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UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A REEVALUATION AND EXTENTION OF PREVIOUS RESEARCH ON STATE AND LOCAL TAXES AND ECONOMIC DEVELOPMENT

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

Doctor of Philosophy

By

Rex Jason Pjesky

Norman, Oklahoma
2002

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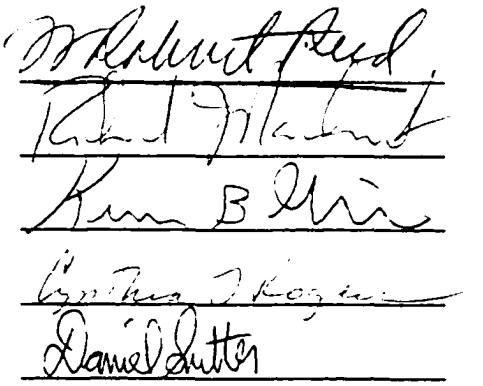
A REEVALUATION AND EXTENTION OF PREVIOUS RESEARCH ON STATE AND LOCAL TAXES AND ECONOMIC DEVELOPMENT

A Dissertation APPROVED FOR THE DEPARTMENT OF ECONOMICS

BY



To Meredith

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I. INTRODUCTION

> "The long-run elasticity of business activity with respect to state and local taxes appears to lie in the range of –0.1 to –0.6 for intermetropolitan or interstate business location decisions...If an entire metropolitan area or state raises its taxes by 10 percent, the estimated long-run effect would be a reduction of business activity between 1 and 6 percent. These estimated tax effects assume public services are held constant as taxes change. Tax increases would have a less negative effect on an area's business activity—or even a positive effect—if public services were simultaneously changed in the same direction." (Bartik 1991, page 43f.)

The above quote from Bartik expresses the conventional wisdom regarding the relationship between state and local taxes and economic performance. While there is a diversity of research findings relating taxes to economic growth, the general consensus is that taxes have a negative impact on state economies. This impact is usually estimated to be small, and may even be positive when tax increases are accompanied by increased expenditures on public goods.

Why might this be of interest? Why should we be concerned about taxes? Governments collect taxes on the margin, which influences the behavior of those being taxed. If an activity, such as consumption, is taxed the price of consumption is raised relative to the benefits. There will be less consumption; free exchange will diminish.

Taxes imposed on activities create a dead-weight loss associated with the changes in price and quantity that occurs as a result of the tax. This reduces overall utility, or welfare, in society.

Vedder (1996) identifies a different reason that taxes may harm the economy. When taxes are raised, more resources are devoted to the public sector.[1] Many economists, including Vedder, believe that there are three reasons why resources are

[1] See Friedman and Friedman (1990) for more discussion on some of the consequences of devoting resources to the public sector.

more productive in the private sector than in the public sector. First, resources in the private sector respond to market incentives, not political incentives. Second, the government is a monopoly provider in most of the services it provides. Finally, as the government gains command of increasing amounts of resources, many will lobby the government to redistribute those resources. Lobbying in this manner destroys resources since it does not create wealth; it only seeks to shift existing wealth from one group to another. Yet, as noted by Bartik, government does provide productive services. Tax revenue, properly spent, can enhance economic performance. Quality schools, good roads, and hospitals can attract business and increase economic development.

A final reason why we should be concerned about state and local taxes is the recent trend that has states assuming more of the responsibilities of government.[2] State governments will have to finance these functions as they are passed to them from Washington. Tax increases are an obvious solution. Policy makers will want insight as to how tax increases will impact their state's economy.

The matter at hand is clearly empirical in nature. Economic theory gives no clear answer as to the effect of increasing state and local taxes on a state's economy, especially if the tax increases are accompanied by increases in spending. The purpose of this study is to reevaluate some of the more influential research that has been published in this field to determine if the research is robust.

Why reevaluate previous research? Policy makers look to the empirical research for guidance on the question of taxes. The conventional wisdom that has arisen from the state and local finance literature is that state and local taxes discourage economic growth.

But there has been much attention given to the possible frailty of the empirical literature on which this conventional wisdom is based. If policy makers are going to make informed decisions about tax policy, it is important that they know the "true" relationship between taxes and state economic growth.

Thus, researchers have been concerned about the true relationship between taxes and state economic growth. Because of the importance of the question, researchers realize that the literature must give a clear picture to policy-makers about the effects of taxation on state and local economic performance. If researchers are not able to produce reliable results, policy-makers will be in a quandary and will lack necessary guidance from economists about the relationship between taxation and economic performance.

While it is true that a large majority of the research in this literature finds that state and local taxes negatively impact state economies, this literature is characterized by much uncertainty. Because of this uncertainty (and the importance of the question), there have been attempts (Bartik 1991, Phillips and Goss 1995, and Wasylenko 1997) to summarize the findings of the literature into an ultimate conclusion.

All three authors reach the conclusion stated in Bartik's quote presented at the beginning of this dissertation. The consensus of the literature is that taxes have a small, negative effect on state economies. In their respective surveys of the literature, all three authors acknowledge that the estimates that make up the body of literature on this topic are frail and unreliable.

There are two aspects of the approach taken by Bartik, Wasylenko, and Phillips and Goss that could suggest the need for further investigation. First, all studies are

---

[2] We would expect that, holding every thing else constant, federal taxes would be reduced as states take more governmental responsibilities. However, federal tax reductions should not influence the variation of

viewed as equally valid; no consideration is given to how well designed or influential a study has been.[3] Second, these studies do not address the robustness of each study's method.

Thus, I have an opportunity to make a contribution to this literature that deals with the alleged non-robustness of the results. My approach is to select a small number of studies that (i) estimate the effect of state tax policy on state economic growth, (ii) employ well-designed research methodologies or (iii) have had a considerable impact on either policy makers, the literature, or both. Studies that pass this threshold are then viewed as legitimate estimates. I will then replicate each study to mimic the data and the methods of the original authors. This will allow me to make systematic changes in the models to test if the results of the research are robust to changes in time-period and changes in measures of economic performance.

If I find that the results of the influential studies are not robust to changes in time-period and measures of economic performance, I can conclude the empirical literature offers little guidance to policy makers. If this is indeed the case, researchers will be forced to pursue other methods when addressing the question of taxation's effect on state economies.

I choose five studies that have been particularly influential in shaping the consensus opinion about the role of taxes and economic well-being. The five studies are:

1. Vedder, Richard. "Taxation and Economic Growth: Lessons for Oklahoma." Contract study performed for the Office of State Finance, State of Oklahoma, 1996.
2. Becsi, Zsolt. "Do State and Local Taxes Affect Relative State Growth?" Economic Review. (March/April 1996): 18-36.

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economic performance among the states because those taxes should affect all states equally.

[3] Phillips and Goss (1995) recognize this weakness of their approach.

3. Helms, L. Jay. "The Effect of State and Local Taxes on Economic Growth: A Time Series-Cross Section Approach." The Review of Economics and Statistics. (1985): 574-82.
4. Mofidi, Alaeddin and Joe Stone. "Do State and Local Taxes Affect Economic Growth?" The Review of Economics and Statistics. (1990): 686-91.
5. Carroll, Robert and Michael Wasylenko. "Do State Business Climates Still Matter?—Evidence of a Structural Change." National Tax Journal. (1994): 19-37. Vol. 47, No. 1.

All five studies report statistically significant, negative impacts of taxes on economic well-being--though it should be noted that these negative impacts are usually estimated to be eliminated, or even reversed, when taxes are used to fund public goods and services other than welfare.

My study consists of four parts. In the first part, I attempt to replicate the original findings for each of the five studies using publicly available data. This replication establishes my ability to reproduce the estimation methodologies of the original studies. Any subsequent differences that I identify must result from factors other than methods.

In addition to employing different variables and using different econometric procedures, each of the studies employs data from different time periods. The second part of this study re-estimates each of the models using data from a common time period: 1977-1997. I choose this time period because most of the important variables, and all of the fiscal variables, are available electronically from 1977 onward. Earlier data is less reliable. Repeating the estimation of the five studies for this time period allows us to determine whether the results of the five studies stay the same when the identical estimation techniques are applied to data from a different time period.

The five different studies employ a variety of dependent variables in determining the effects of taxes. The third part of this analysis uses a common time period (1977-1997) *and* a common dependent variable. All of the replication studies will focus on the

impact of taxes on some variant of *Per Capita Personal Income (PCPI).* *PCPI* is generally regarded as the variable that best measures the overall prosperity of states' economies. The improvement of *PCPI* is a commonly stated goal of state policy makers.

The fourth and final part of the analysis addresses an irregularity in the data. The Bureau of Economic Analysis reports Personal Income on a before tax basis. Thus tax increases that fund increased welfare payment will result in greater Personal Income *by definition*. This increase would have nothing to do with the relationship that I am trying to estimate and could corrupt the estimates.

A significant contribution of this research is the collection of a dataset. I have made available all the basic data that I used in this analysis. I hope that this data can be used by future researchers to further analyze this problem. Six data sets can be found on my personal webpage at http://students.ou.edu/P/Rex.J.Pjesky-1. Each of these data sets is contained in an EXCEL spreadsheet and described below:

1. "BASICDATA". This data set contains all of the fundamental variables used in this study. The data is in cross-sectional, time series (annual) form.

2. "VEDDERDATA". This data set contains the variables used to replicate the Vedder (1996) study. The data set is in cross-sectional form.

3. "BECSIDATA". This data set contains the variables used to replicate the Becsi (1996) study. The data set is in cross-sectional form.

4. "HELMSDATA". This data set contains the variables used to replicate the Helms (1985) study. The data is in cross-sectional, time series (annual) form.

5. "MOFIDI&STONEDATA". This data set contains the variables used to replicate the Mofidi and Stone (1990) study. The data is in cross-sectional, time series (5-year intervals) form.

6. "CARROLL&WASYLENKODATA". This data set contains the variables used to replicate the Carroll and Wasylenko (1994) study. The data is in cross-sectional, time series (annual differences) form.

II. REVIEW OF EMPIRICAL LITERATURE

This chapter will summarize the literature that deals with state and local taxation and spending's relationship to economic performance. The focus of the summary will be how my research fits into the larger picture of the discipline and how it contributes to the body of knowledge of this subject.

There has been much interest in the subject of state and local fiscal policy. No fewer than 75 studies have been done that deal with the role that state and local taxes have on the economy.[4] Most of these studies are attempts to model what drives firm location and expansion decisions.[5]

Two extensive literature reviews focus on how state and local fiscal behavior influences economic outcomes. The first is by Michael Wasylenko (1997); the second is by Ronald Fisher (1997). In addition to these two articles, several shorter "discussion" pieces are also available that address the previous literature (Bartik 1997, Duncan 1997, McGuire 1997, and Ady 1997.)[6] This review relies heavily on these previous summaries.

Researchers have given the issue of taxation much attention for two reasons. First, policy-makers behave as if they believe that taxes matter. Whenever a change in tax policy is debated, the impact of the new policy is always among the most important considerations. Not only do lawmakers believe that their overall tax policy matters, they are often willing to enact special tax status to individual companies or in particular

[4] This number is according to Wasylenko (1997). Depending on how narrowly one defines the topic, there are possibly hundreds of studies that deal with state and local governments' role in economic development.
[5] Most researches in this area believe that income, employment, and other measures of economic development are determined simultaneously with firm location and expansion decisions.
[6] All of these papers are published in the same journal, the New England Economic Review.

circumstances.[7] This creates an environment of tax competition among states and localities. Policy-makers are concerned about the effects of their efforts.

Second, businesses frequently cite a state's "business climate" as an important determinant of their economic activity in that state.[8] Government's relationship to business seems to be an important factor in a firm's location decision. For instance, in the recent right to work campaign in Oklahoma, Governor Frank Keating urged the passing of the right to work law because failing to do so would send a message to businesses that Oklahoma was not business friendly. Thus, the attitudes of businesses and government have been influential in promoting the need for research in this area.

The rest of this chapter is divided into three sections. The first section addresses the main themes of the literature on state and local taxes' relationship with economic growth as described by Wasylenko (1997) and Bartik (1997). The second section relates my research and how it addresses one of the themes identified by Bartik. The third section will place each of the studies I have chosen to replicate in its own historical context. I will discuss some of the strengths and weaknesses of each of the five studies.

As reported in Wasylenko (1997), researchers have wrestled with determining just how much taxation effects economic performance. There are a wide range of estimates regarding the direction and size of the impact that tax policy has on economic development. These estimates are based on a diversity of measures of economic

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[7] For a discussion on the incentives that state and local governments give individual firms, see Ellis and Rogers (2002).

[8] "Business climate" is a vague notion. Many researchers have had difficulty in defining exactly what business climate is. Plaut and Pluta (1983) discuss the fact that many researchers get mired down in the concept. Plaut and Pluta report that business climate is usually defined by tax rates (low being better), right to work laws and low union activity, and a state government that is cooperative with business.

performance, including Personal Income, Per Capita Personal Income, investment, employment, and many others.

There has been much consideration about what could cause the wide range of estimates regarding the elasticity of economic activity with respect to taxes. One possibility is the variety of dependent variables used in the many empirical specifications. A second possibility is the variety of independent variables used in the many empirical specifications. A third possibility is variations in time-periods used in the many empirical studies. Wasylenko (1997) dismisses the first reason and believes that attention should be focused on the second and third reasons. He states: "In effect, the results are not very reliable and change depending on which variables are included in the estimation equation or which time period is analyzed" (1997, page 38).

Bartik (1997) has identified several themes in the literature. The first theme deals with measurement errors. Most studies use data collected at the state level. These data may not be sufficient in capturing the complicated decisions made by firms, governments and households that underlie the growth process. Many researchers use aggregate (state level) statistics out of necessity, but if they are not good proxies for the true economic forces that drive growth, any analysis that uses them will be suspect.

For example, many models use state and local income taxes as a variable. This variable will have significant variation within states that is not captured by the variation in the data. A certain city might have a local income tax that would cause a business to locate somewhere else within a state. Models using state level aggregation would not capture this phenomenon.

Researchers typically believe that taxes inhibit growth but high quality government services enhance growth. But how does one measure the quality of government services? Most use government expenditures (as a percentage of Personal Income) as a proxy for the quality of education or highways in a state. These measures are likely poor proxies for what government does to enhance growth or attract businesses.

There are also potential measurement errors in the tax burdens. Most of these models assume that a higher tax burden should hamper economic growth, but there may be specific traits of each state's tax code that could make this not true. Some states could have tax structures that are more efficient than other state's, collecting more money with less deadweight loss.

Also, these models assume that tax burdens proxy the burden of government. This may not be the case. Taxation and regulation are substitutes. A low tax state may use more regulation causing the tax level to underestimate the impact that government has on the economy.

In addition to the problem in the measurement of the fiscal variables, Wasylenko (1997) notes that many of the non-fiscal variables may also be imprecisely measured. For example, using manufacturing wages as a proxy for labor costs causes two problems. First, wages do not include fringe benefits and other costs (such as unemployment insurance) firms incur when hiring. Second, average state wages cannot possibly capture the real wages firms face when deciding to expand into a state; there is too much variation within each state for the aggregate number to be of much use.

Endogeneity. There are severe endogeneity problems in the models. It is true that we live in an endogenous world. Many of the variables that are included in empirical models are simultaneously determined. Endogeneity biases the estimated coefficients.

Helms (1985) was among the first to acknowledge the possibility of endogeneity. He thought a state's deficit would be simultaneously determined with many of the other fiscal variables. To fix this problem, he employed instrumental variables.

What Helms ignored was a more obvious source of endogeneity in the tax variable. States will vary tax rates as a response to changes in economic performance. Most models, including Helms', ignore this possibility.

It is most likely true that all fiscal variables are endogenous. Spending on public services will naturally increase when taxes are increased and any state with high (low) taxes will naturally have high (low) spending on public services.

Bartik states that the endogeneity issue will be of great concern if fiscal variables are measured using actual revenues and expenditures, even if they are scaled by population or income. To minimize the endogeneity problem, researchers should use tax rates and some measure of the quality of public services that are provided by the state. The standard fix for endogeneity is the use of instrumental variables. However good instruments are hard to find.

The general consensus of the literature. Despite these difficulties, there does exist a general consensus in the literature that taxes matter and have a small, negative effect on business activity. To paraphrase the quote presented at the beginning of this paper, if state and local authorities increased taxes by ten percent, business activity would

decline by one to six percent. If the money is spent on public services, the negative effects of taxation are smaller, or may be positive.

Regardless of the general consensus, many question the entire body of empirical research in the area—most notably Therese McGuire. McGuire (1997) says "Researchers and policy analysts should use caution in advising policymakers on the importance of public services and taxes as tools of economic policy" (McGuire 1997, page 76). For instance, she asked if we really believe that if a high tax state lowered its tax burdens by ten percent that it would then experience a two percent increase in short-run economic performance? And what would happen to Minnesota in the long run? McGuire states that we simply do not know.

McGuire's comments underscore the need for more research. Policymakers look to empirical researchers for guidance on the impact of economic policy. Economists can and should do better in providing useful information to policy makers.

The incompleteness of the literature. The final theme, according to Bartik, is that the research on the relationship between fiscal behavior and welfare is incomplete. Even if we determine the true cost of taxation and the true benefit of public services, there still remains the question of how these costs and benefits are distributed. Any thorough research on the costs and benefits of state and local taxation and spending should include consideration for who is getting the income (or jobs) from the policies and who is paying for the policies.

How Does This Study Fit into the Literature?

My research focuses on the fact that the estimates on the relationship between state and local taxation and economic performance are not robust. While many have

been concerned with factors influencing differences in results across studies (Phillips and Goss' (1995) meta-analysis, for instance) no one has tried to explain conflicts in previous research by using multiple methods from original studies using a common dataset.[9]

In meta-analysis, such as performed by Phillips and Goss (1995), each study represents an observation. Regression analysis is performed in which the dependent variable is the estimated "tax elasticity" from a given study; and the independent variables consist of a series of dummy variables which identify various characteristics of the study (e.g., a dummy variable to indicate whether the study controlled for fixed effects, another dummy variable to indicate whether the study controlled for public services, etc.). Their results by and large confirm Bartik's conclusion, presented at the beginning of this paper.

Other surveys, using a related but less formal approach, are in general agreement (e.g., Wasylenko (1997)). As a result, the preceding quote from Bartik has come to represent the conventional wisdom concerning what we know about state taxes and economic growth.

There are a number of shortcomings with this approach. As Phillips and Goss (1995, page 322) emphasize, it "mixes results from poorly designed studies with those from well designed studies." In other words, literature surveys which employ this approach treat research as a democracy where all studies get one vote and the majority rules. A majority of "poorly designed studies" can outweigh the results of superior, but fewer, well-designed studies.

Another alternative is to consider only studies that have been influential in shaping the opinion of policy makers, have had a great impact on the literature, or both.

[9] Reed and Rogers (2001) check for robustness among different methods.

Studies that pass this threshold constitute the pool of research in which empirical regularities are sought. That is the approach taken in this analysis. I choose five studies that have been particularly influential in shaping the consensus opinion about the role of taxes and economic well-being. This approach is designed to look at variations within each study, as opposed to variations within the entire body of literature. If discrepancies are found within a given study, steps can be taken to isolate the cause of the discrepancies.

Putting the Five Studies in Historical Context

In this section I will briefly attempt to summarize the main contributions of the five studies that I have chosen to replicate. Also, I will discuss strengths and weaknesses of some of the papers. I will comment on each paper in much greater detail in the next section.

Vedder (1996) examined the Oklahoma economy in research done for the Oklahoma State Department of Finance. Vedder's research is important because it had a significant impact on policymakers. Professor Vedder is a prominent proponent of tax cuts to stimulate economic growth. He authored several studies in tax policy for the Joint Economic Committee (Vedder 1995 and Vedder and Gallaway 1998), has been a frequent conference speaker for the American Legislative Exchange Council (ALEC), and served as an economic consultant on tax policy for many states, including Illinois, Ohio, and Oklahoma.

There are two reasons Becsi's (1996) study is noteworthy. His is one of the few studies that considers there might be convergence among state incomes and one of the few studies that attempts to measure average marginal taxes. Convergence occurs

because poor economies grow faster than rich economies because they are able to incorporate existing technology into production.[10] Becsi includes initial income in his regressions to control for initial economic conditions. Yu, Wallace, and Nardinelli (1991) also explore the idea of "catching up." Becsi found evidence that initial conditions are becoming less important. Yu Wallace and Nardinelli found that the importance of taxes might be increasing as the importance of initial conditions is waning. Becsi's results also echoed this finding. This concurs with Vedder's (1990) idea that as other factors that influence economic growth diminish, what ever is left, state and local taxation in this case, will become more important.

The second feature that distinguishes Becsi's from many others in this field is that Becsi estimates average marginal tax rates. Becsi uses a method employed in Koester and Kormendi (1989) to calculate the average marginal tax rate for each state. Estimating the average marginal tax rates in this or any other manner is problematic, which is probably why it is rare in the literature.[11]

State and local governments impose taxes on a few broad categories of activities (property taxes, income taxes and sales taxes) and provide services in a few broad areas (education, health, highways, and public welfare). Helms (1985) was the first to develop a model that can asses the relationships between these various activities and economic

[10] There is a rich empirical literature on convergence in the in area of international economics. See Levine and Renelt (1992), Collins and Bosworth (1996), Andres, Domenech, and Molinas (1996), Easterly, Dremer, Pritchett, and Summers (1993), Barro and Sala-i-Martin (1992), and Barro (1991). In the international literature, these papers must deal with the fact that countries may have different steady state levels of income and growth and the fact that countries have different levels of political stability. These problems do not exist for the U.S. states.

[11] See Easterly and Rebello (1993b) and Romans and Subrahmanyam (1979) for examples of how others have tackled the problem of estimating marginal tax rates. Koester and Kormendi (1989) discuss some possible shortcomings of their approach.

performance. This innovation was the incorporation of a state budget constraint directly into the regression equation.[12]

The budget constraint specification, while it allows for the comparison of the effects of different kinds of spending and taxation, does have some significant drawbacks, as identified by Bartik (1997) and Wasylenko (1997). First, using spending variables that are measured as ratios of actual spending on an activity divided by Personal Income ensures that all fiscal variables will be poorly measured. Researchers do not believe that education spending, as a ratio of Personal Income, is a good measure of the quality of schooling that a child in a given state receives. Likewise, the amount of money that a state spends (as a ratio of Personal Income) on highways and health might not proxy the quality of those services in a state (Wasylenko 1997).[13] Yet it is the quality of schooling, transportation, and other government services that attract business. If a simple measure of spending on these activities does not capture the quality of these services, any estimates on how they affect economic performance are likely to suffer from measurement error and omitted variable bias, obfuscating the true relationship between taxing and spending and economic growth.

In addition to producing fiscal variables that are badly measured, using spending variables as a ratio of Personal Income in a budget constraint model, as Helms does, creates another problem. It is difficult to calculate a simple tax elasticity. Wasylenko (1997) notes that with the budget constraint specification, one tax or spending category

[12] For a more detailed explanation of how the budget constraint works, see the section that deals with my replication of Helms.

[13] In fact, spending on public services may be inversely related to the quality of those services. If, for instance, state has a poor quality school system, that state may increase funding for education. This will not guarantee increased quality.

must be omitted to avoid perfect multicollinearity. This means that all coefficients are interpreted relative to some omitted category.

This second difficulty in Helms model may reflect the practical reality that all policy changes do not occur in a vacuum. The true value in Helms' research is that it acknowledges the fact spending programs must be financed some way, either through deficit spending, taxation, or federal grants.

Mofidi and Stone (1990) wanted to address the "very inconsistent" results of the literature on the relationship between state and local taxes and economic performance. They use the same framework as Helms that tried to identify the effects that different levels of taxation and spending have on the economy. Specifically, they want to "trace [Helms'] hypothesis back to two of the sources of economic growth (manufacturing investment and employment)" (Mofidi and Stone 1990, page 687).

Mofidi and Stone find evidence that specification matters. For each dependent variable (manufacturing investment and employment) they show that changing the specification can have a large impact on the estimated relationship between taxes and economic performance. In some specifications, Mofidi and Stone estimate that taxes have a significant effect on economic growth while in others, Mofidi and Stone estimate that they do not. They believe that differences in specification play a large role in the inconsistent results of the literature.

Carroll and Wasylenko (1994) also follow Helms and use a budget constraint framework in a panel setting. While they are interested in the impact state and local taxes and spending have on economic growth, they are particularly concerned with whether there has been a change in the relationship between taxes, spending and economic

growth. They conclude that the relationship between fiscal policy and employment growth changed around 1980. Taxes seemed to matter in the 1970s but not in the 1980s. Carroll and Wasylenko's finding is important for two reasons. First, if there has been a regime shift in the relationship, researchers need to explore reasons why there was a change. Second, if there are regime changes in the relationship, any panel estimation procedure must consider the possibility that the coefficients are not the same through time if they are going to have accurate estimates.

