxied with the unemployment variable. Because this model does not attempt to model federal economic and political influences on state fiscal outcomes, time effects are included in the model.

Thus far, time effects can be justified in the expenditure and tax base equations, but it is more difficult to justify there presence in the tax rate equation. As this specifications results and that of specification V show, including time effects into the tax rate equation has implications on the interpretation of the effect the tax base has on tax rates.

There are no significant impacts to including time effects in the tax rate equation with respect to the expenditure and tax base structural equations. This is not true, however, for the tax rate equation.

In the tax rate equation significant changes occur when time effects are included. The coefficient on the tax base is no longer statistically significant as it has been throughout the estimations of the model. This suggest that the time effects are irrelevant to the determination of the tax rate. If that is so, then the inclusion of time effects will increase the variance of the coefficient. The standard error does indeed increase when the time effects are included in the sales tax rate equation[6]. From a theoretical standpoint, time effects should, as argued above, be included in the expenditure and base equation, but not in the tax rate equation. This specification confirms time effects are inappropriate. For these reasons the final specification will include time effects in the expenditure and tax base equations, but not in the tax rate equation.

Specification V: Final Results

This specification includes fixed state and time effects in the expenditure and tax base equations and state only fixed effects in the tax rate equation. Before discussing the results of the estimation as individual equations, the importance of the political economy variables needs to be addressed.

In Specification III the complete model was estimated except for the political economy variables. Specification V now returns those variables to the model. A comparison of these two specifications highlights the importance of political economy variables to the model. Most notably, in the expenditure equation the coefficient on the tax base is 2.74 compared with 0.364 in the

[6] The standard error on the tax base coefficient in the tax rate equation is .2012 when time effects are included into all three equations and .1345 when the time effects are removed from the tax rate equation, but left in the other two equations. Test on identification reinforce the inappropriateness of time effects in the tax rate equation.

properly specified estimation. Also in the expenditure equation, federal transfers and the unemployment rate are not statistically significant when these variables are omitted. Thus, omission of the political economy variables creates an omitted variable bias in the coefficient estimations.

Additionally, the identification test revealed that the number of legislators variable should be included in the tax rate equation. Inclusion of this variable only had modest impacts on other variables in the system.

The results of this estimation supports the primary hypothesis, does the size of the base taxed matter with respect to state spending. In addition to the hypothesis on tax base size and expenditures being supported by the empirical evidence, the more fundamental hypotheses that broad tax bases lead to lower tax rates and conversely, higher tax rates lead to narrower tax bases are also supported. What follows is an equation by equation analysis of the empirical results.

Expenditure Equation

Our results show that the size of a tax base significantly effects state spending. Since the model was estimated using a log-linear functional form, the coefficients of the estimations represent percentage changes.

The size of the tax base has a positive and statistically significant impact on expenditures, as noted above. Comparing results from the alternative specification indicates this result is robust to inclusion of fixed effects. The magnitude of the coefficient is 0.37 and statistically significant at the 1 percent level of confidence. This parameter estimate implies a 10 percent increase in the tax base size will increase per capita expenditures by 3.64 percent.

As expected per capita federal transfers positively impact state expenditures. The process of determining many federal transfers into the state require spending by the state, matching funds. The matches are typically determined by the state's

per capita income and the ranking of the state relative to other states. When the model is run without state fixed effects the transfers are statistically significant. Because a states relative standing with the other states matters and this standing is a function of both personal income and population, then the fixed effects approach may not be appropriate for measuring the impact of state transfers on state spending without including time indicator variables. When the system is run with the time variables per capita federal transfers is positive and statistically significant.

TELs on the other hand, do not influence expenditures. Before accounting for the endogeneity inherent in TELs, earlier ordinary least squares specifications found they were statistically significant and positive.

Private per capita personal income is significant at the 5.7 percent level of confidence and is negative. When the model is run with total personal income, private personal income plus government personal income, the sign is reversed. Correcting for the endogeneity between personal income and expenditures by removing personal income accruing to government workers changes the influence personal income has on expenditures. Therefore, state per capita spending is lower for high, private personal income states, all else equal.

Several variables, all statistically significant, have interesting interpretations, as well. The unemployment rate, a business cycle proxy, is significant and positive implying expenditures are responsive to changes in the business cycle. State borrowing is also significant and positive indicating that higher borrowing per capita is accompanied by higher expenditures per capita.

