8-2006

Essays on Tax Competition

Brian Christopher Hill
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Brian Christopher Hill entitled "Essays on Tax Competition." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

Matthew N. Murray, Major Professor

We have read this dissertation and recommend its acceptance:

Donald Bruce, William F. Fox, LeAnn Luna

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a dissertation written by Brian Christopher Hill entitled "Essays on Tax Competition." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

Matthew N. Murray
Major Professor

We have read this dissertation
and recommend its acceptance:

Donald Bruce

William F. Fox

LeAnn Luna

Accepted for the Council:

Anne Mayhew
Vice Chancellor and Dean of
Graduate Studies

(Original signatures are on file with official student records.)

Essays on Tax Competition

A Dissertation
Presented for the
Doctor of Philosophy Degree
The University of Tennessee, Knoxville

Brian Christopher Hill
August 2006

Acknowledgements

Many people are owed a great deal of recognition for the pleasure of my graduate school experience and the completion of this dissertation. The remarks contained here represent only a small sample of the gratitude that is owed to the individuals who have made by time here at the University of Tennessee an enjoyable time.

First and foremost, I thank my parents for the love and support they have provided. This dissertation would not have existed without their continual encouragement and assistance. My brother and sister, as well as their families, also deserve recognition for the love and encouragement they have shown. My extended family, including my loving grandparents, has also provided me with constant encouragement and aid. I am also extremely thankful for my many friends who have provided relaxing interruptions throughout my graduate school experience.

Many of the faculty at Tennessee have exceeded their role of academic instruction by also taking an interest in my growth as an individual. Matt Murray deserves my greatest gratitude for his role as mentor and advisor. I am extremely grateful and proud to have been supervised by someone who so willingly shared his knowledge and guidance throughout my time at Tennessee. My almost daily conversations with him were some of my most important learning experiences as an academic.

Bill Fox has also been an excellent mentor during my graduate school experience. I am sincerely indebted to him for so freely sharing his remarkable amount of knowledge. Don Bruce has also displayed a remarkable willingness to share his vast understanding of economics with graduate students. I am very thankful for this as it played a role in my growth as an economist. I am also appreciative of LeAnn Luna's role as a member of my

committee. Her remarks and contributions to my work have certainly improved this work.

Thankfully, many fellow graduate students became some of my closest friends during graduate school in addition to playing a significant role in my completion of the program. Without exaggeration, I can attribute the successful completion of my first year of graduate school to my friends Jeff Smith, Keith James, Tami Richards, Panos Kasteridis and Maria Sarigiannidou. In addition, my general understanding of economics benefited from informal conversations with Mark Tuttle, Ken Small, John Deskins and Steve Cotten. My time at CBER also profited from time spent with graduate students Laura Ullrich, Karie Barbour, Bryan Shone, Terry Woodall and Beth Howard.

The staff in the Economics Department as well as the Center for Business and Economic Research offered extraordinary assistance. My friends and coworkers at CBER welcomed me as a fellow colleague and provided great aid to my research. In addition, I am very grateful to the staff in the Economics Department for the support they provided. I hope to have coworkers in the future that resemble the colleagues I had at the University of Tennessee.

Abstract

Essay 1

This essay empirically researches the setting of multiple tax rates by county governments in the presence of tax competition and agglomerations. Previous empirical evidence outside the tax arena suggests that firms earn rents in the presence of agglomerations from external economies of scale. As a result, governments might be able to extract a portion of these rents from businesses through higher tax rates. This paper empirically examines how local governments set sales and property tax rates, the two largest taxes paid by businesses at the state and local level, taking into account tax competition pressures and agglomerations. Using county jurisdictions, results are mixed regarding whether county governments set tax rates strategically, depending upon the specification of competitors. When found to set rates strategically, county governments behave as strategic complements. More specifically, a county government responds to an increase of one percentage point in its competitors' sales (property) tax rate by increasing its rate by roughly 1.0 (0.5) percentage points. In addition, property tax rates are positively associated with certain measures of agglomerations, suggesting that governments might attempt to capture a portion of agglomeration rents through imposing higher property tax rates on businesses. These results suggest that agglomeration forces might affect the "race to the bottom" pressures.

Essay 2

This essay empirically investigates how a state that easily maintains and attracts residents conducts its tax policy while simultaneously accounting for the impact that state tax rates have on migration patterns. A state that easily maintains and attracts residents is thought to have some monopoly power that would allow the state to not be as concerned about the race to the bottom in tax rates. Specifically, a state with monopoly power will not feel the same pressure to lower tax rates to attract and maintain individuals. In addition, the state with monopoly power is not as concerned with the tax rates set in other states. State policymakers have long been concerned with the potential for their state's tax policy to drive away residents and prevent non-residents from locating in the state. These fears potentially play a large role in the tax rate choices made by state policymakers. Results using a panel of state data from 1993-2004 confirm both hypotheses. Controlling for the simultaneous nature of the migration response and the tax rate decision, a positive relationship is found between the net in-migration of a state and the state personal income tax rate and the total state tax burden, indicating that a more attractive state is able to impose higher tax rates on its residents. Also a high net in-migration state responds differently to other states' tax rates than a low net in-migration state.

Table of Contents

Part 1: General Introduction 1
Part 2: Essay 1: Competitive Tax Rate Setting in the Presence of Agglomerations 4
1.A Introduction 5
1.B Relevant Literature 9
1.C Modeling Framework 16
1.D Data 26
1.E Results 32
1.F Conclusion 39
Essay 1: References 42
Appendices 46
Part 3: Essay 2: Interactions Between Migration and State Tax Rates: An Empirical Investigation 57
2.A Introduction 58
2.B Relevant Literature 61
2.C Theoretical Background 66
2.D Empirical Strategy and Data 71
2.E Results 84
2.F Conclusion 88
Essay 2: References 91
Appendices 95
Vita 106

List of Tables

Essay 1:	Competitive Tax Rate Setting in the Presence of Agglomerations	4
Table 1.1:	Variable Descriptions and Source Notes	49
Table 1.2:	Summary Statistics	50
Table 1.3:	3SLS Results with 4 Weight Specifications	51
Table 1.4:	3SLS Robustness Results with 4 Weight Specifications	52
Table 1.5:	SUR Yardstick Results with 4 Weight Specifications	53
Appendix Table 1.1:	OLS Results	54
Appendix Table 1.2:	IV Random Effects Results	55
Appendix Table 1.3:	SUR Results with 4 Weight Specifications	56
Essay 2:	Interactions Between Migration and State Tax Rates: An Empirical Investigation	57
Table 2.1:	Variable Descriptions and Source Notes	98
Table 2.2:	Summary Statistics	99
Table 2.3:	2SLS Results	100
Table 2.4:	Simultaneous Tobit Results	101
Table 2.5:	Interaction Models	102
Table 2.6	Interaction Interpretations	103
Appendix Table 2.1:	Strategic Competition Models	104
Appendix Table 2.2:	Mobility Models	105

List of Figures

Essay 1:	Competitive Tax Rate Setting in the Presence of Agglomerations	4
Figure 1.1:	Average Tax Rates	47
Figure 1.2:	Tax Rate Interdependencies	48
Essay 2:	Interactions Between Migration and State Tax Rates: An Empirical Investigation	57
Figure 2.1:	Net Migration Rate and State Tax Measures	96
Figure 2.2:	Net Migration Rankings by State, 2004	97

Part 1: General Introduction

A relatively new area of research in public economics is concerned with tax competition among governments, which occurs when governments levy a tax on a mobile tax base. The general finding in the literature is that governments do not set fiscal policies in isolation. Whether governments set tax rates competitively in order to attract the mobile factor or whether governments are subject to yardstick competition pressures, the tax rate of a jurisdiction is generally found to depend on that of other jurisdictions. One fear of the strategic interaction is that as governments compete for the mobile factor, tax rates will be competed to inefficiently low levels, commonly referred to as the "race to the bottom."

Early theoretical models of tax competition generally began with the assumption that factors are perfectly mobile. Recent theoretical models have offered cases where imperfect mobility of factors may alter some of the "race to the bottom" effects of tax competition. For example, businesses may derive benefits from operating in regions that provide cost advantages, such as labor market pooling, technological spillovers, or proximity to input providers and final demanders. These advantages of operating in an agglomeration may lessen the potential for the business to flee the jurisdiction, allowing the jurisdiction to maintain a higher tax rate than would otherwise be possible.

Individuals may also have mobility constraints from being attached to or attracted to a certain region, due to climate or family reasons for example. Jurisdictions that are attractive to residents and non-residents may then be able to sustain higher tax rates as residents are not as likely to leave the jurisdiction and non-residents remain attracted to the jurisdiction. As countries around the world become more concerned with how mobility of factors has lessened their ability to levy taxes, as evidenced by both the

OECD and the European Union introducing initiatives in the 1990s to curb “harmful” tax competition, it is increasingly important to understand how governments react to each other.

This dissertation hopes to contribute to the literature by examining whether aspects of immobility lessen the effects of tax competition pressures. This is done in two separate essays. The first essay sets out to inform the literature by empirically examining whether county governments are able to maintain higher property or sales tax rates in the presence of agglomerations. The second essay sets out to empirically investigate the relationship between the attraction of the state and the tax rates of the state. It is thought that a more attractive state, as revealed through higher net migration rates is able to maintain higher tax rates on individuals than a low net migration state.

The evidence in the theoretical literature and in the empirical essays provided in this dissertation indicates that governments are able to extract rents from individuals in the presence of factor immobility aspects. This allows for a gap to exist between tax rates across jurisdictions. While this allows the tax rate to remain higher in the jurisdiction with the advantage, whether from agglomerations or a preference for the jurisdiction, the race to the bottom effect is not immediately clear. The jurisdiction without the ability to extract rent may in fact compete more aggressively for the mobile factor and increase the race to the bottom. The gap between rates may remain, but both tax rates may be competed even faster toward the bottom.

Part 2: Essay 1: Competitive Tax Rate Setting in the Presence of Agglomerations

1.A Introduction

Most of the theoretical literature on capital tax competition has found that tax rates on capital are too low, and the resulting provision of public goods is too low as a consequence.[1] These models build upon the idea that mobile capital is competed for by governments through strategically setting tax rates with respect to other jurisdictions.[2] Within these models a "race to the bottom" is predicted in tax rates as governments attempt to attract capital. As capital has increasingly become more mobile and taxes on capital continue to exist, researchers have searched for reasons for the remaining capital tax.

A new strand of theoretical research has grown in an attempt to resolve this puzzle. The standard tax competition models mentioned above failed to recognize an additional effect that capital mobility might have: the creation of agglomeration economies as stressed in the economic geography literature. That is, firms have incentives to locate near other firms if external economies of scale are present. These agglomerations are thought to exist for different reasons including natural advantage, labor market pooling, informational spillovers, and proximity to suppliers of inputs or proximity to producers of output. Regardless of the reason for agglomerations, economic activities are often found to locate in a concentrated area.[3] The question then arises, what effects might this have on tax competition?

---

[1] See Wilson (1999) for a thorough survey of capital tax competition.
[2] Strategic interaction in this setting is defined as one government's maximization problem being dependent upon choices made by other governments.
[3] According to the U.S. Census 75% of U.S. citizens live in cities, even though cities only constitute about 2% of the land area in the continental U.S.

In a number of recent theoretical studies, these agglomerations have been shown to allow for a positive tax gap to exist between jurisdictions, potentially mitigating, but not necessarily fully offsetting, the negative effects of capital tax competition. In the economic geography literature, firms are found to locate in a concentrated area in order to take advantage of the external economies of scale that are present, which leads to agglomerations. The firms are described as locating in the "core" or the "periphery," where firms in the core are defined as enjoying external economies of scale and firms in the periphery do not gain from external economies of scale. The key component of such a model is the ability for the firm to earn rent from the agglomeration. Governments are then able to capture a portion of these rents through the imposition of higher capital tax rates without the fear of capital fleeing the jurisdiction. In effect the agglomeration forces serve to lessen the mobility of the capital.

While the agglomeration allows the tax rate to remain higher in the jurisdiction with the agglomeration, the race to the bottom effect is not immediately clear. The jurisdiction without the agglomeration may compete more aggressively for capital and increase the race to the bottom. The gap between tax rates may remain, but both tax rates may be competed even faster toward the bottom.

As regions become more integrated through lower transportation and communication costs, there is potential for policymakers to fear the expected race to the bottom in capital tax rates. An understanding of tax policy in the presence of agglomeration economies may help shed light on how certain jurisdictions will behave under increased interactions and mobility.

To date an extensive empirical literature exists in explaining the strategic behavior of tax rate setting by governments. Evidence usually indicates that governments behave as strategic complements. That is, a government will increase its own tax rate in response to another government's tax rate increase. Luna (2004) estimates both long run and short run local sales tax rate equations for counties. She assumes strategic interaction with other counties occurs with a one-year time lag and it occurs simultaneously with the state. She finds a positive response by a county to both the neighboring county rates and the state rate. Rork (2003) examines the competition between states in setting their sales tax rates, as well as other tax rates, and finds a negative response of states to their neighboring states. Finally, Brueckner and Saavedra (2001) search for strategic competition in property tax rates by local governments in the Boston metropolitan area and find either positive or no responses to competing jurisdictions' tax changes.

Little empirical research has investigated the effects that agglomerations have on tax rates. If agglomeration rents are present, the downward pressure that capital tax competition places on tax rates will be lessened. Thus, an empirical model describing the determination of tax rates for a jurisdiction should include factors representing both tax competition and agglomerations. Egger, et al (2005) found that tax rates are higher in countries with larger labor forces (an indication of being located in the core according to the paper), which they suggest confirms the theoretical findings of the economic geography literature. In addition, very little attention has been paid to the simultaneity that exists if governments set their own tax rates simultaneously. Given the ability for governments to use multiple tax instruments, it might be that the equations explaining the

tax rate decisions of governments are determined simultaneously requiring use of estimation techniques that correct for the potentially correlated error terms.

This research attempts to help solve this puzzle by examining how county governments in Tennessee might attempt to capture agglomeration rents through increases in property or sales tax rates, taking into consideration tax competition forces.[4] If an agglomeration of firms does exist in a county and rents are earned, the government might attempt to capture a portion of the rents through increasing either the property or sales tax rate, or both.[5]

This study is valuable for several reasons. First, it provides information regarding the relationship between agglomerations and tax rates. By understanding the role that agglomerations play in setting tax rates in a competitive setting, it might be easier to predict how different jurisdictions will respond as interactions between them increase. Second, much of the empirical literature on tax competition has ignored the simultaneous setting of multiple tax instruments. Given the likelihood that governments do consider all instruments when setting each one individually, a simultaneous setting should be estimated when possible. This study takes the simultaneous setting into account by accounting for correlated error terms in estimating models for sales and property tax rates. Finally, the level of analysis in this study is the county level. Given the nature of external economies of scale and agglomerations, it might be more realistic to think that

[4] In 2002, nearly 93% of county tax revenue in Tennessee was from the property and sales tax (Census of Governments, 2002).

[5] Because sales and property tax rates cannot be set independently for consumers and businesses, the ability to capture rents from businesses through these tax rates will be lessened. Even so, the ability for a county government to employ tax rates to extract rents from businesses within their jurisdictions is likely to be done with sales or property tax rates because of their magnitude. In addition, there is evidence that workers earn rents in the presence of agglomerations, and thus the government might be able to extract a portion of their rents, so larger agglomeration economies would still be associated with higher tax rates.

potential benefits are more likely to occur at the local level, so the county level focus is appropriate. In addition, mobility of factors plays an important role in tax competition models. Much of the empirical tax competition research has focused on the country or state level, so this research provides different results for jurisdictions with relatively easier mobility between them.

The structure of the paper is as follows. Section 1.B describes the relevant literature. The theoretical structure and empirical methodology are discussed in Section 1.C, followed by descriptions of the data in Section 1.D. Results are presented in Section 1.E and Section 1.F concludes.

1.B Relevant Literature

As the paper is focused on understanding the relationship between agglomerations and tax rates, two important questions are first addressed to frame the analysis. First, why might tax interdependencies exist and how are they tested for? Different theories explaining strategic interaction are consulted for guidance in approaching these questions. Appropriate definitions of "competitors" are considered and econometric issues associated with the simultaneous setting of tax rates by "competitors" are addressed before estimation. Also, if county governments compete with one another for firms, then the capital tax competition literature is relevant. In an attempt to guide the study, this paper draws on the rather extensive literature on empirically estimating strategic tax rate setting.[6]

[6] See Brueckner (2003) for a summary of the empirical literature.