III. PART ONE: Replication of Previous Studies

This section reports the results of my replication analysis. For each original study, I give (i) an overview of the importance of the original study; (ii) an in-depth description of the variables used in the original study and my replication; (iii) a comparison of the empirical results obtained in the original study and my replication, with an emphasis on the estimated tax effects on economic growth; and (iv) a log of the contacts I made with the author(s) of the original study. While not always successful, I attempted to contact the authors of the original studies in order to get feedback and direction in my replication efforts. In general, I was able to replicate the original studies fairly closely.

Vedder (1996) employed two tax variables in three main equations. He estimated negative coefficients for each tax variable in each equation. I replicated this result in every instance but one. However, my results are statistically weaker than his.

Becsi (1996) estimates a common specification and estimates three equations using three different time periods (1961-1976, 1977-1992, and 1961-1992). He employs only one tax variable. He reports a statistically significant, negative coefficient on the tax variable for each equation. I also obtain a negative coefficient in each equation. While my results are statistically weaker than Becsi's, the estimated tax impacts are very close.

Helms (1985) reports two key equations with respect to taxes and economic well-being. Each of those equations contain two tax variables. He reports a statistically significant, negative coefficient for each tax variable in each equation. I also obtain a statistically significant, negative coefficient for each tax variable in each equation. In terms of estimated impacts, I estimate somewhat larger tax effects.

Mofidi and Stone (1990) estimate two main equations and employ one tax variable. I was only able to estimate one equation due to data limitations. In Mofidi and Stone's original study, their tax variable was estimated to have a statistically significant, negative impact on economic well-being. My replication effort also produces a statistically significant, negative coefficient on the tax variable. My estimated tax impact is virtually identical to Mofidi and Stone's.

Carroll and Wasylenko (1994) estimate four main equations, each of which has 5 tax variables. I was only able to include 4 tax variables in my replication because of data limitations. Of the twenty tax coefficients estimated by Carroll and Wasylenko, 17 are negative and eight are statistically significant (all negative). Of the sixteen tax coefficients estimated in my replication, 9 are negative, though only one of these is statistically significant. However, this comparison overstates the differences between the two sets of coefficients. Some of my estimated tax impacts are larger than those estimated by Carroll and Wasylenko, and some are smaller. The overall estimated impacts appear to be similar.

STUDY ONE: Vedder, Richard. "Taxation and Economic Growth: Lessons for Oklahoma." Contract study performed for the Office of State Finance, State of Oklahoma, 1996.

Overview. In 1996, Professor Richard Vedder conducted a study for the Office of State Finance, State of Oklahoma. The study addresses the relationship between taxation and economic growth using state level data over several decades. The results were applied to an analysis of the consequences of cutting taxes in Oklahoma.

The Vedder study is important because it presents an unusually strong empirical case in favor of the proposition that lower (higher) taxes encourage (discourage) economic growth. Vedder reports that "the expected negative relationship between both tax variables [the level of taxation and the rate of change of taxation] and the rate of economic growth was obtained, and in most instances for both tax variables the results were statistically significant at the five percent level [page 54]."

The tax effects estimated by Vedder include the impact of concomitant changes in public spending. Thus, the finding that higher taxes discourage economic growth is a strong one. It contrasts with Bartik's conclusion (see above) that "Tax increases would have a less negative effect on an area's business activity—or even a positive effect—if public services were simultaneously changed in the same direction."

Variables. Table A1 describes the data used in my replication. The leftmost column reports the variable name used in the original study. The center column gives the author's description of that variable. The rightmost column describes how I replicated that variable.

My replication attempts used publicly available data wherever possible. Data that could be electronically accessed—as opposed to requiring hand entry—were preferred.

Data sources are clearly identified, and the original name of the variable from that data source is used. I choose to report the data in this way so as to facilitate the effort of others who may be interested in replicating/double-checking my results.

The biggest difficulty in replicating Vedder's data arose with the variable *UNEMPLOYMENT*. Vedder calculated average state unemployment rate for the period 1960 through 1991. By combining data from the Bureau of Labor Statistics (BLS) and data collected by Professor Alicia Munnell at Boston College, I was able to obtain a complete series for each state from 1970 through 1991. Unfortunately, I was unable to locate data prior to 1970. As a result, my *UNEMPLOYMENT* variable represents the average unemployment rate from 1970-1991, rather than 1960-1991

The variable *SUNSHINE* also provided some complications. Vedder describes this variable as "the percent of the days of the year the sun shines in a leading city in the state, or an average of several cities." I located city-specific values for this variable at the National Climactic Data Center's website. However, I do not know the specific cities used by Vedder to calculate his average values. A list of the cities I used to calculate this variable is available upon request.

Vedder does not include a table of means and standard deviations by which I can compare my data to his. However, he selectively reports a number of growth rates for specific states. He reports *GROWTH* values for Delaware, Oklahoma, and South Carolina of 60, 87, and 151 percent, respectively. I calculate values of 74, 93, and 154 percent. With respect to *POPULATION CHANGE*, my rates are usually close to his. For Idaho, Montana, Minnesota, Nevada, and Wisconsin, he reports growth rates of "almost 65", 24, 32, 387, and 27 percent, respectively. I calculate values of 64, 24, 32, 374, and

28 percent. Finally, with respect to *TOTAL REAL PERSONAL INCOME GROWTH*, Vedder states that New York and New Hampshire grew 110.3 and 186.3 percent, while I calculate that they grew 89 and 136 percent. In summary, my population variable appears to match quite closely with Vedder's. The Personal Income variables appear to match less closely. In some cases there are substantial discrepancies.

Comparison of Empirical Results. Tables 1.1 through 1.4 compare my replication results with four key regressions in Vedder's study. Table 1.1 regresses *GROWTH* (i.e., growth in real PCPI) on the two tax variables, *TAX60* and *TAXCHANGE*. It uses data from all 50 states and covers the time period 1960-1993. Table 1.2 expands the regression from Table 1.1 by including the control variables *UNION*, *SUNSHINE*, *WAGES*, and *UNEMPLOYMENT*, while deleting observations from Alaska and Hawaii. Table 1.3 regresses *POPULATION CHANGE* on the two tax variables and a slightly different set of control variables (*SUNSHINE*, *WAGES*, *FARM*, and *ENERGY*). It also covers the time period 1960-1993 and only includes observations from the 48 contiguous states. Table 1.4 regresses *TOTAL REAL PERSONAL INCOME GROWTH* on the two tax variables and another slightly different set of control variables (*UNION*, *SUNSHINE*, *FARM*, and *ENERGY*). It includes observations from the 48 contiguous states and covers a slightly different time period (1962-1994).

Overall the two sets of regressions are reasonably close--with some important differences. All the coefficients have the same sign except for the *TAX60* coefficient in Table 1.3 and the constant term in Table 1.4. The replication equations consistently have lower *Adjusted* R^2's than the original equations. The Vedder regressions estimate negative coefficients for *TAX60* and *TAXCHANGE* in each equation. The replication

regressions estimate negative coefficients for these two variables in all but one instance. Like Vedder, I find that both tax variables are significantly related to *GROWTH* (two-tailed, 10 percent level) in the simple (i.e., no control variables) regressions of Table 1.1.[14]

Vedder's main tax results are contained in Tables 1.2 through 1.4. Vedder reports that the coefficient for *TAX60* is negative and significant in only one of the three regressions (the *GROWTH* regression). I obtain the same result. In contrast, Vedder estimates that the coefficient for *TAXCHANGE* is negative and significant in all three regressions. I find it significant in only one regression (the *TOTAL REAL PERSONAL INCOME GROWTH* equation).

My coefficient sizes for *TAX60* are generally within a standard deviation of Vedder's. The exception is Table 1.2, where I estimate a coefficient of -8.51 for *TAX60*, whereas Vedder estimates a value of -3.95. Inexplicably, the coefficient estimates for *TAXCHANGE* differ from Vedder's by approximately an order of magnitude. For example, Vedder reports a coefficient estimate of -6.35 for *TAXCHANGE* in Table 1.1, whereas I estimate a coefficient of -0.44. Even so, the replication results produce similar *t*-statistics.

In conclusion, while there are many similarities between Vedder's empirical results and mine, I find some important differences. With respect to the main regressions of Tables 1.2 through 1.4, Vedder reports that the coefficients for *TAX60* and *TAXCHANGE* are negative and significant (two-tailed, 10 percent level) in one out of three cases and three out of three cases, respectively. The replication analysis produced

[14] Henceforth, unless otherwise stated, we use the "two-tailed, ten percent significance level" standard in judging whether a variable is "significant."

negative and significant coefficients in one out of three cases for both variables. If I use the 5 percent level of significance, the replication results estimate a significant coefficient in only one instance (for *TAX60* in the *GROWTH* regression). While the replication results support Vedder's conclusion that both tax variables are negatively related to economic growth, the results are statistically weaker than what Vedder obtained.

TABLE 1.1
Replication of Vedder (1996): Equation (1), page 49
TIME PERIOD: 1960-1993

VARIABLE	ESTIMATES	
	Vedder Study	*Replication*
TAX60	-5.61 (3.00) [-1.87]	-7.11 (3.03) [-2.35]
TAXCHANGE	-6.35 (1.98) [-3.20]	-0.44 (0.16) [-2.69]
Constant	160.81 (29.83) [5.39]	178.85 (31.06) [5.76]
Adjusted R^2	0.145	0.105
Observations	50	50

NOTE: Dependent variable is *GROWTH*. Variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0117 (α=0.05) and 1.6779 (α=0.10).

TABLE 1.2
Replication of Vedder (1996): Table 8.1, page 52
TIME PERIOD: 1960-1993

VARIABLE	ESTIMATES	
	Vedder Study	*Replication*
TAX60	-3.65 (1.99) [-1.83]	-8.51 (2.82) [-3.02]
TAXCHANGE	-3.64 (1.85) [-1.97]	-0.39 (0.28) [-1.41]
UNION	-0.74 (0.45) [-1.65]	-2.28 (0.49) [-4.69]
SUNSHINE	-1.08 (0.30) [-3.64]	-1.27 (0.36) [-3.49]
WAGES	-1.10 (0.22) [-5.01]	-0.11 (0.31) [-0.34]
UNEMPLOYMENT	3.81 (2.19) [1.74]	5.10 (2.47) [2.06]
Constant	308.90 (29.31) [10.54]	294.12 (45.65) [6.44]
Adjusted R^2	0.685	0.509
Observations	48	48

NOTE: Dependent variable is *GROWTH*. Variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0195 (α=0.05) and 1.6829 (α=0.10).

TABLE 1.3
Replication of Vedder (1996): Table 8.2, page 55
TIME PERIOD: 1960-1993

VARIABLE	ESTIMATES	
	Vedder Study	*Replication*
TAX60	-2.17 (6.03) [-0.36]	0.61 (7.90) [0.08]
TAXCHANGE	-13.26 (5.43) [-2.44]	-1.02 (0.75) [-1.37]
SUNSHINE	6.13 (0.82) [7.49]	4.45 (0.86) [5.20]
WAGES	1.13 (0.48) [2.35]	1.04 (0.78) [1.33]
FARM	-2.44 (0.56) [-4.38]	-4.62 (1.93) [-2.39]
ENERGY	-0.002 (0.001) [-2.14]	-1.92 (1.91) [-1.00]
Constant	-362.10 (84.21) [-4.30]	-285.81 (114.85) [-2.49]
Adjusted R^2	0.602	0.479
Observations	48	48

NOTE: Dependent Variable is *POPULATION CHANGE*. Variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0195 (α=0.05) and 1.6829 (α=0.10).

TABLE 1.4
Replication of Vedder (1996): Table 8.3, page 58
TIME PERIOD: 1962-1994

VARIABLE	ESTIMATES	
	Vedder Study	*Replication*
TAX60	-0.76 (9.50) [-0.08]	-8.50 (11.54) [-0.74]
TAXCHANGE	-17.56 (8.24) [-2.13]	-2.01 (1.03) [-1.94]
UNION	-2.48 (1.31) [-1.90]	-1.70 (1.44) [-1.18]
SUNSHINE	6.41 (1.28) [5.02]	5.39 (1.40) [3.84]
FARM	-4.15 (0.84) [-4.95]	-10.91 (2.61) [-4.18]
ENERGY	-1.38 (0.62) [-2.24]	-4.38 (2.78) [-1.58]
Constant	-65.94 (122.11) [-0.54]	64.17 (155.43) [0.41]
Adjusted R^2	0.594	0.517
Observations	48	48

NOTE: Dependent Variable is *TOTAL REAL PERSONAL INCOME GROWTH*. Variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0195 (α=0.05) and 1.6829 (α=0.10).

STUDY TWO: Becsi, Zsolt. "Do State and Local Taxes Affect Relative State Growth?" Economic Review. (March/April 1996): 18-36.

Overview. Zsolt Becsi is an economist at the Atlanta Federal Reserve. His article on the impact of state and local taxes on economic growth was published in the Atlanta Federal Reserve's journal, *Economic Review*, in 1996. Becsi concludes that taxes negatively impact growth: "The study finds that relative marginal tax rates have a statistically significant negative relationship with relative state growth averaged for the period from 1961 to 1992."

Three characteristics of Becsi's work are particularly noteworthy. First, his is the only study to estimate the impact of the marginal, as opposed to the average, rate of taxation. Second, his work attempts (though it is not entirely successful) to hold constant average tax rates. In other words, his research addresses the question, what would be the impact on state economic growth if marginal tax rates were lowered but total state revenues/spending were held constant? This could occur, for example, if a state adopted a revenue-neutral tax reform that substituted a flat (or flatter) tax in place of a progressive system of taxation.

A third noteworthy characteristic of Becsi's research is that he attempts to identify the effect of "convergence" from tax rates. Assuming diminishing rates of return to capital, states with low incomes should have a higher rate of return to capital. According to the economic theory of convergence, capital should flow to low-income states. Becsi controls for this phenomenon by including a variable that measures income at the beginning of the study period.

Variables. Table A2 describes the data used in my replication. Becsi does not report means and standard errors of his variables, so I am unable to compare the

replicated data in this fashion. However, he has two extensive tables and several charts that report the values of some of his variables, particularly the relative growth variables (*RG6192, RG6177,* and *RG7792*), and state average and marginal tax rates. The replicated variables are close, but not identical, to Becsi's variables.

Comparison of Empirical Results. The core of Becsi's analysis is three regression equations. In each equation, Becsi regresses a variable representing relative PCPI growth (*RG6192, RG6177,* or *RG7792*) on a relative marginal tax rate variable (*RMTR6192, RMTR6176,* or *RMTR7792*) and two control variables. The first control variable is either *RPCPI60* or *RPCPI76* and is included to control for the influence of convergence. The second control variable is *RR6192, RR6176,* or *RR7792,* and is intended to hold constant the average tax rate. The three regressions correspond to the three time periods 1961-1992, 1961-1976, and 1977-1992. Becsi's regression results, along with their corresponding replications, are reported in Tables 2.1 through 2.3.

The coefficient estimates in the replication regressions all have the same sign as those in Becsi's original study. Further, the point estimates (with the exception of the constant terms) are very close to their original estimates. The adjusted R^2's in the replication regressions are, in each case, lower than those in the Becsi study.

Like Becsi, I find that marginal tax rates are negatively associated with PCPI growth for all three time-periods (1961-1976, 1977-1992, and 1961-1992). However, my results are statistically weaker than Becsi's. Becsi's tax coefficients are significant at the 10-percent level (two-tailed test) in all three regressions. In contrast, in the replication regressions, only one of the tax coefficients is significant at that level (the coefficient for

RMTR7792 in Table 2.3). In the other two regressions, I cannot rule out the possibility that marginal tax rates do not affect economic growth.

TABLE 2.1
Replication of Becsi (1996): Equation (R1), page 32
TIME PERIOD: 1961-1992

VARIABLE	ESTIMATES	
	Becsi Study	*Replication*
RMTR6192	-0.0054 (0.0027) [-2.00]	-0.0049 (0.0032) [-1.53]
RPCPI60	-0.0115 (0.0016) [-7.19]	-0.0124 (0.0017) [-7.35]
RR6192	-0.0067 (0.0056) [-1.20]	-0.0091 (0.0064) [-1.43]
Constant	-0.00003 (0.0003) [-0.10]	-0.0099 (0.0386) [-0.26]
Adjusted R^2	0.573	0.506
Observations	50	50

NOTE: Dependent variable is *RG6192*. Variables are defined in Table A2. Huber/White standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0129 (α=0.05) and 1.6787 (α=0.10).

TABLE 2.2
Replication of Becsi (1996): Equation (R2a), page 32
TIME PERIOD: 1961-1976

VARIABLE	ESTIMATES	
	Becsi Study	***Replication***
RMTR6176	-0.0131 (0.007) [-1.87]	-0.0116 (0.007) [-1.55]
RPCPI60	-0.0223 (0.0024) [-9.29]	-0.0232 (0.0027) [-8.56]
RR6176	-0.0235 (0.014) [-1.68]	-0.0198 (0.020) [-1.00]
Constant	0.0006 (0.0008) [0.76]	0.1265 (0.1281) [0.99]
Adjusted R^2	0.539	0.365
Observations	50	50

NOTE: Dependent variable is *RG6176*. Variables are defined in Table A2. Huber/White standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0129 (α=0.05) and 1.6787 (α=0.10).

TABLE 2.3
Replication of Becsi (1996): Equation (R2b), page 32
TIME PERIOD: 1977-1992

VARIABLE	ESTIMATES	
	Becsi Study	***Replication***
RMTR7792	-0.0196 (0.0068) [-2.88]	-0.0186 (0.0087) [-2.15]
RPCPI76	-0.0032 (0.0052) [-0.62]	-0.0029 (0.0061) [-0.48]
RR7792	-0.0194 (0.0098) [-1.98]	-0.0210 (0.0103) [-2.04]
Constant	-0.0007 (0.0008) [-0.88]	-0.0844 (0.0849) [-0.99]
Adjusted R^2	0.394	0.258
Observations	50	50

NOTE: Dependent variable is *RG7792*. Variables are defined in Table A2. Huber/White standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0129 (α=0.05) and 1.6787 (α=0.10).

STUDY THREE: Helms, L. Jay. "The Effect of State and Local Taxes on Economic Growth: A Time Series-Cross Section Approach." The Review of Economics and Statistics. (1985): 574-82.

Overview. Professor Jay Helms' (University of California, Davis) study on the effect of state and local taxes is perhaps the most cited study in the literature on this subject. It was innovative in a number of respects. It was one of the first studies to incorporate fixed effects (for both state and year) in its regression analysis. Fixed effects analysis ignores systematic differences *across* states and focuses on changes *within* states. Changes in state income across time are correlated with changes in that state's taxes.

A second innovation in Helms' study was his incorporation of a financial budget constraint within the estimation equation. Helms includes both revenue, expenditure, and deficit variables. Because the sum of state and local tax revenues must equal the sum of state and local expenditures minus the deficit, Helms's analysis omits "Public Welfare Expenditures" in order to avoid the problem of perfect multicollinearity. The coefficients on the tax variables in Helms' regression thus allow him to address the question, "What would be the impact on state economic growth if states increased taxes while simultaneously increasing spending on welfare." Alternatively, one can use Helms' results to calculate the estimated impact on economic growth of financing higher education, highways, or some other expenditure category through a balanced-budget increase in taxes.

Helms concludes that "tax increases significantly retard economic growth when the revenue is used to fund transfer payments...On the other hand, when the revenue is used to finance enhanced public services (such as highways, education, and public health

and safety), the favorable impact...may more than counterbalance the disincentive effects of the concomitant taxes." Helms' research has been very influential. Among other things, it serves as an empirical basis for Bartik's (1991 page 43f) assessment that "tax increases [could even] have a...positive effect...if public services were simultaneously changed in the same direction."

Variables. The variables used in Helms' study, along with a description of how I replicated them, are reported in Table A3. Helms does not include a table of means and standard deviations, so it is not possible to directly compare the variables in Helms' study with their replicated counterparts.

Generally speaking, data on fiscal variables are electronically available through a variety of sources back to 1977. I hand entered data from annual issues of Government Finances for years prior to 1977. I was not able to construct a continuous time series for the variables *Relative wage*, *Unionization rate*, and *Population Aged 5 through 17* (cf. *Instrumental variables*). I addressed this missing data problem by imputing values using STATA's "Impute" command.

The dependent variable in Helms' study is the natural log of real (1967 dollars) state Personal Income (*ln Y*). The key tax variables are the rate of property taxation and the rate of taxation from all other state and local taxes (*Property tax* and *Other taxes*). These variables--like all the tax, expenditure, and deficit variables used in the study--are measured as ratios with respect to state Personal Income. The coefficients on the tax and expenditures variables may be interpreted as follows. A value of –0.0100 implies that a 1 percent increase in taxes (relative to state Personal Income) accompanied by a 1 percent

increase in public welfare spending (the omitted category) results in a 1 percent decrease in real state Personal Income.

Comparison of Empirical Results. Table 3.1 reports the results of least squares estimation (LSC) of the fixed effects model. There are a number of endogeneity concerns that arise in this estimation framework. One concern is that states experiencing negative income shocks will increase transfer payments. This situation would induce endogeneity between the *Deficit* variable and the LSC equation's error term. To address this problem, Helms uses two-stage least squares and re-estimates the fixed effects model, replacing *Deficit* with its estimated value. These results are reported in Table 3.2 (the IVC estimates). Helms does not report R^2 values for his regressions. However, he does report the standard error of the equation (SEE). As a result, I use the SEE estimates to compare goodness of fit between Helms' and the replication regressions.

The replication estimates in Table 3.1 are quite similar to those of Helms' original study. The estimated coefficients have the same sign in every instance. Further, the replication results generally lie within a standard deviation of the original estimates. The estimated SEE in the replication equation is lower than that of the original study. Since the values of the dependent variable are not identical, this does not necessarily imply that the replication equation has a higher R^2. However, it does suggest that the replication equation does a comparable job in terms of goodness of fit.

Like Helms, I find that the estimated coefficients for *Property tax* and *Other taxes* are negative and significant. Both Helms' original study and the replication results suggest that *Property tax* exerts a greater adverse impact on state Personal Income than *Other taxes*, which include income taxes. The coefficients on the tax variables all assume

that tax increases (decreases) are met by corresponding, balanced-budget changes in public welfare spending. However, the coefficient estimates also allow one to estimate the impact on state Personal Income of tax changes accompanied by corresponding changes in other expenditure categories.

Helms' results suggest that if the tax increases were devoted to increases in any expenditure category other than public welfare spending, state Personal Income would rise. This conclusion follows from the fact that the estimated coefficients on the expenditure variables are larger in absolute value than those on the tax variables. My results are not quite as strong, but they generally support this conclusion.

One concern with the regression reported in Table 3.1 is that it may be picking up the effect of state business cycles. When states experience economic downturns, spending on public welfare increases as a percentage of *Personal Income*. If one assumes that other categories of state spending and taxes stay constant (a debatable assumption), then the increased spending must generate greater state deficits. In econometric terms, this introduces the problem of "endogeneity." Which biases the coefficient estimates.

To address this concern, Helms uses the econometric technique of "instrumental variable" (IV) estimation.[15] Table 3.2 reports these results. The replication estimates are close to Helms' IV estimates, though the coefficients for the fiscal variables are larger in absolute value. Interestingly, Helms found larger fiscal effects using IV estimation, and the replication study yields the same result. Further, the replication IV study produces a

[15] Note that this procedure is not equivalent to Two-Stage Least Squares (2SLS). In 2SLS estimation, all of the non-endogenous right-hand side variables must be used as instruments or the resulting coefficients will be biased (Baltagi, 1998). It does not appear that Helms uses all of the right-hand side variables as instruments. I estimated the model with the full set of right-hand side variables as instruments and obtained virtually identical estimates as the ones reported here. For more information, see http://www.stata.com/support/faqs/stat/ivreg.html

lower estimate of SEE than does the corresponding Helms study, suggesting at least a comparable fit. Despite the correction for endogeneity, the IV estimates lead to essentially the same conclusions that I obtained from the LS analysis.