Finally, the two political economy variables, upper distance and lower distance, are statistically significant at the 1 percent and 10 percent level of confidence, respectively. Party incumbency strength in the lower chamber relates to higher state expenditures, while party incumbency strength in the upper chamber

leads to lower expenditures. This relationship may make sense within the context of where spending is originated and amended. The lower chamber, typically, originates all revenue and appropriation bills and the upper chamber will amend those bills. Before a final spending measure is passed, usually a conference committee involving both chambers is required to pass the appropriation bill.

Thus, all else equal, party power in the lower chamber will tend to pass higher spending legislation, but that spending is not passed on when party incumbency power exist in the upper chamber. Political economy outcomes have not been the focus of this study and these variables may suffer from some omitted variable bias. For example, it may matter where whether the same party has power in both chambers and which party has an overall majority.

Sales Tax Base Equation

As expected, the sales tax base and rate have an inverse relationship. The coefficient on the sales tax rate, -0.594, is statistically significant at the 1 percent level of confidence. This parameter estimate implies a 10 percent rise in the tax rate would reduce the sales tax base by 5.94 percent, a relatively inelastic response.

The parameter estimate is capturing two effects from base size changes, a political economy change to the base size and a change in the demand for goods and services in the base. The consumer demand effect arises from a tax rate increase and thus a price increase for goods in the base. This price increase will lead to a decrease in consumption of goods in the base, all else equal. The political economy effect is the choice to limit or reduce the base and increase the rate.

Because, the state finance model does not include a model of consumer demand it is not possible to separate these two effects. Since both effects on the base are negatively correlated with a rise in the tax rate, it is expected that the

political economy response to changes in the tax rate is even more inelastic than estimated in this study.

Also, of importance to the tax base is the rate of taxation of personal income from other tax sources. This "effective tax rate" for other revenue is inversely related to the sales tax base. Thus, higher rates of taxation on personal income reduces the sales tax base. In a related vein, higher per capita other revenue is statistically significant and positive. This implies that a greater reliance on other revenue sources, all else equal, will leave a broader base available for sales taxation, but the reduction in income from the higher "effective tax rate" narrows the sales tax base.

Finally, the political economy variable on the number of elected state legislators is statistically significant and positive at the 1 percent level of confidence. The positive coefficient on the number of legislators implies that the probability of a state using a broad base sales tax increases with the number of elected legislators.

Sales Tax Rate Equation

As with the sales tax base equation, the sales base and rate retain their inverse relationship. The coefficient on the tax base, -0.593, is statistically significant at the 1 percent level of confidence. This estimate implies a 10 percent increase in the size of the tax base would reduce the sales tax rate by 5.93 percent. Because there are no consumption effects, this is purely a political economy response to the change in the base size. A t-test to determine if the coefficient is statistically the same as negative one (-1) generated a t-statistic of 2.70 and the null hypothesis was rejected. Thus, the response can not be characterized as a revenue neutral response.

The number of legislators is significant at the 10 percent level of confidence and is positive. Just as with the tax base, states with a large number of legislators will have both broader bases and higher tax rates, all else equal.

In the tax base equation, per capita expenditures where statistically insignificant, but they are significant and positively related to tax rates. The taxation of personal income is significant and negative and as with the sales tax base implies a higher "effective tax rate" on other income, not consumed by the sales tax, will reduce the rate applied to the sales tax base.

Also of interest are the variables pertaining to revenue forecast and bordering states tax rates. The coefficient on the change in forecasted revenues, measured as the change in revenues from the previous to the current year, is positive and significant at the 10 percent level of confidence. Therefore, the increase in forecasted revenue needs will increase the chances of there being a sales tax rate increase.

The weighted average border tax rates is positive and significant at the 1 percent level of confidence. This strongly implies the sales tax rates imposed by border states are considered, either directly or indirectly, when a state sets its sales tax rate and is consistent with findings by Fox (1986).

Chapter 6 will present the implications and limitations of these empirical findings and discuss future research possibilities.