A second issue is whether firms benefit from locating near one another and how these agglomeration economies are measured. An extensive literature is consulted explaining the nature and effects of agglomerations. While little is empirically known about the effects of agglomerations on tax rates, other studies have examined the effects of agglomerations on variables such as wages and productivity. These studies help guide the decision on the best way to measure the presence of agglomerations.

Tax Competition Models

Standard Tax Competition. The standard theoretical explanation for capital tax competition arises because of capital mobility.[7] Zodrow and Mieszkowski (1986) and Wilson (1986) were among the first to formally examine tax competition for capital between governments. In the case of capital tax competition, governments compete for a fixed level of capital by luring capital into the jurisdiction with lower capital tax rates. The end result of the theory is a race to the bottom between governments with respect to capital tax rates.

Because of the assumption of fixed capital supply, an outflow of capital resulting from an increase in tax rates from one jurisdiction represents an inflow into the other jurisdiction. Thus, the optimization problem for the government consists of the tax rates of its own jurisdiction as well as tax rates of the other jurisdiction. In other words, governments behave strategically when setting capital tax rates.

Yardstick Competition. In addition to tax competition arising from factor mobility, the theory of yardstick competition provides another explanation for strategic

[7] Because this paper is primarily concerned with tax competition for capital, discussion of commodity tax competition is excluded. For important contributions to the literature, see Mintz and Tulkens (1986) and Kanbur and Keen (1993).

interaction between governments. Besley and Case (1995) propose a model of tax setting in the presence of multiple jurisdictions, where asymmetric information regarding the politicians' decisions exists between voters and politicians. As a result, voters make decisions about politicians' abilities to set taxes and expenditures in a relative way; that is, a politician's performance is measured relative to politicians from other jurisdictions. In this world, a voter may not mind that her taxes are rising if voters from other jurisdictions are experiencing similar tax increases. Because voters decide whether or not to vote for an incumbent based on their jurisdiction's taxes compared with other jurisdictions', incumbents may consider other jurisdictions' tax rates before setting their own tax rate.

Agglomerations

As far back as Marshall (1920) researchers have studied the incentives for firms to locate near each other and form what is called an agglomeration. Agglomeration economies are thought to benefit a firm to the extent that locating within the agglomeration lowers the cost of operating the firm because of positive externalities from the agglomeration. This is usually thought to occur through a number of avenues. The presence of a trained labor force, or labor market pooling, makes the cost of hiring and training new employees relatively cheaper. Knowledge spillovers exist to the extent that technological advancements developed in one firm spread to surrounding firms at a lower cost than transmitting over greater distances. The proximity of firms to producers of intermediate inputs and to the final demanders of a firm's output lowers the cost of production as well.

One of the most commonly disputed dimensions of agglomeration economies is the scope of the externality. The literature has generally labeled the scope of the agglomerations into three categories: (1) internal economies of scale, (2) economies of scale external to the firm but internal to the industry (localization economies) and (3) economies of scale that are external to the firm *and* the industry (urbanization economies).[8] An additional line of disagreement is over the geographic scope of the externality with some arguing that any benefits from externalities occur at a very localized level, thus discussions of agglomeration economies should not extend to too great a geographic size (Rosenthal and Strange (2003b).

Localization economies are often attributed to Marshall who envisioned local clusters of industries:

> When an industry has thus chosen a locality for itself, it is likely to stay there long: so great are the advantages which people following the same skilled trade get from near neighbourhood to one another…Employers are apt to resort to any place where they are likely to find a good choice of workers with the special skill they require. (Marshall (1920), p. 271)

Researchers have generally suggested that Marshall's thinking indicates that external economies of scale might arise from labor market pooling. It has also been suggested that localization economies are beneficial to industries through increased communication, leading to relatively cheaper transmission of technological spillovers. Current examples of localized economies often offered are Silicon Valley, the carpet industry in North Georgia and the furniture industry in Western North Carolina.

[8] See Eberts and McMillen (1999) for a discussion of the different scopes of agglomerations.

In contrast to Marshall's view of specialized industrial clusters being advantageous to businesses, Jacobs (1969) stressed the importance of urban diversity. She conjectured that the presence of diversity in a region promotes innovation across industries.[9]

A relatively large body of literature exists examining the role that localization and urbanization economies have on the productivity of a region as well as the role that agglomerations play in the location of economic activity, such as foreign direct investment. The former studies generally show that localization economies have significant positive impacts on productivity while urbanization economies have less of an impact (Nakamura (1985), Henderson (1986) and Rosenthal and Strange (2003a)). The economic activity location literature has also found that economic activity is more likely to locate near other similar activities, which is evidence of localization economies (Head, et al. (1995) and Hilber and Voicu (2006)).

The literature has proposed several different measures of agglomeration economies depending on whether the measure is attempting to measure localization or urbanization economies. The theoretical microfoundations of agglomeration economies provide the best guide to choosing an appropriate measure. Unfortunately, it is the benefits that arise from labor market pooling, technological spillovers or diversity that are responsible for the externalities. Because it is not possible to measure the benefit that a firm receives from these sources, the literature has done its best to derive appropriate measures of an agglomeration. Because the impact of agglomeration economies can

[9] See van der Panne (2004) for a recent discussion of the differences between Marshallian and Jacobian externalities and the relevant literature supporting each argument.

originate through a number of avenues, it is best to consider several different agglomeration measures.

Glaeser, et al. (1992) examines agglomeration impacts by estimating the impact that local industrial specialization and diversity has on a city's growth. In order to measure specialization of an industry in an area, they used a location quotient for industry *i*, measured as

$$specialization_{it} = \frac{e_{it} / E_{it}}{e_{st} / E_{st}} \qquad (1)$$

where *e* is the number of jobs in an industry, *E* is the total number of jobs and the subscripts *i*, *s* and *t* denote counties, the United States and year, respectively. The variable measures how specialized an industry is in a county relative to how it would be if the industry was randomly spread across the U.S.[10]

While this variable is an easily derived measure, Rosenthal and Strange (2003b) discuss some potential problems with it. One of the primary concerns with such a measure of specialization is the issue of relative versus absolute effects of industry concentration. Microfoundation theories of agglomeration economies primarily rely upon the absolute scale of an industry providing benefits to a region as opposed to the relative scale of the industry. While the theory of localization economies does not speak directly to effects of the relative share of the industry in the county, there are benefits to the measure. Primarily, the share variable can be viewed as a net effect. That is, large

[10] An identical measure was calculated with county employment relative to Tennessee employment. Models discussed below were conducted with the measure and results remained consistent with those discussed in the paper. The national ratio was used to remain consistent with the majority of the literature (Glaeser, et al (1992) and Gabe (2005)).

absolute size of industry in a county is suggestive of localization economies but being small in relative size implies that there is substantial additional activity in the area that might introduce congestion costs. As a result, the relative size of the industry captures the benefits of the localization economies, excluding any congestion costs.

As discussed above, the urbanization economies may also play an important role in providing external economy of scale benefits to a region. One variable commonly used in the literature to examine whether urbanization economies have an impact is the population of the region. Early studies on the origin and productivity of cities (Sveikauskas (1975), Segal (1976) and Moomaw (1981)) used population size to measure the benefits of a density of economic activity. More recent studies have viewed diversity of economic activity as a more appropriate measure of Jacobs' urbanization economies theory. These studies typically employ a Herfindahl-Hirschman index (HHI) of employment diversity generally measured as, $\sum s_{it}^2$, where *s* is the share of employment in industry *i*. Examples of such queries generally find that diversity of industry within a jurisdiction broadly encourages growth (Glaeser, et al (1992)), encourages growth of high-tech firms (Henderson, et al (1995)) and encourages firm births (Rosenthal and Strange (2003a)).[11]

Together the literature offers many insights but also leaves many unanswered questions. While the empirical literature has made important gains in understanding strategic interaction between governments, it has largely neglected the simultaneous

[11] One of the more recent indices used in examining whether an industry is agglomerated is the one developed by Ellison and Glaeser (1997). This index requires the use of plant level data within industries, which are not always available in rural counties. For this purpose the index is not used in this study, but is a possible alternative for any further investigations of the impact of agglomerations on tax policy at a MSA level.

setting of multiple tax instruments and the presence of agglomerations. This paper contributes to the existing literature on tax competition primarily by addressing these issues. The tax competition literature suggests that county governments would be hesitant to set tax rates too high out of fear that capital would flee the jurisdiction. Because of this fear, county governments might be expected to set tax rates as strategic complements with other counties. If agglomerations exist, capital is less likely to flee so the governments can set higher tax rates without the fear of a capital outflow. As a result, county governments will be able to impose higher tax rates in the presence of agglomeration economies.

1.C Modeling Framework

Krugman's (1991) study of the "new economic geography" led to renewed interest in the notion of agglomerations and led to several studies that recognized the potential for agglomeration economies to alter the general findings from the tax competition literature (Kind, et al (1998 and 2000), Ludema and Wooton (2000) and Baldwin and Krugman (2004)). These papers recognized that the capital mobility driving the tax competition models also potentially leads to the formation of agglomerations.

The earning of rent in an agglomeration then offers governments an opportunity to forestall the race to the bottom in capital tax rates. Given that there is evidence of firms earning rents in the presence of agglomerations, it follows that governments might then attempt to raise the tax rates paid by the firms to capture a portion of the rents. This will offset the race to the bottom that is predicted in the standard tax competition models. The following sections present the standard tax competition model followed by some

insights from tax competition in the presence of agglomeration economies. In contrast, the presence of the agglomerations may expedite the race to the bottom in capital tax rates. The jurisdiction without the agglomeration benefits may compete more vigorously for the capital. Because too great of a gap in tax rates will cause capital outflow, the jurisdiction with the agglomeration will have to lower its rates as well to maintain the gap.

Standard Tax Competition Model

The basic tax competition model employed here considers a two-region (*i* and *j*) version of the standard Zodrow and Mieszkowski (1986) model. Each region has three sectors: a production sector, a household sector and a public sector. Mobile capital (*K*) and immobile labor (*L*) are assumed to be the only two inputs used in production. Households are assumed to supply the labor or own the capital used in production. The production process is described by $F(K_i, L_i)$ which can be rewritten as

$$y_i = f(k_i), \quad f'(k_i) > 0, \quad f''(k_i) < 0 \tag{2}$$

where *y* is the output to labor ratio and *k* is the capital-labor ratio.[12]

The utility of a representative household is given by

$$u(x_i, g_i), \quad \partial u/\partial x_i, \partial u/\partial g_i > 0, \quad \partial^2 u/\partial x_i^2, \partial^2 u/\partial g_i^2 < 0 \tag{3}$$

where *x* and *g* are private and public good consumption, respectively. The household's budget constraint is given by

$$x_i = (f(k_i) - f'(k_i)k_i + \rho\bar{k})(1 - t_i) \tag{4}$$

[12] This is allowed assuming that the production function is homogeneous of degree one.

where $f(k_i) - f'(k_i)k_i$ is the wage received by region *i*, ρ is the net return to capital and $\bar{k}$ is the proportion of total capital owned by the individual. Following Baldwin and Krugman (2004), it is assumed that all factor income is taxed at the same rate, *t*. The amount of the public good available for consumption is equal to the amount of revenue raised by the government, given by $g_i = t_i k_i$, where t_i is the tax rate on capital.

Perfect Capital Mobility. The total amount of capital in the world, k_w is given by the sum of capital in both regions, $k_i + k_j = k_w$. When capital is perfectly mobile, owners of the capital can move capital outside of one region into the other if the net rates of return are different. When the net return to capital is equal in both regions, there will be no incentive for capital to flee, thus the outcome is characterized by the condition

$$f'(k_i)(1-t_i) = f'(k_j)(1-t_j). \qquad (5)$$

An increase in the tax rate by region *i* will cause an outflow of capital from *i* to *j*, and a subsequent increase in the gross return to capital in region *i* and a decrease in the gross return to capital in region *j*. The elasticity of capital in region *i* with respect to its tax rate (ε_{k_i}) is given by totally differentiating equation (5), holding *j*'s tax rate constant:

$$\varepsilon_{k_i} = \frac{f'(k_i)t_i}{k_i(f''(k_i)(1-t_i) + f''(k_j)(1-t_j))} < 0. \qquad (6)$$

The negative sign on the elasticity indicates that capital will flee the jurisdiction given a higher tax rate.

In the standard tax competition models, it is assumed that governments play a Nash game in setting tax rates. Specifically, governments are assumed to maximize the representative household's utility, subject to the household and government budget

constraints, also taking the other jurisdiction's tax rate as given. The first order condition of the optimization problem gives the marginal rate of substitution between the public good and private income. Using the implicit function theorem, this is given by

$$\frac{u_{g_i}}{u_{x_i}} = \frac{-dx_i / dt_i}{dg_i / dt_i} = \frac{m_i}{y_i(1+\varepsilon_{k_i}\frac{k_i}{y_i}f'(k_i))} \qquad (7)$$

where $m_i = f(k_i) - f'(k_i)k_i + \rho\bar{k}$. The key conclusion of the models is that the marginal cost of increasing the public good (given by the right side of equation (7)) can be shown to be greater than one because of the capital outflow resulting from an increase in the tax rate. As a result, the governments are shown to set tax rates on capital inefficiently low.

Agglomeration Model. An assortment of new economic geography models shows scenarios where tax competition does not lead to a race to inefficiently low capital tax rates (Ludema and Wooten (2000), Kind, et al. (2000) and Baldwin and Krugman (2004)). These models generally conclude that a tax can be levied on a mobile factor because of the existence of rents from agglomerations. These models find that all economic activity locates in one region and the return to capital is higher in the presence of the agglomeration than the potential return in other regions. This allows for a higher tax in the region with the agglomeration without causing an outflow of capital.

Following Krogstrup (2004) the positive tax difference in the presence of agglomerations is demonstrated with the use of production under external economies of scale. Assume that capital is the only factor of production and that there is a positive second derivative of the economy-wide production function:

$$y_i = f(k_i), \quad f'(k_i) > 0, \quad f''(k_i) > 0, \quad f(0) = 0. \qquad (8)$$

It is assumed that individual firms continue to operate in a perfect competition environment and earn zero profits. A unit of capital under the presence of increasing returns to scale is paid its average product

$$r = \frac{f(k_i)}{k_i}. \tag{9}$$

Perfect Capital Mobility with Agglomeration Economies. The presence of external economies of scale leads to some differences in the findings of the standard tax competition model. In this model, a capital outflow from jurisdiction *i* to *j* will increase the productivity of capital in *j* and will lead to more capital flow to *j* until all capital is in the jurisdiction. The tax competition game in this setting again begins with governments simultaneously choosing their tax rates to maximize the representative household's utility, taking the tax rate of the other jurisdiction as constant. If a difference exists in the net return to capital, capital will migrate into the region with the higher net return until all capital locates in one region.

In this core-periphery model of the game, all capital is located for production in one region only. Because owners of capital can live in either jurisdiction, the income of the owners is given by

$$x_c = x_p = \left(\left(\frac{f(k_w)}{k_w} \right) (1 - t_c) \right) \cdot \bar{k} \tag{10}$$

where *c* and *p* subscripts represent the core and periphery jurisdictions, respectively. Tax revenues are given by

$$g_c = t_c k_w \qquad \text{and} \tag{11}$$

$$g_p = 0. \tag{12}$$

Under the core-periphery setting, the core is able to impose taxes on capital as long as the tax difference does not exceed the difference between the gross return to capital in the core and the potential gross return to capital in the periphery. The upper limit of the tax rate is given by the difference in the average return to capital when all capital is located in the core, $\frac{f(k_w)}{k_w}$, and the marginal return to capital when it is the first capital to locate in the periphery, $f'(0)$. This is given by

$$t^u = \frac{f(k_w)}{k_w} - f'(0) > 0.$$

The key result is that t^u is positive, which results from the average product of capital being greater than the marginal product of capital when the production function enjoys increasing returns to scale.

If the tax rate is set above this upper limit, capital will flee the core jurisdiction into the periphery and, given the increasing returns to scale, will continue until all capital has relocated into the new jurisdiction. To prevent this from happening, the core sets a tax rate on capital that is greater than zero but less than t^u.

Standard tax competition models suggest that jurisdictions will compete for mobile capital by setting tax rates that are inefficiently low with resulting inefficiently low public good provision. Allowing for the presence of agglomerations enables one jurisdiction to maintain a positive tax difference over the other jurisdiction without fear of capital fleeing the jurisdiction.