TABLE 3.1
Replication of Helms (1985): Fixed Effects/LSC Equation, Table 1, page 579
TIME PERIOD: 1966-1979

VARIABLE	ESTIMATES	
	Helms Study	*Replication*
Property tax	-0.0121 (0.0046) [-2.63]	-0.0115 (0.0047) [-2.44]
Other taxes	-0.0089 (0.0043) [-2.07]	-0.0101 (0.0043) [-2.36]
User fees	-0.0079 (0.0057) [-1.37]	-0.0129 (0.0057) [-2.28]
Deficit	-0.0193 (0.0040) [-4.83]	-0.0159 (0.0040) [-3.94]
Federal source revenue	-0.0195 (0.0040) [-4.88]	-0.0145 (0.0040) [-3.63]
Health	0.0295 (0.0076) [3.88]	0.0220 (0.0076) [2.89]
Highways	0.0171 (0.0046) [3.72]	0.0114 (0.0046) [2.50]
Local schools	0.0181 (0.005) 93.62]	0.0142 (0.0050) [2.82]
Higher education	0.0193 (0.0061) [3.16]	0.0127 (0.0066) [1.91]

TABLE 3.1 (continued)
Replication of Helms (1985): Fixed Effects/LSC Equation, Table 1, page 579
TIME PERIOD: 1966-1979

VARIABLE	ESTIMATES	
	Helms Study	***Replication***
Other expenditures	0.0134 (0.0047) [2.85]	0.0097 (0.0046) [2.10]
Relative wage	-0.000260 (0.000170) [-1.53]	-0.000638 (0.000270) [-2.36]
Unionization rate	-0.001786 (0.000663) [-2.69]	-0.001275 (0.000801) [-1.59]
Population density	-0.000549 (0.000148) [-3.71]	-0.000665 (0.000179) [-3.73]
ln Y_{t-1}	0.9184 (0.0221) [41.56]	0.9149 (0.0211) [43.38]
Standard Error of the Equation	0.0242	0.0229
Observations	672	672

NOTE: Dependent variable is $ln\ Y_t$. Variables are defined in Table A3. A constant term and two-way fixed effects (state and year) year were also included in the regression equation. Standard errors are reported in parentheses; t-statistics are reported in brackets. Critical values (two-tailed) for the t-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 3.2
Replication of Helms (1985): Fixed Effects/IVC Equation, Table 1, page 579
TIME PERIOD: 1966-1979

VARIABLE	ESTIMATES	
	Helms Study	*Replication*
Property tax	-0.0194 (0.0055) [-3.53]	-0.0335 (0.0115) [-2.91]
Other taxes	-0.0162 (0.0052) [-3.12]	-0.0309 (0.0109) [-2.84]
User fees	-0.0140 (0.0062) [-2.26]	-0.0311 (0.0104) [-3.00]
Deficit	-0.0274 (0.0052) [-5.27]	-0.0399 (0.0121) [-3.30]
Federal source revenue	-0.0252 (0.0046) [-5.48]	-0.0305 (0.0087) [-3.52]
Health	0.0363 (0.0081) [4.48]	0.0399 (0.0117) [3.40]
Highways	0.0245 (0.0055) [4.45]	0.0332 (0.0113) [2.94]
Local schools	0.0262 (0.0060) [4.37]	0.0386 (0.0126) [3.06]
Higher education	0.0272 (0.0069) [3.94]	0.0362 (0.0130) [2.78]

TABLE 3.2 (continued)
Replication of Helms (1985): Fixed Effects/IVC Equation, Table 1, page 579
TIME PERIOD: 1966-1979

VARIABLE	ESTIMATES	
	Helms Study	***Replication***
Other expenditures	0.0214 (0.0056) [3.82]	0.0333 (0.0121) [2.75]
Relative wage	-0.000241 (0.000171) [-1.41]	-0.000643 (0.000278) [-2.31]
Unionization rate	-0.001997 (0.000671) [-2.98]	-0.000927 (0.000821) [-1.13]
Population density	-0.000520 (0.001490) [-0.35]	-0.000672 (0.000184) [-3.65]
ln Y_{t-1}	0.9104 (0.0224) [40.64]	0.9055 (0.0225) [40.17]
Standard Error of the Equation	0.0243	0.0230
Observations	672	672

NOTE: This equation is identical to the equation estimated in Table 3.1 except that *Deficit* is assumed endogenous and is replaced with its estimated value as a function of exogenous variables. The dependent variable is *ln* Y_t. Variables are defined in Table A3. A constant term and two-way fixed effects (state and year) year were also included in the regression equation. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

STUDY FOUR: Mofidi, Alaeddin and Joe Stone. "Do State and Local Taxes Affect Economic Growth?" The Review of Economics and Statistics. (1990): 686-91.

Overview. Professor Joe Stone (University of Oregon) and Alaeddin Mofidi published their paper on state and local taxes and economic growth in the Review of Economics and Statistics five years after Helms published his paper in that journal. The two papers are very similar, but differ in two important respects. First, Mofidi and Stone used different dependent variables than did Helms. They use manufacturing investment and employment, whereas Helms uses state Personal Income. Their reason for doing so was to "test...the structural linkages implicit in Helms results (page 687)." In other words, they attempt to identify the economic avenue through which taxes exert their influence on the state economic growth. Another key difference is that Mofidi and Stone transform their data into five-year differenced data. Five-year differencing helps to minimize concerns of serial correlation that may be present in annual data.

With respect to taxes, Mofidi and Stone reach essentially the same conclusion as Helms. They conclude that "state and local taxes have a significantly negative effect on net investment and employment in manufacturing when the revenues are devoted to transfer-payment programs...." The impact of increasing taxes and devoting the revenues to other expenditure categories is estimated to be ambiguous, depending on the specific category. This differs from Helms' study where all the coefficients on the spending variables are larger in absolute terms when compared to the tax variables.

Variables. Table A4 describes the variables employed in the replication of Mofidi and Stone (1990). Unfortunately, I was unable to locate data on manufacturing net investment before 1977 despite several consultations with data technicians at the U.S.

Census Bureau (Census of Manufacturers). As a result, I focus on the regression in which manufacturing employment is the dependent variable.

I encountered difficulties in obtaining data on several of the non-fiscal explanatory variables. Despite the assistance of data technicians at the Bureau of Labor Statistics (BLS), I was unable to obtain *Unemployment rate* data prior to 1970. I was not able to obtain *Union rate* data for 1962 or *Age 13-17 ratio* data prior to 1980. Lastly, I was unable to obtain a continuous time series for *Durable goods employment* prior to 1969, preventing the construction of the *Industry mix ratio* variable. As a result, all of these variables are omitted from the replication exercise.

I was able to construct a complete time series for *Female ratio*, *Nonwhite ratio,* and *Age 18-64 ratio*, but in each case there were a substantial number of missing observations that were filled through imputation using STATA's "Impute" command. Finally, there are a number of ways of categorizing states by region. I follow the BEA Region categorizations (cf. "http://www.bea.doc.gov/bea/regional/docs/regions.htm"), equating *North* with the Great Lakes and Plains regions, *South* with the Southeast and Southwest regions, *West* with the Rocky Mountain and Far West regions, and *East* with the New England and Mideast regions. Mofidi and Stone do not report a table of means and standard deviations, so it is not possible to directly compare their variables with mine.

The dependent variable in Mofidi and Stone's study is the natural log of the ratio of *Manufacturing employment*$_t$ over *Manufacturing employment*$_{t-5}$. The key tax variable is all state and local taxes (*Taxes*), expressed as a percentage of state Personal Income and differenced in 5-year intervals. The coefficients on the tax and expenditures

variables may be interpreted as follows. A value of –1.00 implies that a 1 percent increase in taxes over a five-year period (relative to state Personal Income) accompanied by a 1 percent increase in public welfare spending during the same period (also relative to state Personal Income) results in a 1 percent decrease in the five-year, (log) percentage growth rate of *Manufacturing employment*.

Comparison of Empirical Results. Table 4.1 compares Mofidi and Stone's estimates with those of my replication study. I note that all the fiscal variables have the same sign and that the R^2's of the two equations are very close. In contrast, many of the control variables have different signs. The coefficients on the *Taxes* variable is very similar across the two equations (-5.12 versus –4.96). Like Mofidi and Stone, the replication equation estimates that a 1 percent increase in state and local taxes over a five year period (relative to Personal Income) is associated with a 5 (log) percentage decrease in manufacturing employment over the same period. The result is significant at the 5 percent level (two-tailed test).

Author Contact Log. Professor Joe Stone was initially contacted by email in early May. He responded quickly and that email was followed up with several phone calls and additional emails in the month of May. He was able to provide helpful advice concerning a number of data issues.

TABLE 4.1
Replication of Mofidi and Stone (1990): Employment(a) Equation, Table 1, page 689
TIME PERIOD: 1962-1982

VARIABLE	ESTIMATES	
	Mofidi and Stone Study	***Replication***
Taxes	-4.96 (1.57) [-3.15]	-5.12 (2.19) [-2.33]
Other revenues	-6.13 (1.54) [-3.98]	-4.24 (2.15) [-1.97]
Health	5.62 (2.16) [2.60]	2.04 (4.14) [0.49]
Education	4.33 (1.97) [2.20]	0.95 (2.50) [0.38]
Highways	3.77 (2.05) [1.84]	1.79 (2.31) [0.78]
Other expenditures	5.49 (1.70) [3.23]	6.96 (2.48) [2.81]
Surplus(Deficit)	5.71 (1.56) [3.66]	4.49 (2.15) [2.09]
UI Benefits	-4.34 (2.09) [-2.08]	-11.95 (2.65) [-4.50]
Unemployment rate	-1.28 (0.40) [-3.17]	n.a.

TABLE 4.1 (continued)
Replication of Mofidi and Stone (1990): Employment(a) Equation, Table 1, page 689
TIME PERIOD: 1962-1982

VARIABLE	ESTIMATES	
	Mofidi and Stone Study	*Replication*
Female ratio	1.35 (2.45) [0.55]	-2.13 (1.19) [-1.79]
Nonwhite ratio	-0.39 (0.42) [-0.93]	0.57 (0.27) [2.11]
Age 13-17 ratio	-0.47 (1.88) [-0.25]	n.a.
Age 18-65 ratio	2.02 (0.64) [3.16]	3.64 (1.01) [3.61]
Union ratio	0.19 (0.23) [0.83]	n.a.
Industry mix ratio	1.31 (0.32) [4.09]	n.a.
North	-4.79 (1.99) [-2.41]	5.63 (2.07) [2.72]
South	-1.54 (1.92) [-0.80]	8.88 (2.14) [4.15]
West	-2.46 (1.97) [-1.25]	7.88 (2.15) [3.66]

TABLE 4.1 (continued)
Replication of Mofidi and Stone (1990): Employment(a) Equation, Table 1, page 689
TIME PERIOD: 1962-1982

VARIABLE	ESTIMATES	
	Mofidi and Stone Study	***Replication***
1967-72	-6.05 (3.46) [-1.75]	-9.08 (3.18) [-2.86]
1972-77	-4.90 (4.05) [-1.21]	-17.35 (3.69) [-4.71]
1977-82	-1.60 (6.15) [-0.26]	-29.03 (3.49) [-8.32]
Intercept	15.73 (2.93) [5.37]	8.24 (2.61) [3.16]
R^2	0.56	0.54
Observations	200	200

NOTE: The dependent variable is *Manufacturing employment*. Variables are defined in Table A4. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

STUDY FIVE: Carroll, Robert and Michael Wasylenko. "Do State Business Climates Still Matter?—Evidence of a Structural Change." National Tax Journal. (1994): 19-37. Vol. 47, No. 1.

Overview. Professor Michael Wasylenko (Syracuse University) and Michael Carroll (Office of Tax Analysis, U.S. Department of Treasury) focus their analysis on the existence of a structural change in the relationship between taxes and economic growth (as measured by employment). They test "whether the coefficients on fiscal variables change from one time period (the 1970s) to the next (the 1980s)." They reject the null hypothesis of no change. While their results are difficult to interpret in a consistent fashion, they report that "our results suggest that fiscal variables influenced manufacturing employment in states more significantly during the 1970s than during the 1980s (page 19)."

Methodologically, the Carroll and Wasylenko study is noteworthy because it addresses an econometric shortcoming of cross-sectional, time series studies that employ (i) fixed effects and (ii) use the lagged value of the dependent variable as an explanatory variable (such as Helms (1985)). First differencing eliminates the fixed effect, but induces a correlation between the error term and the differenced, lagged dependent variable (Nickell, 1981). To address this problem, Carroll and Wasylenko follow a suggestion by Holtz-Eakin et al. (1988, 1989) and use instrumental variables to proxy for the differenced, lagged dependent variable.[16,17]

Variables. Table A5 describes the variables Carroll and Wasylenko employ in their study, along with the particular variable constructions used in the replication. I was

[16] Essentially, the inclusion of a lagged dependent variable with a fixed effect induces a correlation between the lagged dependent variable and the error term, even when the error term is not autocorrelated.
[17] Following Greene (pages 583-584), I use the second and third lags of the dependent variable as instruments for the differenced, first and second lagged dependent variable.

unable to create a usable time series for the variable *Electric price*. The series was discontinued in 1989. Data for 1983-1988 is available, but can only be obtained at considerable expense. As a result, I do not employ an *Electric price* variable in the 1967-1988 replication. (The 1977-1997, Part Three re-estimation study employs a different series for *Electric price* that is defined as the "Commercial Sector Energy Price Series (Electricity)". Unfortunately, this series only goes back to 1970, and is unavailable for the 1967-1988 analysis.)

The *Industry mix* variable is based on a predicted value of employment using shift-share analysis. However, as described in Carroll and Wasylenko's paper, it does not make sense to use this variable in the *Total nonagricultural employment* equation. As a result, I omit it from the replication for this equation. *Sales taxes* (State and Local Sales Taxes) is not available prior to 1973. Therefore, I do not use this variable for the 1967-1988 analysis. I was unable to generate complete series for *Real wage, Union rate* and *Young*. Imputation was used to fill in missing values where applicable.

Finally, Carroll and Wasylenko's *Productivity* variable uses Gross State Product data, but this data is unavailable prior to 1977. The good news is that I was able to obtain a Gross State Product series from Dr. Timothy Bartik of the Upjohn Institute. The bad news is that his series only goes to 1986 (not 1988). Further, the Bartik Gross State Product series is sufficiently different from the Gross State Product series available from the BEA that I could not splice the two series. As a result, I predicted Bartik's Gross State Product data for the missing years using BEA Gross State Product and Personal Income data.

Unlike the previous studies I have examined, Carroll and Wasylenko report a table of means and standard deviations. Curiously, they report means and standard deviations for data from only one year of their sample (1988). Table 5.1 compares means and standard deviations for their study and my replication.

Most of the variables have very similar means and standard deviations except for *Industry mix*. Carroll and Wasylenko report a mean of 3.78 for this variable, whereas my attempt to replicate this variable produced a mean value of 247.40 (in thousands). I was unable to determine the source of the discrepancy. I note that the fiscal variables are virtually identical.

Carroll and Wasylenko estimate regression equations using two different dependent variables: *Total nonagricultural employment* and *Manufacturing employment.* For each equation, the dependent variable is the natural log of the ratio of $Employment_t$ over $Employment_{t-1}$. The key tax variables are *Property*, *Personal income*, *Corporate income*, and *Other taxes* (I was unable to create a complete time series for *Sales taxes*). All of the tax variables are expressed as a percentage of *Personal Income* net of *Transfer Payments* and *Government and Government Enterprises*, and are differenced. The coefficients on the tax and expenditures variables may be interpreted as follows. A value of –0.01 implies that a 1 percent increase in taxes (relative to the net *Personal Income* variable) accompanied by a 1 percent increase in public welfare spending (relative to the net *Personal Income* variable) results in a 1 percent decrease in the (log) percentage growth rate of the respective employment variable.

Comparison of Empirical Results. Carroll and Wasylenko estimate a total of four equations. The regression equations differ by dependent variable (either *Total*

nonagricultural employment or *Manufacturing employment*) and time period. For the *Total nonagricultural employment* equations, Carroll and Wasylenko estimate separate regressions for the time periods 1967-1976 and 1977-1988. For the *Manufacturing employment* equations, they estimate regressions for the periods 1967-1983 and 1984-1988. Tables 5.2 through 5.5 compare Carroll and Wasylenko's estimates with those of my replication study.

The respective estimates from the original study and the replication are generally close. Carroll and Wasylenko predict that the tax variable coefficients will be negative and the public spending variable coefficients will be positive. Across the four regression equations, fifteen of forty associated fiscal coefficients estimated by Carroll and Wasylenko are wrong-signed, three significantly wrong-signed. Similarly, the replication produces eleven (out of 36) wrong-signed estimates, none of which are significant.

Of the twenty tax coefficients estimated by Carroll and Wasylenko, 17 are negative and eight are statistically significant (all negative). Of the sixteen tax coefficients estimated in my replication, 9 are negative, though only one of these is statistically significant. Some of my estimated tax impacts are larger than those estimated by Carroll and Wasylenko, and some are smaller. The overall estimated impacts appear to be similar.

I estimate that a 1 percent increase in state and local property taxes (relative to *Personal Income* net of *Transfer payments* and *Government and government enterprises*) reduces employment by approximately 1-2 percent. Other types of taxes are estimated to have a smaller impact. The variable *Property* is the only tax variable that has a significant coefficient in any of the four equations in the replication analysis.

Author Contact Log. Professor Michael Wasylenko was contacted in May 2001 via email. He directed us to Dr. Robert Carroll who works at the U.S. Treasury. Dr. Carroll responded to my email late May, 2001. Dr. Carroll was very helpful in discussing various data problems.

TABLE 5.1
Replication of Carroll and Wasylenko (1994): Means and Standard Deviations, Table 2, page 23
TIME PERIOD: 1988

VARIABLE	MEAN (STANDARD DEVIATION)	
	Carroll and Wasylenko Study	*Replication*
Real wage	\$8.49 (0.95)	\$8.17 (0.94)
Electric price	\$398.00 (105.00)	n.a.
Industry mix	3.78 (5.56)	247.40 (296.2)
Unionization	14.8 (5.8)	14.90 (5.87)
Productivity	45.42 (7.17)	41.25 (31.3)
Density	167.2 (234.8)	159.16 (220.20)
Old	12.4 (1.7)	11.73 (1.99)
Young	18.9 (1.80)	18.99 (1.96)
Property	\$4.42 (1.64)	\$4.44 (1.61)
Personal income	\$2.58 (1.44)	\$2.80 (1.57)
Corporate income	\$0.63 (0.33)	\$0.65 (0.37)

TABLE 5.1 (continued)
Replication of Carroll and Wasylenko (1994): Means and Standard Deviations, Table 2, page 23 *TIME PERIOD: 1988*

VARIABLE	MEAN (STANDARD DEVIATION)	
	Carroll and Wasylenko Study	*Replication*
Other taxes	$1.27 (0.73)	$1.38[a] (1.06)
User fees	$6.61 (2.65)	$6.59 (2.43)
Federal aid	$4.58 (1.71)	$4.56 (1.55)
Deficit	$0.61 (0.92)	$0.97 (1.04)
Health	$2.15 (1.05)	$2.15 (1.02)
Higher education	$2.49 (0.89)	$2.48 (0.80)
Primary and secondary education	$6.18 (1.47)	$6.18 (1.28)
Highway	$2.38 (0.95)	$2.37 (0.84)
Other expenditures	$8.88 (2.02)	$8.91 (1.84)

NOTE: Variables are defined in Table A5.

[a] In the 1967-1988 replication study, *Other taxes* includes *State and Local Sales Taxes*. However, Carroll and Wasylenko exclude *State and Local Sales Taxes* from their construction of *Other taxes*. While I do not have state and local sales tax data going back to 1967, I do have it for 1988. This allows us to use Carroll and Wasylenko's construction for the purpose of comparing means and standard deviations.

TABLE 5.2
Replication of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Column 1, page 28
TIME PERIOD: 1967-1976

	ESTIMATES	
VARIABLE	*Carroll and Wasylenko Study*	*Replication*
Property	-0.006 (0.032) [-1.86]	-0.0091 (0.0080) [-1.14]
Personal income	0.006 (0.04) [0.15]	0.0017 (0.0086) [0.19]
Corporate income	-0.008 (0.0068) [-1.18]	0.0009 (0.0155) [0.06]
Sales taxes	-0.002 (0.0031) [-0.65]	n.a.
Other taxes	-0.002 (0.0033) [-0.61]	0.0024 (0.0079) [0.30]
User fees	-0.00002 (0.004) [-0.01]	-0.0044 (0.0086) [-0.52]
Federal aid	-0.006 (0.003) [-1.99]	-0.0050 (0.0071) [-0.69]
Deficit	0.001 (0.0019) [0.54]	0.0028 (0.0069) [0.40]
Health	-0.004 (0.006) [-0.67]	0.0087 (0.0127) [0.69]

TABLE 5.2 (continued)
Replication of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Column 1, page 28
TIME PERIOD: 1967-1976

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Higher education	-0.002 (0.0035) [-0.57]	-0.0004 (0.0098) [-0.04]
Primary and secondary education	0.002 (0.004) [0.50]	0.0032 (0.0079) [0.41]
Highways	0.003 (0.0031) [0.97]	0.0054 (0.0080) [0.67]
Other expenditures	-0.0009 (0.0028) [-0.32]	0.0012 (0.0074) [0.16]
Lagged dependent variable	0.568 (0.0535) [10.62]	0.6713 (0.1519) [4.42]
Real wage	0.0005 (0.005) [0.10]	-0.0003 (0.0050) [-0.06]
Electric price	-0.00008 (0.000) [-2.89]	n.a.
Industry mix	0.0002 (0.0001) [2.34]	n.a.
Unionization	-0.0006 (0.0007) [-0.85]	0.0001 (0.0012) [0.07]

TABLE 5.2 (continued)
Replication of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Column 1, page 28
TIME PERIOD: 1967-1976

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Productivity	-0.0002 (0.0006) [-0.32]	-0.000003 (0.000001) [-2.73]
Density	0.00007 (0.0002) [0.30]	0.0002 (0.0007) [0.31]
Old	0.0072 (0.004) [1.81]	-0.0052 (0.0099) [-0.52]
Young	-0.0053 (0.0028) [-1.91]	-0.0097 (0.0073) [-1.33]
Intercept	0.041 (0.003) [13.5]	0.0088 (0.0080) [1.10]
R^2	0.68	0.65
Observations	480	480

NOTE: The dependent variable is *Total nonagricultural employment*. Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 5.3
Replication of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Column 2, page 28
TIME PERIOD: 1977-1988

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Property	-0.005 (0.0017) [-2.89]	-0.0066 (0.0114) [-0.58]
Personal income	-0.004 (0.0019) [-2.10]	0.0026 (0.0120) [0.21]
Corporate income	-0.0002 (.0050) [-0.04]	0.0027 (0.0187) [0.14]
Sales taxes	-0.001 (0.0017) [-0.58]	n.a.
Other taxes	-0.003 (0.0019) [-1.55]	0.0047 (0.0108) [0.43]
User fees	-0.002 (0.0018) [-1.14]	-0.0015 (0.0105) [-0.14]
Federal aid	-0.004 (0.0019) [-2.09]	-0.0067 (0.0107) [-0.63]
Deficit	0.004 (0.0012) [3.31]	0.0043 (0.0102) [0.42]
Health	-0.002 (0.0031) [-0.65]	0.0012 (0.0157) [0.08]

TABLE 5.3 (continued)
Replication of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Column 2, page 28
TIME PERIOD: 1977-1988

VARIABLE	ESTIMATES	
	Carroll and Wasylenko Study	*Replication*
Higher education	-0.00002 (0.0033) [-0.01]	-0.0049 (0.0148) [-0.33]
Primary and secondary education	-0.006 (0.0023) [-2.59]	-0.0012 (0.0128) [-0.09]
Highways	0.004 (0.0022) [1.83]	0.0048 (0.0122) [0.39]
Other expenditures	-0.0024 (0.0018) [-1.36]	0.0001 (0.0113) [0.01]
Lagged dependent variable	0.731 (0.0516) [14.17]	0.6999 (0.2288) [3.06]
Real wage	0.004 (0.0029) [1.39]	0.0080 (0.0121) [0.66]
Electric price	0.00001 (0.00001) [0.71]	n.a.
Industry mix	0.0001 (0.00004) [1.96]	n.a.
Unionization	0.0002 (0.0003) [0.69]	0.0002 (0.0015) [0.13]

TABLE 5.3 (continued)
Replication of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Column 2, page 28
TIME PERIOD: 1977-1988

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Productivity	-0.0018 (0.0004) [-4.05]	-0.000002 (0.000002) [-0.97]
Density	0.00002 (0.0004) [0.05]	0.0005 (0.0014) [0.32]
Old	0.0079 (0.0042) [1.88]	-0.0156 (0.0159) [-0.98]
Young	-0.009 (0.0113) [-0.80]	-0.0256 (0.0119) [-2.16]
Intercept	0.019 (0.0026) [7.20]	0.0368 (0.0088) [4.19]
R^2	0.81	0.72
Observations	576	576

NOTE: The dependent variable is *Total nonagricultural employment.* Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 5.4
Replication of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Column 1, page 29
TIME PERIOD: 1967-1983