Table 5.1: Three Stage Least Squares Specifications

Specification	Description
I	Fixed effects estimation without political economy, local economy, or border effect variables
II	Same as specification I with local economy variables included
III	Same as specification II with border effects included
IV	Complete model estimated with time effects included in the tax rate equation
V	Final specification of the complete state finance model

Table 5.2 Three Stage Least Square Specification Results I -V

3SLS Estimations: Per Capita Expenditures

Specification	I			II			III			IV			V		
	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat
Sales Tax Base*	1.293	2.223	0.026	1.600	2.312	0.021	2.742	5.187	0.000	0.370	2.644	0.008	0.364	2.602	0.009
Per Capita Federal Transfers*	0.756	1.908	0.056	0.441	0.861	0.389	-0.323	-1.023	0.306	0.522	3.432	0.001	0.505	3.321	0.001
TEL*										0.061	0.726	0.468	0.066	0.790	0.431
Per Capita Private Income	-0.450	-1.225	0.221	-0.663	-1.549	0.121	-1.187	-3.068	0.002	-0.275	-1.904	0.057	-0.294	-2.037	0.042
Unemployment Rate	0.016	0.641	0.522	0.016	0.662	0.508	0.012	0.821	0.412	0.032	2.388	0.017	0.032	2.417	0.016
Per Capita Local Transfers				0.008	0.529	0.597	0.020	1.710	0.087	0.003	0.608	0.543	0.004	0.724	0.484
Per Capita Local Expenditures				0.068	0.594	0.553	0.197	1.748	0.080	0.169	3.399	0.001	0.176	3.529	0.000
Per Capita Borrowing	0.003	1.398	0.162	0.003	1.636	0.102	0.003	1.716	0.086	0.003	3.060	0.002	0.003	3.035	0.002
Upper Distance										-0.003	-3.353	0.001	-0.003	-3.541	0.000
Lower Distance										0.002	1.562	0.118	0.002	1.742	0.081
Governor										-0.005	-0.935	0.350	-0.005	-0.873	0.383
Per Capita Private GSP	0.281	2.001	0.045	0.330	2.239	0.025	0.411	2.115	0.034	0.344	4.162	0.000	0.353	4.280	0.000
Percent under 18	-0.110	-1.026	0.305	-0.123	-1.093	0.274	-0.184	-1.122	0.262	-0.047	-0.870	0.384	-0.046	-0.867	0.386
Percent 65 and over	0.114	0.615	0.538	0.034	0.154	0.877	-0.080	-0.318	0.750	0.070	0.826	0.409	0.064	0.763	0.445
Population Density	0.323	0.894	0.371	0.026	0.053	0.958	-0.699	-1.967	0.049	0.234	1.654	0.098	0.219	1.547	0.122
Population Growth	-0.001	-0.422	0.673	-0.001	-0.352	0.725	-0.001	-0.434	0.664	0.000	0.483	0.629	0.000	0.531	0.596
Poverty Rate	0.021	0.610	0.542	0.022	0.629	0.530	0.026	0.472	0.637	-0.004	-0.160	0.873	-0.004	-0.169	0.866
constant	9.208	2.509	0.012	(dropped)			(dropped)			6.379	5.553	0.000	(dropped)		
state indicators	*output omitted*			*output omitted*			*output omitted*			*output omitted*			*output omitted*		
year indicators	*output omitted*			*output omitted*			*output omitted*			*output omitted*			*output omitted*		
quasi R-squared	0.762			0.690			0.141			0.956			0.957		
Chi-square	3.65E+03		0.000	3.54E+06		0.000	1.60E+03		0.000	1.50E+04		0.000	1.54E+07		0.000