Building upon the theoretical structure the empirical literature on tax competition has generally proposed reaction functions of the form

$$s_{it} = \alpha_1 \sum_{j \neq i} \omega_{ij} s_{jt} + X_{it}\alpha + A_{it}\gamma + \varepsilon_{it} \quad (13)$$

$$p_{it} = \beta_1 \sum_{j \neq i} \omega_{ij} p_{jt} + Z_{it}\beta + A_{it}\delta + u_{it} \quad (14)$$

where *s* and *p* are the county sales and property tax rates, respectively, *A* is a vector of agglomeration measures, *X* and *Z* are vectors of control variables and ε and *u* are error terms.[13] As described in Brueckner (2003), estimation of the above equations does not allow one to attribute competition to standard capital tax competition or yardstick competition pressures. This is investigated in a later section.

Neighbor Specification

Before estimation of equations (13) and (14), assignment of counties as competitors must be completed. The term $\sum_{j \neq i} \omega_{ij} t_{jt}$, $t = s, p$, serves to aggregate the competing neighboring counties' tax rates, where ω_{ij} defines which counties are competitors and is specified a priori. Given that the interest of the paper is how counties set tax rates to attract businesses, what counties should be considered as competitors? The best way to define a jurisdiction's competitors depends upon the theoretical framework for the competition: capital tax competition or yardstick competition. If one considers standard tax competition to be the appropriate theory and to remain consistent with most literature, geographical neighbors might be a natural starting point, especially if the ability to move between jurisdictions is relatively easier in closer proximities. If bordering counties are the competitors the spatial weight term, ω_{ij}, is defined as the following: $\omega_{ij} = 1$ if counties *i* and *j* are contiguous and zero otherwise. The matrix is

[13] See Rork (2003) for a recent example.

row-standardized, meaning the sum of the weights equals one, so the term $\sum_{j \neq i} \omega_{ij} t_{jt}$ becomes the average of the neighbors' tax rates. This is referred to as the simple contiguity weight specification.

Because tax competition might result from movement of factors across jurisdictions, one can also imagine that a county might be more concerned with the actions of its more populous neighbors. Thus, it would place more weight on its neighbors that are more heavily populated. This leads to the population-contiguity matrix. It continues to define only the counties that border a county as neighbors, but the counties are given different weights based upon the proportion of the county's population to the entire bordering population. Again, the matrix is row-standardized so the term $\sum_{j \neq i} \omega_{ij} t_{jt}$ becomes a population-weighted average of the neighbors' tax rates and is referred to as a population-weighted contiguity weight specification.

It is also possible that counties consider other demographically or economically similar counties when setting tax rates as opposed to just physical neighbors. For example, Fletcher and Murray (2006) recently investigated the strategic setting of sales tax bases by states using different definitions of neighbors, including contiguity definitions, and found that non-geographic competition can be important.

If yardstick competition is the theory explaining strategic interaction, the non-geographic definition of neighbors might be even more important. Given the fact that politicians are judged based upon their relative performance, it might be that politicians consider other jurisdictions that contain similar median voters. To allow for this, a weight matrix is specified such that a county's competitors continue to be only bordering

counties, but more weight is placed on the counties with similar per capita incomes. Specifically, the weight applied to each county is the reciprocal of the absolute value of the difference in per capita income and again the matrix is row-standardized (Case, Rosen and Hines (1993) and Fletcher and Murray (2006).

As agglomerations play a key role in the location of capital, one might expect that counties with similar industrial structures compete for capital. For example, if a manufacturing firm is earning significant rents in an agglomeration it will not want to flee a jurisdiction unless another jurisdiction contains similar agglomeration externalities or sufficiently compensates with a lower tax rate. Here neighbors continue to be defined as only bordering counties, but more weight is placed on the neighbors with more similar industry diversity.[14]

Econometric Issues

Several econometric issues raised by Brueckner (2003) are addressed before estimating equations (13) and (14). First, because it is hypothesized that counties set tax rates strategically, the tax rates on the right hand side of the equations are endogenous. Simple ordinary least squares (OLS) estimation would lead to inconsistent estimates of the parameters. The literature commonly uses one of two estimation methods for equations (13) and (14). The first method inverts the equations and then estimates the model using maximum likelihood (ML) techniques and the second uses instrumental variables (IV) methods. The ML approach has been used by a number of studies, but if spatial error dependence is present, this approach may lead to spurious results. Following

[14] The theoretical model suggests that tax rates depend upon agglomeration measures. Including the agglomeration measure as a spatial weight introduces potential endogeneity, so the weights are lagged by one year.

Brueckner (2003), the IV approach involves regressing $\sum_{j \neq i} \omega_{ij} t_{jt}$ on X and $\sum_{j \neq i} \omega_{ij} X_{jt}$ and using the fitted values $\sum_{j \neq i} \omega_{ij} \hat{t}_{jt}$ as instruments for $\sum_{j \neq i} \omega_{ij} t_{jt}$. Both of these approaches will lead to consistent estimates of the parameters.[15]

A second problem involves the potential spatial error dependence that exists in estimating equations (13) and (14). If spatial error dependence is present, the error vector is defined by

$$\varepsilon = \lambda W \varepsilon + \mu \qquad (15)$$

where W is the weight matrix, μ is a well-behaved error vector and λ is an unknown parameter. If spatial dependence is ignored, the estimated finding of strategic interaction may be misleading. Spatial dependence in the error may induce correlation in the tax rates even though strategic interaction may not be present. Kelejian and Prucha (1998) show that reliance upon the IV estimation technique leads to consistent estimates even in the presence of spatial error dependence. Because the IV approach eliminates the problem of spatial error dependence, it is the method used in this study.

An additional problem is that counties set their tax rates within the same setting; therefore, the error term in the sales tax rate could be correlated with the error term in the property tax rate equation. As a result, the two-equation system is be estimated using three stage least squares (3SLS), which involves estimating the system of equations with

[15] Before a 2SLS approach is taken, proper tests of endogeneity will be performed as suggested by Hausman (1978).

generalized least squares (GLS) after the system of equations has been estimated with two stage least squares (2SLS) methods.[16]

1.D Data

Tax Rates

This research hopes to help inform the literature on whether local governments might attempt to capture agglomeration rents through increases in property or sales tax rates, taking into consideration tax competition forces. County governments in Tennessee are the level of government chosen here for a couple of reasons. First, given the concern of extending the benefits of agglomerations to too large a geographic area (Rosenthal and Strange (2003b)), research on the effects of agglomerations is more worthwhile at the county level. Second, the majority of the tax competition literature has focused on either the country or state level. While such investigations are interesting, the relative ease of mobility between counties, due to the close geographic proximity and similar cultural environments, suggests that the tax competitive pressures might differ at the county level.

The use of Tennessee data here does not necessarily provide parallels to all other states. Certainly the use of property taxes at the local level is not unique to Tennessee. According to the U.S. Census of Governments, local governments collected nearly 97 percent of state and local property tax revenue in 2004. In contrast, local governments collected less than 20 percent of state and local sales tax revenue in 2004. Even though roughly 30 states allow localities to impose sales tax rates, only about 15 of these states

[16] See Heyndels and Vuchelen (1998) for similar methodology.

permit any variation in the tax rates chosen by localities. The use of Tennessee data is still useful here for informing the literature on local property tax competition at the county level. While not all states allow local option sales tax rate variation, the research here remains important in informing how sales tax rates are set in such a setting. The panel of data used here will consist of the property and sales taxes from 1993- 2003, which are the primary taxes paid by businesses.[17] Tables 1.1 and 1.2 (all tables and figures provided in appendix) include descriptions, sources and summary statistics of the data used in this study.

The property tax paid in Tennessee counties is levied on real and personal property by county and municipal governments. The amount of property tax paid depends on three factors: the appraisal value set by the county assessor, the level of assessment set by the state and the tax rate set by the locality. The tax rate a business pays depends upon what type of property the property is as real and personal property are assessed at different percentages. After the property has been properly appraised and assessed, the tax rate is applied to the value. The effective rate paid by a firm on property is *Effective rate = Statutory rate x Appraisal ratio x Assessment level*. To best test whether county governments attempt to capture agglomeration rents from businesses, this paper will look at effective tax rates on real commercial and industrial property.

[17] As Ring (1999) shows, more than 40 percent of sales tax revenue is derived from purchases made by businesses. Also, Cline, et al. (2004) find that in 2003 property taxes on business property and general sales taxes on business inputs account for over 60% of the total state and local business taxes paid by businesses.

Tennessee imposes a sales tax on all retail sales, leases and rentals of most goods, as well as taxable services.[18] The sales tax paid in Tennessee is a combination of the state rate and the local option rate imposed by county and/or city governments. The Tennessee state sales tax rate is applied equally across all counties within the state. The state sales tax rate was 6 percent in 1993 and was increased to 7 percent in 2003 except for grocery sales.

The counties then have the option of imposing an additional sales tax rate up to a state determined maximum on top of the state rate. The maximum rate is 2.75 percent throughout the panel and in 2003, 31 of the 95 counties imposed the maximum. For this reason, a dummy variable for whether the local sales tax rate is at the maximum is included in the sales tax rate equations. If a county does not impose the maximum rate, internal city governments then have the option to impose a rate less than or equal to the difference between the state-imposed maximum rate and the county rate.[19] Figure 1.1 displays the change in the averages of the local sales tax rate and the effective property tax rate on real commercial and industrial property over the panel. One can see an increase in the sales tax rate over time coupled with a slight decrease in the property tax rate over the time period.

Agglomeration Measures

As discussed above, there is disagreement whether benefits from agglomeration occur because of localization or urbanization economies. As a result, a number of

[18] All Tennessee sales tax information is obtained from the Tennessee Department of Revenue *Sales and Use Tax Guide* (2003). For a more thorough description of Tennessee taxes, see also the *Tennessee Tax Guide* (2003).
[19] According to Tennessee Code Annotated, Section 67-6-703 (a) (1), "The levy of the tax by a county shall preclude, to the extent of the county tax, any city or town within such county from levying the tax."

agglomeration variables have been used to measure the impact of an agglomeration on a firm. This research follows the past literature by allowing both specialization and diversity to play a role.

As described above, localization economies exist to the extent that firms operating in close proximity to other firms within the same industry enjoy external benefits. In order to measure the concentration of an industry in a county, this paper will use a measure similar to the measure from Glaeser, et al. (1992) defined as

$$specialization_i = \frac{e_{it} / E_{it}}{e_{st} / E_{st}} \tag{16}$$

where e is the number of jobs in an industry, E is the total number of jobs and the subscripts i and s represents counties and the United States.[20] Given the small size of some counties, data on all industries are not always readily available. For this reason, the measure is calculated for the specialization of the manufacturing, retail trade and service sectors in each county.[21] This variable measures how specialized the county is in the industry relative to how specialized it would be if spread randomly across the U.S. with a larger number representing more specialization in the industry.

As seen in Table 1.2, the maximum value in 2003 is 3.17 for manufacturing specialization, 1.66 for retail specialization and 1.12 for service specialization. If industry specialization provides benefits to a firm operating within the agglomeration, it is expected that tax rates would be higher in counties with more industrial specialization.

[20] Because of the possibility that firms and the resulting jobs locate in an area due to the tax policy, it is possible that the industrial specialization measure is endogenous to the tax rate. As a result, the specialization variables are lagged by one period in the estimation.

[21] The manufacturing, retail and service industries combine for over 60% of the total jobs for the state of Tennessee (BEA). Even limiting the industries to these three, several gaps remained in the panel and were filled by linearly interpolating the data.

As discussed above, it is not necessarily the relative size of the industry in the region, but potentially the absolute size of the industry. As a result, total county jobs in the manufacturing, retail and service sectors are included in an additional specification for robustness tests.

In addition to including measures for localization economies, urbanization economy variables are included. Jacobian externalities suggest that diversity of industry provides benefits to firms located within the diverse environment. For this purpose, a Herfindahl-type index, similar to that used in Henderson, et al. (1995) and Rosenthal and Strange (2003a), is included to capture this effect. This is given by $\sum s_i^2$ where *s* is defined as industry *i*'s share of total employment in county *i*. Again, because data on all industries are not available for every county, the industries examined are manufacturing, retail trade and service. A higher measure of the HHI-type index suggests a lack of job diversity in the county. If diversity provides external benefits to firms operating within the agglomeration, as in Jacobs' theory, it is expected that the industry diversity variable would have a negative effect on the tax rate.

The final measure of agglomerations is the population of a county. Early studies demonstrated that areas with large populations are positively associated with growth (Sveikauskas (1975), Segal (1976) and Moomaw (1981)), therefore a larger population might provide external benefits to firms with the potential for the government to extract some of these rents.

Explanatory Variables

Theoretical models of tax competition and agglomerations described above suggest that other variables besides the neighbors' rates and agglomeration factors might affect the tax rates, so they must be included in the estimation procedure. County unemployment rates are included because prior studies have shown that economic characteristics affect tax decisions. It might be expected that higher unemployment rates are signs of fiscal stress, so a positive sign might be expected. Per capita income, percent of population between ages 5 and 17, percent of the population over age 65 and population density are included to account for effects of demographic characteristics on tax rates.

On one hand, higher income individuals might prefer the sales tax relative to other taxes because of its regressive nature. On the other hand, higher income individuals might consume a relatively large amount of taxable goods, so a lower sales tax rate is allowed. If high-income individuals live in higher valued property, then the tax rate on property might be lower because of the larger base. Individuals between the ages of 5 and 17 and over 65 are often larger consumers of public services; thus a higher sales or property tax rate might be expected to meet the higher demand. Tennessee's requirement that one-half of local sales tax revenue be targeted for education may be consistent with this expectation. In addition to firms benefiting from operating in an agglomeration, evidence shows that workers are potentially benefactors of this increased productivity in the form of higher wages (Ciccone and Hall (1996)). If employees of the productive firms capture some of the rent, then the government may not be able to capture any leading to a lower tax rate.

In addition, government services will play a role in the setting of the tax rate. It might be expected that a higher tax rate will be permitted if government services received from the tax revenue are substantial, so per capita county government expenditures are included.[22]

County and year dummy variables are included to control for unobserved county- and time-specific characteristics that are time invariant. Finally, dummies are included for whether a county is on the state border and whether it is part of a Metropolitan Statistical Area (MSA).[23]

1.E Results

Baseline

Results for the baseline 3SLS estimations of equations (13) and (14) are presented in Table 1.3 with the columns separated according to the competitor specifications.[24] Before discussing specific results, it can be said that generally, county governments behave strategically with other county governments. When coefficient estimates on the neighbor's tax rate are statistically significant, the estimates are positive indicating that county governments behave as strategic complements. Results from the first regressions do not provide any specific tax competition theory to the strategic interaction.

An interesting finding also appears with respect to the specialization of manufacturing in the county. Greater manufacturing specialization in a county is

[22] Expenditures are included in per capita terms to eliminate scale issues arising from larger counties requiring more government services.
[23] The tax base is not explicitly controlled for in the initial models. Instead, proxies for the base, such as income and demographic characteristics are included. This is further examined in a later section.
[24] Regular OLS and IV results are presented in Appendix Tables 1.1 and 1.2 for comparison to the 3SLS coefficient estimates. It can be noted that coefficient estimates from the IV and 3SLS estimates are very similar.

consistently associated with higher property tax rates and occasionally with lower sales tax rates. This suggests that firms may be earning rents from locating in areas with a concentration of manufacturing firms and that county governments are able to extract a portion of the rents through higher property tax rates. However, counties with more specialization in the manufacturing sector are also found to have lower sales tax rates. The coefficient estimate on the measure of overall industry diversity is not significant in any of the specifications.

Sales Tax Rates. Evidence from two of the four neighbor specifications suggests that counties behave as strategic complements with respect to sales tax rates. Coefficient estimates are positive and statistically significant with magnitudes around 0.6. These suggest that a one percentage point increase in the average of the neighbors' sales tax rate would provoke a 0.60 percentage point increase in the county's own sales tax rate. These results are consistent with the positive coefficient estimates found in Luna (2004) but differ from the finding that states behave as strategic substitutes (indicated by the negative and significant coefficient estimate) with respect to sales tax rates in Rork (2003). These results indicate that the level of government is important in examining strategic behavior even with identical tax instruments.

As mentioned above, sales tax rates are negatively correlated with manufacturing specialization in two of the four specifications. The percent of population between the ages of 5 and 17 negative and significant in three of the four weight specifications, which is counter to what was hypothesized (see discussion of property tax rate below).