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Property	-0.014 (0.0038) [-3.69]	-0.0210 (0.0084) [-2.49]
Personal income	-0.009 (0.005 [-1.80]	-0.0012 (0.0093) [-0.13]
Corporate income	-0.022 (0.0098) [-2.25]	-0.0125 (0.0164) [-0.76]
Sales taxes	-0.013 (0.0045) [-2.91]	n.a.
Other taxes	-0.013 (0.0044) [-2.93]	-0.0089 (0.0082) [-1.08]
User fees	-0.006 (0.0036) [-1.67]	-0.0110 (0.0082) [-1.34]
Federal aid	-0.012 (0.0036) [-3.35]	-0.0142 (0.0078) [-1.82]
Deficit	0.008 (0.0029) [2.78]	0.0128 (0.0075) [1.70]
Health	0.009 (0.007) [1.29]	0.0237 (0.0128) [1.85]

TABLE 5.4 (continued)
Replication of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Column 1, page 29*TIME PERIOD: 1967-1983*

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Higher education	-0.006 (0.0057) [-1.06]	-0.0020 (0.0109) [-0.19]
Primary and secondary education	0.006 (0.0039) [1.52]	0.0103 (0.0088) [1.17]
Highways	0.011 (0.004) [2.74]	0.0153 (0.0087) [1.76]
Other expenditures	0.004 (0.0037) [1.09]	0.0047 (0.0082) [0.58]
Lagged dependent variable	0.488 (0.058) [8.42]	0.6217 (0.1315) [4.73]
Real wage	0.012 (0.0075) [1.61]	0.0008 (0.0061) [0.13]
Electric price	0.00001 (0.00003) [0.32]	n.a.
Industry mix	0.00007 (0.0001) [0.99]	0.0003 (0.0001) [1.89]
Unionization	-0.001 (0.001) [-1.03]	0.0006 (0.0013) [0.47]

TABLE 5.4 (continued)
Replication of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Column 1, page 29*TIME PERIOD: 1967-1983*

VARIABLE	ESTIMATES	
	Carroll and Wasylenko Study	***Replication***
Productivity	-0.003 (0.009) [-3.17]	0.000003 (0.000001) [-2.67]
Density	-0.0007 (0.0005) [-1.43]	-0.0009 (0.0009) [-1.01]
Old	0.006 (0.0059) [1.01]	-0.0115 (0.0108) [-1.07]
Young	-0.002 (0.0026) [-0.78]	-0.0196 (0.0083) [-2.35]
Intercept	0.027 (0.0064) [4.20]	0.0173 (0.0083) [2.09]
R^2	0.71	0.69
Observations	816	816

NOTE: The dependent variable is *Manufacturing employment*. Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 5.5
Replication of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Column 2, page 29*TIME PERIOD: 1984-1988*

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Property	-0.002 (0.0074) [-0.27]	-0.0166 (0.0672 [-0.25]
Personal income	-0.0009 (0.0047) [-0.19]	-0.0019 (0.0592) [-0.03]
Corporate income	0.0030 (0.012) [0.25]	0.0003 (0.0823) [0.00]
Sales taxes	0.007 (0.0043) [1.63]	n.a.
Other taxes	-0.002 (0.0053) [-0.38]	0.0039 (0.0547) [0.07]
User fees	-0.002 (0.0042) [-0.48]	-0.0061 (0.0533) [-0.11]
Federal aid	-0.002 (0.0024) [-0.82]	-0.0104 (0.0528) [-0.20]
Deficit	0.003 (0.0037) [0.82]	0.0077 (0.0529) [0.15]
Health	0.007 (0.0088) [0.80]	0.0096 (0.0803) [0.12]

TABLE 5.5 (continued)
Replication of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Column 2, page 29*TIME PERIOD: 1984-1988*

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Higher education	-0.007 (0.0088) [-0.80]	-0.0103 (0.0719) [-0.14]
Primary and secondary education	-0.014 (0.0068) [-2.06]	0.0037 (0.0699) [0.05]
Highways	-0.0008 (0.0073) [-0.11]	0.0024 (0.0666) [0.04]
Other expenditures	-0.009 (0.0051) [-1.76]	0.0019 (0.0588) [0.03]
Lagged dependent variable	0.554 (0.1518) [3.65]	0.9228 (1.6398) [0.56]
Real wage	-0.0060 (0.0066) [-0.91]	-0.0162 (0.0689) [-0.24]
Electric price	0.00003 (0.0001) [0.59]	n.a.
Industry mix	-0.0001 (0.0001) [-0.55]	0.0001 (0.0013) [0.08]
Unionization	0.001 (0.0005) [2.06]	0.0003 (0.0081) [0.04]

TABLE 5.5 (continued)
Replication of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Column 2, page 29 *TIME PERIOD: 1984-1988*

	ESTIMATES	
VARIABLE	***Carroll and Wasylenko Study***	***Replication***
Productivity	-0.0009 (0.0015) [-0.61]	0.000001 (0.00001) [0.08]
Density	-0.002 (0.0006) [-3.10]	-0.0029 (0.0056) [-0.52]
Old	0.002 (0.0143) [0.14]	-0.0120 (0.0685) [-0.17]
Young	0.005 (0.0049) [1.03]	0.0049 (0.0616) [0.08]
Intercept	0.025 (0.0063) [3.99]	-0.0089 (0.0328) [-0.27]
R^2	0.65	0.58
Observations	240	240

NOTE: The dependent variable is *Manufacturing employment*. Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

IV. PART TWO: Re-estimation of Previous Studies Using Data From an Identical Time Period (1977-1997)

In this section, I repeat the analysis of the previous section, except that all analyses employ data from an identical time period. I choose the time period 1977-1997 because it is the most recent period for which most of the variables in my analyses—particularly the state and local fiscal variables--are available in electronic form.

In the ideal, I would keep every aspect of the estimation the same, changing only the time period from which observations are drawn. In a few instances this ideal had to be compromised as variables were modified due to data limitations. For example, I use a different GSP series in calculating *Productivity* in the Carroll and Wasylenko study because the original series was discontinued. However, overall, the estimation methodologies and variables are virtually identical, with the only difference being that observations from a different time period are being used. This allows me to determine whether the original studies would have produced the same estimated tax impacts had they been estimated using the most recently available, most reliable data. My main finding is that they would not produce the same estimated tax impacts.

Almost across the board, I find that using data from 1977-1997 causes me to estimate tax impacts that are negative but much smaller in absolute value, or even positive. In some cases, the estimated tax effects are positive and significant. This greatly confounds the interpretation of the original studies. I will discuss possible reasons for this surprising finding in the Conclusion section of this dissertation.

Tables 6.1.1 to 6.5.2 present the results of this re-estimation analysis. In the first column of each table (first two columns in the case of Carroll and Wasylenko (1994)), the replication results from Part One are presented. In the second column (third column in

the case of Carroll and Wasynlenko), I report the results from estimating the same equation, only this time using data from 1977-1997.

When I reestimate Vedder's (1996) three main equations using the time period 1977-1997, I estimate substantially smaller tax effects (cf. Tables 6.1.1 to 6.1.3). The replicated results from the earlier time period are characterized by negative coefficients for five of the six tax coefficients, two of which are significant. These three regressions use data from 1960-1993, 1960-1993, and 1962-1994, respectively. When the same regression equations are estimated using data from 1977-1997, the estimated tax impacts are generally smaller, and sometimes positive. Only three of the six tax variables have estimated coefficients that are negative, none of the six are statistically significant.

Becsi (1996) estimates three main tax equations, one for each of three time periods. Table 6.2.1 compares the equation estimated for the time period 1977-1992 with the same equation estimated with data from the years 1977-1997. The addition of just five more years of data causes the estimated adverse tax impact to vanish. The tax coefficient is estimated to be negative and statistically significant in the 1977-1992 equation. It is positive (but insignificant) in the 1977-1997 equation.

Helms (1985) estimates two main equations using data from 1966-1979, each of which has two tax variables. My replication equation produces negative and statistically significant coefficients for each of the tax variables in each equation when I use data from 1966-1979. A very different result is obtained when data from 1977-1997 is used (cf. Table 6.3.1 and 6.3.2). Three of the four estimated tax coefficients are positive, two of which are significant. I do obtain one negative coefficient, and it is significant.

However, the estimation of two, statistically significant positive coefficients for the tax variables using the later data confounds the interpretation of Helms' original study.

Another result from Tables 6.3.1 and 6.3.2 deserves comment. Many of the signs (which were positive originally) on the spending variables switch to negative. In the instrumental variables specification presented in Table 6.3.2, all of the coefficients on spending variables are negative and significant.

Table 6.4.1 reports the results of this re-estimation analysis for Mofidi and Stone (1990). In my replication of their original study I estimated a tax coefficient that was negative and statistically significant using data from 1962-1982. When the same equation is estimated using data from 1977-1997, the tax coefficient is still estimated to be negative, but substantially smaller in absolute value, and statistically insignificant.

The results of the re-estimation analysis for Carroll and Wasylenko (1994) is reported in Tables 6.5.1 and 6.5.2. The replication results reported in Table 6.5.1 use data from 1967-1976 and 1977-1988. The replication results reported in Table 6.5.2 use data from 1967-1984 and 1984-1988. In both cases, these results are compared with results based on data from 1977-1997.

The estimated coefficient for the *Property* variable is negative and substantially smaller in absolute value in Table 6.5.2 for the 1977-1997 re-estimation. The estimated coefficient for the *Corporate income* variable is positive and much larger in absolute value in the 1977-1997 re-estimations in both tables. The coefficients for the other tax variables are similar across time periods. Overall, the 1977-1997 results present a more ambiguous picture of the impact of taxes since two of the four significant tax coefficients are positive.

TABLE 6.1.1
Re-estimation of Vedder (1996): Table 8.1, page 52

VARIABLE	ESTIMATES	
	1960-1993	*1977-1997*
TAX60/ TAX77	-8.51 (2.82) [-3.02]	0.21 (1.29) [0.16]
TAXCHANGE	-0.39 (0.28) [-1.41]	0.08 (0.19) [0.42]
UNION	-2.28 (0.49) [-4.69]	-1.26 (0.36) [-3.51]
SUNSHINE	-1.27 (0.36) [-3.49]	-0.57 (0.19) [-3.08]
WAGES	-0.11 (0.31) [-0.34]	0.52 (0.13) [3.88]
UNEMPLOYMENT	5.10 (2.47) [2.06]	-1.62 (1.10) [-1.43]
Constant	294.12 (45.65) [6.44]	42.15 (21.11) [2.00]
Adjusted R^2	0.509	0.303
Observations	48	48

NOTE: Dependent variable is *GROWTH*. Variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0195 (α=0.05) and 1.6829 (α=0.10).

TABLE 6.1.2
Re-estimation of Vedder (1996): Table 8.2, page 55

VARIABLE	ESTIMATES	
	1960-1993	*1977-1997*
TAX60/ TAX77	0.61 (7.90) [0.08]	-0.63 (2.75) [-0.23]
TAXCHANGE	-1.02 (0.75) [-1.37]	-0.07 (0.43) [-0.16]
SUNSHINE	4.45 (0.86) [5.20]	2.16 (0.35) [6.10]
WAGES	1.04 (0.78) [1.33]	0.01 (0.34) [0.04]
FARM	-4.62 (1.93) [-2.39]	-3.91 (1.91) [-2.05]
ENERGY	-1.92 (1.91) [-1.00]	-1.11 (0.88) [-1.26]
Constant	-285.81 (114.85) [-2.49]	-91.18 (45.10) [-2.02]
Adjusted R^2	0.479	0.436
Observations	48	48

NOTE: Dependent Variable is *POPULATION CHANGE*. Variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0195 (α=0.05) and 1.6829 (α=0.10).

TABLE 6.1.3
Re-estimation of Vedder (1996): Table 8.3, page 58

VARIABLE	ESTIMATES	
	1962-1994	*1977-1997*
TAX60/ TAX77	-8.50 (11.54) [-0.74]	1.36 (3.76) [0.36]
TAXCHANGE	-2.01 (1.03) [-1.94]	-0.03 (0.57) [-0.05]
UNION	-1.70 (1.44) [-1.18]	-1.49 (0.88) [-1.69]
SUNSHINE	5.39 (1.40) [3.84]	2.16 (0.54) [4.02]
FARM	-10.91 (2.61) [-4.18]	-7.72 (1.99) [-3.87]
ENERGY	-4.38 (2.78) [-1.58]	-3.40 (1.06) [-3.22]
Constant	64.17 (155.43) [0.41]	-38.23 (48.01) [-0.80]
Adjusted R^2	0.517	0.494
Observations	48	48

NOTE: Dependent Variable is *TOTAL REAL PERSONAL INCOME GROWTH.* Variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0195 (α=0.05) and 1.6829 (α=0.10).

TABLE 6.2.1
Re-estimation of Becsi (1996): Equation (R2b), page 32

VARIABLE	ESTIMATES	
	1977-1992	*1977-1997*
RMTR7792/ RMTR7797	-0.0186 (0.0087) [-2.15]	0.0043 (0.0069) [0.62]
RPCPI76	-0.0029 (0.0061) [-0.48]	-0.0139 (0.0079) [-1.76]
RR7792/ RR7797	-0.0210 (0.0103) [-2.04]	0.0396 (0.0363) [1.09]
Constant	-0.0844 (0.0849) [-0.99]	-0.1066 (0.0827) [-1.29]
Adjusted R^2	0.258	0.198
Observations	50	50

NOTE: Dependent variable is *RG7792/RG7797*. Variables are defined in Table A2. Huber/White standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 2.0129 (α=0.05) and 1.6787 (α=0.10).

TABLE 6.3.1
Re-estimation of Helms (1985): Fixed Effects/LSC Equation, Table 1, page 579

VARIABLE	ESTIMATES	
	1966-1979	*1977-1997*
Property tax	-0.0115 (0.0047) [-2.44]	-0.0105 (0.0029) [-3.63]
Other taxes	-0.0101 (0.0043) [-2.36]	0.0062 (0.0029) [2.13]
User fees	-0.0129 (0.0057) [-2.28]	-0.0003 (0.0028) [-0.11]
Deficit	-0.0159 (0.0040) [-3.94]	-0.0047 (0.0026) [-1.82]
Federal source revenue	-0.0145 (0.0040) [-3.63]	-0.0012 (0.0024) [-0.49]
Health	0.0220 (0.0076) [2.89]	-0.0028 (0.0041) [-0.68]
Highways	0.0114 (0.0046) [2.50]	0.0048 (0.0035) [1.35]
Local schools	0.0142 (0.0050) [2.82]	-0.0023 (0.0036) [-0.63]
Higher education	0.0127 (0.0066) [1.91]	0.0108 (0.0057) [1.88]

TABLE 6.3.1 (continued)
Re-estimation of Helms (1985): Fixed Effects/LSC Equation, Table 1, page 579

VARIABLE	ESTIMATES	
	1966-1979	*1977-1997*
Other expenditures	0.0097 (0.0046) [2.10]	-0.0051 (0.0030) [-1.69]
Relative wage	-0.000638 (0.000270) [-2.36]	-0.0004 (0.0002) [-2.28]
Unionization rate	-0.001275 (0.000801) [-1.59]	-0.00001 (0.0005) [-0.03]
Population density	-0.000665 (0.000179) [-3.73]	-0.00004 (0.0001) [-0.46]
ln Y_{t-1}	0.9149 (0.0211) [43.38]	0.9580 (0.0131) [73.28]
Standard Error of the Equation	0.0229	0.0191
Observations	672	960

NOTE: Dependent variable is *ln* Y_t. Variables are defined in Table A3. A constant term and two-way fixed effects (state and year) year were also included in the regression equation. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 6.3.2
Re-estimation of Helms (1985): Fixed Effects/IVC Equation, Table 1, page 579

VARIABLE	ESTIMATES	
	1966-1979	*1977-1997*
Property tax	-0.0335 (0.0115) [-2.91]	0.0136 (0.0087) [1.56]
Other taxes	-0.0309 (0.0109) [-2.84]	0.0350 (0.0102) [3.43]
User fees	-0.0311 (0.0104) [-3.00]	0.0275 (0.0099) [2.77]
Deficit	-0.0399 (0.0121) [-3.30]	0.0259 (0.0107) [2.42]
Federal source revenue	-0.0305 (0.0087) [-3.52]	0.0154 (0.0063) [2.44]
Health	0.0399 (0.0117) [3.40]	-0.0321 (0.0109) [-2.94]
Highways	0.0332 (0.0113) [2.94]	-0.0170 (0.0083) [-2.06]
Local schools	0.0386 (0.0126) [3.06]	-0.0291 (0.0099) [-2.94]
Higher education	0.0362 (0.0130) [2.78]	-0.0216 (0.0124) [-1.74]

TABLE 6.3.2 (continued)
Re-estimation of Helms (1985): Fixed Effects/IVC Equation, Table 1, page 579

VARIABLE	ESTIMATES	
	1966-1979	*1977-1997*
Other expenditures	0.0333 (0.0121) [2.75]	-0.0327 (0.0099) [-3.30]
Relative wage	-0.000643 (0.000278) [-2.31]	-0.0006 (0.0002) [-2.71]
Unionization rate	-0.000927 (0.000821) [-1.13]	0.0003 (0.0005) [0.52]
Population density	-0.000672 (0.000184) [-3.65]	-0.000002 (0.0001) [-0.02]
ln Y_{t-1}	0.9055 (0.0225) [40.17]	0.9463 (0.0139) [67.85]
Standard Error of the Equation	0.0230	0.0191
Observations	672	960

NOTE: This equation is identical to the equation estimated in Table 3.1 except that *Deficit* is assumed endogenous and is replaced with its estimated value as a function of exogenous variables. The dependent variable is *ln* Y_t. Variables are defined in Table A3. A constant term and two-way fixed effects (state and year) year were also included in the regression equation. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 6.4.1
Re-estimation of Mofidi and Stone (1990): Employment(a) Equation, Table 1, page 689

VARIABLE	ESTIMATES	
	1962-1982	*1977-1997*
Taxes	-5.12 (2.19) [-2.33]	-1.23 (1.59) [-0.78]
Other revenues	-4.24 (2.15) [-1.97]	-1.99 (1.46) [-1.36]
Health	2.04 (4.14) [0.49]	-0.98 (3.08) [-0.32]
Education	0.95 (2.50) [0.38]	-1.92 (2.35) [-0.82]
Highways	1.79 (2.31) [0.78]	1.36 (2.65) [0.51]
Other expenditures	6.96 (2.48) [2.81]	3.03 (1.63) [1.86]
Surplus(Deficit)	4.49 (2.15) [2.09]	1.67 (1.47) [1.14]
UI Benefits	-11.95 (2.65) [-4.50]	-10.80 (2.18) [-4.95]
Unemployment rate	n.a.	n.a.

TABLE 6.4.1 (continued)
Re-estimation of Mofidi and Stone (1990): Employment(a) Equation, Table 1, page 689

VARIABLE	ESTIMATES	
	1962-1982	*1977-1997*
Female ratio	-2.13 (1.19) [-1.79]	-3.90 (1.77) [-2.21]
Nonwhite ratio	0.57 (0.27) [2.11]	0.28 (0.29) [0.98]
Age 13-17 ratio	n.a.	n.a.
Age 18-65 ratio	3.64 (1.01) [3.61]	4.94 (0.92) [5.38]
Union ratio	n.a.	n.a.
Industry mix ratio	n.a.	n.a.
North	5.63 (2.07) [2.72]	11.30 (1.85) [6.12]
South	8.88 (2.14) [4.15]	10.20 (1.79) [5.69]
West	7.88 (2.15) [3.66]	15.41 (1.99) [7.74]

TABLE 6.4.1 (continued)
Re-estimation of Mofidi and Stone (1990): Employment(a) Equation, Table 1, page 689

VARIABLE	ESTIMATES	
	1962-1982	*1977-1997*
1967-72	-9.08 (3.18) [-2.86]	8.76 (3.51) [2.50]
1972-77	-17.35 (3.69) [-4.71]	19.51 (3.42) [5.71]
1977-82	-29.03 (3.49) [-8.32]	12.99 (3.17) [4.10]
Intercept	8.24 (2.61) [3.16]	-23.10 (3.11) [-7.43]
R^2	0.54	0.50
Observations	200	200

NOTE: The dependent variable is *Manufacturing employment*. Variables are defined in Table A4. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 6.5.1
Re-estimation of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Columns 1-2, page 28

	ESTIMATES		
VARIABLE	*1967-1976*	*1977-1988*	*1977-1997*
Property	-0.0091 (0.0080) [-1.14]	-0.0066 (0.0114) [-0.58]	-0.0094 (0.0026) [-3.56]
Personal income	0.0017 (0.0086) [0.19]	0.0026 (0.0120) [0.21]	0.0036 (0.0030) [1.20]
Corporate income	0.0009 (0.0155) [0.06]	0.0027 (0.0187) [0.14]	0.0101 (0.0056) [1.80]
Sales taxes	n.a.	n.a.	n.a.
Other taxes	0.0024 (0.0079) [0.30]	0.0047 (0.0108) [0.43]	0.0054 (0.0022) [2.42]
User fees	-0.0044 (0.0086) [-0.52]	-0.0015 (0.0105) [-0.14]	-0.0008 (0.0022) [-0.35]
Federal aid	-0.0050 (0.0071) [-0.69]	-0.0067 (0.0107) [-0.63]	-0.0036 (0.0021) [-1.74]
Deficit	0.0028 (0.0069) [0.40]	0.0043 (0.0102) [0.42]	0.0025 (0.0019) [1.30]
Health	0.0087 (0.0127) [0.69]	0.0012 (0.0157) [0.08]	-0.0046 (0.0039) [-1.19]

TABLE 6.5.1 (continued)
Re-estimation of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Columns 1-2, page 28

	ESTIMATES		
VARIABLE	*1967-1976*	*1977-1988*	*1977-1997*
Higher education	-0.0004 (0.0098) [-0.04]	-0.0049 (0.0148) [-0.33]	-0.0018 (0.0038) [-0.48]
Primary and secondary education	0.0032 (0.0079) [0.41]	-0.0012 (0.0128) [-0.09]	-0.0033 (0.0028) [-1.18]
Highways	0.0054 (0.0080) [0.67]	0.0048 (0.0122) [0.39]	0.0051 (0.0029) [1.75]
Other expenditures	0.0012 (0.0074) [0.16]	0.0001 (0.0113) [0.01]	0.0012 (0.0023) [0.50]
Lagged dependent variable	0.6713 (0.1519) [4.42]	0.6999 (0.2288) [3.06]	0.7166 (0.0525) [13.66]
Real wage	-0.0003 (0.0050) [-0.06]	0.0080 (0.0121) [0.66]	0.0042 (0.0041) [1.02]
Electric price	n.a.	n.a.	n.a.
Industry mix	n.a.	n.a.	n.a.
Unionization	0.0001 (0.0012) [0.07]	0.0002 (0.0015) [0.13]	-0.0002 (0.0005) [-0.46]

TABLE 6.5.1 (continued)
Re-estimation of Carroll and Wasylenko (1994): Total Nonagricultural Employment Equation, Table 3, Columns 1-2, page 28

	ESTIMATES		
VARIABLE	***1967-1976***	***1977-1988***	***1977-1997***
Productivity	-0.000003 (0.000001) [-2.73]	-0.000002 (0.000002) [-0.97]	-0.0005 (0.0002) [-2.99]
Density	0.0002 (0.0007) [0.31]	0.0005 (0.0014) [0.32]	0.0003 (0.0004) [0.66]
Old	-0.0052 (0.0099) [-0.52]	-0.0156 (0.0159) [-0.98]	-0.0017 (0.0025) [-0.69]
Young	-0.0097 (0.0073) [-1.33]	-0.0256 (0.0119) [-2.16]	-0.0099 (0.0023) [-3.15]
Intercept	0.0088 (0.0080) [1.10]	-0.0368 (0.0088) [-4.19]	0.0058 (0.0031) [1.84]
R^2	0.65	0.72	0.65
Observations	480	576	960

NOTE: The dependent variable is *Total nonagricultural employment.* Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 6.5.2
Re-estimation of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Columns 1-2, page 29

	ESTIMATES		
VARIABLE	***1967-1983***	***1984-1988***	***1977-1997***
Property	-0.0210 (0.0084) [-2.49]	-0.0166 (0.0672) [0.25]	-0.0126 (0.0053) [-2.36]
Personal income	-0.0012 (0.0093) [-0.13]	-0.0019 (0.0592) [-0.03]	0.0040 (0.0060) [0.67]
Corporate income	-0.0125 (0.0164) [-0.76]	0.0003 (0.0823) [0.00]	0.0080 (0.0113) [0.70]
Sales taxes	n.a.	n.a.	n.a.
Other taxes	-0.0089 (0.0082) [-1.08]	0.0039 (0.0547) [0.07]	0.0051 (0.0045) [1.14]
User fees	-0.0110 (0.0082) [-1.34]	-0.0061 (0.0533) [0.11]	-0.0019 (0.0044) [-0.44]
Federal aid	-0.0142 (0.0078) [-1.82]	-0.0104 (0.0528) [-0.20]	-0.0049 (0.0042) [-1.18]
Deficit	0.0128 (0.0075) [1.70]	0.0077 (0.0529) [0.15]	0.0037 (0.0039) [0.95]
Health	0.0237 (0.0128) [1.85]	0.0096 (0.0803) [0.12]	0.0039 (0.0078) [0.50]