*endogenous

3SLS Estimations: Sales Tax Base

Specification	I			II			III			IV			V		
	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat
Sales Tax Rate*	-0.028	-0.050	0.960	-0.307	-0.876	0.381	-0.37573	-1.912	0.056	-0.503	-3.201	0.001	-0.594	-3.917	0.000
Taxation of Personal Income	-0.015	-0.155	0.877	-0.062	-0.949	0.343	-0.06682	-1.734	0.083	-0.147	-3.369	0.001	-0.158	-3.710	0.000
Per Capita Expenditures*	0.321	0.813	0.416	0.153	0.758	0.449	0.10132	0.520	0.603	0.025	0.169	0.866	-0.006	-0.041	0.967
Per Capita Private Income	0.407	1.138	0.255	0.280	1.180	0.238	0.136502	0.642	0.521	0.091	0.555	0.579	0.159	0.998	0.319
Per Capita Other Revenue	0.027	0.213	0.831	0.079	0.883	0.377	0.061981	1.212	0.226	0.159	1.902	0.057	0.197	2.405	0.016
Border Base							0.031862	1.243	0.214	0.078	1.301	0.193	0.049	0.846	0.398
Change in Income (t-2)	0.000	-0.199	0.843	0.000	0.198	0.843	0.000793	1.521	0.128	0.000	-0.120	0.905	0.000	-0.083	0.934
Change in Revenue (t-2)	0.000	-0.284	0.776	0.000	-0.424	0.672	-9.6E-05	-0.266	0.791	0.000	-0.040	0.968	0.000	-0.049	0.961
Number of Legislators										0.362	3.587	0.000	0.372	3.690	0.000
Per Capita Private GSP	-0.147	-0.886	0.375	-0.219	-1.570	0.117	-0.19409	-1.919	0.055	-0.229	-2.220	0.026	-0.304	-2.998	0.003
Percent under 18	0.072	0.602	0.547	0.035	0.358	0.720	0.02149	0.249	0.804	0.015	0.193	0.847	0.004	0.052	0.958
Percent 65 and over	0.007	0.022	0.983	-0.131	-0.609	0.543	-0.21394	-1.250	0.211	-0.280	-2.089	0.037	-0.309	-2.379	0.017
Population Density	0.158	0.867	0.386	0.245	1.877	0.061	0.248662	2.281	0.023	0.298	3.037	0.002	0.334	3.458	0.001
Population Growth	0.001	0.381	0.704	0.001	0.890	0.373	0.001475	1.246	0.213	0.002	1.480	0.139	0.002	1.519	0.129
Poverty Rate	-0.017	-0.568	0.570	-0.017	-0.630	0.529	-0.00988	-0.359	0.72	-0.003	-0.124	0.902	-0.009	-0.373	0.709
constant	(dropped)			-4.902	-2.667	0.008	(dropped)			(dropped)			(dropped)		
state indicators	*output omitted*			*output omitted*			*output omitted*			*output omitted*			*output omitted*		
year indicators	*output omitted*			*output omitted*			*output omitted*			*output omitted*			*output omitted*		
Adjusted or quasi R-squared	0.999			0.999			0.999			0.999			0.999		
Chi-square	2.52E+06		0.000	3.54E+06		0.000	2.86E+06		0.000	3.83E+06		0.000	3.83E+06		0.000

*endogenous

3SLS Estimations: Sales Tax Rate

Specification	I			II			III			IV			V		
	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat
Sales Tax Base*	-0.784	-4.734	0.000	-0.748	-4.730	0.000	-0.434	-2.734	0.006	-0.069	-0.343	0.731	-0.593	-3.947	0.000
Number of Legislators													0.241	1.692	0.091
Per Capita Expenditures*	0.303	2.508	0.012	0.280	2.544	0.011	0.324	3.107	0.002	0.360	1.447	0.148	0.369	3.338	0.001
TEL*										-0.210	-1.476	0.140	-0.144	-1.369	0.171
Border Rate							0.295	5.749	0.000	0.216	2.682	0.007	0.305	5.367	0.000
Change Total Revenue (t-1)	0.002	1.367	0.171	0.002	1.319	0.187	0.003	1.940	0.052	0.004	1.883	0.060	0.003	1.769	0.077
Taxation of Personal Income	-0.142	-4.321	0.000	-0.148	-4.558	0.000	-0.121	-3.767	0.000	-0.074	-1.229	0.219	-0.122	-3.622	0.000
Per Capita Private Income	0.454	3.685	0.000	0.442	3.640	0.000	0.292	2.453	0.014	-0.133	-0.626	0.531	0.421	3.147	0.002
Per Capita Other Revenue	0.067	0.892	0.372	0.081	1.148	0.251	-0.029	-0.409	0.683	-0.330	-2.349	0.019	-0.027	-0.356	0.722
Per Capita Private GSP	-0.659	-7.621	0.000	-0.657	-7.708	0.000	-0.502	-5.847	0.000	-0.400	-2.679	0.007	-0.597	-5.277	0.000
Percent under 18	-0.068	-0.784	0.433	-0.069	-0.813	0.416	-0.128	-1.556	0.120	-0.165	-1.691	0.091	-0.103	-1.150	0.250
Percent 65 and over	-0.217	-2.346	0.019	-0.200	-2.235	0.025	-0.192	-2.231	0.026	-0.382	-2.559	0.011	-0.276	-3.049	0.002
Population Density	0.427	4.879	0.000	0.433	5.028	0.000	0.301	3.462	0.001	0.129	1.036	0.300	0.307	3.327	0.001
Population Growth	0.002	1.446	0.148	0.002	1.445	0.149	0.002	1.631	0.103	0.003	1.822	0.068	0.002	1.682	0.093
Poverty Rate	-0.050	-1.814	0.070	-0.049	-1.824	0.068	-0.028	-1.050	0.294	0.056	1.348	0.178	0.012	0.350	0.726
constant	-6.819	-5.393	0.000	-6.546	-5.459	0.000	-5.274	-4.613	0.000				-7.455	-5.110	0.000
state indicators	*output omitted*			*output omitted*			*output omitted*			*output omitted*			*output omitted*		
year indicators										*output omitted*					
Adjusted or quasi R-squared	0.999			0.999			0.999			0.999			0.999		
Chi-square	1.65E+06		0.000	1.67E+06		0.000	1.80E+06		0.000	3.02E+06		0.000	1.63E+06		0.000