Property Tax Rates. Evidence from one of the four neighbor specifications indicates that counties behave strategically with respect to the property tax rate.

Coefficient estimates are positive and significant, again indicating that governments behave as strategic complements with respect to property tax rates, consistent with Brueckner and Saavedra (2001) and Heyndels and Vuchelen (1998). The significance of the neighbor's coefficient estimate in the income weight specification might be portrayed as more of a yardstick competition setting as discussed above, so these results are potential evidence that property tax rates compete through yardstick pressures, which will be explored in the next section. It might also be that if property is intending to flee a county, it might be expected that it would flee to a more economically similar county.

Evidence from all specifications suggests that the specialization of manufacturing plays an important role in the setting of the property tax rate. Manufacturing specialization is positively correlated with property tax rates in all specifications. If locating in an area with a specialized industry is a source of positive externalities for a firm within the industry or for all firms, then the positive correlation indicates that county governments are potentially able to extract a portion of the rents earned from firms operating in these localization economies.

The percent of population between the ages of 5 and 17 is always positive and significant, potentially as a result of the use of property tax revenue as a large source of revenue for education. A higher proportion of an older population is negatively associated with property tax rates, which might result from the lack of concern of the older population with education, which is financed so heavily by property tax revenues.

Robustness Checks

As discussed above, one concern with the industry specialization variables used in the baseline models is that models of agglomeration benefits do not necessarily indicate

that relative scale of the industry provides benefits to the industry.[25] Instead, benefits are often thought to arise from absolute size of the industry in the region. To examine this, Table 1.4 includes estimates with the absolute size of the manufacturing, retail and service sectors, as opposed to the relative size of the industry.

Results continue to indicate that county governments behave as strategic complements with respect to both sales and property tax rates. Coefficient estimates on the property tax rate are positive and statistically significant in all weight specifications, but are positive and significant in only two of the four weight specifications with respect to the sales tax rate. However, estimated agglomeration parameters differ from the baseline specification. Coefficient estimates on the number of retail jobs in the county are positive and significant in the property tax rate equation in three of the four weight specifications, while the manufacturing jobs parameter estimates are negative and significant in three of the four weight specifications. In addition, coefficient estimates on the number of service jobs in the county are positive and significant in all four weight specifications.

If locating in an area with a large number of retail and service jobs is a source of positive externalities for a firm, then the positive correlation indicates that county governments are potentially able to extract a portion of the rents earned from firms operating in these localization economies.

The difference in the results may be the result of the ability to export taxes in the presence of a large percentage of manufacturing firms. As discussed in McLure (1967)

[25] As discussed above, the relative size of the industry is a common measure in the empirical literature and does provide some benefits, such as accounting for negative congestion costs (Rosenthal and Strange (2003b).

and in Gade and Adkins (1990), if manufacturing firms are able to shift some of their tax burden on consumers and if consumers are located nationally, then high taxes on manufacturing firms, such as a high property tax rate, allows the jurisdiction to export a significant portion of the overall tax burden. Therefore, the results in Table 2.3 might actually be indication that county governments are attempting to export tax burdens as opposed to capturing agglomeration rents.

These results also provide evidence that sales tax rates are higher in a more diversified economy. Coefficient estimates on the industry diversity variable are negative and significant in two weight specifications. If firms gain external benefits from being located in a diversified economy as suggested by Jacobs (1969), the higher sales tax rate may be used to extract some rent from these firms.

Yardstick Competition

Evidence from the baseline 3SLS result with the income-weighted average weight suggests that yardstick competition might be the theory behind the strategic interaction between county governments when setting property tax rates. As proposed in Brueckner (2003), coefficient estimates from the baseline equations presented above cannot be specifically attributed to factor mobility tax competition or yardstick competition. Brueckner shows that both theoretical structures lead to tax rates in jurisdiction *i* being a function of tax rates in other jurisdictions, leading to the above estimating equations. This section investigates a potential method that will allow coefficient estimates to signify yardstick competition specifically as opposed to attributing strategic interaction to either standard factor mobility tax competition or yardstick competition.

Standard tax competition models lead to tax rates being set interdependently because the tax rate in one jurisdiction affects the tax bases of other jurisdictions. If county *i* increases its tax rate, tax base will flee into county *j*. The resulting increase in county *j*'s tax base can lead the government to either raise or lower its rate. If the government chooses to maintain its tax revenue, the government can decrease its rate and maintain tax revenues. If the jurisdiction places higher valuation on public versus private goods, then an increase in *i*'s tax rate might be followed by an increase in *j*'s tax rate.

Because standard tax competition models and factor mobilities are reflected by altering tax bases, if the tax base can be controlled for, any interaction still observed can be attributed to yardstick competition. For this purpose the following equations are estimated

$$s_{it} = \alpha_1 \sum_{j \neq i} \omega_{ij} s_{jt-1} + \alpha_2 SB_{it-1} + X_{it}\alpha + A_{it}\gamma + \varepsilon_{it} \qquad (17)$$

$$p_{it} = \beta_1 \sum_{j \neq i} \omega_{ij} p_{jt-1} + \beta_2 PB_{it-1} + Z_{it}\beta + A_{it}\delta + u_{it} \qquad (18)$$

where the variables are the same as in equations (13) and (14) with the exception of *SB* and *PB,* which are defined here as sales and property tax base, respectively.[26] Coefficient estimates of α_1 and β_1 from equations (17) and (18) should be evidence of yardstick competition.

[26] Given the ability of governments to raise revenue from multiple sources, governments may be engaged in making tax portfolio choices. For example, a jurisdiction with a significant amount of revenue from the property tax may have the ability to impose lower sales tax rates. For this purpose, models were estimated with both tax bases in each equation to control for the tax portfolio choice of governments. Results remain qualitatively similar to those presented in Table 1.4, so are not included.

For purposes of simplifying the estimation procedure, it is assumed that a county government responds with a one-year time lag in response to its neighbors' rates.[27] In order for the coefficient estimates to indicate yardstick competition, a few assumptions must hold true. First, there are only two methods through which tax rates can be interdependent – yardstick competition or factor mobility tax competition. Second, the government responds with a one-year time lag whether the strategic interaction is because of yardstick pressures or movement of the base. These two assumptions are summarized in Figure 1.2. If these hold and the tax base is controlled for, any correlation between t_{it-1} and t_j can be attributed to yardstick competition.

Because the neighbor's tax rate is lagged, it is no longer necessary to estimate the equations with 2SLS procedures. However, it remains that governments set the tax rates under similar conditions, resulting in potentially correlated error terms. For this purpose, the system of equation is estimated with seemingly unrelated regression (SUR) methods. Results are presented in Table 1.4.[28] Generally, evidence indicates that there is positive strategic interaction between county governments in setting sales tax rates and occasionally in setting property tax rates. However, the results in these models are suggestive of yardstick competition between counties as opposed to factor mobility induced tax competition.

A higher average (even when a weighted average) sales tax rate of bordering counties is associated with higher own county sales tax rates in every specification. Property tax

[27] Estimating the model with contemporaneous behavior here is complicated by inclusion of the tax base, given its endogeneity with the tax rates.

[28] Results from the SUR method cannot be directly compared to the baseline results, so equations (17) and (18) without the base included are estimated with SUR methods and presented in Appendix Table 1.3 for comparison.

rates are positively correlated with neighbor's property tax rates in two of the settings as well. Consistent with the baseline results, the specialization of manufacturing in a county plays an important role in both sales and property tax rates. As discussed above, the share specification might be evidence of tax exporting by counties as opposed to the capture of agglomeration rents.

1.F Conclusion

Examining the strategic interaction between governments in a federal system is a relatively new area of study. As a result, very few general results are known at this time. This research sets out to contribute to the literature by examining how local governments behave in the presence of tax competition and agglomerations. Lessons learned from local governments can then be applied to situations where the setting is similar, i.e. relatively low transportation cost movement between jurisdictions. In addition, the simultaneous setting of multiple tax instruments is addressed.

Baseline results suggest that when strategic interaction exists between county governments with respect to setting local sales and property tax rates, the governments behave as strategic complements. That is, governments respond to an increase in their competitors' rates by increasing their own rate. The positive interaction between governments allows for the potential race to the bottom in tax rates.

The paper also set out to examine the role that agglomerations play in the setting of tax rates. As proposed by theoretical literature, the presence of agglomerations allows firms to earn rents through external economies of scale. The government then potentially captures a portion of these rents. One way to capture the rents is to impose higher tax

rates on businesses. Because the sales and property taxes are the two largest taxes paid by businesses at the state and local level, governments might realistically use these tax rates to extract some of the rent from the firms. Coefficient estimates reveal that property tax rates are higher in counties with highly specialized areas of manufacturing employment (Table 1.3) or in counties with large absolute numbers of service and retail jobs (Table 1.4).

Because the microfoundations of agglomerations do not necessarily indicate that the relative size of the industry is a source of external benefits, the baseline results may not represent potential rent extraction by the government. The higher property tax rate in heavily specialized manufacturing counties may be evidence of tax exporting. The evidence that county governments may extract rent from firms in areas with a large number of service jobs might be the result that service jobs are inputs into many firms production. Therefore close proximity to many service jobs lowers one of the firms input costs. In only one model is there evidence that sales tax rates may be used to extract rent from firms operating in an agglomeration economy. This is perhaps not surprising because the sales tax rate does not differ for consumers, thus any attempt to extract rent from firms through the sales tax rate would also have consequences on consumers.

Theoretical predictions from the capital tax competition literature indicate that if governments do behave strategically, then capital tax rates will be competed to an inefficiently low level. The presence of agglomeration economies alters the tax competition by decreasing the incentive for capital to flee the jurisdiction, thus allowing the government to impose higher tax rates in agglomeration economies. The findings from this paper indicate that county governments are able to extract rents from firms in

the presence of certain agglomeration forces, but the effect that agglomerations have on the race to the bottom is not addressed.

Essay 1: References

Baldwin, Richard E. and Paul Krugman. 2004. "Agglomeration, Integration and Tax Harmonisation." *European Economic Review* 48: 1-23.

Besley, Timothy and Anne Case. 1995. "Incumbent Behavior: Vote-Seeking, Tax-Setting and Yardstick Competition." *American Economic Review* 85: 25-45.

Brueckner, Jan K. 2003. "Strategic Interaction Among Governments: An Overview of Empirical Studies." *International Regional Science Review* 26: 175-188.

Brueckner, Jan K. and Luz A. Saavedra. 2001. "Do Local Governments Engage in Strategic Property-Tax Competition?" *National Tax Journal* 54: 203-229.

Ciccone, C. and R. Hall. 1996. "Productivity and the Density of Economic Activity." *American Economic Review* 86: 54-70.

Cline, Robert, William F. Fox, Tom Neubig and Andrew Phillips. 2004. "Total State and Local Business Taxes: A 50-State Study of the Taxes Paid by Business in Fiscal 2003." *State Tax Notes*, March 1: 737-750.

Eberts, Randall W. and Daniel P. McMillen. 1999. "Agglomeration Economies and Urban Public Infrastructure." *Handbook of Regional and Urban Economics*, E.S. Mills and P. Cheshire, eds.

Egger, Peter, Michael Pfaffermayr and Hannes Winner. 2005. "Commodity Taxation in a Linear World: A Spatial Panel Data Approach." *Regional Science and Urban Economics* 35: 527-541.

Ellison, Glenn and Edward Glaeser. 1997. "Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach." *Journal of Political Economy* 105: 889-927.

Fletcher, Jason and Matthew N. Murray. 2006. "Competition Over the Tax Base in the State Sales Tax." *Public Finance Review* (Forthcoming).

Gade, Mary N. and Lee C. Adkins. 1991. "Tax Exporting and State Revenue Structures." *National Tax Journal* 43: 39-52.

Glaeser, Edward L., Hedi D. Kallal, Jose A. Scheinkman and Andrei Shleifer. 1992. "Growth in Cities." *Journal of Political Economy* 100: 1126-1152.

Hausman, J. A. 1978. "Specification Tests in Econometrics." *Econometrica* 46: 1251-1271

Head, Keith, John Ries and Deborah Swenson. 1995. "Agglomeration Benefits and Location Choice: Evidence from Japanese Manufacturing Investments in the United States." *Journal of International Economics* 38: 223-247.

Henderson, Vernon. 1986. "Where Does an Industry Locate?" *Journal of Urban Economics* 35: 83-104.

Henderson, Vernon, Ari Kuncoro and Matt Turner. 1995. "Industrial Development in Cities." *Journal of Political Economy* 103: 1067-1090.

Heyndels, Bruno and Jef Vuchelen. 1998. "Tax Mimicking Among Belgian Municipalities." *National Tax Journal* 51: 89-101.

Hilber, Christian A.L. and Ioan Voicu. 2006. "Agglomeration Economies and the Location of Foreign Direct Investment: Quasi-Experimental Evidence from Romania." Research Papers in Environmental and Spatial Analysis no. 105.

Jacobs, Jane. 1969. *The Economy of Cities*. Macmillan: London.

Kanbur, Ravi and Michael Keen. 1993. "Jeux Sans Frontieres: Tax Competition and Tax Coordination When Countries Differ in Size." *American Economic Review* 83: 877-892.

Kelejian, Harry and Ingmar Prucha. 1998. "A Generalized Spatial Two-Stage Least Squares Procedure for Estimating a Spatial Autoregressive Model with Autoregressive Disturbances." *Journal of Real Estate Finance and Economics* 17: 99-121.

Kind, Hans Jarle, Karen Helene Midelfart Knarvik and Guttorm Schjelderup. 2000. "Competing for Capital in a Lumpy World." *Journal of Public Economics* 78: 253-274.

Kind, Hans Jarle, Karen Helene Midelfart Knarvik and Guttorm Schjelderup. 1998. "Industrial Agglomeration and Capital Taxation." Norwegian School of Economics, Department of Economics, Discussion Paper 7/98.

Krogstrup, Signe. 2004. "Increasing Returns in a Standard Tax Competition Model." HEI Working Paper No. 02/2004.

Krugman, Paul. 1991. "Increasing Returns and Economic Geography." *Journal of Political Economy* 99: 483-499.

Ludema, Rodney D. and Ian Wooton. 2000. "Economic Geography and the Fiscal Effects of Regional Integration." *Journal of International Economics* 52: 331-357.

Luna, LeAnn. 2004. "Local Sales Tax Competition and the Effect on County Governments' Tax Rates and Tax Bases." *Journal of American Taxation Association* 26: 43-62.

Marshall, Alfred. 1920. *Principles of Economics*. New York: Macmillan.

McLure, Charles E., Jr. 1967. "The Interstate Exporting of State and Local Taxes: Estimates for 1962." *National Tax Journal* 20: 49-75.

Mintz, Jack, and Henry Tulkens. 1986. "Commodity Tax Competition Between Member States of a Federation: Equilibrium and Efficiency." *Journal of Public Economics* 29: 133-72.

Moomaw, Ronald. 1981. "Productivity and City Size: A Critique of the Evidence." *Quarterly Journal of Economics* 96: 675-688.

Nakamura, Ryohei. 1985. "Agglomeration Economies in Urban Manufacturing Industries: A Case of Japanese Cities." *Journal of Urban Economics* 17: 108-124.

Ring, Raymond J., Jr. 1999. "Producers' and Consumers' Share of the General Sales Tax." *National Tax Journal* 52: 79-90.

Rork, Jonathan C. 2003. "Coveting Thy Neighbors' Taxation." *National Tax Journal* 56: 775-87.

Rosenthal, Stuart S. and William C. Strange. 2003a. "Geography, Industrial Organization and Agglomeration." *Review of Economics and Statistics* 85: 377-393.

Rosenthal, Stuart S. and William C. Strange. 2003b. "Evidence on the Nature and Sources of Agglomeration Economies." *Handbook of Regional and Urban Economics*, J.V. Henderson and J.F. Thisse, eds.

Segal, David. 1976. "Are There Returns to Scale in City Size?" *Review of Economics and Statistics* 58: 339-350.

Sveikauskas, Leo. 1975. "The Productivity of Cities." *Quarterly Journal of Economics* 89: 393-413.

Troske, Kenneth R. 1999. "Evidence on the Employer Size–Wage Premium from Worker–Establishment Matched Data." *Review of Economics and Statistics* 81: 15-26.

Van der Panne, Gerben. 2004. "Agglomeration Externalities: Marshall versus Jacobs." *Journal of Evolutionary Economics* 14: 593-604.