TABLE 6.5.2 (continued)
Re-estimation of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Columns 1-2, page 29

	ESTIMATES		
VARIABLE	*1967-1983*	*1984-1988*	*1977-1997*
Higher education	-0.0020 (0.0109) [-0.19]	-0.0103 (0.0719) [-0.14]	-0.0119 (0.0076) [-1.56]
Primary and secondary education	0.0103 (0.0088) [1.17]	0.0037 (0.0699) [0.05]	-0.0066 (0.0056) [-1.18]
Highways	0.0153 (0.0087) [1.76]	0.0024 (0.0666) [0.04]	0.0048 (0.0058) [0.82]
Other expenditures	0.0047 (0.0082) [0.58]	0.0019 (0.0555) [0.03]	0.0006 (0.0046) [0.14]
Lagged dependent variable	0.6217 (0.1315) [4.73]	0.9228 (1.6398) [0.56]	0.7937 (0.0881) [9.01]
Real wage	0.0008 (0.0061) [0.13]	-0.0162 (0.0689) [-0.24]	0.0028 (0.0083) [0.33]
Electric price	n.a.	n.a.	n.a.
Industry mix	0.0003 (0.0001) [1.89]	0.0001 (0.0013) [0.08]	0.0001 (0.0001) [0.57]
Unionization	0.0006 (0.0013) [0.47]	0.0003 (0.0081) [0.04]	-0.0001 (0.0011) [-0.06]

TABLE 6.5.2 (continued)
Re-estimation of Carroll and Wasylenko (1994): Manufacturing Employment Equation,
Table 4, Columns 1-2, page 29

	ESTIMATES		
VARIABLE	*1967-1983*	*1984-1988*	*1977-1997*
Productivity	0.000003 (0.000001) [-2.67]	0.000001 (0.00001) [0.08]	-0.0002 (0.0003) [-0.61]
Density	-0.0009 (0.0009) [-1.01]	-0.0029 (0.0056) [-0.52]	-0.0023 (0.0008) [-2.93]
Old	-0.0115 (0.0108) [-1.07]	-0.0120 (0.0685) [-0.17]	-0.0016 (0.0049) [-0.33]
Young	-0.0196 (0.0083) [-2.35]	0.0049 (0.0616) [0.08]	-0.0056 (0.0063) [-0.89]
Intercept	0.0173 (0.0083) [2.09]	-0.0089 (0.0328) [-0.27]	0.0040 (0.0059) [0.67]
R^2	0.69	0.58	0.61
Observations	816	240	960

NOTE: The dependent variable is *Manufacturing employment*. Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

V. PART THREE: Repeating the Empirical Analysis Using Data from an Identical Time Period (1977-1997) and A Common Dependent Variable

In this section, I repeat the analysis of the previous section except that all of the re-estimations employ data from an identical time period *and* a common dependent variable. All of the analyses use a dependent variable that is some variant of *Per Capita Personal Income (PCPI). PCPI* is generally regarded as the variable that best measures the overall prosperity of states' economies. In a few instances, I also make some minor modifications to the variables. For example, in re-estimating Vedder's *GROWTH* equation for the 1977-1997 period, I calculated the variable *TAXCHANGE* using data from 1977-1996 (following Vedder's original methodology). For the sake of consistency, the regression results in this section redefine *TAXCHANGE* using data from 1977-1997. The main result from this section is that taxes are generally estimated to have an insignificant effect on *PCPI.* In most cases, the corresponding coefficient is estimated to be positive.

Vedder's (1996) original study examined the impact of taxes on three different dependent variables: *GROWTH*, *POPULATION CHANGE*, and *TOTAL REAL PERSONAL INCOME GROWTH. GROWTH* is the name that Vedder uses for real PCPI growth. Table 7.1 reports the results of estimating Vedder's original specifications using *Real PCPI Growth* for the time period 1977-1997. Since all four equations in Table 7.1 have the same dependent variable, the only difference across equations is the set of explanatory variables.

The key coefficients in Table 7.1 are those of the tax variables *TAX77* and *TAXCHANGE.* The size and statistical significance of these coefficients are substantially impacted by the set of explanatory variables included in the equation. In the simplest

equation (cf. "Equation 1" column), which includes only a constant term and the two tax variables, both coefficients are estimated to be negative and statistically significant. In the fourth equation (cf. "Table 8.3" column), one of the tax coefficients is positive and one is negative, but both are insignificant.

The specification in the fourth equation is noteworthy because this equation has an *Adjusted* R^2 value that is substantially higher than the other equations (0.490 versus the next highest value of 0.300). This means that the fourth equation has much greater explanatory power than the other equations and thus should be accorded greater importance. The bottom line is that Vedder's (1996) results are not robust to the inclusion of other explanatory variables. In the preferred equation, the tax coefficients have mixed signs and are statistically insignificant.

Table 7.2 reports the re-estimation analysis for Becsi's (1996) study. Becsi's original study used relative PCPI growth as the dependent variable. My re-estimation uses the same dependent variable. As a result, the resulting estimates are identical to the 1977-1997 results presented in Table 6.2.1. As I noted in discussing those results, the tax variable has an estimated positive coefficient and is statistically insignificant.

Helms' (1985) original study examined the impact of taxes on the log of real *Personal Income*. I re-estimate his equation, replacing the log of real *Personal Income* with the log of real *PCPI* for the dependent variable. The results are similar to the 1977-1997 results reported in Tables 6.3.1 and 6.3.2. Only one of the four tax coefficients is negative, though it is statistically significant (cf. Table 7.3). Three of the four tax coefficients are estimated to be positive, and each of these is significant.

Mofidi and Stone's (1990) original study examined the impact of taxes on the five-year, log percentage change in *Manufacturing employment*. In my re-estimation, I substitute the five-year, log percentage change in real *PCPI* for the dependent variable. In the *Manufacturing employment* equation using data from 1977-1997 and reported in Table 6.4.1, I estimated a negative but insignificant effect of taxes. With real *PCPI* as the dependent variable, the same specification results in a positive but statistically insignificant, estimated tax impact (cf. Table 7.4).

Carroll and Wasylenko's (1994) study, like Mofidi and Stone's study, focused on the impact of taxes on the one-year difference in the log of employment. Table 7.5 reports the estimated impact when the dependent variable is the one-year difference in the log of real *PCPI*. The results are similar despite the change in the dependent variable. The re-estimation uses five tax variables. Four of the tax variables have positive estimated coefficients, while one has a negative estimated coefficient. Three of the five tax coefficients are statistically significant; two are positive and one is negative.

TABLE 7.1
Re-estimation of Vedder (1996):
Dependent Variable = Real PCPI Growth (1977-1997)

VARIABLE	ESTIMATES			
	Equation 1 (page 49)	*Table 8.1 (page 52)*	*Table 8.2 (page 55)*	*Table 8.3 (page 58)*
TAX77	-3.73 (1.14) [-3.26]	-0.07 (1.28) [-0.05]	-0.57 (1.23) [-0.47]	1.74 (1.11) [1.57]
TAXCHANGE	-0.36 (0.22) [-1.67]	0.02 (0.18) [0.10]	-0.21 (0.18) [-1.15]	-0.01 (0.15) [-0.09]
UNION[a]	n.a.	-1.22 (0.35) [-3.43]	n.a.	-1.13 (0.26) [-4.40]
SUNSHINE	n.a.	-0.57 (0.19) [-3.06]	-0.09 (0.16) [-0.56]	-0.45 (0.16) [-2.89]
WAGES[b]	n.a.	0.51 (0.13) [3.80]	-0.07 (0.15) [-0.46]	n.a.
UNEMPLOYMENT[c]	n.a.	-1.68 (1.09) [1.54]	n.a.	n.a.
FARM[d]	n.a.	n.a.	-1.76 (0.85) [-2.06]	-2.16 (0.57) [-3.79]
ENERGY	n.a.	n.a.	-1.48 (0.40) [-3.74]	-1.69 (0.31) [-5.45]
Constant	73.74 (13.03) [5.66]	45.54 (20.96) [2.17]	57.64 (21.16) [2.72]	64.32 (14.41) [4.46]

TABLE 7.1 (continued)
Re-estimation of Vedder (1996):
Dependent Variable = Real PCPI Growth (1977-1997)

	ESTIMATES			
VARIABLE	***Equation 1 (page 49)***	***Table 8.1 (page 52)***	***Table 8.2 (page 55)***	***Table 8.3 (page 58)***
Adjusted R^2	0.155	0.300	0.253	0.490
Observations	50	48	48	48

NOTE: The dependent variable is *Real PCPI Growth (1977-1997)*, where

$$\textit{Real PCPI Growth (1977-1997)}_s = \left(\frac{X_{s,1997} - X_{s,1977}}{X_{s,1977}} \right) \times 100, \text{ and}$$

$$X_{s,t} = \left(\frac{\textit{Personal Income}_{s,t}}{\textit{Population}_{s,t}} \right) \times \left(\frac{CPI_{1982}}{CPI_t} \right).$$ Unless noted otherwise below, variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic for the first column are 2.012 (α=0.05) and 1.678 (α=0.10). Critical values (two-tailed) for columns 2-4 are 2.020 (α=0.05) and 1.683 (α=0.10).

[a] ***UNION*** is the unionization rate from 1987.
[b] ***WAGES*** uses wage data from 1977, 1984, 1990, and 1997 and is otherwise defined as in Table A1.
[c] ***UNEMPLOYMENT*** is the average unemployment rate from 1977-1997.
[d] ***FARM*** uses farm and income data from 1987.

TABLE 7.2
Re-estimation of Becsi (1996), Equation (R1), page 32:
Dependent Variable = Relative PCPI Growth (1977-1997)

VARIABLE	ESTIMATES
RMTR7792	0.0043 (0.0069) [0.62]
RPCPI76	-0.0139 (0.0079) [-1.76]
RR7797	0.0396 (0.0363) [1.09]
Constant	-0.1066 (0.0827) [-1.29]
Adjusted R^2	0.198
Observations	50

NOTE: Dependent variable is *Relative PCPI Growth (1977-1997)*, where *Relative PCPI Growth (1977-1997)* $= \left(\left(\frac{X_{s,1997}}{X_{s,1977}} \right)^{1/20} - \left(\frac{X_{US,1997}}{X_{US,1977}} \right)^{1/20} \right) \times 100$, $X_{i,t} = \left(\frac{Personal\ Income_{i,t}}{Population_{i,t}} \right)$, and i indexes an individual state or the entire U.S., respectively. Variables are defined in Table A2 with the appropriate adjustment in years. Huber/White standard errors are reported in parentheses; t-statistics are reported in brackets. Critical values (two-tailed) for the t-statistic are 2.0129 (α=0.05) and 1.6787 (α=0.10).

TABLE 7.3
Re-estimation of Helms (1985):
Dependent Variable = Log of Real PCPI

VARIABLE	ESTIMATES *LSC equation* *Table 1* *(page 579)*	 *IVC equation* *Table 1* *(page 579)*
Property tax	-0.0072 (0.0025) [-2.84]	0.0195 (0.0089) [2.19]
Other taxes	0.0045 (0.0025) [1.78]	0.0367 (0.0105) [3.48]
User fees	0.0003 (0.0025) [0.12]	0.0312 (0.0102) [3.08]
Deficit	-0.0037 (0.0022) [-1.68]	0.0301 (0.0110) [2.74]
Federal source revenue	0.0008 (0.0022) [0.36]	0.0190 (0.0063) [3.05]
Health	0.0002 (0.0036) [0.06]	-0.0323 (0.0111) [-2.91]
Highways	0.0035 (0.0031) [1.12]	-0.0204 (0.0083) [-2.46]
Local schools	-0.0015 (0.0032) [-0.46]	-0.0313 (0.0101) [-3.10]
Higher education	0.0092 (0.0048) [1.92]	-0.0261 (0.0124) [-2.10]

TABLE 7.3 (continued)
Re-estimation of Helms (1985):
Dependent Variable = Log of Real PCPI

VARIABLE	ESTIMATES *LSC equation Table 1 (page 579)*	*IVC equation Table 1 (page 579)*
Other expenditures	-0.0044 (0.0028) [-1.59]	-0.0360 (0.0104) [-3.45]
Relative wage	0.0003 (0.0002) [1.38]	0.0003 (0.0002) [1.18]
Unionization rate	0.0001 (0.0004) [0.16]	0.0003 (0.0005) [0.63]
Population density	-0.00003 (0.0001) [-0.39]	0.00001 (0.0001) [0.07]
ln Y_{t-1}	0.8464 (0.0208) [40.77]	0.8089 (0.0261) [30.97]
Standard Error of the Equation	0.0170	0.0169
Observations	960	960

NOTE: Dependent variable is *Log of Real PCPI*, where $Log\ of\ Real\ PCPI_{s,t} = ln\left(\left(\frac{Personal\ Income_{s,t}}{Population_{s,t}}\right)\times\left(\frac{CPI_{1982}}{CPI_t}\right)\right)$. Variables are defined in Table A3 with the appropriate adjustment in years. A constant term and two-way fixed effects (state and year) year were also included in the regression equation. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 7.4
Re-estimation of Mofidi and Stone (1990), Employment(a) Equation, Table 1, page 689:
Dependent Variable = Five-year, Log Percentage Change in Real PCPI

VARIABLE	ESTIMATES
Taxes	0.10 (0.58) [0.18]
Other revenues	-1.25 (0.55) [-2.27]
Health	0.18 (1.13) [0.16]
Education	0.33 (0.85) [0.39]
Highways	0.10 (0.96) [0.10]
Other expenditures	1.15 (0.59) [1.94]
Surplus(Deficit)	0.66 (0.55) [1.21]
UI Benefits	3.52 (1.11) [3.18]
Unemployment rate	-1.49 (0.19) [-7.92]

TABLE 7.4 (continued)
Re-estimation of Mofidi and Stone (1990), Employment(a) Equation, Table 1, page 689:
Dependent Variable = Five-year, Log Percentage Change in Real PCPI

VARIABLE	ESTIMATES
Female ratio	-0.67 (0.63) [-1.06]
Nonwhite ratio	0.04 (0.10) [0.41]
Age 13-17 ratio	n.a.
Age 18-65 ratio	2.21 (0.35) [6.40]
Union ratio	0.50 (0.18) [2.83]
Industry mix ratio[a]	-0.15 (0.16) [-0.95]
North	-2.16 (0.67) [-3.23]
South	-1.19 (0.67) [-1.79]
West	-3.06 (0.74) [-4.15]

TABLE 7.4 (continued)
Re-estimation of Mofidi and Stone (1990), Employment(a) Equation, Table 1, page 689:
Dependent Variable = Five-year, Log Percentage Change in Real PCPI

VARIABLE	ESTIMATES
1982-87	10.17 (1.42) [7.17]
1987-92	5.74 (1.50) [3.83]
1992-97	4.54 (1.29) [3.53]
Intercept	2.75 (1.33) [2.07]
R^2	0.82
Observations	200

NOTE: The dependent variable is *Five-year, Log Percentage Change in Real PCPI*, where *Five-year, Log Percentage Change in Real PCPI* =

$$\left[ln\left(\left(\frac{Personal\ Income_{s,t}}{Population_{s,t}}\right)\times\left(\frac{CPI_{1982}}{CPI_t}\right)\right) - ln\left(\left(\frac{Personal\ Income_{s,t-5}}{Population_{s,t-5}}\right)\times\left(\frac{CPI_{1982}}{CPI_{t-5}}\right)\right)\right]\times 100.$$

Unless noted otherwise below, variables are defined in Table A4 with the appropriate adjustment in years. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

[a] ***Industry mix ratio*** uses BEA *Durable goods employment* and BLS *Total nonagricultural employment.*

TABLE 7.5
Re-estimation of Carroll and Wasylenko (1994):
Dependent Variable = One-Year Difference in Log of Real PCPI

VARIABLE	ESTIMATES
Property	-0.0082 (0.0031) [-2.64]
Personal income	0.0055 (0.0036) [1.50]
Corporate income	0.0181 (.0078) [2.32]
Sales taxes[a]	0.0033 (0.0030) [1.09]
Other taxes	0.0106 (0.0036) [2.93]
User fees	0.0025 (0.0026) [0.99]
Federal aid	0.0001 (0.0024) [0.05]
Deficit	-0.0010 (0.0023) [-0.42]
Health	-0.0030 (0.0045) [-0.66]

TABLE 7.5 (continued)
Re-estimation of Carroll and Wasylenko (1994):
Dependent Variable = One-Year Difference in Log of Real PCPI

VARIABLE	ESTIMATES
Higher education	0.0080 (0.0044) [1.81]
Primary and secondary education	0.0044 (0.0033) [1.33]
Highways	0.0023 (0.0034) [0.68]
Other expenditures	-0.0034 (0.0027) [-1.27]
Lagged dependent variable	-0.3461 (0.1741) [-1.99]
Real wage	0.0112 (0.0048) [2.31]
Electric price	-0.0006 (0.0009) [-0.74]
Industry mix	-0.00001 (0.0001) [-0.15]
Unionization	0.0006 (0.0006) [1.00]

TABLE 7.5 (continued)
Re-estimation of Carroll and Wasylenko (1994):
Dependent Variable = One-Year Difference in Log of Real PCPI

VARIABLE	ESTIMATES
Productivity[b]	0.0006 (0.0002) [3.11]
Density	0.0003 (0.0005) [0.57]
Old	-0.0009 (0.0029) [-0.30]
Young	-0.0258 (0.0037) [-6.98]
Intercept	0.0253 (0.0040) [6.42]
R^2	0.59
Observations	960

NOTE: The dependent variable is *One-Year Difference in Log of Real PCPI*, where *One-Year Difference in Log of Real PCPI* =

$$ln\left(\left(\frac{Personal\ Income_{s,t}}{Population_{s,t}}\right)\times\left(\frac{CPI_{1982}}{CPI_t}\right)\right)-ln\left(\left(\frac{Personal\ Income_{s,t-1}}{Population_{s,t-1}}\right)\times\left(\frac{CPI_{1982}}{CPI_{t-5}}\right)\right).$$

Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

[a] ***Sales taxes*** is defined as the ratio of *State and Local Total Sales and Gross Receipt Taxes* over *Personal Income.*

[b] ***Productivity*** uses BEA's Gross State Product series.

VI. PART FOUR: Repeating the Empirical Analysis Using Data from an Identical Time Period (1977-1997) and A Common Dependent Variable

In this section, I repeat the analysis of the previous section except that I correct for a possible accounting perversity that might cause problems in the estimates, particularly in the panel studies. In the previous section, I often found a positive relationship between tax burden changes and PCPI. This conflicts with the original finding of the five studies and conflicts with my replication of those studies.

It is difficult to imagine a plausible economic rationale for why increasing taxes to fund welfare payments will increase economic development. However, there is an accounting explanation. The Bureau of Economic Analysis measures *Personal Income* before taxes are subtracted. Welfare payments are included in its calculation of *Personal Income*. This amounts to double counting and leads to the following accounting perversity: A state that raised taxes by $1 billion and used those tax revenues to fund public welfare payments would increase its measured *Personal Income* by $1 billion.[18]

For example, suppose that society consisted of person A with a Personal Income of $100 and person B with a Personal Income of $10. Total Personal Income would be $110. Now suppose that the government taxed person A one dollar and transferred it to person B. Taxes are not taken out of Personal Income but transfer payments are included in Personal Income, so Total Personal Income would increase to $111.

Note that this problem is exacerbated in models that employ a Helms-type budget constraint. In this framework, welfare expenditures are omitted to avoid multicollinearity. Helms-type models are designed to address the following question:

[18] Dr. Larkin Warner suggested this explanation to me. Dr. James Wilbanks also suggested this as a possibility.

what happens to income if a state increases taxes and spends the extra revenue on welfare payments?

If state and local authorities raised taxes with the intent of increasing welfare payments by the dollar amount of the tax increase (which is what the model assumes), income would be increased by the amount of welfare expenditure increase. If welfare payments are an important enough component of Personal Income, there could be spurious correlation between taxes and income in these types of models.

FIGURE ONE:
Welfare Payments as a Percentage of Personal Income

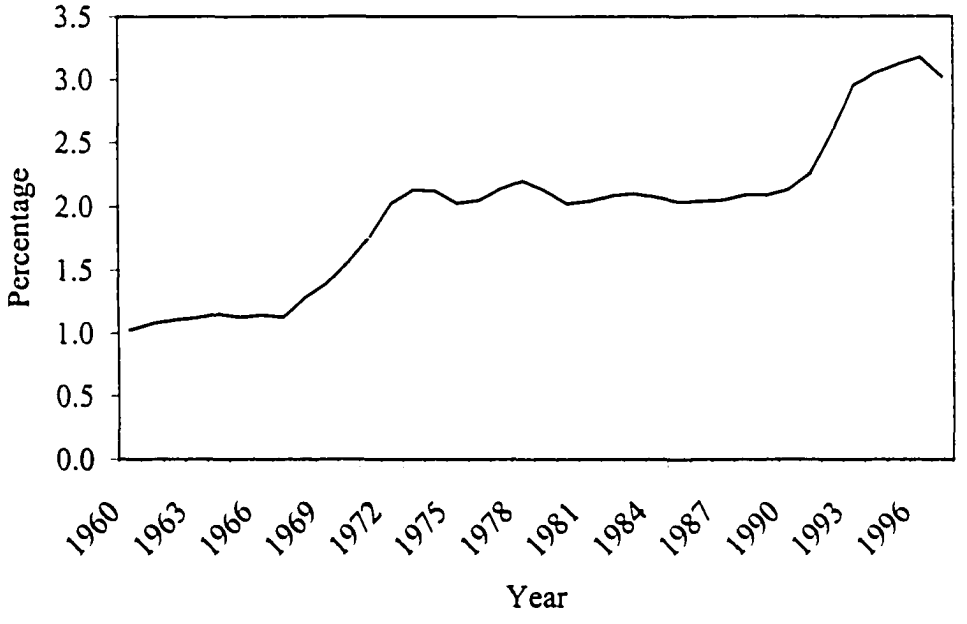

Figure One illustrates how welfare payments, as a percentage of Personal Income, have increased over time for all fifty states. Note that while welfare expenditures are relatively small (usually one to five percent of Personal Income), they increase in size

over time, especially during the nineties. This could explain the tendency to estimate more positive coefficients during the later time-period.

In order to correct for this accounting consequence, I repeat the analysis of the previous section with the following exception: I replace the dependent variable *Per Capita Personal Income* with a new variable called *Net Per Capita Personal Income* (*NPCPI*).

$$NPCPI_{i,t} = \left(\frac{Personal\ Income_{i,t-1} - Welfare\ Expeditures_{i,t}}{Population_{i,t-1}} \right)$$

This should eliminate any built-in accounting bias that might be tainting my analysis.

Table 8.1 reports the tax coefficients from re-estimation of all the models with the new dependent variable, comparing them to the coefficients estimated in Part Three.[19] If the accounting bias is a problem, I expect the re-estimated tax coefficients to be less positive/more negative using the dependent variable *NPCPI*.

Indeed that is what I find. Eleven of the fifteen tax coefficients reported in Table 8.1 become either less positive or more negative. Furthermore, the models that I expect to perform "better" with the new dependent variable do tend to perform better.

I expect the coefficients in the Vedder and Becsi models to remain similar to what was estimated in Part Three. Their models have no Helms-type budget constraint so there should be no accounting bias. The accounting bias, if it is in fact a problem, should be more evident in the studies that employ the Helms-type budget constraint (Helms, Mofidi and Stone, and Carroll and Wasylekno.) These studies are more vulnerable to the accounting bias because they are designed to estimate the impact that a tax increase has

[19] The full results of all the models are presented in tables 8.2-8.6.

on Personal Income if the additional revenue is spent on welfare. Vedder and Becsi's model make no such assumptions.

The tax coefficients in Vedder's and Becsi's models are very similar to what I estimated in Part Three.[20] The one exception is a sign change on the *TAX77* coefficient in Vedder's Income Equation.

The estimated coefficients on the tax variables in the three panel studies (Helms, Mofidi and Stone, and Carroll and Wasylenko) show many differences. When Per Capita Personal Income is used as a dependent variable only three of the ten tax coefficients are estimated to be negative (two of the three are significant). The other seven have a positive sign (four of the seven are significant). When Net Per Capita Personal Income is used as a dependent variable, seven of the ten tax coefficients are estimated to be negative (none of the seven are significant). Only three are positive, with one being significant.