*endogenous

Chapter 6: Conclusions

This study empirically tested the relationship between the tax base and government expenditures. Additionally, this study examined the relationship between the tax base and tax rate and determinants influencing those variables.

The purpose of the study was to move the discussion of policy away from purely normative assertions on government objectives and place the focus on a positive analysis of how public institutions actually function. To execute this analysis, an empirical model of a state's finances was developed based on prior work examining state fiscal relationships.

The econometric model draws from literature on the demand for government goods and services, optimal tax models, and the fundamental revenue and accounting equilibrium conditions. The model consisted of five structural equations and two equilibrium identities. The seven equations were designed to describe the revenue and expenditure aspects of a state's finances. Specifically, this model allows one to test whether government spending may be constrained by restrictions on the tax base made available to the taxing authority. Therefore, the emphasis was on the tax base and its relationship with government expenditures. The equations in the model were constructed to assure the influence the size of the tax base has on expenditures could be measured.

Optimal tax theory assumes a rather innocuous relationship between the tax base and government spending, while public choice theory, as developed by Buchanan and others, assumes the two can be related. Thus, the empirical model was developed to reconcile these different views on the relationship between the tax base and expenditures. The empirical model is developed as a fixed effects model. The final specification included state and time fixed effects.

Since the model represents a system of equations, the use of ordinary least squares estimation was inappropriate. Therefore, the state finance system of equations was estimated using three stage least squares. Consistent with other empirical work on state fiscal relationships, a log-linear functional form was assumed. The model was estimated using data from forty-eight states for the sixteen year period from 1977 to 1992.

Within the expenditure equation, the coefficient on the tax base is positive and is statistically significant in the various fixed effects three stage least squares specifications estimated. The estimated response of expenditures to changes in the tax base size is relatively inelastic. Nonetheless, this result implies that it is erroneous to treat the broadening of a tax base as unrelated to state expenditure outcomes. This study has shown it can no longer be appropriate to assume that government outcomes are analogous to an equi-revenue provider of goods and services. The results imply that it is important to not only consider the efficiency implications from base broadening, but also the ability of this base increase to fuel higher government spending.

As stated at the beginning of this study, there exist a divergence of views in assigning an objective function to government. At one end of the continuum there is the benevolent equi-revenue provider, at the other the revenue maximizing Leviathan. This study has shed some light on the appropriate setting for the study of government fiscal activity. These objective functions, as suggested above, lie at the ends of possible government objectives. This study has not determined the true objective function of government, but rather has shown that the outcomes of government activity are not consistent with the pure equi-revenue provider. With a purely equi-revenue government provider of goods and services the coefficient on the tax base would be statistically insignificant.

Chapter One described two views on government and the citizenry, The classical view assumed government acts at the behest of its citizenry. The second view describes the state and its government as presiding over its citizenry. Depending on which of these views is adopted can determine possible explanations for the relationship between the tax base and expenditures discovered in this study. The first view might, for example, explain base broadness as facilitating inefficiencies in the provision of government goods and services, while the second view could explain this relationship as a result of the abuse of the taxing authority's power. It is not the purpose of this study to determine which of these views is appropriate for government and the citizens of the state.