Wheeler, Christopher H. 2006. "Productivity and the Geographic Concentration of Industry: The Role of Plant Scale." *Regional Science and Urban Economics* 36: 313-330.

Wilson, John. 1999. "Theories of Tax Competition." *National Tax Journal* 52: 269-304.

Wilson, John. 1986. "A Theory of Interregional Tax Competition." *Journal of Urban Economics* 19: 296-315.

Zodrow, George R. and Peter Mieszkowski. 1986. "Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods." *Journal of Urban Economics* 19: 356-370.

Appendices

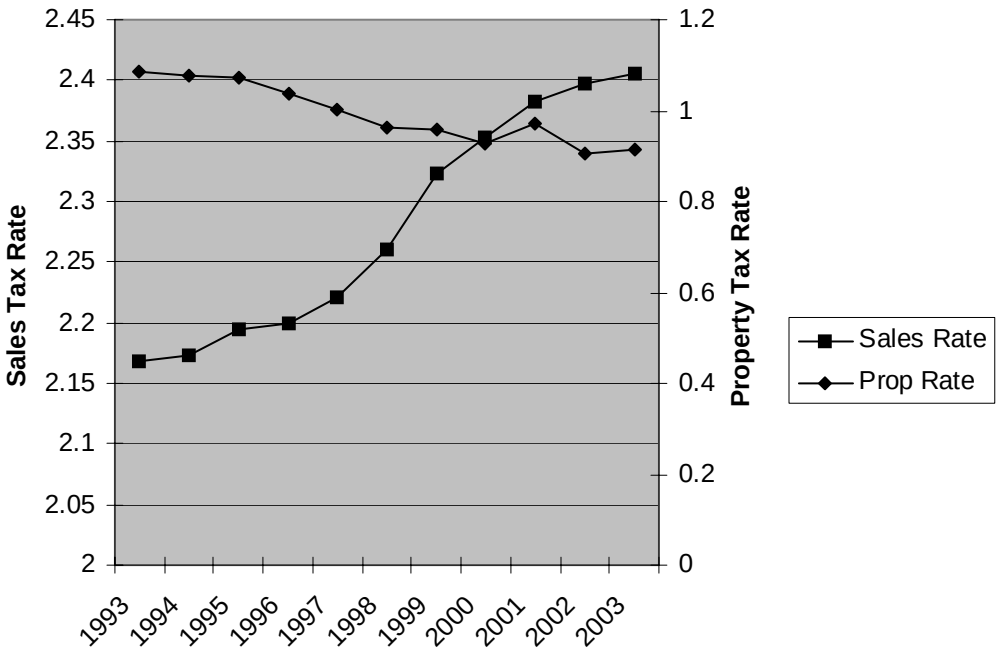

Figure 1.1: Average Tax Rates

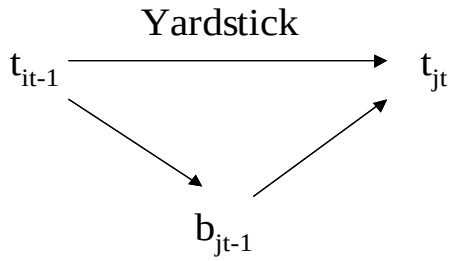

Figure 1.2: Tax Rate Interdependencies

Table 1.1: Variable Description and Source Notes

Variable Name	Description	Source
Local Option Sales Tax Rate	County's local option sales tax rate	TN Dept of Revenue
Avg Neighbors' Sales Tax Rate	Average of neighbors' local option sales tax rates	Author's Calculations
Effective Property Tax Rate	Effective county property tax rate on real commerical and industrial property	Comptroller of TN
Avg Neighbors' Effective Property Tax Rate	Average of neighbors' effective property tax rates	Author's Calculations
Mfg Specialization	Proportion of county's total employment in the manufacturing sector divided by that of the United States	Bureau of Economic Analysis
Retail Specialization	Proportion of county's total employment in the retail sector divided by that of the United States	Bureau of Economic Analysis
Service Specialization	Proportion of county's total employment in the service sector divided by that of the United States	Bureau of Economic Analysis
Industry Diversity	Sum of the manufacturing, retail and service shares of total county employment squared	Bureau of Economic Analysis
Mfg Jobs	Total number of county jobs in the manufacturing sector	Bureau of Economic Analysis
Retail Jobs	Total number of county jobs in the retail sector	Bureau of Economic Analysis
Service Jobs	Total number of county jobs in the service sector	Bureau of Economic Analysis
Average Weekly Wage	Average weekly wage of all workers in the county ($)	Bureau of Labor Statistics
Population	Population of the county	U.S. Census Bureau
Per Capita Income (scaled by 1000)	County's per capita income scaled by 1000	Bureau of Economic Analysis
County Unemployment Rate	County's unemployment rate	U.S. Census Bureau
% of Population Aged 5-17	Percent of county's population between the ages of 5 and 17	U.S. Census Bureau
% of Population Aged 65+	Percent of county's population over the age of 65	U.S. Census Bureau
Per Capita Govt Expenditures	County per capita government expenditures	TN Dept of Revenue

Table 1.2: Summary Statistics

	1993				2003			
Variable	**Mean**	**Std Dev**	**Min**	**Max**	**Mean**	**Std Dev**	**Min**	**Max**
Local Option Sales Tax Rate	2.17	0.32	1.00	2.75	2.41	0.30	1.50	2.75
Avg Neighbors' Sales Tax Rate	2.18	0.16	1.85	2.50	2.42	0.17	2.00	2.75
Effective Property Tax Rate	1.09	0.27	0.38	2.42	0.91	0.20	0.29	1.56
Avg Neighbors' Effective Property Tax Rate	1.08	0.13	0.79	1.46	0.91	0.12	0.63	1.21
Mfg Specialization	1.69	0.53	0.52	3.06	1.56	0.70	0.38	3.17
Retail Specialization	0.82	0.24	0.29	1.81	0.98	0.18	0.54	1.66
Service Specialization	0.55	0.16	0.23	1.02	0.50	0.23	0.02	1.12
Industry Diversity	0.13	0.04	0.03	0.24	0.10	0.05	0.01	0.27
Mfg Jobs	5697.43	8263.52	370.00	51396.00	4480.93	6400.32	105.00	40137.00
Retail Jobs	5128.66	13020.26	99.00	91397.00	4212.40	9825.88	150.00	67739.00
Service Jobs	8199.82	23999.67	150.00	156934.00	12489.44	38102.91	16.00	252336.00
Average Weekly Wage	366.27	66.46	262.46	584.63	529.51	91.99	360.00	777.00
Population	53533.33	108429.70	4533.00	846395.00	61024.09	117633.70	4999.00	905678.00
Per Capita Income (scaled by 1000)	16.20	2.93	10.38	28.74	23.33	4.46	14.61	42.69
County Unemployment Rate	7.31	2.53	2.90	14.90	6.59	1.62	3.40	10.60
% of Population Aged 5-17	18.24	1.42	15.62	21.96	16.92	1.37	12.25	20.69
% of Population Aged 65+	14.22	2.36	7.53	19.52	13.95	2.42	7.69	22.06
Per Capita Govt Expenditures	897.20	277.02	379.20	2922.90	1531.40	371.41	588.70	2818.70

Neighbor's averages are calculated according to the simple contiguity weight specification

Table 1.3: 3SLS Results with 4 weight specifications

	Contiguity Weights		Pop-Contig Weights		Inc-Contig Weights		JDiv-Contig Weights	
	Prop	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**
Avg of Neighbors' Rates	0.255	**0.616****	0.205	0.205	**0.559*****	0.263	0.218	**0.621****
	(0.219)	(0.271)	(0.137)	(0.222)	(0.206)	(0.167)	(0.219)	(0.270)
Mfg Specialization (t-1)	**0.046*****	-0.037	**0.045*****	**-0.064*****	**0.054*****	**-0.057****	**0.047*****	-0.037
	(0.017)	(0.025)	(0.017)	(0.022)	(0.017)	(0.023)	(0.017)	(0.025)
Retail Specialization (t-1)	0.020	-0.032	0.020	-0.018	0.014	-0.023	0.021	-0.032
	(0.038)	(0.049)	(0.038)	(0.049)	(0.039)	(0.050)	(0.038)	(0.049)
Service Specialization (t-1)	0.017	0.018	0.020	0.022	-0.003	0.016	0.018	0.017
	(0.046)	(0.059)	(0.046)	(0.060)	(0.048)	(0.061)	(0.046)	(0.059)
Industry Diversity	0.271	-0.134	0.248	-0.404	0.192	-0.344	0.272	-0.127
	(0.187)	(0.286)	(0.189)	(0.260)	(0.194)	(0.265)	(0.187)	(0.287)
Population	**0.004*****	-0.001	**0.004*****	-0.002	**0.004*****	-0.002	**0.004*****	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Average Weekly Wage	0.000	-0.000	0.000	-0.000	**0.000****	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per Capita Income (scaled by 1000)	**-0.010***	**0.012***	**-0.010****	0.010	**-0.012****	0.010	**-0.010***	**0.012****
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
County Unemployment Rate	0.002	-0.004	0.002	-0.004	0.002	-0.004	0.002	-0.004
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
% of Population Aged 5-17	**0.043*****	**-0.025****	**0.047*****	**-0.019***	**0.035*****	**-0.023****	**0.043*****	**-0.025****
	(0.008)	(0.010)	(0.008)	(0.011)	(0.009)	(0.011)	(0.008)	(0.010)
% of Population Aged 65+	**-0.018***	0.004	**-0.020****	-0.008	-0.012	-0.004	**-0.019****	0.004
	(0.009)	(0.011)	(0.008)	(0.010)	(0.009)	(0.011)	(0.009)	(0.011)
Per Capita Government Expenditures (t-1)	0.000	-0.000	**0.000****	0.000	0.000	0.000	**0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.250	1.117	**2.584****	**2.406*****	**2.344****	**2.228*****	-0.210	1.102
	(0.336)	(0.837)	(1.025)	(0.604)	(0.999)	(0.526)	(0.335)	(0.833)
R-squared	0.84	0.87	0.84	0.87	0.83	0.87	0.84	0.87

N=950 for all regressions

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

County and year fixed effects as well as MSA and border dummies are included in all estimations

Spatially weighted explanatory variables are used as instruments for the sales and property tax rate equations

Weight matrices are defined in the text

Table 1.4: 3SLS Robustness Results with 4 weight specifications

	Contiguity Weights		**Pop-Contig Weights**		**Inc-Contig Weights**		**JDiv-Contig Weights**	
	Prop	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**
Avg of Neighbors' Rates	**0.483****	**0.659****	**0.410*****	0.141	**0.604*****	0.246	**0.454***	**0.665****
	(0.235)	(0.267)	(0.156)	(0.230)	(0.205)	(0.169)	(0.233)	(0.265)
Mfg Jobs (t-1)	**-0.014****	**0.012***	**-0.014****	0.009	-0.009	0.012	**-0.014****	0.012
	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)	(0.008)	(0.006)	(0.007)
Retail Jobs (t-1)	**0.004***	-0.000	**0.005****	0.001	0.004	0.001	0.004	-0.000
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Service Jobs (t-1)	**0.003*****	**0.002***	**0.004*****	**0.003***	**0.004*****	**0.003****	**0.003*****	**0.002***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Industry Diversity	0.252	-0.230	0.179	**-0.628****	0.172	**-0.549****	0.259	-0.225
	(0.180)	(0.296)	(0.186)	(0.257)	(0.186)	(0.257)	(0.179)	(0.296)
Population	0.001	-0.001	-0.001	**-0.004***	0.000	-0.003	0.001	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Average Weekly Wage	**0.000***	-0.000	0.000	**-0.001***	**0.001****	**-0.001***	**0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per Capita Income (scaled by 1000)	**-0.015*****	**0.010***	**-0.015*****	0.009	**-0.015*****	0.008	**-0.014*****	**0.010***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
County Unemployment Rate	-0.001	-0.003	-0.001	-0.001	-0.001	-0.001	-0.000	-0.003
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
% of Population Aged 5-17	**0.040*****	**-0.026****	**0.048*****	**-0.020***	**0.034*****	**-0.024****	**0.040*****	**-0.025****
	(0.008)	(0.010)	(0.008)	(0.011)	(0.008)	(0.011)	(0.008)	(0.010)
% of Population Aged 65+	-0.013	0.009	**-0.016***	-0.002	-0.012	0.001	-0.014	0.009
	(0.009)	(0.011)	(0.008)	(0.010)	(0.009)	(0.011)	(0.009)	(0.011)
Per Capita Government Expenditures (t-1)	**0.000****	-0.000	**0.000*****	0.000	0.000	-0.000	**0.000****	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.163	0.933	-0.057	**2.534*****	0.000	**2.412*****	-0.136	0.916
	(0.327)	(0.844)	(0.274)	(0.632)	(0.000)	(0.595)	(0.326)	(0.838)
R-squared	0.84	0.87	0.84	0.87	0.83	0.87	0.84	0.87

N=950 for all regressions

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

County and year fixed effects as well as MSA and border dummies are included in all estimations

Spatially weighted explanatory variables are used as instruments for the sales and property tax rate equations

Weight matrices are defined in the text

Table 1.5: SUR Yardstick Results with 4 weight specifications

	Contiguity Weights		Pop-Contig Weights		Inc-Contig Weights		JDiv-Contig Weights	
	Prop	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**
Avg of Neighbors' Rates (t-1)	0.087	**0.510*** **	**0.111** **	**0.691*** **	**0.153*** **	**0.241*** **	0.087	**0.507*** **
	(0.063)	(0.042)	(0.045)	(0.048)	(0.052)	(0.032)	(0.063)	(0.042)
Tax Base (t-1)	**0.000*** **	-0.000	**0.000*** **	-0.000	**0.000*** **	0.000	**0.000*** **	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mfg Specialization (t-1)	**0.059*** **	**-0.043** **	**0.058*** **	**-0.053** **	**0.063*** **	**-0.059*** **	**0.059*** **	**-0.044** **
	(0.016)	(0.021)	(0.016)	(0.021)	(0.016)	(0.022)	(0.016)	(0.021)
Retail Specialization (t-1)	0.034	-0.038	0.032	-0.019	0.035	-0.034	0.034	-0.037
	(0.036)	(0.048)	(0.036)	(0.047)	(0.036)	(0.050)	(0.036)	(0.048)
Service Specialization (t-1)	0.005	0.037	0.002	0.021	0.002	0.022	0.005	0.036
	(0.044)	(0.058)	(0.044)	(0.057)	(0.044)	(0.061)	(0.044)	(0.058)
Industry Diversity	0.115	-0.153	0.107	-0.123	0.083	-0.310	0.115	-0.151
	(0.182)	(0.240)	(0.182)	(0.234)	(0.182)	(0.250)	(0.182)	(0.240)
Population	-0.000	-0.001	-0.001	-0.000	-0.000	-0.002	-0.000	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Average Weekly Wage	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per Capita Income (scaled by 1000)	**-0.012*** **	**0.014** **	**-0.013*** **	**0.011***	**-0.013*** **	**0.011***	**-0.012*** **	**0.015** **
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
County Unemployment Rate	0.001	-0.002	0.001	-0.003	0.001	-0.003	0.001	-0.001
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
% of Population Aged 5-17	**0.043*** **	**-0.023** **	**0.045*** **	**-0.027*** **	**0.041*** **	**-0.022** **	**0.043*** **	**-0.023** **
	(0.007)	(0.010)	(0.007)	(0.009)	(0.007)	(0.010)	(0.007)	(0.010)
% of Population Aged 65+	**-0.017** **	-0.001	**-0.017** **	-0.007	**-0.016** **	-0.005	**-0.017** **	-0.001
	(0.008)	(0.010)	(0.008)	(0.010)	(0.008)	(0.010)	(0.008)	(0.010)
Per Capita Government Expenditures (t-1)	**0.000***	-0.000	**0.000** **	-0.000	**0.000***	0.000	**0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.85	0.88	0.85	0.88	0.85	0.87	0.85	0.88

N=855 for all regressions
Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
County and year fixed effects as well as MSA and border dummies are included in all estimations
Spatially weighted explanatory variables are used as instruments for the sales and property tax rate equations
Weight matrices are defined in the text