Of the three models, Carroll and Wasylenko's shows the greatest change with regard to the new dependent variable. Using Per Capita Personal Income, four of five coefficients are positive (with two of the five being significant). When Net Per Capita Personal Income is used, four of five coefficients are negative. Helms' model changes slightly. Using Per Capita Personal Income, two of the four coefficients are positive and significant. When Net Per Capita Personal Income is used, only one of the coefficients in Helms' model is positive, and it is insignificant. Mofidi and Stone's model shows little change from using the new dependent variable.

[20] I only consider Vedder's original Per Capita Income Growth and Total Income Growth equations here. The full results of all four of his equations can be found in Table 8.2.

Clearly, changing the dependent variable to address the accounting bias issue generally "improved" the performance of five models. I expect to find negative coefficients on all tax variables. While I do not find negative coefficients on all of the tax variables, I estimate negative coefficients more frequently.

This result suggests that the accounting bias issue present in these models could be a source of spurious correlation between tax burdens and Personal Income. Welfare payments have risen during the past forty years and may be a significant enough fraction of Personal Income to reverse the signs of the tax coefficients.

TABLE 8.1
Tax Estimates from the Five Models Using Per Capita Personal Income and Net (of Welfare Expenditures) Per Capita Personal Income (1977-1997)

	ESTIMATES	
STUDY TAX VARIABLE (Model)	***Dependent Variable: Per Capita Personal Income***	***Dependent Variable: Net Per Capita Personal Income***
VEDDER	-0.07	-0.67
$TAX77_s$	(1.28)	(1.33)
(Growth Equation)	[-0.05]	[-0.05]
VEDDER	1.74	0.96
$TAX77_s$	(1.11)	(1.18)
(Income Equation)	[1.57]	[0.82]
VEDDER	0.02	-0.11
$TAXCHANGE_s$	(0.18)	(0.19)
(Growth Equation)	[0.10]	[0.58]
VEDDER	-0.01	-0.11
$TAXCHANGE_s$	(0.15)	(0.16)
(Income Equation)	[-0.09]	[-0.68]
BECSI	0.0043	0.0039
$RMTR7797_s$	(0.0069)	(0.007)
	[0.62]	[0.53]
HELMS	-0.0072	-0.0036
$PROPERTY\ TAX_{i,s}$	(0.0045)	(0.0023)
(Fixed Effects Model/OLS)	[-2.44]	[-1.55]
HELMS	-0.0045	0.0025
$OTHER\ TAXES_{i,s}$	(0.0025)	(0.0023)
(Fixed Effects Model/OLS)	[-1.78]	[1.08]
HELMS	0.0195	-0.0058
$PROPERTY\ TAX_{i,s}$	(0.0089)	(0.0088)
(Fixed Effects Model/IV)	[2.91]	[-0.66]

TABLE 8.1 (Continued)
Tax Estimates from the Five Models Using Per Capita Personal Income and Net (of Welfare Expenditures) Per Capita Personal Income (1977-1997)

	ESTIMATES	
STUDY TAX VARIABLE (Model)	***Dependent Variable: Per Capita Personal Income***	***Dependent Variable: Net Per Capita Personal Income***
HELMS	0.0367	-0.0007
OTHER TAXES	(0.0105)	(0.0069)
(Fixed Effects Model/IV)	[3.48]	[-0.10]
MOFIDI AND STONE	0.10	0.45
$TAXES_{i,s}$	(0.58)	(0.56)
	[0.18]	[0.81]
CARROLL AND WASYLENKO	-0.0082	-0.0004
$PROPERTY_{i,s}$	(0.0036)	(0.0023)
	[-2.26]	[-0.17]
CARROLL AND WASYLENKO	0.0055	-0.0023
$PERSONAL\ INCOME_{i,s}$	(0.0043)	(0.0027)
	[1.29]	[-0.85]
CARROLL AND WASYLENKO	0.0181	-0.0010
$CORPORATE\ INCOME_{i,s}$	(0.0091)	(0.0058)
	[1.99]	[-0.17]
CARROLL AND WASYLENKO	0.0033	-0.0100
$SALES\ TAXES_{i,s}$	(0.0036)	(0.0023)
	[0.93]	[-4.41]
CARROLL AND WASYLENKO	0.0106	0.0068
$OTHER\ TAXES_{i,s}$	(0.0042)	(0.0027)
	[2.50]	[3.19]

NOTE: Standard errors are reported in parentheses, t-statistics are reported in brackets.

TABLE 8.2
Re-estimation of Vedder (1996):
Dependent Variable = Real Net PCPI Growth (1977-1997)

	ESTIMATES			
VARIABLE	***Equation 1 (page 49)***	***Table 8.1 (page 52)***	***Table 8.2 (page 55)***	***Table 8.3 (page 58)***
TAX77	-4.49 (1.14) [-3.94]	-0.67 (1.33) [-0.50]	-0.75 (1.23) [-0.61]	0.96 (1.18) [0.82]
TAXCHANGE	-0.45 (0.22) [-2.07]	-0.11 (0.19) [-0.58]	-0.28 (0.18) [-1.55]	-0.11 (0.16) [-0.68]
UNION[a]	n.a.	-0.96 (0.38) [-2.52]	n.a.	-0.96 (0.27) [-3.52]
SUNSHINE	n.a.	-0.52 (0.19) [-2.66]	-0.11 (0.16) [-0.67]	-0.41 (0.17) [-2.44]
WAGES[b]	n.a.	0.39 (0.15) [2.55]	-0.15 (0.16) [-0.95]	n.a.
UNEMPLOYMENT[c]	n.a.	-1.97 (1.13) [-1.74]	n.a.	n.a.
FARM[d]	n.a.	n.a.	-1.59 (0.84) [-1.89]	-1.64 (0.61) [-2.71]
ENERGY	n.a.	n.a.	-1.37 (0.38) [-3.58]	-1.50 (0.33) [-4.54]
Constant	87.54 (12.99) [6.74]	64.73 (21.77) [2.97]	72.96 (21.09) [3.46]	71.68 (15.31) [4.68]

TABLE 8.2 (continued)
Re-estimation of Vedder (1996):
Dependent Variable = Real Net PCPI Growth (1977-1997)

	ESTIMATES			
VARIABLE	***Equation 1 (page 49)***	***Table 8.1 (page 52)***	***Table 8.2 (page 55)***	***Table 8.3 (page 58)***
Adjusted R^2	0.222	0.195	0.214	0.384
Observations	50	48	48	48

NOTE: The dependent variable is *Net Real PCPI Growth (1977-1997)*, where

$$\textit{Real Net PCPI Growth (1977-1997)}_s = \left(\frac{X_{s,1997} - X_{s,1977}}{X_{s,1977}} \right) \times 100, \text{ and}$$

$$X_{s,t} = \left(\frac{\textit{Personal Income}_{s,t-1} - \textit{Welfare Expenditures}_{s,t}}{\textit{Population}_{s,t-1}} \right) \times \left(\frac{CPI_{1982}}{CPI_t} \right).$$

Unless noted otherwise below, variables are defined in Table A1. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic for the first column are 2.012 (α=0.05) and 1.678 (α=0.10). Critical values (two-tailed) for columns 2-4 are 2.020 (α=0.05) and 1.683 (α=0.10).

[a] ***UNION*** is the unionization rate from 1987.
[b] ***WAGES*** uses wage data from 1977, 1984, 1990, and 1997 and is otherwise defined as in Table A1.
[c] ***UNEMPLOYMENT*** is the average unemployment rate from 1977-1997.
[d] ***FARM*** uses farm and income data from 1987.

TABLE 8.3
Re-estimation of Becsi (1996), Equation (R1), page 32:
Dependent Variable = Relative Net PCPI Growth (1977-1997)

VARIABLE	ESTIMATES
RMTR7792	0.0039 (0.007) [0.53]
RPCPI76	-0.0165 (0.009) [-1.79]
RR7797	0.0383 (0.036) [1.06]
Constant	-0.1104 (0.089) [-1.25]
Adjusted R^2	0.244
Observations	50

NOTE: Dependent variable is *Relative PCPI Growth (1977-1997)*, where *Relative Net PCPI Growth (1977-1997)* $= \left(\left(\frac{X_{s,1997}}{X_{s,1977}} \right)^{1/20} - \left(\frac{X_{US,1997}}{X_{US,1977}} \right)^{1/20} \right) \times 100$, $X_{i,t} = \left(\frac{Personal\ Income_{i,t-1} - Welfare\ Expeditures_{i,t}}{Population_{i,t-1}} \right)$, and i indexes an individual state or the entire U.S., respectively. Variables are defined in Table A2 with the appropriate adjustment in years. Huber/White standard errors are reported in parentheses; t-statistics are reported in brackets. Critical values (two-tailed) for the t-statistic are 2.0129 (α=0.05) and 1.6787 (α=0.10).

TABLE 8.4
Re-estimation of Helms (1985):
Dependent Variable = Log of Real Net PCPI

VARIABLE	ESTIMATES *LSC equation Table 1 (page 579)*	*IVC equation Table 1 (page 579)*
Property tax	-0.0036 (0.0023) [-1.55]	-0.0058 (0.0088) [-0.66]
Other taxes	0.0025 (0.0023) [1.08]	-0.0007 (0.0069) [-0.10]
User fees	-0.0022 (0.0023) [-0.99]	-0.0050 (0.0069) [-0.73]
Deficit	-0.0005 (0.0021) [-0.24]	-0.0065 (0.0051) [-1.28]
Federal source revenue	-0.0100 (0.0020) [-5.06]	-0.0107 (0.0083) [-1.29]
Health	0.0003 (0.0033) [0.08]	0.0030 (0.0141) [0.21]
Highways	0.0038 (0.0029) [1.31]	0.0060 (0.0127) [0.48]
Local schools	-0.0045 (0.0029) [-1.55]	-0.0044 (0.0119) [-0.37]
Higher education	-0.0108 (0.0044) [-2.44]	-0.0090 (0.0199) [-0.45]

TABLE 8.4 (continued)
Re-estimation of Helms (1985):
Dependent Variable = Log of Real Net PCPI

VARIABLE	ESTIMATES *LSC equation* *Table 1* *(page 579)*	 *IVC equation* *Table 1* *(page 579)*
Other expenditures	-0.0095 (0.0025) [-3.83]	-0.0075 (0.0082) [-0.91]
Relative wage	0.0007 (0.0002) [3.54]	0.0007 (0.0009) [0.73]
Unionization rate	-0.000004 (0.0004) [-0.01]	-0.0001 (0.0020) [-0.05]
Population density	0.00003 (0.0001) [0.34]	0.00003 (0.0004) [0.08]
ln Y_{t-1}	0.7759 (0.0203) [38.28]	0.7829 (0.1025) [7.64]
Standard Error of the Equation	0.0157	0.0153
Observations	960	960

NOTE: Dependent variable is *Log of Real Net PCPI,* where

$$\text{Log of Real Net PCPI}_{s,t} = \ln\left(\left(\frac{Personal\ Income_{s,t-1} - WE_{s,t}}{Population_{s,t-1}}\right) \times \left(\frac{CPI_{1982}}{CPI_t}\right)\right)$$

WE is Welfare expenditures. Variables are defined in Table A3 with the appropriate adjustment in years. A constant term and two-way fixed effects (state and year) year were also included in the regression equation. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

TABLE 8.5
Re-estimation of Mofidi and Stone (1990), Employment(a) Equation, Table 1, page 689:
Dependent Variable = Five-year, Log Percentage Change in Real Net PCPI

VARIABLE	ESTIMATES
Taxes	0.45 (0.56) [0.81]
Other revenues	-0.64 (0.53) [-1.21]
Health	-0.86 (1.09) [-0.79]
Education	-0.64 (0.82) [-0.78]
Highways	-0.79 (0.93) [-0.85]
Other expenditures	0.84 (0.57) [1.47]
Surplus(Deficit)	-0.21 (0.53) [-0.40]
UI Benefits	3.98 (1.07) [3.71]
Unemployment rate	-0.67 (0.18) [-3.67]

TABLE 8.5 (continued)
Re-estimation of Mofidi and Stone (1990), Employment(a) Equation, Table 1, page 689:
Dependent Variable = Five-year, Log Percentage Change in Real Net PCPI

VARIABLE	ESTIMATES
Female ratio	-2.12 (0.61) [-3.48]
Nonwhite ratio	0.08 (0.10) [0.85]
Age 13-17 ratio	n.a.
Age 18-65 ratio	1.93 (0.33) [5.77]
Union ratio	0.62 (0.17) [3.63]
Industry mix ratio[a]	-0.24 (0.15) [-1.60]
North	-1.83 (0.65) [-2.82]
South	-1.25 (0.65) [-1.93]
West	-3.51 (0.71) [-4.91]

TABLE 8.5 (continued)
Re-estimation of Mofidi and Stone (1990), Employment(a) Equation, Table 1, page 689:
Dependent Variable = Five-year, Log Percentage Change in Real Net PCPI

VARIABLE	ESTIMATES
1982-87	11.09 (1.37) [8.07]
1987-92	1.19 (1.45) [0.82]
1992-97	5.04 (1.25) [4.05]
Intercept	4.94 (1.29) [3.83]
R^2	0.75
Observations	200

NOTE: The dependent variable is *Five-year, Log Percentage Change in Real PCPI*, where *Five-year, Log Percentage Change in Real Net PCPI* = $\left[\ln\left(\left(\frac{PI_{s,t-1}-WE_{s,t}}{Population_{s,t-1}}\right)\times\left(\frac{CPI_{1982}}{CPI_t}\right)\right)-\ln\left(\left(\frac{PI_{s,t-6}-WE_{s,t-5}}{Population_{s,t-6}}\right)\times\left(\frac{CPI_{1982}}{CPI_{t-5}}\right)\right)\right]\times 100.$ Where WE is Welfare expenditures. PI is Personal Income. Unless noted otherwise below, variables are defined in Table A4 with the appropriate adjustment in years. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

[a] ***Industry mix ratio*** uses BEA *Durable goods employment* and BLS *Total nonagricultural employment.*

TABLE 8.6
Re-estimation of Carroll and Wasylenko (1994):
Dependent Variable = One-Year Difference in Log of Real Net PCPI

VARIABLE	ESTIMATES
Property	-0.0004 (0.0023) [-0.17]
Personal income	-0.0023 (0.0027) [-0.85]
Corporate income	-0.0010 (.0058) [-0.17]
Sales taxes[a]	-0.0100 (0.0023) [-4.41]
Other taxes	0.0068 (0.0027) [3.19]
User fees	-0.0017 (0.0019) [-0.89]
Federal aid	-0.0052 (0.0018) [-2.87]
Deficit	-0.0037 (0.0017) [-2.19]
Health	-0.0083 (0.0034) [-2.45]

TABLE 8.6 (continued)
Re-estimation of Carroll and Wasylenko (1994):
Dependent Variable = One-Year Difference in Log of Real Net PCPI

VARIABLE	ESTIMATES
Higher education	-0.0182 (0.0033) [-5.51]
Primary and secondary education	-0.0146 (0.0024) [-6.00]
Highways	-0.0024 (0.0025) [-0.97]
Other expenditures	-0.0081 (0.0020) [-4.03]
Lagged dependent variable	0.3027 (0.1524) [1.99]
Real wage	0.0115 (0.0036) [3.19]
Electric price	0.0001 (0.0006) [0.19]
Industry mix	-0.000002 (0.0001) [-0.03]
Unionization	-0.00004 (0.0005) [-0.08]

TABLE 8.6 (continued)
Re-estimation of Carroll and Wasylenko (1994):
Dependent Variable = One-Year Difference in Log of Real Net PCPI

VARIABLE	ESTIMATES
Productivity[b]	-0.0001 (0.0001) [-0.58]
Density	0.0012 (0.0003) [3.41]
Old	-0.0089 (0.0021) [-4.21]
Young	-0.0110 (0.0028) [-3.95]
Intercept	0.0086 (0.0033) [2.40]
R^2	0.75
Observations	960

NOTE: The dependent variable is *One-Year Difference in Log of Real PCPI*, where *One-Year Difference in Log of Real Net PCPI* = $\ln\left(\left(\frac{PI_{s,t-1} - WE_{s,t}}{Population_{st-1}}\right)\times\left(\frac{CPI_{1982}}{CPI_t}\right)\right) - \ln\left(\left(\frac{PI_{s,t-2} - WE_{s,t-1}}{Population_{s,t-2}}\right)\times\left(\frac{CPI_{1982}}{CPI_{t-1}}\right)\right)$. WE is Welfare expenditures. PI is Personal Income. Variables are defined in Table A5. Standard errors are reported in parentheses; *t*-statistics are reported in brackets. Critical values (two-tailed) for the *t*-statistic are 1.96 (α=0.05) and 1.65 (α=0.10).

[a] ***Sales taxes*** is defined as the ratio of *State and Local Total Sales and Gross Receipt Taxes* over *Personal Income.*
[b] ***Productivity*** uses BEA's Gross State Product series.

VI. CONCLUSION

This study has engaged in a four-part analysis of the relationship between taxes and economic development. It is the findings of Part Three that should be of most interest to policy-makers. When the original studies are re-estimated using data from 1977-1997 and the dependent variable is made to be a variant of *PCPI*, the results of the original studies are confounded.

Part One of this study established my ability to recreate the data and methodology of the original studies. In Part One, 25 of the 32 tax coefficients that I estimated in my replication had the same sign as the coefficients in the original studies. Most of the signs that differed were on coefficients that were very close to zero.[21]

Part Two of this study simply changed the time-period of the analysis. This change in time-period switched the signs of about half of the coefficients. If the regression model is sound, researchers do not generally believe that the estimated coefficients will change much with a small change in time-period. However, this is what we observe here.

In Part Three, I estimate nineteen tax coefficients (see Tables 7.1-7.5) using a different time-period, and a different dependent variable. If the models in the five studies capture the true relationship between taxes and economic performance, most (if not all) of the coefficients should be negative, like they were in the original studies and my replication in Part One. They are not. Of the nineteen tax coefficients, only eight of them are estimated to be negative and most of the negative coefficients are from the re-estimation of Vedder.

[21] The coefficients in the original studies tended to have more significant coefficients.

In Part Three taxes are generally estimated to have an insignificant effect on *PCPI*. In most cases, the corresponding coefficient is estimated to be positive. As an interesting aside, given this perverse finding, it is doubtful if any of the original studies would have been published had they used more recent data. Because of this, policy makers should not use these studies as rationale for tax policy.

It is highly unlikely that the empirical finding that higher tax rates are associated with increased *PCPI* represents the true relationship between taxes and economic development. There is no plausible economic theory that suggests that increasing taxes to fund welfare transfers will increase economic development. However that is the strict interpretation of the results presented in Tables 7.3, 7.4, and 7.5. Therefore, the perverse empirical relationship that I identify between taxes and *PCPI* is most likely a spurious result. The rest of this section identifies future avenues for research to further investigate this empirical finding.

While it is difficult to imagine a plausible economic theory that suggests that increasing taxes to fund welfare transfers will increase economic development, there is an accounting explanation. The Bureau of Economic Analysis measures *Personal Income* before taxes are subtracted. However, it includes transfer payments in its calculation of *Personal Income*. Therefore there is a bias that leads to the following accounting perversity: A state that raised taxes by $1 billion and used those tax revenues to fund public welfare payments would increase its measured *Personal Income* by $1 billion.

I investigated this possibility in Part Four by using *Net* (of welfare expenditures) *Per Capita Personal Income* as a dependent variable. The results, shown in tables 8.1-8.6 confirm that the "accounting bias" issue is significant: eleven of the fifteen tax

coefficients are negative Part Four. This is in stark contrast to Part Three, where eleven of nineteen coefficients are estimated to be positive.[22]

This suggests that when using a budget constraint framework, it is appropriate to net out welfare spending from the dependent variable. But, not all of the coefficients agree between the author's original time-period and the 1977-1997 time-period. Therefore, there are probably other factors in the data that are causing problems in addition to accounting bias.

The second possibility has to do with "endogeneity". The empirical framework underlying fixed effects, cross-sectional time-series analysis assumes that the tax variables are exogenous. In other words, any correlations observed between changes in taxes and changes in *PCPI* are attributed causally to taxes. However, there are at least three reasons why the direction of causation may go in the other direction, from changes in *PCPI* to changes in taxes.

First, states may adjust tax rates in response to changing economic conditions. The State of Oklahoma is presently experiencing this phenomenon. Because of the recent economic downturn, Oklahoma has a projected budget deficit, which is not allowed by the Oklahoma Constitution. The solution proposed by many state lawmakers is to raise the top marginal tax rate to seven percent. This would also (presumably) increase the tax burden of the state. So there is a relationship between tax burdens and Personal Income that is not the one assumed by these econometric models.

Second, the progressivity of the tax code may induce a correlation between changes in state income and changes in taxes. Becsi (1996) presents evidence that state

[22] Although many of the signs on the tax coefficients do change, the significant coefficients by and large remain unchanged.

tax structures are "progressive." The consequence of this is that state "tax rates" (calculated as the ratio of state and local taxes over Personal Income) will increase as state income increases. This could explain the positive tax coefficients that I observe in my fixed effects, cross-sectional time-series analyses. This source of endogeneity is especially interesting in my case because incomes and tax revenues increased dramatically in the mid-nineties.

Third, voter preference may induce a positive relationship between tax rates and incomes. Many have suggested that government services are luxury goods. Therefore, as incomes increase, demand for government services will soar. Voters are willing to incur a higher tax burden to satisfy their demand for government services. Again, this would cause changes in income to influence changes in tax burdens, not the changes in tax burdens to influence changes in incomes, as these models assume.

While some of the fixed effects, cross-sectional time-series studies acknowledge the possibility of endogeneity, none of them directly address it. Helms (1995) used instrumental variables to correct for endogeneity, but he is concerned with endogeneity between the state's economy and the state's budget deficit. Tax rates are assumed to be exogenous in his analysis.

An obvious direction for future research is to investigate the sources of endogeneity. There is evidence in this dissertation that endogeneity is at least partly responsible for the positive correlations between tax variables and *PCPI*. Table 7.3 demonstrates that the signs and significance levels of the other fiscal variables are highly sensitive to Helms' correction for endogeneity of the *Deficit* variable. This should certainly be explored in future research.

The empirical relationship between taxes and income is complicated by a great number of measurement problems, particularly in the fiscal variables. For instance, Bartik and others believe that tax revenue, properly spent, can enhance economic performance. The panel models incorporate this idea by including many fiscal spending categories such as highway spending and education spending. These variables are meant to proxy the quality of the physical infrastructure or the quality of the educational system in a state.

However, the amount of money that a state spends on a given activity may not reflect the quality of the service that it gives its citizens in that category. For instance, a state with poor schools may be inclined to increase spending on education. The models studied here assume that the quality of schooling will go up. This may not be the case. The true relationship between spending and outcome is elusive.[23]

In addition to endogeneity, other statistical problems in the models could cause a significant difference in the coefficients when the time period changes. First, there could be an omitted variable that is highly correlated with tax burdens. This omitted variable could bias the coefficients.

There could also be heteroscedasticity or serial correlation in the error term of these models. These problems, if not modeled, could bias the results and cause significant changes in the coefficients when the sample changes. If these problems exist, I would expect several changes in the coefficients on the non-fiscal control variables. In tables 6.1.1 through 6.5.2 there are 39 non-fiscal control variables. Ten of the 39 change sign. This suggests that heteroscedasticity and serial correlation deserve further attention.

[23] Dr. Daniel Sutter suggested this possibility to me.

A final possibility that could be driving the differences in results is another data issue. The Bureau of Economic Analysis revises its Personal Income data periodically. I believe that it is highly unlikely that data revision is the key factor in the results of this dissertation.

This study has progressed the study of state taxes and economic growth by identifying problems inherent in previous studies. On the negative side, the nature of this "progress" is that it has made clear that the findings of previous studies do not hold up when the original studies are re-estimated using more recent, more reliable data. On the positive side, this study has identified a number of promising directions for future research. Missing from the existing literature on the subject is a comprehensive approach to taxes and economic development that systematically investigates this relationship using a common data set. This study makes the first step towards accomplishing this goal.

In reviewing the literature on state taxes and economic development, Theresa McGuire (1992, page 458) offered the following assessment.

> "My conclusion...is that we are uncertain about the effects of economic development policies, including broad state fiscal policy, on economic growth. How does this conclusion translate into policy? My message to policy makers is that the effects of state and local tax policy are so uncertain that concern over this issue should not be a driving force in general policy decisions."

Until further research leads us to a better understanding, Professor McGuire's conclusion remains the best characterization of our current state of knowledge on this important subject.