Thus, the empirical results do not confirm that the motive of government is one of pure revenue maximization. This study does show when a government has access to a broader base that government generates higher spending, all else equal. This difference in spending could be thought of as surplus where the difference in revenue generated and the demand for government goods and services is referred to as a surplus, this surplus may arise for various reasons. Because this surplus must be used, spending rises. There are several possible explanations why governments may be observed accruing a surplus. Surplus may arise because of the short-sightedness of political decision making, bureaucratic inefficiency, or the lower cost of generating revenue by using an efficient tax.

Short-sightedness, a natural response to vote maximizing, is to distribute short run benefits that out weigh short run cost at the expense of ignoring the long run implications for such action. Short-sightedness may increase long term costs to government and this difference is reflected as a current period surplus.

Bureaucratic inefficiencies can arise because public sector bureaus face an incentive structure far less conducive to operating efficiency than do private sector

firms, comparatively [7]. In part these inefficiencies persist, as noted by Hoyt (1999), because residents often do not bear the full cost of inefficient government activities and they, therefore, have less of an incentive to curtail governments inefficiencies.

This is not meant to imply that government workers are indolent or incapable, nor politicians greedy or dishonest, but rather the incentives they face may lead to short-sightedness and operational inefficiencies. As Aristotle noted, *what is common to many is taken least care of, for all men have greater regard for what is their own than for what they possess in common with others.*

Finally, the efficiency of a tax potentially improved by base broadening could lower the marginal cost of raising revenues thus enhancing revenue generation. The efficiency gain assumes that the tax rate is lowered to finance any given level of spending. The improvement in generating more revenue also improves the probability a government can engage in generating a surplus. The lower marginal cost of raising revenue would also increase the demand for government services. This is analogous to a demand response for a normal good from a price decrease. If the increase in demand for government goods and services is just equal to the additional revenue raised, then no surplus would occur. Otherwise, the efficiency obtained from an increase in the size of the tax base would lead to a surplus.

Again, it is ones view of government, the state, and the citizenry that will shape the arguments for why base broadness leads to higher government spending, all else equal. As noted in Chapter One, states have recently been seeking their tax bases to include e-commerce and services. While the arguments for the increase speak of declining revenues from the sales tax, policy makers should also consider that base broadening gains in efficiencies may also fuel increased spending.

[7] The Mercatus Center at George Mason University, "Second Annual Performance Report Scorecard: Which Government Agencies Inform the Public?", May 16 ,2001 conclude federal government agencies had little ability to measure its effectiveness and could not link there performance data to their cost.

In addition to examining the impact the tax base has on government spending, tax base and tax rate relationships were examined. The tax base and rate equations confirmed the fundamental hypothesis that the tax base and tax rate are inversely related. Under the final specification the tax rate equation was sensitive to the inclusion of fixed time effects. These effects were omitted because a theoretical justification for their presence in the estimated model could not be established.

The results fully support the theoretical relationship between the tax base and rate. Thus, the empirical evidence finds base broadening will lead to lower rates and conversely, rate increases reduce the base size.

The reduction in the tax base because of an increase in the tax rate, however, could not be isolated into the two separate impacts from changes in consumer demand and a political economy response to setting higher tax rates. A tax rate increase will, for example encourage consumers, when possible, to substitute for goods not in the tax base. This substitution effect, a response to the price increase on goods in the base, would imply the political response may be quite small. The tax rate response to a base broadening, however, is a political economy response consistent with the public finance literature. The reduction in the tax rate from a tax base increase can be considered a purely political economy response.

In order to investigate the possibility of a revenue neutral response through base and rate changes, the final specification was run using only the actual dollar amount of the base taxed by the state. Therefore, the coefficients are not measuring the impact on the percent of the tax base that is taxed, but the actual size of the base in CPI adjusted dollars.

Neither response by the tax base or rate is a revenue neutral response. To examine the possibility of a neutral response, Table 6.1 lists the sample means for the sales tax base, sales tax rate, and the revenue these means would generate

(mean tax base times mean tax rate). Table 6.1 then shows how either a ten percent increase in the sales tax rate or sales tax base is not sufficiently offset by a reduction in the other variable, respectively, to maintain revenue neutrality. Using the sample means of the tax base (measured as the dollars taxed), the tax rate, and the parameter estimates from this modified specification to test for revenue neutrality, result in concluding that a base or rate increase will not be revenue neutral, all else equal.