Appendix Table 1.1: OLS Results

	Contiguity Weights		Pop-Contig Weights		Inc-Contig Weights		JDiv-Contig Weights	
	Prop	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**
Avg of Neighbors' Rates	0.0726	**0.4724*** **	0.0369	**0.5330*** **	**0.1559*** **	**0.2246*** **	0.0798	**0.4721*** **
	(0.0675)	(0.0415)	(0.0473)	(0.0467)	(0.0546)	(0.0316)	(0.0679)	(0.0415)
Mfg Specialization (t-1)	**0.0285***	**-0.0379***	**0.0289***	**-0.0517** **	**0.0314***	**-0.0463** **	**0.0287***	**-0.0382***
	(0.0168)	(0.0209)	(0.0168)	(0.0209)	(0.0168)	(0.0217)	(0.0168)	(0.0209)
Retail Specialization (t-1)	-0.0377	0.0260	-0.0360	0.0351	-0.0387	0.0428	-0.0377	0.0267
	(0.0365)	(0.0450)	(0.0365)	(0.0452)	(0.0363)	(0.0466)	(0.0365)	(0.0450)
Service Specialization (t-1)	0.0329	0.0224	0.0339	0.0138	0.0281	0.0203	0.0328	0.0219
	(0.0466)	(0.0587)	(0.0466)	(0.0586)	(0.0465)	(0.0610)	(0.0466)	(0.0587)
Industry Diversity	**0.4434** **	-0.1596	**0.4378** **	-0.1805	**0.4184** **	-0.3180	**0.4433** **	-0.1571
	(0.1880)	(0.2394)	(0.1882)	(0.2389)	(0.1875)	(0.2483)	(0.1880)	(0.2394)
Population	**0.0005*** **	-0.0000	**0.0005*** **	-0.0001	**0.0005*** **	-0.0002	**0.0005*** **	-0.0000
	(0.0002)	(0.0005)	(0.0002)	(0.0005)	(0.0002)	(0.0005)	(0.0002)	(0.0005)
Average Weekly Wage	0.0003	-0.0001	0.0002	-0.0001	0.0003	-0.0001	0.0003	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Per Capita Income (scaled by 1000)	-0.0052	0.0080	-0.0050	0.0055	-0.0057	0.0062	-0.0052	0.0080
	(0.0042)	(0.0052)	(0.0042)	(0.0052)	(0.0042)	(0.0054)	(0.0042)	(0.0052)
County Unemployment Rate	0.0026	**-0.0053***	0.0025	**-0.0067** **	0.0025	-0.0049	0.0026	**-0.0053***
	(0.0024)	(0.0031)	(0.0024)	(0.0031)	(0.0024)	(0.0032)	(0.0024)	(0.0031)
% of Population Aged 5-17	**0.0392*** **	**-0.0150***	**0.0401*** **	**-0.0166***	**0.0372*** **	-0.0146	**0.0391*** **	**-0.0150***
	(0.0070)	(0.0089)	(0.0070)	(0.0090)	(0.0071)	(0.0092)	(0.0070)	(0.0089)
% of Population Aged 65+	**-0.0175*** **	-0.0120	**-0.0180*** **	**-0.0190** **	**-0.0160** **	**-0.0133***	**-0.0174*** **	-0.0120
	(0.0064)	(0.0075)	(0.0064)	(0.0076)	(0.0064)	(0.0077)	(0.0064)	(0.0075)
Per Capita Government Expenditures (t-1)	**0.0000** **	-0.0000	**0.0000** **	-0.0000	**0.0000** **	0.0000	**0.0000** **	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	0.2416	**1.4762*** **	0.2595	**1.5370*** **	0.1900	**2.1048*** **	0.2354	**1.4746*** **
	(0.2061)	(0.2632)	(0.2039)	(0.2635)	(0.2011)	(0.2617)	(0.2061)	(0.2633)
R-squared	0.21	0.54	0.20	0.50	0.22	0.52	0.21	0.54

N=950 for all regressions

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

County and year fixed effects as well as MSA and border dummies are included in all estimations

Weight matrices are defined in the text

Appendix Table 1.2: IV Random Effects Results

	Contiguity Weights		Pop-Contig Weights		Inc-Contig Weights		JDiv-Contig Weights	
	Prop	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**
Avg of Neighbors' Rates	-0.0147	**0.5874*** **	0.0782	0.4052	**0.5048** **	0.1248	-0.0266	**0.5712*** **
	(0.2397)	(0.1811)	(0.1391)	(0.2665)	(0.2361)	(0.2582)	(0.2431)	(0.1832)
Mfg Specialization (t-1)	**0.0290***	**-0.0369***	**0.0292***	**-0.0510** **	**0.0380** **	**-0.0482** **	**0.0289***	**-0.0376***
	(0.0168)	(0.0219)	(0.0168)	(0.0211)	(0.0177)	(0.0220)	(0.0169)	(0.0218)
Retail Specialization (t-1)	-0.0356	0.0032	-0.0350	0.0378	-0.0423	0.0397	-0.0355	0.0070
	(0.0366)	(0.0470)	(0.0366)	(0.0456)	(0.0371)	(0.0480)	(0.0366)	(0.0468)
Service Specialization (t-1)	0.0346	0.0209	0.0334	0.0150	0.0144	0.0200	0.0348	0.0204
	(0.0469)	(0.0588)	(0.0466)	(0.0588)	(0.0484)	(0.0612)	(0.0469)	(0.0587)
Industry Diversity	**0.4464** **	-0.1155	**0.4288** **	-0.2600	**0.3572***	-0.4174	**0.4468** **	-0.1196
	(0.1881)	(0.2740)	(0.1903)	(0.2919)	(0.1960)	(0.3278)	(0.1881)	(0.2750)
Population	**0.0005** **	-0.0001	**0.0005*** **	-0.0002	**0.0005*** **	-0.0002	**0.0005** **	-0.0002
	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0003)
Average Weekly Wage	0.0002	-0.0002	0.0003	-0.0001	**0.0003***	-0.0001	0.0002	-0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Per Capita Income (scaled by 1000)	-0.0044	**0.0095***	-0.0055	0.0054	**-0.0082***	0.0061	-0.0043	**0.0093***
	(0.0047)	(0.0055)	(0.0045)	(0.0052)	(0.0046)	(0.0055)	(0.0047)	(0.0054)
County Unemployment Rate	0.0026	**-0.0052***	0.0025	**-0.0060***	0.0024	-0.0043	0.0026	**-0.0051***
	(0.0024)	(0.0031)	(0.0024)	(0.0034)	(0.0025)	(0.0034)	(0.0024)	(0.0031)
% of Population Aged 5-17	**0.0405*** **	**-0.0178** **	**0.0400*** **	**-0.0158***	**0.0308*** **	-0.0150	**0.0406*** **	**-0.0172***
	(0.0075)	(0.0090)	(0.0070)	(0.0087)	(0.0082)	(0.0092)	(0.0075)	(0.0089)
% of Population Aged 65+	**-0.0190** **	-0.0084	**-0.0172** **	**-0.0179** **	-0.0100	**-0.0136***	**-0.0192** **	-0.0090
	(0.0076)	(0.0084)	(0.0069)	(0.0080)	(0.0076)	(0.0081)	(0.0076)	(0.0083)
Per Capita Government Expenditures (t-1)	**0.0000** **	-0.0000	**0.0000** **	-0.0000	**0.0000***	0.0000	**0.0000** **	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	0.3044	**1.2230** **	0.2165	**1.8036*** **	-0.0537	**2.3688*** **	0.3136	**1.2560** **
	(0.2847)	(0.5326)	(0.2416)	(0.6145)	(0.2639)	(0.6679)	(0.2862)	(0.5353)
R-squared	0.20	0.53	0.20	0.51	0.21	0.51	0.20	0.53

N=950 for all regressions

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

County and year fixed effects as well as MSA and border dummies are included in all estimations

Spatially weighted explanatory variables are used as instruments for the sales and property tax rate equations

Weight matrices are defined in the text

Appendix Table 1.3: SUR Results with 4 weight specifications

	Contiguity Weights		Pop-Contig Weights		Inc-Contig Weights		JDiv-Contig Weights	
	Prop	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**	**Prop**	**Sales**
Avg of Neighbors' Rates (t-1)	0.023	**0.510*** **	0.042	**0.691*** **	**0.113** **	**0.241*** **	0.027	**0.507*** **
	(0.064)	(0.042)	(0.046)	(0.048)	(0.054)	(0.032)	(0.065)	(0.042)
Mfg Specialization (t-1)	**0.047*** **	**-0.043** **	**0.046*** **	**-0.053** **	**0.050*** **	**-0.059*** **	**0.047*** **	**-0.044** **
	(0.017)	(0.021)	(0.017)	(0.021)	(0.017)	(0.022)	(0.017)	(0.021)
Retail Specialization (t-1)	0.023	-0.038	0.022	-0.019	0.024	-0.034	0.023	-0.037
	(0.037)	(0.048)	(0.037)	(0.047)	(0.037)	(0.050)	(0.037)	(0.048)
Service Specialization (t-1)	0.024	0.036	0.022	0.020	0.020	0.022	0.024	0.035
	(0.045)	(0.058)	(0.045)	(0.057)	(0.045)	(0.061)	(0.045)	(0.058)
Industry Diversity	0.278	-0.152	0.276	-0.119	0.254	-0.311	0.277	-0.150
	(0.186)	(0.239)	(0.186)	(0.233)	(0.186)	(0.249)	(0.186)	(0.239)
Population	**0.004*** **	-0.002	**0.004*** **	-0.000	**0.004*** **	-0.002	**0.004*** **	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Average Weekly Wage	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per Capita Income (scaled by 1000)	-0.007	**0.014** **	**-0.008** *	**0.011** *	**-0.008** *	**0.011** *	-0.007	**0.014** **
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
County Unemployment Rate	0.002	-0.002	0.002	-0.003	0.002	-0.003	0.002	-0.001
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
% of Population Aged 5-17	**0.045*** **	**-0.023** **	**0.046*** **	**-0.027*** **	**0.043*** **	**-0.022** **	**0.045*** **	**-0.023** **
	(0.007)	(0.010)	(0.007)	(0.009)	(0.008)	(0.010)	(0.007)	(0.010)
% of Population Aged 65+	**-0.023*** **	-0.001	**-0.023*** **	-0.007	**-0.021*** **	-0.005	**-0.023*** **	-0.001
	(0.008)	(0.010)	(0.008)	(0.010)	(0.008)	(0.010)	(0.008)	(0.010)
Per Capita Government Expenditures (t-1)	**0.000** *	-0.000	**0.000** *	-0.000	**0.000** *	0.000	**0.000** *	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.84	0.88	0.84	0.88	0.84	0.87	0.84	0.88

N=855 for all regressions
Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
County and year fixed effects as well as MSA and border dummies are included in all estimations
Spatially weighted explanatory variables are used as instruments for the sales and property tax rate equations
Weight matrices are defined in the text

Part 3: Essay 2: Interactions Between Migration and State Tax Rates: An Empirical Investigation

This Subcommittee's original premise that Maine's comparatively high individual income tax rates would act as a considerable barrier to attracting or retaining retirees was refuted by data provided by a variety of sources. **That does not mean that Maine's individual income tax code is competitive with so-called retiree magnet states. Clearly, there are reasons other than Maine's tax policy which allow Maine to attract a net gain in the number of retirees moving into the state.**

"A Golden Opportunity II: How Maine Can Enhance the Retirement Industry,"
Maine State Planning Office, 1999.

2.A Introduction

State policymakers have long been concerned with the potential for their state's tax policy to drive away residents and prevent non-residents from relocating to the state. These fears potentially play a large role in the tax rate choices made by state policymakers. In addition, if states are competing to attract and maintain individuals by choosing tax rates that are attractive, a state must consider another state's tax rates before choosing its own in order to ensure its tax rates are competitive. The result of the competition might be the familiar "race to the bottom." While the majority of the "race to the bottom" predictions are specifically concerned with capital tax competition, the competition over states to attract individuals into the state provides a parallel analysis.

Empirical investigations of a race to the bottom in capital taxes generally build upon the capital tax competition proposition that capital tax rates are negatively correlated with the degree of capital mobility. The empirical analysis pursued here begins from a similar idea. If individuals are able to move freely between states, states may expect to set tax rates lower with increased mobility of individuals. While individuals are free to choose locations in most developed economies and therefore may move in response to tax rates, there are certainly costs involved in any relocation

decision.[29] These involve not only pecuniary costs, such as transportation expenses, but also non-pecuniary costs, such as the psychological cost of leaving friends and family or leaving a preferred geography such as a beach or mountains.

Recent theoretical models have investigated the role that these non-pecuniary costs have on subnational personal income tax rates. If these non-pecuniary costs are sufficiently large, the race to the bottom in personal taxes may be altered. For example, residents of a state that is attractive for climate reasons may be less likely to leave the state, thus the relative attractiveness of the state increases the costs of moving away. Similarly the attractive state is in a better position to draw non-residents. This has the effect of lowering the cost of leaving the current location for the attractive state. The dual impact of being costly to leave and relatively inexpensive to enter the state provides some monopoly power to the state. As a result, an attractive state does not feel the same pressure as an unattractive state in setting its tax policy to attract and maintain residents. Thus the attractive state is able to maintain a higher tax rate than the unattractive state. This monopoly power also allows the state to pay less attention to other states' tax rates.

While much of the theoretical literature has hypothesized that the mobility of the tax base is important to the rate that is set, the vast majority of the empirical work has not explicitly measured the mobility of the tax base but has instead examined the effects of mobility by testing for strategic interactions between government. Specifically, many studies have regressed a state's tax rate on the tax rate of neighboring states. While these

[29] The US Supreme Court has interpreted the US Constitution in numerous cases as allowing for citizens of the US to enter or leave a state without limitations. In addition, the US Supreme Court has ruled that states must treat residents equally, regardless of the length of residence in the state. For example, California recently drafted legislation (later overturned by the Supreme Court) requiring that welfare benefits of families who had resided in California for less than one year be no higher than the benefits received in the prior state of residence.

empirical models do not directly measure tax base mobility, the results generally indicate that states do not set tax rates in isolation.[30]

While these findings indicate that governments behave strategically, the mobility of the tax base is not the only underlying behavior that may lead to the relationship. The interaction may be the result of yardstick competition, where voters decide whether or not to vote for a politician based on their state's tax rates compared with other states' rates. Thus, politicians may consider other states' tax rates when setting their own rate.

A similar body of literature investigates whether the relaxation of capital controls has had a significant effect on the ability to impose capital taxes (Slemrod (2004), Bretschger and Hettich (2002) and Rodrik (1997)). The findings in the literature are mixed with recent empirical studies concluding that decreasing the constraints to capital flows leads to lower capital taxes. One drawback to this literature is that the models do not allow for strategic interaction, so this literature cannot address whether changes in mobility affect the intensity of the competition in addition to its effects on the level of tax rates. In addition, no direct measure of mobility is available so the measures used in the studies may not be the best measures of the mobility described in the theoretical models.

The research presented here sets out to empirically investigate the relationship between the monopoly power of the state and the tax rates of the state, while also informing the literature on how the monopoly power of the state affects the strategic interaction. The monopoly power of the state is derived from its unique attributes and amenities, which provides it the ability to maintain residents and attract non-residents relatively easily. Thus, the first hypothesis of this research is that a state with higher net

[30] See Brueckner (2003) for a survey of empirical tax competition research.

in-migration will have the ability to maintain higher tax rates on individuals without fearing the race to the bottom as much as a less attractive state. The second hypothesis of this study is that an attractive state will interact differently with other states if the interaction is a reflection of tax base mobility.

Results using a panel of state data from 1993-2004 confirm both hypotheses. Controlling for the simultaneous nature of the migration response and the tax rate decision, a positive relationship is found between the net in-migration of a state and the state personal income tax rate and the total state tax burden, indicating that a more attractive state is able to impose higher tax rates on its residents. The second hypothesis is also confirmed. Using an interaction term between the neighbor's tax rate and the net in-migration of a state, it is found that the coefficient estimate on the neighbor's personal income tax rate variable is positive when the state has higher net in-migration as opposed to negative for an average or lower net migration state indicating a different type of strategic interaction.

The plan of the paper is as follows. Section 2.B provides an overview of relevant literature. Section 2.C presents a brief theoretical model. Section 2.D details the empirical strategy and data that will be implemented. Section 2.E presents results followed by conclusions in section 2.F.