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XI. Appendix

TABLE A1
Description of Variables Used in Vedder Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Dependent Variables		
GROWTH$_s$	"growth in real personal income per capita 1960-1993"	$GROWTH_s = \left(\frac{X_{s,1993} - X_{s,1960}}{X_{s,1960}} \right) \times 100$, where $X_{s,t} = \left(\frac{Personal\ Income_{s,t}}{Population_{s,t}} \right) \times \left(\frac{CPI_{1982}}{CPI_t} \right)$. DATA SOURCES: *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000. *CPI* data downloaded from "http://stats.bls.gov/top20.html#OPLC".
POPULATION CHANGE$_s$	"population growth between the states from 1960 to 1993"	$Population\ Change_s = \left(\frac{X_{s,1993} - X_{s,1960}}{X_{s,1960}} \right) \times 100$, where $X_{s,t} = Population_{s,t}$. DATA SOURCES: *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A1 (continued)
Description of Variables Used in Vedder Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
TOTAL REAL PERSONAL INCOME GROWTH$_s$	"the growth of total real personal income, 1962-1994"	$Total\ Real\ Personal\ Income\ Growth_s = \left(\frac{X_{s,1994} - X_{s,1962}}{X_{s,1962}} \right) \times 100$, where $X_{s,t} = Personal\ Income_{s,t} \times \left(\frac{CPI_{1982}}{CPI_t} \right)$. DATA SOURCES: *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.
Independent Variables		
TAX60$_s$	"the level of state and local taxation as a percent of personal income in fiscal year 1960"	$TAX60_s = \left(\frac{State\ and\ Local\ Tax\ Revenues_{s,1960}}{Personal\ Income_{s,1959}} \right) \times 100$. DATA SOURCES: *State and Local Tax Revenues* hand entered from Government Finances (for fiscal year 1960). *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A1 (continued)
Description of Variables Used in Vedder Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
TAXCHANGE$_s$	"the change in that tax burden [TAX60] from 1960 through 1992"	$TAXCHANGE_s = \left(\frac{X_{s,1992} - X_{s,1960}}{X_{s,1960}} \right) \times 100$, where $X_{s,t} = \frac{State\ and\ Local\ Tax\ Revenues_{s,t}}{Personal\ Income_{s,t-1}}$. DATA SOURCES: *State and Local Tax Revenues$_{s,1960}$* hand entered from 1960 fiscal year issue of Government Finances. *State and Local Tax Revenues$_{s,1992}$* downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.
UNION$_s$	"the percent of the nonagricultural labor force in labor unions at midperiod (1974)"	DATA SOURCE: *UNION* hand entered from the Statistical Abstract of the United States.

TABLE A1 (continued)
Description of Variables Used in Vedder Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
SUNSHINE$_s$	"the percent of the days of the year the sun shines in a leading city in the state, or an average of several cities"	DATA SOURCE: *SUNSHINE* hand calculated from individual city data posted on National Climatic Data Center's website, "http://www.ncdc.noaa.gov/ol/climate/newccd/avgsun.html", Summer 2000.
WAGES$_s$	"average worker wage payments from four different dates within the time period, indexed to average 100 for all states"	$WAGES_s = \left(\frac{X_s}{Y}\right) \times 100$, where $X_s = \frac{\left(\sum_{t=1969,1976,1985,1992} \frac{Wage\ and\ salary\ disbursements\ by\ place\ of\ work_{s,t}}{Wage\ and\ salary\ employment\ by\ place\ of\ work_{s,t}}\right)}{4}$ and $Y = \frac{\sum_{s=1}^{48} X_s}{48}$. DATA SOURCES: *Wage and salary disbursements by place of work* and *Wage and salary employment by place of work* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A1 (continued)
Description of Variables Used in Vedder Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
UNEMPLOYMENT$_s$	"the average annual unemployment rate for [the period] 1960 through 1991"	DATA SOURCES: Individual years of *Unemployment rate* electronically provided from the BLS for 1991-1976 (some of the larger states go back to 1970) (contact person at BLS: Yvonne Terwilliger). Missing data back to 1970 was filled in with unemployment rate data from Professor Alicia Munnell (Boston College). No data could be found prior to 1970. The *UNEMPLOYMENT* variable used in replication is the average value for 1970-1991 (not 1960-1991).
FARM$_s$	"the percent of farm receipts as a percent of personal income in 1975"	$FARM_s = \left(\frac{Farm\ Income_{s,1975}}{Personal\ Income_{s,1975}} \right) \times 100$. DATA SOURCES: *Farm Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.
ENERGY$_s$	"mineral production as a percent of personal income in 1980"	$ENERGY = \left(\frac{Mining\ Earnings_{s,1980}}{Personal\ Income_{s,1980}} \right) \times 100$. DATA SOURCES: *Mining Earnings* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A2
Description of Variables Used in Becsi Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Dependent Variables		
RG6192$_s$ ***RG6176$_s$*** ***RG7792$_s$***	"average annual differential growth rate of [per capita personal income] over 1961-1992/1961-1976/1977-1992"	$RG6192_s = \left(\left(\frac{X_{s,1992}}{X_{s,1961}} \right)^{1/31} - \left(\frac{X_{US,1992}}{X_{US,1961}} \right)^{1/31} \right) \times 100$, where $X_{i,t} = \left(\frac{Personal\ Income_{i,t}}{Population_{i,t}} \right)$, where i indexes an individual state or the entire U.S., respectively. The other dependent variables are defined similarly. DATA SOURCES: *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A2 (Continued)
Description of Variables Used in Becsi Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Independent Variables		
RPCPI60$_s$ ***RPCPI76$_s$***	"relative initial average personal income in 1960/1976"	$RPCPI60_s = ln\left(\frac{X_{s,1960}}{X_{US,1960}}\right) \times 100$, where $X_{i,t} = \left(\frac{Personal\ Income_{i,t}}{Population_{i,t}}\right)$, where i indexes an individual state or the entire U.S., respectively. The other independent variable is defined similarly. DATA SOURCES: *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A2 (continued)
Description of Variables Used in Becsi Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
RMTR6192$_s$ ***RMTR6176$_s$*** ***RMTR7792$_s$***	"relative marginal tax rate" over the period 1961-1992/1961-1976/1977-1992	$RMTR6192_i = ln\left(\frac{X_s}{X_{US}}\right) \times 100$, where X_i is defined as the slope coefficient MTR_i in the regression $State\ and\ Local\ Tax\ Revenues_{i,t} = \alpha_i + MTR_i Personal\ Income_{i,t-1}$, $t=1961,1962,...,1992$, and i indexes an individual state or the entire U.S., respectively. The other independent variables are defined similarly. DATA SOURCES: *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001. *State and Local Tax Revenues* for 1961 through 1976 hand entered from annual issues of Government Finances. . *State and Local Tax Revenues* for 1977 through 1992 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001.

TABLE A2 (continued)
Description of Variables Used in Becsi Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
RR6192$_s$ ***RR6176$_s$*** ***RR7792$_s$***	"relative regressivity" over the period 1961-1992/1961-1976/1977-1992; where "relative regressivity" is defined as the ratio of the Average Tax Rate to the Marginal Tax Rate	$RR6192_i = ln\left(\frac{X_s}{X_{US}}\right) \times 100$, where $X_i = \frac{Y_i}{MTR_i}$, $Y_i = \frac{\left(\sum_{t=1961}^{1992} State\ and\ Local\ Tax\ Revenues_{i,t}\right)}{32}$, MTR_i is defined as the slope coefficient MTR_i in the regression $State\ and\ Local\ Tax\ Revenues_{i,t} = \alpha_i + MTR_i Personal\ Income_{i,t-1}$, $t=1961,1962,...,1992$, and i indexes an individual state or the entire U.S., respectively. The other independent variables are defined similarly. DATA SOURCES: *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001. *State and Local Tax Revenues* for 1961 through 1976 hand entered from annual issues of Government Finances. . *State and Local Tax Revenues* for 1977 through 1992 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001.

TABLE A3
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Dependent Variable		
$ln\ Y_{s,t}$	log of "state personal income, measured in 1967 dollars per calendar year"	$ln\ Y_{s,t} = ln\left(Personal\ Income_{s,t} \times \frac{CPI_{1967}}{CPI_t} \right)$, $s=1\text{-}48,\ t=1966\text{-}1979.$ DATA SOURCES: *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001. *CPI* data downloaded from "http://stats.bls.gov/top20.html#OPLC", June 2001.
Independent Variables		
$Property\ tax_{s,t}$	"property taxes as a percent of state personal income"	$Property\ Tax_{s,t} = \left(\frac{State\ and\ Local\ Property\ Tax\ Revenues_{s,t}}{Personal\ Income_{s,t-1}} \right) \times 100$, $s=1\text{-}48,\ t=1966\text{-}1979.$ DATA SOURCES: *State and Local Property Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State and Local Tax Revenues* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Other taxes$_{s,t}$	"other state and local taxes as a percent of state personal income"	*Other taxes*$_{s,t}$ = $\left(\left(\frac{\textit{State and Local Tax Revenues}_{s,t}}{\textit{Personal Income}_{s,t-1}} \right) - \left(\frac{\textit{State and Local Property Tax Revenues}_{s,t}}{\textit{Personal Income}_{s,t-1}} \right) \right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: *State and Local Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State and Local Tax Revenues* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *State and Local Property Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State and Local Property Tax Revenues* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
$User\ fees_{s,t}$	"user fees as a percent of state personal income"	$User\ fees_{s,t} = \left(\left(\frac{General\ Revenue\ from\ Own\ Source_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{State\ and\ Local\ Tax\ Revenues_{s,t}}{Personal\ Income_{s,t-1}} \right) \right) \times 100,$ $s=1\text{-}48,\ t=1966\text{-}1979.$ DATA SOURCES: *General Revenue from Own Source* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue from Own Source* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *State and Local Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State and Local Tax Revenues* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Deficit$_{s,t}$	"deficit as a percent of state personal income"	$Deficit_{s,t} = \left(\left(\frac{Direct\ General\ Expenditure_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{General\ Revenue_{s,t}}{Personal\ Income_{s,t-1}} \right) \right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: *Direct General Expenditure* for 1966 through 1976 hand entered from annual issues of Government Finances. *Direct General Expenditure* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *General Revenue* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Federal source revenue$_{s,t}$	"federal source revenue as a percent of state personal income"	*Federal source revenue*$_{s,t}$ $= \left(\left(\frac{General\ Revenue_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{General\ Revenue\ from\ Own\ Source_{s,t}}{Personal\ Income_{s,t-1}} \right) \right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: *General Revenue* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *General Revenue from Own Source* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue from Own Source* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
$Health_{s,t}$	"state and local expenditures on public health as a percent of state personal income"	$Health_{s,t} = \left(\frac{Health\ and\ Hospital\ Expenditures_{s,t}}{Personal\ Income_{s,t-1}} \right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: *Health and Hospital Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Health and Hospital Expenditures* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: 97Rex3.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.
$Highways_{s,t}$	"state and local expenditures on highways as a percent of state personal income"	$Highways_{s,t} = \left(\frac{Highway\ Expenditures_{s,t}}{Personal\ Income_{s,t-1}} \right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: *Highway Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Highway Expenditures* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Local schools$_{s,t}$	"state and local expenditures on local schools as a percent of state personal income"	*Local schools*$_{s,t}$ = $\left(\frac{\textit{Elementary and Secondary Education Expenditures}_{s,t}}{\textit{Personal Income}_{s,t-1}}\right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: *Elementary and Secondary Education Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Elementary and Secondary Education Expenditures* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.
Higher education$_{s,t}$	"state and local expenditures on higher education as a percent of state personal income"	*Higher education*$_{s,t}$ = $\left(\frac{\textit{Higher Education Expenditures}_{s,t}}{\textit{Personal Income}_{s,t-1}}\right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: *Higher Education Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Higher Education Expenditures* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Other expenditures$_{s,t}$	"all other state and local expenditures as a percent of state personal income"	$Other\ expenditures_{s,t} = \left(\begin{array}{l} Direct\ General\ Expenditures_{s,t} - Health\ and\ Hospital\ Expenditures_{s,t} \\ - Highway\ Expenditures_{s,t} - Elementary\ and\ Secondary\ Education \\ Expenditures_{s,t} - Higher\ Education\ Expenditures_{s,t} - Public\ Welfare \\ Expenditures_{s,t} \end{array} \right), \times \left(\frac{100}{Personal\ Income_{s,t-1}} \right).$ *s=1-48, t=1966-1979.* DATA SOURCES: *Direct General Expenditures, Health and Hospital Expenditures, Highway Expenditures, Elementary and Secondary Education Expenditures, Higher Education Expenditures,* and *Public Welfare Expenditures* 1966 through 1976 hand entered from annual issues of Government Finances. *Direct General Expenditures, Elementary and Secondary Education Expenditures,* and *Higher Education Expenditures* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Health and Hospital Expenditures* and *Highway Expenditures* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls", May 2001. *Public Welfare Expenditures* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex4.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Relative wage$_{s,t}$	"average hourly earnings of production workers in manufacturing expressed as a percentage of the national average in that year"	$Relative\ wage_{s,t} = \left(\frac{Average\ Hourly\ Earnings_{s,t}}{Average\ Hourly\ Earnings_{US,t}} \right) \times 100$, *s=1-48, t=1966-1979.* DATA SOURCES: State-level data for a random assortment of years electronically provided by the BLS (contact person at BLS: Paul Chester). Most of the remaining data was filled in from various issues of the Handbook of Labor Statistics. However, there remained 9 missing observations: Colorado (1975, 1976), Iowa (1975), Kansas (1975-1978), Michigan (1975), and Texas (1975). The values of these observations were imputed using STATA's "Impute" command.
Unionization rate$_{s,t}$	"nonagricultural unionization rate"	DATA SOURCES: Data for the years 1964, 1966, 1968, 1970, 1972, 1974, 1976, and 1978 hand entered from various issues of the Statistical Abstract of the U.S.. Data for the years 1983-1998 hand entered from data provided by the AFL-CIO (Contact: Public Policy Dept., 815 16th Street N.W., Washington, D.C., 20006). Data for the missing years were imputed using STATA's "Impute" command.
Population density$_{s,t}$	"population per square mile"	$Population\ density_{s,t} = \frac{Population_{s,t}}{Land\ Area_{s,t}}$, *s=1-48, t=1966-1979.* DATA SOURCES: *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000. *Land Area* data hand entered from 1999 issue of National Geographic Road Atlas.

Table A3 (continued)
Description of Variables Used in Helms Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Instrumental variables$_{s,t}$ (Endogenous variable = ***Deficit***$_{s,t}$)	"The appropriate estimator excludes both the deficit and transfers from the set of instrumental variables...In addition to the [exogenous] fiscal variables and the lagged [exogenous] fiscal variables, I have included the fraction of the population aged 5 through 17 and the fraction over age 65"	Current [exogenous] fiscal variables: *Property tax*$_{s,t}$, *Other taxes*$_{s,t}$, *User fees*$_{s,t}$, *Federal source revenue*$_{s,t}$, *Health*$_{s,t}$, *Highways*$_{s,t}$, *Local schools*$_{s,t}$, *Higher education*$_{s,t}$, and *Other expenditures*$_{s,t}$. Lagged [exogenous] fiscal variables: *Property tax*$_{s,t-1}$, *Other taxes*$_{s,t-1}$, *User fees*$_{s,t-1}$, *Federal source revenue*$_{s,t-1}$, *Health*$_{s,t-1}$, *Highways*$_{s,t-1}$, *Local schools*$_{s,t-1}$, *Higher Education*$_{s,t-1}$, and *Other expenditures*$_{s,t-1}$. *Fraction of Population Aged 5 through 17*$_{s,t}$ = $\frac{\textit{Population Aged 5 through 17}_{s,t}}{\textit{Population}_{s,t}}$. *Fraction of Population Aged 65 and Older*$_{s,t}$ = $\frac{\textit{Population Aged 65 and Older}_{s,t}}{\textit{Population}_{s,t}}$. DATA SOURCES: *Population Aged 5 through 17* data for years 1966-1968 hand entered from various issues of Statistical Abstract of the U.S.. *Population Aged 5 through 17* data for years 1970-1979 downloaded "http://www.census.gov/population/www/estimates/statepop.html", June 2001. *Population Aged 5 through 17* data for 1969 imputed using STATA's "Impute" command. *Population Aged 65 and Older* data for years 1966-1969 hand entered from various issues of Statistical Abstract of the U.S.. *Population Aged 65 and Older* data for years 1970-1979 downloaded "http://www.census.gov/population/www/estimates/ statepop.html", June 2001. *Population* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A4
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Dependent Variable		
Manufacturing employment$_{s,t}$	"full time equivalent workers in manufacturing expressed in logarithmic, first-difference form (multiplied by one hundred)"	*Manufacturing employment$_{s,t}$* $= \left(ln\left(\frac{Manufacturing\ employment_{s,t}}{Manufacturing\ employment_{s,t-5}} \right) \right) \times 100$, where *s=1-50, t = 1967,1972,1977,1982.* DATA SOURCES: *Manufacturing employment* data for all years downloaded from http://www.bls.gov/790home.htm", July 2001 (see "Selective Access").
Independent Variables		
Taxes$_{s,t}$	"state and local government taxes as a percentage of state personal income in first-differenced form, expressed in percentage points"	$Taxes_{s,t} = \left(\left(\frac{State\ and\ Local\ Tax\ Revenues_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{State\ and\ Local\ Tax\ Revenues_{s,t-5}}{Personal\ Income_{s,t-6}} \right) \right) \times 100$, where *s=1-50, t = 1967,1972,1977,1982.* DATA SOURCES: *State and Local Tax Revenues* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *State and Local Tax Revenues* for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Other revenues$_{s,t}$	"other state and local government revenues as a percentage of state personal income in first-differenced form, expressed in percentage points"	$$Other\ revenues_{s,t} = \left[\left(\left(\frac{General\ Revenue_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{State\ and\ Local\ Tax\ Revenues_{s,t}}{Personal\ Income_{s,t-1}} \right) \right) - \left(\left(\frac{General\ Revenue_{s,t-5}}{Personal\ Income_{s,t-6}} \right) - \left(\frac{State\ and\ Local\ Tax\ Revenues_{s,t-5}}{Personal\ Income_{s,t-6}} \right) \right) \right] \times 100,$$ where $s=1\text{-}50,\ t = 1967, 1972, 1977, 1982.$ DATA SOURCES: *General Revenue* data for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *General Revenue* data for years earlier than 1977 hand entered from annual issues of Government Finances. *State and Local Tax Revenues* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *State and Local Tax Revenues* for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
$Health_{s,t}$	"state and local government health expenditures as a percentage of state personal income in first-differenced form, expressed in percentage points"	$Health_{s,t} = \left(\left(\frac{Health\ and\ Hospital\ Expenditures_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{Health\ and\ Hospital\ Expenditures_{s,t-5}}{Personal\ Income_{s,t-6}} \right) \right) \times 100,$ where $s=1\text{-}50$, $t = 1967, 1972, 1977, 1982$. DATA SOURCES: *Health and Hospital Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls", May 2001. *Health and Hospital Expenditures* for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Education$_{s,t}$	"state and local government education expenditures as a percentage of state personal income in first-differenced form, expressed in percentage points"	$Education_{s,t} = \left(\left(\frac{General\ Education\ Expenditures_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{General\ Education\ Expenditures_{s,t-5}}{Personal\ Income_{s,t-6}} \right) \right) \times 100,$ where $s=1\text{-}50$, $t = 1967, 1972, 1977, 1982$. DATA SOURCES: *General Education Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *General Education Expenditures* for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Highways$_{s,t}$	"state and local government highway expenditures as a percentage of state personal income in first-differenced form, expressed in percentage points"	$Highways_{s,t} = \left(\left(\frac{Highway\ Expenditures_{s,t}}{Personal\ Income_{s,t-1}}\right) - \left(\frac{Highway\ Expenditures_{s,t-5}}{Personal\ Income_{s,t-6}}\right)\right) \times 100,$ where $s=1\text{-}50$, $t = 1967, 1972, 1977, 1982$. DATA SOURCES: *Highway Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls", May 2001. *Highway Expenditures* for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A4 (continued) Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Other expenditures$_{s,t}$	"all other state and local expenditures as a percent of state personal income"	$Other\ expenditures_{s,t} = \left[\left(Direct\ General\ Expenditures_{s,t} - Health\ and\ Hospital\ Expenditures_{s,t} - General\ Education\ Expenditures_{s,t} - Highway\ Expenditures_{s,t} - Public\ Welfare\ Expenditures_{s,t}\right) \times \left(\frac{100}{Personal\ Income_{s,t-1}}\right)\right] - \left[\left(Direct\ General\ Expenditures_{s,t-5} - Health\ and\ Hospital\ Expenditures_{s,t-5} - General\ Education\ Expenditures_{s,t-5} - Highway\ Expenditures_{s,t-5} - Public\ Welfare\ Expenditures_{s,t-5}\right) \times \left(\frac{100}{Personal\ Income_{s,t-6}}\right)\right]$, where $s=1\text{-}50,\ t = 1967, 1972, 1977, 1982$. DATA SOURCES: *Direct General Expenditures* and *General Education Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Health and Hospital Expenditures* and *Highway Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls", May 2001. *Public Welfare Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex4.xls", May 2001. *Direct General Expenditures, Health and Hospital Expenditures, General Education Expenditures, Highway Expenditures* and *Public Welfare Expenditures* for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Surplus(Deficit)$_{s,t}$	"state and local government surplus as a percentage of state personal income in first-differenced form, expressed in percentage points"	$Surplus(Deficit)_{s,t} = \left[\left(\left(\frac{General\ Revenue_{s,t}}{Personal\ Income_{s,t-1}} \right) - \left(\frac{Direct\ General\ Expenditures_{s,t}}{Personal\ Income_{s,t-1}} \right) \right) - \left(\left(\frac{General\ Revenue_{s,t-5}}{Personal\ Income_{s,t-6}} \right) - \left(\frac{Direct\ General\ Expenditures_{s,t-5}}{Personal\ Income_{s,t-6}} \right) \right) \right] \times 100,$ where $s=1\text{-}50$, $t = 1967, 1972, 1977, 1982$. DATA SOURCES: *General Revenue* data for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Direct General Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *General Revenue* and *Direct General Expenditure* data for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
UI benefits$_{s,t}$	"state unemployment insurance tax revenues as a percentage of state personal income in first-differenced form, expressed in percentage points""	$UI\ Benefits_{s,t} = \left(\left(\frac{UI\ Benefit\ Payments_{s,t}}{Personal\ Income_{s,t-1}}\right) - \left(\frac{UI\ Benefit\ Payments_{s,t-5}}{Personal\ Income_{s,t-6}}\right)\right) \times 100$, where $s=1\text{-}50$, $t = 1967, 1972, 1977, 1982$. DATA SOURCES: *UI Benefit Payments* and *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.
Unemployment rate$_{s,t}$	"state unemployment rate in first-differenced form "	$Unemployment\ rate_{s,t} = \left(Unemployment\ rate_{s,t} - Unemployment\ rate_{s,t-5}\right)$, where $s=1\text{-}50$, $t = 1967, 1972, 1977, 1982$. DATA SOURCES: Individual years of *Unemployment rate* electronically provided from the BLS for 1976 and later (some of the larger states go back to 1970) (contact person at BLS: Yvonne Terwilliger). No data could be found prior to 1970.

TABLE A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Female ratio$_{s,t}$	"percentage of population female in first-differenced form"	*Female ratio*$_{s,t}$ = $\left[\left(\frac{\textit{Female population}_{s,t}}{\textit{Population}_{s,t}}\right)-\left(\frac{\textit{Female population}_{s,t-5}}{\textit{Population}_{s,t-5}}\right)\right]\times 100$, where s=*1-50*, t = *1967,1972,1977,1982.* DATA SOURCES: *Female population* data for years 1980 and later downloaded from "http://www.census.gov/population/www/estimates/statepop.html", June 2001. *Female population* data for 1970 and 1960 hand entered from the Statistical Abstract of the U.S. Data for missing years were imputed using STATA's "Impute" command. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Nonwhite ratio$_{s,t}$	"percentage of population nonwhite in first-differenced form"	$Nonwhite\ ratio_{s,t} = \left[\left(\left(\frac{Population_{s,t} - White\ population_{s,t}}{Population_{s,t}}\right) - \left(\frac{Population_{s,t-5} - White\ population_{s,t-5}}{Population_{s,t-5}}\right)\right)\right] \times 100,$ where $s=1\text{-}50,\ t = 1967, 1972, 1977, 1982.$ DATA SOURCES: *White population* data for years 1980 and later downloaded from "http://www.census.gov/population/www/estimates/statepop.html", June 2001. *White population* data for 1970 and 1960 hand entered from the Statistical Abstract of the U.S. Data for missing years were imputed using STATA's "Impute" command. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.
Age 13-17 ratio$_{s,t}$	"percentage of population ages 13-17 in first-differenced form"	DATA SOURCES: *Population aged 13-17* data is not available for years earlier than 1980.