Table 6.1: Revenue Changes from Tax or Base Increases ($000)

		Tax Base ($000)	Tax Rate	Sales Tax Revenue ($000)
	Mean:	$29,595,670	0.045	$1,319,967
	Tax Rate Parameter	Predicted Base	Rate (10% increase)	New Revenue
Tax Base Equation	-0.3357	$28,602,143	0.049	$1,403,221
	Tax Base Parameter	Base (10% increase)	Predicted Rate	New Revenue
Tax Rate Equation	-0.3007	$32,555,237	0.043	$1,408,303

As Chapter 3 showed, the broader tax base minimized the excess burden of the tax through lower tax rates, but this broader base allows government to generate greater surplus or maximize its revenues. This empirical study confirms these implications postulated in Chapter 3. Thus, there is a trade-off to consider when allowing government broad access to a tax base. The amount of the base made available should be considered within the context of a traditional cost benefit analysis where it can be stated; a broader tax base will lead to lower tax rates, but

also increase government spending, all else equal. Thus, any efficiency gains may be offset by fueling revenue growth.

Additionally, the empirical study included border effects in the base and rate equations. These border effects were included to capture the yardstick competition that states may engage in. It was found that bordering states influence a state's fiscal policy decisions. This type of yardstick competition occurs between states with respect to setting tax rates, but not choosing the tax base. Thus, a state surrounded by low tax rate states is more likely to set low rates as well.

Future Research and Limitations

This empirical study has established a relationship between government spending and the size of a tax base, future research on this subject should branch out in two directions. Theoretical models of local government will need to incorporate both the costs and benefits from tax base broadening. Empirical models will need to examine other tax bases and possibly develop a comprehensive model encompassing a government's total tax structure.

Here the sales tax was used to measure the impact on expenditures from base broadness. Future work will need to determine if other taxes employed by government, such as the income and property tax exhibit the same properties. Also, it would be interesting to determine if the comprehensiveness of a governments total tax structure similarly impacts spending. Empirical test could also examine if these results hold for the federal government, other local governments and international governments.

Additional future work would include the development of a theoretical framework to contrast the trade off this study has shown is inherent in broadening the tax base. Chapter 3 in this study only establishes the possibility that the tax

base and government spending are related, but does not construct a framework for modeling the costs and benefits from changes in the tax base.

There are several limitations to this study. First, the results of this empirical test can not be used to definitively assign specific maximizing objective for state governments. Multiple objectives, such as maximizing income or employment in the state can coalesce with the bureaucratic or revenue maximizing objective function. Nonetheless, this empirical examination on the role played by the tax base reveals government to be something other than an equi-revenue provider of goods and services. The main conclusion therefore is that a state's access to a broad base will allow the state to increase its expenditures, all else equal.

By measuring the tax base size as the tax base divided by the state's private gross state product to determine the base broadness, it is possible that this measure under represents a state's base broadness. Ring (1999) shows how the sales tax may not be merely a flat tax on consumers, but for many states the sales tax falls on intermediate goods purchased by businesses. Therefore, the tax base for those states taxing intermediate goods may have a broader base than the base broadness measure used in this study. However, the use of private gross state product, a value added measure of a state's business activity, rather than the state's private personal income, may lessen this impact on accurately portraying the sales tax base comprehensiveness. Additional measures of the degree with which intermediate goods enter the tax base should help enhance the researchers ability to portray the broadness of the tax base.

Another limitation to the model is the use of other revenues to control for other tax bases and rates utilized in the state. The purpose of including this variable is to control for the sources of other revenue. This is in essence an aggregation of data serving as a proxy for data on other tax variables. Because the proxy corresponds reasonably well to movements in the theoretically correct variables

and its omission runs the risk of biased coefficients, this limitation is not econometrically problematic. There is only a loss of information on how these other revenue bases and rates interact. A broader study encompassing a state's total tax structure would be able to include these variables into the equations.

Finally, the accounting literature has looked at the accounting choices of firms with respect to how close they are to violating debt covenants. For example, there may be two firms who both face debt covenants that put the debt into default if they are violated, but one firm is near the violation thresholds and the other is not. Research has found that these two firms tend to make different accounting choices. This information could be included as a control variable in both the estimation of TELs and tax bases.

In summary, this study has advanced both the public finance and public choice literature by integrating the two strains and empirically examining the relationship between the tax base and government spending. It has addressed the question " do broad base taxes lead to higher expenditures?"; and the answer is yes.