2.B Relevant Literature

Mobility and Subnational Fiscal Policies

Research has long considered the impact that capital and labor mobility has on government policies. In an early study Tiebout (1956) examined how the mobility of

individuals affects the setting of local government fiscal policies. In Tiebout's model individuals are free to choose where to locate and will continue to costlessly move until finding the location with the individual's optimal bundle of public services and taxes. This freedom to choose where to locate, as well as create new jurisdictions, leads to an efficient set of local fiscal policies as measured by the willingness of individuals to remain in the jurisdiction. Fischel (1975) extended Tiebout's model by substituting firms as the mobile factor and continues to find that mobility leads to the efficient bundle of public services and taxes.

One assumption of Tiebout's original model that has been routinely investigated is the assumption that government policies generate zero interregional externalities. Recent theoretical models of tax competition incorporated the role of interregional externalities and found that government taxes and subsequent spending are set at an inefficiently low level.[31] The tax and spending bundle is set inefficiently low if governments ignore the fiscal externality that exists due to the mobility of factors. For example, an increase in a tax on individuals may lead these individuals to flee to another jurisdiction. To maintain the population, the government may keep the rate low, and in doing so harms the other jurisdiction that would have benefited from the arrival of the population and the subsequent increase in the tax base.[32]

While much of the theoretical literature has hypothesized that the mobility of the tax base is important to the rate that is set, the vast majority of the empirical work has not

[31] See Wilson (1999) for a review of the literature.

[32] Brennan and Buchanan (1980) reach a conclusion similar to the tax competition literature regarding the role of mobility on the size of government, but their model does not indicate that welfare is reduced because of the mobility of factors. They hypothesize that without the mobility of factors, the revenue maximizing government would impose fiscal policies that maximize revenue but are larger than required to maximize welfare of individuals.

explicitly measured the mobility of the tax base but has instead examined strategic interactions between governments. Studies of strategic interaction between government vary across levels of government and tax rates. Rork (2003) looks at strategic interaction between states in setting excise tax rates, general sales tax rates and personal and corporate income tax rates. He finds coefficient estimates on the neighbor's tax rates ranging from –0.24 to 0.64 depending on the tax rate. Esteller-More and Sole-Olle (2002) study strategic personal income tax setting between Canadian provinces and find that provinces behave as strategic complements; that is, an increase in a neighboring province's rate is positively correlated with the own province's personal income tax rate.

Other studies have looked at strategic interaction between local governments. Brueckner and Saavedra (2001) examine strategic property tax rate setting among municipal governments in the Boston metro area and find that the reaction function is upward sloping. Heyndels and Vuchelen (1998) also find evidence of strategic income and property tax competition among Belgian municipalities.

One drawback to these studies is that none allow mobility to play an explicit role in the empirical models. The finding that a government's tax rate is a function of neighboring governments' tax rates may be the result of two underlying behaviors. One is that governments are competing for the mobile tax base by setting tax rates competitively with other jurisdictions in an attempt to attract and maintain tax base.

Yardstick competition pressures are another possible explanation for the correlation between governments' tax rates. Besley and Case (1995) propose a model of tax setting in the presence of multiple jurisdictions, where asymmetric information regarding the politicians' decisions exists between voters and politicians. As a result,

voters make decisions about politicians' abilities to set taxes and expenditures in a relative way; that is, a politician's performance is measured relative to the performance of politicians in other jurisdictions. In this world, a voter may not mind that her taxes are rising if voters from other jurisdictions are experiencing similar tax increases. Because voters decide whether or not to vote for an incumbent based on their jurisdiction's taxes compared with other jurisdictions', incumbents may consider other jurisdictions' tax rates before setting their own tax rate. Following Brueckner (2003), the behavioral models lead to an identical empirical specification, which does not allow the researcher to attribute evidence of strategic interaction to a certain behavior.

A small body of literature has sought to get closer to the mobility issue by investigating how decreased capital mobility restrictions affect capital tax rates. All of the studies assume that decreasing restrictions on international capital flows are proxies for increased capital mobility; therefore fewer trade restrictions are expected to lead to declines in capital tax rates. One method that studies have pursued to proxy this openness is the amount of trade flows in and out of a country. Rodrik (1997) uses a panel of OECD countries and finds that increased trade openness (measured as imports plus exports as a percentage of GDP) is associated with reductions in tax rates on capital. Bretschger and Hettich (2002) also regress effective corporate income tax rates on the same measure of trade openness as well as an index of openness.[33] They find that integration in the global economy has a negative impact on corporate taxes.

[33] The openness index is from Quinn (1997). It is a qualitative index, ranging from 0 (most closed) to 14 (most open). It is constructed by analyzing restrictions on both capital inflows and outflows and by incorporating international agreements that impose constraints on capital flows.

Slemrod (2004) regresses statutory and average corporate income tax rates on the same measure of trade openness (imports plus exports as a percentage of GDP) as well as a qualitative measure of policy openness derived in Sachs and Warner (1995). He finds that increased measures of trade openness are associated with lower statutory corporate income tax rates. A potential weakness of these studies is that the literature does not allow for strategic interaction between governments to occur. Also, given that there are no direct measures of mobility, the measures used in these studies may not accurately proxy the mobility constraints faced by governments in setting tax rates.

The two bodies of literature described above provide two important findings. First, the evidence is compelling that governments behave strategically. However, because of the empirical specification of the majority of these models, the strategic interaction cannot necessarily be attributed to greater mobility of the tax base. Instead, yardstick competition may be the behavior driving the interaction. Therefore, the models cannot explicitly derive a relationship between the mobility of the factor and the tax rate. The second important finding from the other body of literature is that tax rates are generally found to be lower in the presence of greater tax base mobility. As discussed above, one potential weakness of these studies is that the models do not allow for strategic interaction between governments. This empirical investigation seeks to remedy these shortcomings by allowing strategic interaction and the mobility of the tax base to affect a state's tax rate. This is accomplished by specifying a state's tax rate as a function of its neighbors' tax rates as well as the net migration rate of the state, which is used as a proxy for the mobility of the tax base.

2.C Theoretical Background

To motivate the empirical analysis of the role that attractiveness and neighbors' tax rates have in the setting of a state's tax rate, consider the following model.[34] Imagine a simple economy with two states, the East and the West, indexed by E and W, respectively. Residents of each state are assumed to be *freely* mobile between the two, but not necessarily *perfectly* (or costlessly) mobile since certain states are more attractive because of family or friend ties to the area or a geographic/climate preference for the area. To calculate its optimal tax policy, the state first estimates the equilibrium migration response of a change in the tax rate for individuals in or out of the state. The state then chooses its optimal tax policy by maximizing an objective function discussed below, taking the other states' tax policies as given and accurately predicting the migration responses.

The economy consists of *n* individuals who differ only in their preferences for each state. It is assumed there is an individual of each preference type, denoted by *x*, where *x* is uniformly distributed from 0 to1. The utility function of an individual is additionally comprised of consumption of a private good (*c*) and a public good (*g*). Following Wellisch (1994) and Mansoorian and Myers (1993), the utility function of individuals is additively separable in the preference for the location. As a result, the utility function of individual *x* is given by

$$V(x) = \begin{cases} U_E(c_E, g_E) + a(1-x) \\ U_W(c_W, g_W) + ax \end{cases}$$ if the household lives in the East or West.

[34] The model described here borrows from Hindriks (1999 and 2001) and Wellisch (1994).

All residents in the East have the same sub-utility given by U_E with differences arising from differences in preferences for the state. The taste parameter *x* measures the benefit from living in the West and (*1-x*) is the benefit of living in the East. Therefore, residents with relatively small *x* prefer to live in the East, and those with relatively large *x* prefer to live in the West. The parameter $a > 0$ measures the intensity of the individual's preferences for (or the allure of) the East, with $a = 0$ representing no preference and thus perfect mobility.

Individuals face no restrictions in choosing their state of residence although behavior is influenced by state-specific preferences. Following Hindriks (1999 and 2001), it can be shown using the utility functions that for each pair (t_E, t_W) there exists an $x_E(t_E, t_W)$ such that all individuals with preferences $x \leq x_E(t_E, t_W)$ locate in the East and all others in the West. Because *x* is uniformly distributed, it follows that $x_E(t_E, t_W)$ is the percent of the *n* individuals that live in the East. Because individuals differ in their preferences for a state, the migration equilibrium is characterized by the marginal individual being indifferent between the states, which is given by the parameter x_E. The migration equilibrium is given by

$$U_E(c_E, g_E) + a(1 - x_E) = U_W(c_W, g_W) + a x_E . \qquad (1)$$

Solving equation (1) for x_E, it can be shown that the migration responses of an individual to the tax rate is given by

$$\frac{\partial x_E(t_E, t_W)}{\partial t_E} = \frac{\frac{\partial U_E}{\partial c_E}\frac{\partial c_E}{\partial t_E} + \frac{\partial U_E}{\partial g_E}\frac{\partial g_E}{\partial t_E} - \left(\frac{\partial U_W}{\partial c_W}\frac{\partial c_W}{\partial t_E} + \frac{\partial U_W}{\partial g_W}\frac{\partial g_W}{\partial t_E}\right) + a}{2a}. \qquad (2)$$

The most interesting aspect of the response for this research is the result that the migration decision of the individual in response to a change in the tax rate depends on the attractiveness of the East. If equation (2) is negative, which is expected because a higher tax rate increases the cost of living in the state, the negative reaction can be shown to be decreasing in the allure of the East. Similarly, $\frac{\partial x_W(t_E, t_W)}{\partial t_E}$ can be shown to be a function of the attractiveness of the East. If this response is positive, as expected, the positive reaction can be shown to be decreasing in the attractiveness of the East as well. The key result is that the attraction of the East enables the state to continue to maintain and attract some individuals, even with an increase in its tax rate, providing some monopoly power to the attractive state's government.

Now that the state can accurately predict the equilibrium migration response of individuals, the jurisdiction must set the optimal fiscal policies taking the other jurisdiction's policies as given. Consider a setting where the government attempts to maximize revenue.[35] As in Kanbur and Keen (1993), the revenue maximization objective function may be interpreted as a welfare maximization problem when individuals place high marginal valuation on consumption of a public good relative to a private good. The maximization problem of the government is given by

$$\max_{t_E} t_E y_E n x_E(t_E, t_W) \qquad (3)$$

[35] Hindriks' (1999) theoretical model assumes that the government sets out to maximize the income of the residents, as opposed to the utility of the individual. His results also hold when the jurisdiction sets the optimal policies according to majority rule voting (see Hindriks (2001)). These models rely on some assumptions regarding information about the migrating individuals. Specifically, assumptions must be made regarding the fiscal burden of the in-migrating individuals to determine whether the inflow of the individuals provides benefits to the current residents.

where *t* is a proportional income tax.[36] The term $nx_E(t_E, t_W)$ measures the number of individuals in the East, so $y_E nx_E(t_E, t_W)$ gives the total income in the East.

The first order condition is given by the following:

$$y_E nx_E(t_E, t_W) + t_E y_E n \frac{\partial x_E(t_E, t_W)}{\partial t_E} = 0. \qquad (4)$$

By plugging equation (2) into (4) it is seen that the equilibrium tax rate of the East, taking the West's tax rate as given and accurately forecasting the migration response, as shown above in equation (2), is a function of the attraction of the East (*a*), the income of the individuals in the East (*y*) and the number of individuals in the East (*nx*) among other variables.

As discussed above, the allure of the state allows the state to maintain some individuals even with a higher tax rate than an unattractive state and some individuals continue to enter the state even with the relatively higher tax rate. As a result, the more attractive state, whether due to family/friend ties to the area or geographic/climate preferences for the area, will experience more in-migration and less out-migration, holding all else constant. For this reason, the equilibrium tax rate of the tax rate is expected to be higher in a more attractive state, revealed through higher net in-migration (in-migration minus out-migration) to the state.

Following the tax competition literature, the derivative of equation (4) with respect to t_W yields the reaction function

[36] Income taxes are used in the model for illustration purposes, but other tax rates will lead to similar results (Goodspeed (2000)).

$$y_E n \frac{\partial x_E(t_E, t_W)}{\partial t_W} + t_E y_E n \frac{\partial x_E^2(t_E, t_W)}{\partial t_E \partial t_W}. \quad (5)$$

As seen in the prior literature (Goodspeed (2002) and Besley and Rosen (1997)), the sign of the reaction function with respect to the neighbor's tax rate can be positive, negative or zero. Of particular interest to this research, equation (5) reduces to zero if the population does not migrate in response to the tax rate.

The theoretical model presented above indicates that the taxes of a state are the function of how good the state is at maintaining residents and attracting non-residents as well as the taxes of the neighboring states. In addition, the theory above reveals that the magnitude of the response to the neighbors' tax rates depends upon the attraction of the state. In other words, the extent of tax competition pressures on a state depends on the how attractive the state is, which leads to the following empirical equation:

$$t_{it} = \beta_0 + \beta_1 M_{it} + \beta_2 t_{jt} + \beta_3 M_{it} t_{jt} + X_{it}\beta + u_{it} \quad (6)$$

where *M* represents the net-migration of individuals of the state, t_{it} represents the own state tax rate, t_{jt} represents the neighbor's tax rate and *X* is vector of control variables as suggested by the behavioral model.

A high net in-migration state is revealed as having the ability to attract new residents and maintain current residents relatively well. This monopoly power will allow the state government to avoid the pressure of pursuing a race to the bottom set of tax policies, leading to relatively higher tax rates than a low net migration state. The interaction term $M_{it} t_{jt}$ is included as the response to the neighbors' tax rates is expected to differ with different magnitudes of the net migration. A state that is able to avoid a

race to the bottom in taxes on individuals because of the attraction of the state is also less likely to feel the pressure from other states' taxes.

2.D Empirical Strategy and Data

Estimation of the above framework is complicated by the simultaneous nature of the model: tax rates affect net migration, while net migration in turn influences tax rates. As a result, simply estimating equation (6) by OLS will lead to biased results if the net migration is correlated with the error term as suggested by the theory. As seen in equation (2) from the theoretical model above, the in- and out-migration flows of the state are a function of the state's tax rate. Thus, the net in-migration will be a function of the tax rates leading to the following system of equations:

$$t_{it} = \beta_0 + \beta_1 M_{it} + \beta_2 t_{jt} + \beta_3 M_{it} t_{jt} + X_{it}\beta + \lambda_i + f_t + u_{it} \quad (7)$$

$$M_{it} = \alpha_0 + \alpha_1 t_{it} + \alpha_2 t_{jt} + Z_{it}\alpha + \lambda_i + f_t + \varepsilon_{it} \quad (8)$$

where Z is a vector of control variables that affect the net migration of a state and λ and f are state and year fixed effects, respectively. Estimation of the system of equation requires at least one variable in the net migration equation that significantly affects net migration but does not have an independent effect on state tax rates and at least one variable in the tax rate equation that significantly affects state tax rates but does not have an independent effect on net migration.

Tax Rate Data

The theoretical model described above employs a state income tax rate as the tax instrument. It is realistic to believe that individuals migrate in response to other taxes, and that the monopoly power of state due to the attachment of individuals can affect more

than the state income tax rate. For this reason, a measure of the total tax burden is used as an alternative, calculated as the total state tax revenue divided by the total state personal income.[37]

An additional specification includes a measure of the state's personal income tax burden. This is chosen for three reasons. First, the personal income tax, along with the sales tax, is a significant portion of revenue raised by many states.[38] For this reason, the states may be especially concerned with the impacts of the personal income tax on migration responses. As the primary interest of the paper is the effect that the attractiveness of the state has on state tax rates, the importance of the state personal income tax in state revenue collection also suggests it may be a primary method of extracting rent from individuals. The second reason for considering the personal income tax is that it is primarily a state policy tool while the sales tax is more frequently a state and local policy tool.[39] The final reason is that the personal income tax is a direct levy on residents while the sales tax is an indirect tax on residents, tourists and businesses.

The state's average personal income tax rate is used here as opposed to the statutory marginal income tax rate. The first reason is, given that some state tax systems are progressive, no single rate accounts for the incentives faced by all individuals so the average rate captures migration incentives faced by poor as well as rich individuals.[40] The second reason for the average rate is to allow comparison to the majority of

[37] The models were also run with the combined state and local tax burden. Results remain consistent with the state tax burden but are omitted for brevity. Data on state and local government revenue are not currently available after 2002, so the analysis with the state and local tax burden is for 1993-2002.
[38] The average amount of state revenue collected by states through personal income and sales taxes were roughly 34.1 and 32.7 percent, respectively in 2005 (Federation of Tax Administrators).
[39] According to the U.S. 2002 Census of Governments, local governments in 16 states collected income tax revenue while local governments in 35 states collected sales tax revenue.
[40] The evidence that welfare recipients move in response to fiscal policies helps support the use of an average personal income tax rate (Gelbach (2004) and McKinnish (2005)).

empirical strategic interaction studies on income taxation behavior (Esteller-More and Sole-Olle (2002), Rork (2003) and Hayashi and Boadway (1999)). The average personal income tax rate is calculated as the total state personal income tax revenue divided by the total state personal income.