TABLE A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Age 18-64 ratio$_{s,t}$	"percentage of population ages 18-64 in first-differenced form"	*Age 18-64 ratio$_{s,t}$* = $\left[\left(\frac{\text{Population aged 18 - 64}_{s,t}}{\text{Population}_{s,t}}\right) - \left(\frac{\text{Population aged 18 - 64}_{s,t-5}}{\text{Population}_{s,t-5}}\right)\right] \times 100$, where *s=1-50, t = 1967,1972,1977,1982.* DATA SOURCES: *Population aged 18-64* data for years 1970 and later downloaded from "http://www.census.gov/population/www/estimates/statepop.html", June 2001. *Population aged 18-64* data for 1960 electronically provided by U.S. Census Bureau (contact person at Census: Marie Pees). Values for missing years of *Population aged 18-64* data were imputed using STATA's "Impute" command. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000. NOTE: Mofidi and Stone use Age 18-65 ratio instead of Age 18-64 ratio.
Union rate$_{s,t}$	"nonagricultural unionization rate in first-differenced form"	*Union rate$_{s,t}$ = Union$_{s,t}$ − Union$_{s,t-5}$*, where *s=1-50, t = 1967,1972,1977,1982.* DATA SOURCES: Data for the years 1964, 1966, 1968, 1970, 1972, 1974, 1976, and 1978 hand entered from various issues of the Statistical Abstract of the U.S.. Data for the years 1983-1998 hand entered from data provided by the AFL-CIO (Contact: Public Policy Dept., 815 16th Street N.W., Washington, D.C., 20006). Data for missing years after 1964 were imputed using STATA's "Impute" command. No data is available before 1964.

Table A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Industry mix ratio$_{s,t}$	"percentage of nonagricultural employment in durable goods industries in first-differenced form"	*Industry mix ratio*$_{s,t}$ $\left(\left(\frac{\textit{Durable goods employment}_{s,t}}{\textit{Total nonagricultural employment}_{s,t-1}}\right) - \left(\frac{\textit{Durable goods employment}_{s,t-5}}{\textit{Total nonagricultural employment}_{s,t-6}}\right)\right) \times 100$, where *s=1-50, t = 1967,1972,1977,1982.* DATA SOURCES: *Durable goods employment* data for 1969 and later downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000. *Durable goods employment* data before 1969 not available for all states. *Total nonagricultural employment* data for all years downloaded from http://www.bls.gov/790home.htm", July 2001 (see "Selective Access").

Table A4 (continued)
Description of Variables Used in Mofidi and Stone Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
$North_s$ $South_s$ $West_s$	"region binary variables"	$North_s = \begin{pmatrix} Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, \\ Minnesota, Missouri, Nebraska, North\ Dakota, South\ Dakota \end{pmatrix}$, $South_s = \begin{pmatrix} Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, \\ Mississippi, North\ Carolina, South\ Carolina, Tennessee, \\ Virginia, West\ Virginia, Arizona, New\ Mexico, Oklahoma, \\ Texas \end{pmatrix}$, $West_s = \begin{pmatrix} Colorado, Idaho, Montana, Utah, Wyoming, Alaska, \\ California, Hawaii, Nevada, Oregon, Washington \end{pmatrix}$, $East_s = \begin{pmatrix} Connecticut, Maine, Massachusetts, New\ Hampshire, \\ Rhode\ Island, Vermont, Delaware, Maryland, New\ Jersey, \\ New\ York, Pennsylvania \end{pmatrix}$.
$1967\text{-}72_{s,t}$ $1972\text{-}77_{s,t}$ $1977\text{-}82_{s,t}$	"time binary variables"	*Description same as name.*

TABLE A5
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Dependent Variables		
Total nonagricultural employment$_{s,t}$	"total nonagricultural employment expressed in first-difference form"	*Total nonagricultural employment$_{s,t}$* = $ln\left(\frac{\text{Total nonagricultural employment}_{s,t}}{\text{Total nonagricultural employment}_{s,t-1}}\right)$, where *s=1-48, t = 1967-88.* DATA SOURCES: *Total nonagricultural employment* data for all years downloaded from http://www.bls.gov/790home.htm", July 2001 (see "Selective Access").
Manufacturing employment$_{s,t}$	"total nonagricultural employment expressed in first-difference form"	*Manufacturing employment$_{s,t}$* $= ln\left(\frac{\text{Manufacturing employment}_{s,t}}{\text{Manufacturing employment}_{s,t-5}}\right)$, where *s=1-48, t = 1967-88.* DATA SOURCES: *Manufacturing employment* data for all years downloaded from http://www.bls.gov/790home.htm", July 2001 (see "Selective Access").

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Independent Variables		
Real wage$_{s,t}$	"average wage for production workers (in 1982 dollars) expressed in first-difference form."	$Real\ wage_{s,t} = \left(\left(Average\ hourly\ earnings_{s,t} \times \frac{CPI_{1982}}{CPI_t} \right) - \left(Average\ hourly\ earnings_{s,t-1} \times \frac{CPI_{1982}}{CPI_{t-1}} \right) \right)$, where s=*1-48*, t = *1967-88*. DATA SOURCES: State-level data for *Average hourly earnings* was electronically provided for a random assortment of years by the BLS (contact person at BLS: Paul Chester). Most of the remaining data was filled in from various issues of the Handbook of Labor Statistics. However, there remained 9 missing observations: Colorado (1975, 1976), Iowa (1975), Kansas (1975-1978), Michigan (1975), and Texas (1975). The values of these observations were imputed using STATA's "Impute" command. *CPI* data downloaded from "http://stats.bls.gov/top20.html#OPLC", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Electric price$_{s,t}$	"average electric bills deflated (in 1982 dollars) for commercial businesses in first-difference form"	$Electric\ price_{s,t} = \left(\begin{array}{l} \left(Electric\ price_{s,t} \times \frac{CPI_{1982}}{CPI_t} \right) \\ -\left(Electric\ price_{s,t-1} \times \frac{CPI_{1982}}{CPI_{t-1}} \right) \end{array} \right)$, where $s=1\text{-}48$, $t = 1967\text{-}88$. DATA SOURCES: Carroll and Wasylenko use "Average Electric Bills in Real Terms (30KWH-6000KWH Commercial Service Class) from annual issues of Typical Electric Bills, Energy Information Administration (EIA), Department of Energy. This series was discontinued in 1989, and only available after 1982 via purchase from the EIA at considerable expense. Instead, I use "Commercial Sector Energy Price Series (Electricity)" for individual states, which can be downloaded from "ftp://ftp.eia.doe.gov/pub/state.prices/data/Allprice.csv". This series only goes back to 1970. *CPI* data downloaded from "http://stats.bls.gov/top20.html#OPLC", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Industry mix$_{s,t}$ *(Manufacturing employment equation)*	"the level of state employment in a particular industry that would have been attained had state employment grown at the national rate for that industry minus the level that would have attained given that national growth rate for all industries, expressed in first-difference form"	$Industry\ mix_{s,t} = \left(\begin{bmatrix} Manufacturing\ employment_{s,t-1} \times (1 + R1_t - R2_t) \end{bmatrix} - \begin{bmatrix} Manufacturing\ employment_{s,t-2} \times (1 + R1_{t-1} - R2_{t-1}) \end{bmatrix} \right)$, where $R1_t = \left(\frac{Manufacturing\ employment_{US,t} - Manufacturing\ employment_{US,t-1}}{Manufacturing\ employment_{US,t-1}} \right)$, $R2_t = \left(\frac{Total\ nonagr.\ employment_{US,t} - Total\ nonagr.\ employment_{US,t-1}}{Total\ nonagricultural\ employment_{US,t-1}} \right)$, where s=*1-48*, t = *1967-88*. *Manufacturing employment* and *Total nonagricultural employment* (state) data for all years downloaded from http://www.bls.gov/790home.htm", July 2001 (see "Selective Access"). *Manufacturing employment* and *Total nonagricultural employment* (U.S.) data for all years downloaded from http://www.bls.gov/ceshome.htm", July 2001 (see "Selective Access"). NOTE: It is not possible to calculate an *Industry mix* variable for the *Total nonagricultural employment equation* because there does not exist a *Total employment* time series.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Union rate$_{s,t}$	"percent of the work force unionized, expressed in first-differenced form"	*Union rate*$_{s,t}$ = *Union*$_{s,t}$ − *Union*$_{s,t-5}$, where *s=1-48, t = 1967-88.* DATA SOURCES: Data for the years 1966, 1968, 1970, 1972, 1974, 1976, and 1978 hand entered from various issues of the Statistical Abstract of the U.S.. Data for the years 1983-1998 hand entered from data provided by the AFL-CIO (Contact: Public Policy Dept., 815 16th Street N.W., Washington, D.C., 20006). Data for missing years were imputed using STATA's "Impute" command.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Productivity$_{s,t}$	"gross state product (in 1982 dollars) as a ratio of total employment in each state, expressed in first-difference form"	$Productivity_{s,t} = \left(\left(\frac{Gross\ State\ Product : Bartik_{s,t}}{Total\ nonagricultural\ employment_{s,t}} \right) - \left(\frac{Gross\ State\ Product : Bartik_{s,t-1}}{Total\ nonagricultural\ employment_{s,t-1}} \right) \right)$, where s=1-48, t = 1967-88. DATA SOURCES: *Gross State Product:Bartik* electronically obtained from Dr. Timothy Bartik (Upjohn Institute) for the years up to 1986. Predicted values for *Gross State Product:Bartik* for 1987 and 1988 were obtained from the regression equation, $Gross\ State\ Product : Bartik_{s,t} = \hat{\beta}_{0,s} + \hat{\beta}_{1,s} Gross\ State\ Product_{s,t} + \beta_{2,s} Personal\ Income_{s,t}$, where s = 1-48, t=1987,1988, and $\hat{\beta}_{0,s}$, $\hat{\beta}_{1,s}$, and $\hat{\beta}_{2,s}$ were obtained from an estimation of the above equation for the years 1977-1986 (the years for which the *Gross State Product* series from Bartik and the *Gross State Product* series from the BEA overlap). *Total nonagricultural employment* data for all years downloaded from http://www.bls.gov/790home.htm", July 2001 (see "Selective Access"). *Gross State Product* data downloaded from "http://www.bea.doc.gov/bea/regional/gsp/", June 2001. *Personal Income* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001. NOTE: I use the BEA's *Gross State Product* series for the 1977-1997 period.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
$Density_{s,t}$	"population density, expressed in first-difference form"	$Density_{s,t} = \left(\frac{Population_{s,t}}{Land\ Area_{s,t}}\right) - \left(\frac{Population_{s,t-1}}{Land\ Area_{s,t-1}}\right)$, where $s=1\text{-}48$, $t = 1967\text{-}88$. DATA SOURCES: *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000. *Land Area* data hand entered from 1999 issue of National Geographic Road Atlas.
$Old_{s,t}$	"percent of population 65 years of age or over, expressed first-differenced form"	$Old_{s,t} = \left[\left(\frac{Population\ aged\ 65+_{s,t}}{Population_{s,t}}\right) - \left(\frac{Population\ aged\ 65+_{s,t-1}}{Population_{s,t-1}}\right)\right] \times 100$, where $s=1\text{-}48$, $t = 1967\text{-}88$. DATA SOURCES: *Population aged 65+* data for years 1966-1969 hand entered from various issues of Statistical Abstract of the U.S.. *Population aged 65+* for years 1970 and later downloaded from "http://www.census.gov/population/www/estimates/statepop.html", June 2001. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
$Young_{s,t}$	"percent of population from 5 to 17 years of age, expressed in first-differenced form"	$Young_{s,t} = \left[\left(\frac{Population\ aged\ 5\text{-}17_{s,t}}{Population_{s,t}}\right) - \left(\frac{Population\ aged\ 5\text{-}17_{s,t-1}}{Population_{s,t-1}}\right)\right] \times 100,$ where s=*1-48*, t = *1967-88*. DATA SOURCES: *Population Aged 5 through 17* data for years 1966-1968 hand entered from various issues of Statistical Abstract of the U.S. *Population Aged 5 through 17* data for 1969 imputed using STATA's "Impute" command. *Population Aged 5 through 17* data for 1970 and later downloaded "http://www.census.gov/population/www/estimates/statepop.html", June 2001. *Population* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", September 2000.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Property$_{s,t}$	"state and local property tax revenues per $100 of personal income, expressed in first-differenced form"	$Property_{s,t} = \left(\left(\frac{State\ and\ Local\ Property\ Tax\ Revenues_{s,t}}{X_{s,t-1}} \right) - \left(\frac{State\ and\ Local\ Property\ Tax\ Revenues_{s,t-1}}{X_{s,t-2}} \right) \right) \times 100$, where $X = \left(\begin{matrix} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{matrix} \right)$, *s=1-48, t = 1967-88.* DATA SOURCES: *State and Local Property Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State and Local Property Tax Revenues* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued): Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Personal income$_{s,t}$	"state individual income tax revenues per $100 of personal income, expressed in first-differenced form"	$Personal\ income_{s,t} = \left(\left(\frac{State\ and\ Local\ Individual\ Income\ Taxes : BEA_{s,t}}{X_{s,t-1}} \right) - \left(\frac{State\ and\ Local\ Individual\ Income\ Taxes : BEA_{s,t-1}}{X_{s,t-2}} \right) \right) \times 100,$ where $X = \left(\begin{array}{c} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{array} \right)$, $s=1\text{-}48,\ t = 1967\text{-}88.$ DATA SOURCES: *State and Local Individual Income Taxes:BEA* downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001. NOTE#1: I use state *and* local individual income taxes, whereas Carroll and Wasylenko state that they use only state income taxes. NOTE#2: The analysis for the 1977-1997 period uses the data series *State and Local Individual Income Taxes* produced by the U.S. Census. The Census series differs from the BEA series. Since Census produces the other tax and expenditure series, I deemed it appropriate to use the Census number for income taxes where possible. The Census income tax series is available in electronic form only back to 1977 (the BEA series extends back to 1958). The Census series was downloaded from "ftp://ftp.census. gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Corporate income$_{s,t}$	"state corporate income tax revenues per $100 of personal income, expressed in first-differenced form"	$Corporate\ income_{s,t} = \left(\left(\frac{State\ Corporate\ Income\ Tax\ Revenues_{s,t}}{X_{s,t-1}} \right) - \left(\frac{State\ Corporate\ Income\ Tax\ Revenues_{s,t-1}}{X_{s,t-2}} \right) \right) \times 100,$ where $X = \left(\begin{array}{c} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{array} \right),$ $s=1\text{-}48,\ t = 1967\text{-}88.$ DATA SOURCES: *State Corporate Income Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State Corporate Income Tax Revenues* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from "http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Sales taxes$_{s,t}$	"state and local sales taxes per $100 of personal income, expressed in first-differenced form"	$Sales\ taxes_{s,t} = \left(\left(\frac{State\ and\ Local\ Sales\ Taxes_{s,t}}{X_{s,t-1}} \right) - \left(\frac{State\ and\ Local\ Sales\ Taxes_{s,t-1}}{X_{s,t-2}} \right) \right) \times 100$, where $X = \left(Personal\ Income - Transfer\ Payments - Government\ and\ Government\ Enterprises \right)$, *s=1-48, t = 1967-88.* DATA SOURCES: *State and Local Sales Taxes* for 1973 through 1976 hand entered from annual issues of Government Finances. *State and Local Sales Taxes* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *State and Local Sales Taxes* are not available prior to 1973. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued): Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Other taxes$_{s,t}$	"other state and local tax revenues per $100 of personal income, expressed in first-differenced form"	$Other\ taxes_{s,t}$ = $\left[\left(\begin{array}{l} State\ and\ Local\ Tax\ Revenues_{s,t} - State\ and\ Local \\ Property\ Tax\ Revenues_{s,t} - State\ and\ Local\ Individual \\ Income\ Taxes_{s,t} - StateCorporate\ Income\ Tax\ Revenues_{s,t} \end{array}\right) \times (100/X_{s,t-1})\right]$ $- \left[\left(\begin{array}{l} State\ and\ Local\ Tax\ Revenues_{s,t-1} - State\ and\ Local\ Property\ Tax \\ Revenues_{s,t-1} - State\ and\ Local\ Individual\ Income\ Taxes_{s,t-1} - State \\ Corporate\ Income\ Tax\ Revenues_{s,t-1} \end{array}\right) \times (100/X_{s,t-2})\right]$ where $X = \left(\begin{array}{l} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{array}\right)$, s=1-48, t = 1967-88. DATA SOURCES: *State and Local Tax Revenues*, *State and Local Property Tax Revenues*, and *State Corporate Income Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State and Local Tax Revenues*, *State and Local Property Tax Revenues*, and *State Corporate Income Tax Revenues* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls". *State and Local Individual Income Taxes* downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001. *Personal Income*, *Transfer Payments*, and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001. NOTE#1: We use state *and* local rather than just state income taxes. NOTE#2: *Other taxes* excludes *State and Local Sales Taxes* in the 77-97 sample.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
User fees$_{s,t}$	"state and local miscellaneous fees and charges per $100 of personal income, expressed in first-differenced form"	$User\ fees_{s,t} = \left[\begin{pmatrix} (General\ Revenue\ from\ Own\ Source_{s,t} / X_{s,t-1}) \\ -(State\ and\ Local\ Tax\ Revenues_{s,t} / X_{s,t-1}) \end{pmatrix} - \begin{pmatrix} (General\ Revenue\ from\ Own\ Source_{s,t-1} / X_{s,t-2}) \\ -(State\ and\ Local\ Tax\ Revenues_{s,t-1} / X_{s,t-2}) \end{pmatrix} \right] \times 100,$ where $X = \begin{pmatrix} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{pmatrix}$, $s=1\text{-}48,\ t = 1967\text{-}88.$ DATA SOURCES: *General Revenue from Own Source* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue from Own Source* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *State and Local Tax Revenues* for 1966 through 1976 hand entered from annual issues of Government Finances. *State and Local Tax Revenues* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Federal aid$_{s,t}$	"intergovernmental aid received by the states from the federal government per $100 of personal income, expressed in first-differenced form"	*Federal aid$_{s,t}$* = $\left[\left(\frac{General\ Revenue_{s,t} - General\ Revenue\ from\ Own\ Source_{s,t}}{X_{s,t-1}}\right) - \left(\frac{General\ Revenue_{s,t-1} - General\ Revenue\ from\ Own\ Source_{s,t-1}}{X_{s,t-2}}\right)\right] \times 100$ where $X = \left(\begin{array}{c} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{array}\right)$, *s=1-48, t = 1967-88.* DATA SOURCES: *General Revenue* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *General Revenue from Own Source* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue from Own Source* for 1977 through 1979 downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Deficit$_{s,t}$	"total state and local general revenue minus state and local direct general expenditure per $100 of personal income, expressed in first-differenced form"	$Deficit_{s,t} = \left[\begin{pmatrix} (General\ Revenue_{s,t} / X_{s,t-1}) \\ -(Direct\ General\ Expenditure_{s,t} / X_{s,t-1}) \end{pmatrix} - \begin{pmatrix} (General\ Revenue_{s,t-1} / X_{s,t-2}) \\ -(Direct\ General\ Expenditure_{s,t-1} / X_{s,t-2}) \end{pmatrix} \right] \times 100,$ where $X = \begin{pmatrix} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{pmatrix},$ $s=1\text{-}48,\ t = 1967\text{-}88.$ DATA SOURCES: *General Revenue* for 1966 through 1976 hand entered from annual issues of Government Finances. *General Revenue* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex1.xls", May 2001. *Direct General Expenditure* for 1966 through 1976 hand entered from annual issues of Government Finances. *Direct General Expenditure* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
$Health_{s,t}$	"state and local health expenditures per $100 of personal income, expressed in first-differenced form"	$Health_{s,t} = \left[\begin{matrix}\left(Health\ and\ Hospital\ Expenditures_{s,t}/X_{s,t-1}\right) \\ -\left(Health\ and\ Hospital\ Expenditures_{s,t-1}/X_{s,t-2}\right)\end{matrix}\right] \times 100$, where $X = \left(\begin{matrix}Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises\end{matrix}\right)$, *s=1-48, t = 1967-88.* DATA SOURCES: *Health and Hospital Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Health and Hospital Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls". *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Higher education$_{s,t}$	"state and local higher education expenditures per $100 of personal income, expressed in first-differenced form"	$Higher\ education_{s,t} = \left[\begin{array}{l} \left(Higher\ Education\ Expenditures_{s,t} / X_{s,t-1}\right) \\ -\left(Higher\ Education\ Expenditures_{s,t-1} / X_{s,t-2}\right) \end{array} \right] \times 100$, where $X = \left(\begin{array}{c} Personal\ Income - Transfer\ Payments - Government\ and \\ Government\ Enterprises \end{array} \right)$, $s=1\text{-}48$, $t = 1967\text{-}88$. DATA SOURCES: *Higher Education Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Higher Education Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Primary and secondary education$_{s,t}$	"state and local primary and secondary education expenditures per $100 of personal income, expressed in first-differenced form"	*Primary and secondary education*$_{s,t}$ = $\left[\left(\textit{Elementary and Secondary Education Expenditures}_{s,t}/X_{s,t-1}\right) - \left(\textit{Elementary and Secondary Education Expenditures}_{s,t-1}/X_{s,t-2}\right)\right] \times 100$, where $X = \left(\begin{array}{c}\textit{Personal Income - Transfer Payments - Government and} \\ \textit{Government Enterprises}\end{array}\right)$, *s=1-48, t = 1967-88.* DATA SOURCES: *Elementary and Secondary Education Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Elementary and Secondary Education Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

TABLE A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Highway$_{s,t}$	"state and local highway expenditures per $100 of personal income, expressed in first-differenced form"	$Highways_{s,t} = \left[\begin{array}{l}(Highway\ Expenditures_{s,t}/X_{s,t-1}) \\ -(Highway\ Expenditures_{s,t-1}/X_{s,t-2})\end{array}\right] \times 100$, where $X = \left(\begin{array}{l}Personal\ Income - Transfer\ Payments - Government\ and \\ \quad Government\ Enterprises\end{array}\right)$, *s=1-48, t = 1967-88.* DATA SOURCES: *Highway Expenditures* for 1966 through 1976 hand entered from annual issues of Government Finances. *Highway Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls", May 2001. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.

Table A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	***Other Expenditures***$_{s,t}$
DESCRIPTION OF VARIABLE IN ORIGINAL STUDY	"other state and local expenditures per $100 of personal income, expressed in first-differenced form"
DESCRIPTION OF VARIABLE IN REPLICATION	$Other\ expenditures_{s,t} = 100\times \left[\left(\begin{array}{l} Direct\ General\ Expenditures_{s,t} - Health\ and\ Hospital\ Expenditures_{s,t} - Higher\ Education \\ Expenditures_{s,t} - Primary\ and\ Secondary\ Education\ Expenditures_{s,t} - Highway \\ Expenditures_{s,t} - Public\ Welfare\ Expenditures_{s,t} \end{array} \Big/ X_{s,t-1} \right) - \left(\begin{array}{l} Direct\ General\ Expenditures_{s,t-1} - Health\ and\ Hospital\ Expenditures_{s,t-1} - Higher\ Education \\ Expenditures_{s,t-1} - Primary\ and\ Secondary\ Education\ Expenditures_{s,t-1} - Highway \\ Expenditures_{s,t-1} - Public\ Welfare\ Expenditures_{s,t-1} \end{array} \Big/ X_{s,t-1} \right) \right]$, where $X = \left(\begin{array}{l} Personal\ Income - Transfer\ Payments - Government\ and \\ \quad Government\ Enterprises \end{array} \right)$, $s=1\text{-}48,\ t = 1967\text{-}88.$

Table A5 (continued)
Description of Variables Used in Carroll and Wasylenko Study

VARIABLE NAME IN ORIGINAL STUDY	*DESCRIPTION OF VARIABLE IN ORIGINAL STUDY*	*DESCRIPTION OF VARIABLE IN REPLICATION*
Other expenditures$_{s,t}$ (Continued)	"other state and local expenditures per $100 of personal income, expressed in first-differenced form" (Continued)	DATA SOURCES: *Direct General Expenditures, Higher Education Expenditures,* and *Primary and Secondary Education Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex2.xls", May 2001. *Health and Hospital Expenditures* and *Highway Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex3.xls", May 2001. *Public Welfare Expenditures* for 1977 and later downloaded from "ftp://ftp.census.gov/pub/outgoing/govs/", file name: "97Rex4.xls", May 2001. *Direct General Expenditures, Health and Hospital Expenditures, Higher Education Expenditures, Primary and Secondary Education Expenditures, Highway Expenditures* and *Public Welfare Expenditures* for years earlier than 1977 hand entered from annual issues of Government Finances. *Personal Income, Transfer Payments,* and *Government and Government Enterprises* data downloaded from http://www.bea.doc.gov/bea/regional/spi/", June 2001.