The relationships developed in this study can be used in future research examining different levels of government. Hopefully, this empirical essay on the relationship between the tax base and government spending will lead to further inquiries into the role tax bases play in determining government spending outcomes.

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Appendix A: OLS Estimation Results

OLS Estimations: Per Capita Expenditures

Specification:	I			II			III		
	Coeff.	**t-stat**	**p-stat**	**Coeff.**	**t-stat**	**p-stat**	**Coeff.**	**t-stat**	**p-stat**
Sales Tax Base*	0.002	2.135	0.033	0.003	2.922	0.004	0.096	4.977	0.000
Per Capita Federal Transfers*	0.575	25.512	0.000	0.560	25.009	0.000	0.262	11.512	0.000
TEL*				0.066	6.489	0.000	0.038	4.479	0.000
Per Capita Private Income	-0.029	-0.367	0.714	-0.142	-1.815	0.070	-0.454	-6.124	0.000
Unemployment Rate	0.061	3.554	0.000	0.033	1.878	0.061	0.026	2.393	0.017
Per Capita Local Transfers	0.046	8.388	0.000	-0.062	-2.386	0.017	0.240	7.898	0.000
Per Capita Local Expenditures	-0.079	-3.029	0.003	0.047	8.576	0.000	0.007	2.046	0.041
Per Capita Borrowing	0.006	4.091	0.000	0.006	3.865	0.000	0.002	3.743	0.000
Upper Distance				-0.004	-2.091	0.037	-0.002	-3.354	0.001
Lower Distance				0.000	-0.237	0.812	0.001	0.835	0.404
Governor				-0.003	-0.348	0.728	-0.007	-1.688	0.092
Per Capita Private GSP	0.454	9.383	0.000	0.484	10.095	0.000	0.444	9.565	0.000
Percent under 18	-0.410	-5.556	0.000	-0.395	-5.431	0.000	-0.010	-0.251	0.802
Percent 65 and over	-0.041	-1.149	0.251	-0.002	-0.064	0.949	-0.058	-0.966	0.334
Population Density	-0.002	-0.400	0.689	0.003	0.637	0.524	0.027	0.577	0.564
Population Growth	0.003	2.153	0.032	0.001	0.775	0.438	0.001	1.524	0.128
Poverty Rate	-0.027	-1.195	0.233	-0.046	-2.063	0.039	-0.006	-0.432	0.666
constant	3.546	6.253	0.000	4.428	7.783	0.000	7.421	16.539	0.000
state indicators							*output omitted*		
year indicators							*output omitted*		
Adjusted or quasi R-squared	0.718			0.731			0.972		
F-stat	144.820		0.000	116.120		0.000	282.050		0.000

* Endogenous Variables

OLS Estimations: Sales Tax Base

Specification:	I			II			III		
	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat	Coeff.	t-stat	p-stat
Sales Tax Rate *				1.150	299.037	0.000	-0.420	-13.330	0.000
Taxation of Personal Income				0.030	2.328	0.020	-0.096	-2.299	0.022
Per Capita Expenditures*				-0.344	-2.172	0.030	0.359	5.491	0.000
Per Capita Private Income				-0.589	-3.001	0.003	0.192	1.293	0.196
Per Capita Other Revenue				-0.137	-1.123	0.262	-0.071	-1.038	0.300
Border Base				-0.033	-8.259	0.000	-0.020	-0.324	0.746
Change in Income (t-2)				0.012	2.239	0.025	-0.001	-0.507	0.612
Change in Revenue (t-2)				-0.007	-1.339	0.181	0.001	0.553	0.581
Number of Legislators				-0.162	-4.109	0.000	0.474	4.539	0.000
Per Capita Private GSP				0.354	2.530	0.012	-0.183	-1.917	0.056
Percent under 18				0.194	0.909	0.364	0.008	0.109	0.913
Percent 65 and over				-0.423	-4.075	0.000	-0.224	-2.006	0.045
Population Density				-0.112	-7.354	0.000	0.181	1.977	0.048
Population Growth				0.013	3.344	0.001	0.002	1.676	0.094
Poverty Rate				0.138	2.155	0.032	-0.001	-0.030	0.976
constant				7.971	4.260	0.000	-8.648	-8.129	0.000
state indicators									
year indicators									
Adjusted or quasi R-squared				0.995			0.998		
F-stat				9.419E+03		0.000	3.986E+04		0.000
* Endogenous Variables									

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