Regressing the state's personal income tax rate on the net migration of the state and the neighbor's personal income tax rate is complicated by the fact that the average personal income tax rate includes many zeros (roughly 15 percent of the panel). To properly estimate such a system, the model is further described by the following system of equations:

$$M_{it} = \alpha_0 + \alpha_1 t_{it}^* + \alpha_2 t_{jt} + X\alpha + \lambda_i + f_t + \varepsilon_{it} \tag{9}$$

$$t_{it}^* = \beta_0 + \beta_1 M_{it} + \beta_2 t_{jt} + \beta_3 M_{it} t_{jt} + Z\beta + \lambda_i + f_t + \mu_{it} \tag{10}$$

$$t_{it} = \begin{cases} t_{it}^* \rightarrow t > 0 \\ 0 \rightarrow otherwise \end{cases}. \tag{11}$$

Following Nelson and Olsen (1978) and as outlined in Maddala (1983), estimation of the above model consists of the following procedure. First, reduced form equations for (9) and (10) are written as

$$M_{it} = \Pi_{it}^1 X + u_{it} \tag{12}$$

$$t_{it}^* = \Pi_{it}^2 X + \eta_{it} \tag{13}$$

where X includes all exogenous variables in X and Z from (9) and (10). The reduced form equation for migration rates is then estimated by OLS and the reduced form equation for income tax rates is estimated by the Tobit method. From these estimations,

predicted values are calculated, giving $\hat{M}_{it}$ and $\hat{t}_{it}^{*}$. Equation (9) is then estimated by OLS using $\hat{t}_{it}^{*}$ for t_{it}^{*} and equation (10) is estimated by Tobit using $\hat{M}_{it}$ for M_{it}.[41]

Migration Data

As described above, one of the primary questions of interest for this study is how the attraction of a state influences its tax rates. It is hypothesized that a more attractive state is relatively better at maintaining residents and continuing to attract some non-residents after a tax increase. These suggest that the more attractive state will experience higher net in-migration, measured as in-migration minus out-migration. Dating back to 1993, the U.S. Census Bureau has collected annual net domestic migration numbers and net international migration numbers for each state. Net domestic migration is calculated as the difference between the number of domestic individuals that moved into the state and the number of individuals who moved out of the state to another state during the time period. The net international migration is the difference between the number of migrants to a state from outside the U.S. and the number of migrants from a state to anywhere outside the U.S. for the time period. In addition, total net migration is calculated by combining the domestic and international migration numbers.

For this research, the domestic migration data are used for comparability to other studies of interstate migration.[42] In addition, it might be expected that larger states

[41] In addition to the Tobit method, the Heckman selection model is also used for estimating models with a large number of zeros. The primary difference in the method is that the procedure involves two stages with the first stage being a probit estimating the probability that the state has a positive income tax rate. The inverse Mills ratio is then estimated and included as a regressor in an OLS estimation of the positive values of the state income tax rate. While the Heckman two-step procedure may be appropriate for estimation of equations (10) and (11), to the author's knowledge there is no Heckman simultaneous procedure to estimate the system of equations.

[42] The estimations presented below are also conducted with the total migration rates. Coefficient estimates are not significantly changed so results are not presented but are available from the author.

experience more in and out-migration, so the net migration is calculated as a rate to eliminate scale issues and also to remain comparable to other aggregate migration studies (Gale and Heath (2000) and Conway and Rork (2006)). Specifically, the net migration rate is calculated as the net in-migration divided by the lag of the population of the state.

Explanatory Variables.

In explaining both migration and personal income tax rates, other variables besides tax rates and migration rates are certainly important so must be controlled for in the estimation as guided by the behavioral models. Previous empirical literature on migration and tax rate setting will help guide the choice of explanatory variables.

Tax Literature. In addition to the impact that net migration has on state taxes, the behavioral model above, as well as a large body of theoretical and empirical literature, indicates that a state's taxes are correlated with other states' taxes.[43] Before including a measure of the other state's tax rates, assignment of states as competitors must be completed. While the decision of defining a state's competitors is left to the researcher, previous research can help guide the choice.

The strategic interaction is generally thought to occur because of the movement or threat of movement of the base between states. Studies on determinants of migration have long found that distance between locations has a negative impact on the migration between locations (Greenwood (1997)). As a result, geographically closer states might be a natural starting point. Evidence of migration occurring more commonly among bordering states is also observed in the data. For example, the 2000 Census indicates that 41.5, 43, 41, and 57 percent of out-of-state movers to Alabama, Connecticut, Maryland

[43] Differentiating equation (2) with respect to t_W shows the relationship between jurisdictions' tax rates.

and Oregon, respectively, came from bordering states. Obvious exceptions include Florida and California where only 8% and 15% of out-of-state movers came from bordering states.

Once only bordering states are defined as competitors, different weights can be placed on the neighbors resulting in several different measures of neighbors. The first and most commonly used in the literature is referred to as a contiguity matrix and is simply the average of the bordering states' tax rates (Rork (2003), Esteller-More and Sole-Olle (2002) and Fredriksson, et al. (2004)). In this specification, all bordering states are given equal weight.

Because states might be more concerned with the behavior of the larger bordering states, it might make more sense that a state places more weight on the more populous bordering states. For example, Nevada shares borders with five states but nearly 43 percent of migrants from bordering states come from California, the most populous bordering state. This specification is called the population-contiguity matrix and is commonly found in the literature (Rork (2003) and Fredriksson, et al. (2004)). It continues to define only the states that border a state as neighbors, but the states are given different weights based upon the proportion of the state's population to the entire bordering population, so the neighbor's tax measure becomes a population-weighted average of the neighbors' tax rates.

The final weighing scheme employed continues to consider only bordering states as competitors, but distance between the states' major cities plays a key role. As pointed out above, it is commonly found that greater distance between states will lead to less migration between the states. In addition, many individuals commonly move from

metropolitan area to metropolitan area. According to the U.S. Census Bureau's Current Population Survey in 2003, roughly 45 percent of individuals who moved outside of an MSA were individuals who moved from one metro area to another metro area. For this specification, only bordering states continue to be considered as neighbors but more weight is applied to states with less distance between the most populous cities. For example, Tennessee would place more weight on Arkansas than North Carolina, as Memphis is closer in distance to Little Rock than to Charlotte. The city-contiguity measure is simply a distance-weighted average of the bordering states.[44]

Because it is hypothesized that states set tax rates strategically, the tax rate on the right hand side of the equation is endogenous, so ordinary least squares (OLS) estimation would lead to inconsistent estimates of the parameters.[45] The literature commonly uses one of two approaches to correct for endogeneity. The first is an instrumental variables (IV) methods which, following Brueckner (2003), involves instrumenting the neighbor's tax rate with weighted explanatory variables.[46]

A second method in dealing with the endogenous neighbor's tax measure is by assuming a lagged as opposed to a contemporaneous response. In addition to the elimination of endogeneity concerns, the lagged strategic variable allows for the potentially realistic possibility that strategic behavior occurs with a time lag if

[44] Defining neighbors as only geographic neighbors is not the only method. For example, Fletcher and Murray (2005) and Case, Rosen and Hines (1993) explore the interaction between economic or demographic neighbors. Defining neighbors by geography exclusively is the only way to choose a clearly exogenous neighbor definition, so pursuit of additional neighbor definitions is left for future research.
[45] See Brueckner (2003) for a review of econometric concerns in estimating strategic interaction models.
[46] For examples of the IV method, see Rork (2003), Esteller-More and Sole-Olle (2002) and Fredriksson, et al. (2004). In addition to correcting for the endogeneity, the IV method leads to consistent estimates in the presence of spatial error dependence (Kelejian and Prucha (1998)), which may induce correlation in the tax rates even though strategic interaction may not be present.

governments cannot immediately adjust their own tax policies.[47] Because the primary interest in this research is the effect of net migration on state taxes and there is evidence of lagged strategic interaction (see sources in footnote 45), the analysis here assumes that strategic interaction occurs with a one-year time lag.

It is also important to control for other variables influencing the setting of the state taxes. Following Esteller-More and Sole-Olle (2002) and Rork (2003), the fiscal stress or economic resources available are potentially important determinants of the rate set by a state. A state with a high per capita outstanding debt might be forced to raise revenue by setting higher taxes (Rork (2003)). In addition, per capita federal transfers received by the state may allow the state government to collect fewer revenues due to the revenue from the transfer (Esteller-More and Sole-Olle (2002)).

Per capita income is also included to control for resources available to finance public services. As pointed out in Esteller-More and Sole-Olle (2002), if public goods are normal goods it might be expected that higher income states would desire more public goods and therefore accept a higher tax burden. On the other hand, a richer population translates to a larger base, which allows for lower tax rates.

The next set of control variables are intended to control for the expenditure needs of the state. The most obvious variable to include is the per capita government expenditures, as more expenditure requires more revenue. Other studies have not included expenditures explicitly, but rather proxies for expenditure needs (Esteller-More and Sole-Olle (2002) and Rork (2003)). These are included as well as certain shares of

[47] For examples of the lagged method, see Fredriksson, et al. (2004), Fredriksson and Millimet (2002) and Hayashi and Boadway (2001).

the population are thought to favor or require more government services. For this purpose, percent of the population between age 5 and 17, percent of the population over the age of 65 and the total population are included, all of which may lead to more expenditures so a larger tax burden might be expected. The greater the share of the population with a college degree may also affect government spending if a college degree translates to more income. The unemployment rate has been shown in past studies to influence tax rates, as higher unemployment rates might encourage government to alter its fiscal structure to encourage job growth.

The final set of explanatory variables included is intended to control for the political environment of the jurisdiction (Esteller-More and Sole-Olle (2002) and Rork (2003)). Two dummy variables that measure whether the state's legislature and governor are the same party are included. A dummy is included for whether both the lower house and the governor of the state are Democratic or whether both the lower house and the governor are Republican. Both levels of government being in the same party potentially allows passage of bills to occur easier, thereby leading to more government spending and higher taxes. Finally, year and state fixed effects are included to control for changes in time that are constant across states and changes in states that are constant across time, respectively.

Migration Literature. While the primary interest of this research is to understand the effect that net migration has on state tax burdens, the simultaneity and resulting econometric procedure require an understanding of how migration is determined. Researchers and policymakers have long been concerned with the movement of

individuals between jurisdictions. It is this literature that helps guide the analysis here.[48] The literature has generally classified determinants of migration into three categories – personal, place and fiscal characteristics. Models generally assume that individuals compare utilities in all potential locations and choose the location that maximizes their utility.

As summarized in Cebula (1979) and more recently in Charney (1993), many fiscal characteristics are likely to affect the utility, thus affecting both in and out migration of individuals. Governments are able to influence individuals' utilities through tax and expenditure policies that may change income and the subsequent consumption of individuals. The fiscal variables of particular interest for this study are the state tax measures (overall burden and personal income tax rate) chosen and the neighbors' state tax measures. As seen in the model, the choice of location for individuals is a function of the tax rate of their own jurisdiction as well as other potential jurisdictions.

While the literature on the effects of tax policy on migration continues to grow, the results thus far are mixed. Reasons provided for the lack of significance of taxes in migration decisions may be the capitalization of taxes into wages or the presence of other amenities that compensate individuals for the higher tax burdens. Given the evidence that capitalization of income taxes exists in higher wages (Wallace (1993 and 2002) and Feldstein and Wrobel (1998)), the lack of significance of taxes should not be surprising.

In addition to potential capitalization, aggregate data studies are not able to capture the possibility that some individuals are attracted to higher tax burdens if the ensuing government spending is beneficial to them while others are repelled by the

[48] See Greenwood (1985 and 1997) for surveys on migration and its determinants.

higher tax burden as described in the subnational redistribution literature (Hindriks (1999 and 2001), Razin, Sadka and Swagel (2002) and Wildasin (1994 and 1991)). This asymmetry in responses to taxes may be reason for the lack of consistent findings in the aggregate data literature.

Several of the more recent aggregate studies have made an effort to examine the movement of a subset of the population, which eliminates the potential asymmetry among migrants. A body of literature has emerged with the intent to understand how fiscal policies such as estate, inheritance and gift taxes affect elderly migration with few results (Conway and Houtenville (1998), Gale and Heath (2000) and Conway and Rork (2006)). Another body of literature investigates whether welfare individuals are attracted to favorable fiscal policies of a state, also with many mixed results.[49] Gelbach (2004) offers an example of a recent study and finds that welfare recipients are less likely to leave high benefit states.

Even with the lack of empirical findings, the theoretical models of utility maximization suggest that individuals will consider the tax and expenditure bundle of a state before moving, so tax measures as well as per capita government expenditures and per capital federal transfers of the state are included. It is expected that higher government expenditures and transfers will lead to greater net migration rates, ceteris paribus.

Personal characteristics are also an important component of the individual's migration decision. One of the most generally accepted findings in the migration literature is that age and education are both important factors in migration decisions. It is

[49] See Moffitt (1992) for a review of the welfare migration literature.

generally found that propensity for migrating reaches a peak in the early ages and then falls steadily as age increases until migration propensities increase again as individuals reach retirement age (Plane (1993) and Greenwood (1997)). Another general finding is that the propensity to migrate increases as education levels increase (Greenwood (1997)). Because of these findings the percent of population between the ages of 5 and 17, the percent of the population over the age of 65 and percent of the population with a college degree are included. The poverty status of an individual is also commonly found to be an important determinant of migration patterns with poverty thought to lessen the ability of the individual to move (Cushing (1993)), so the poverty rate of the state is included.

The final category of determinants of migration is place characteristics. Because the migration decision depends upon the comparison of utilities between jurisdictions, individuals are thought to calculate expected incomes in potential destinations. Factors that influence the expected income include measures of labor market opportunities, such as the unemployment rate and per capita personal income (Cebula (2004) and Cushing and Poot (2004)). It is generally thought that an area with more opportunities for an individual to be employed will be more attractive for an individual to live in.

Another important component of place characteristics include amenities and cost-of-living of a location. Amenities are intended to measure the quality of life in a jurisdiction and may include distance to beach, the number of sunny days or some measure of cultural activities. Data on these variables are limited and many do not vary over time. As a result, these are not specifically included but are instead captured with a state-specific variable used in the panel specification. One measure of quality of life that does vary over time and is available is the amount of crime in an area. It is hypothesized

that crime, measured as an index of the number of crimes per 100,000 inhabitants, will be a deterrent to in-migration and encourage out-migration. Interestingly, the empirical literature has found crime to be positively associated with the in-migration of elderly individuals (Conway and Houtenville (1998) and Duncombe, et al. (2001)). Energy prices are included as a measure for the cost-of-living with the expectation that a more expensive state will attract fewer non-residents and repel more residents, ceteris paribus.

As discussed above, exclusion restrictions are required to estimate the system of simultaneous equations. From the discussion of explanatory variables, several control variables that meet the requirements emerge. Variables that are theoretically correlated with tax measures but have no independent effect on migration rates include the per capita debt, population and the set of political dummy variables. Variables that are theoretically correlated with migration rates but have no independent effect on tax burdens include the crime index, poverty rates and energy prices.

See Tables 2.1 and 2.2 (all tables and figures included in appendix) for descriptions and sources of the data as well as summary statistics. Figure 2.1 displays the trend of net migration rates and the two state tax rates described above from 1993-2004. As can be seen, both the state personal income tax rate and the net migration rate have remained relatively stable over the time period with the state tax burden decreasing slightly. Figure 2.2 divides the states into columns according to whether the states had positive or negative net in-migration rates in 2004. The average state tax burdens of the negative and positive net migration states in 2004 were 6.30 and 6.46, respectively. Even though higher net migration states had higher state tax burdens as hypothesized, there is no statistically significant difference between the two averages. The average personal

income tax rate in 2004 of the highest net in-migration states is lower than that in the lowest net migration states (1.71 versus 2.33 percent).

2.E Results

The theoretical model presented in section 2.C indicates that the taxes of a state are the function of how attractive the state is as well as the taxes of the neighboring states. In addition, the theory reveals that the magnitude of the neighbors' taxes depends upon the monopoly power of the state resulting from its ability to maintain and attract individuals. In other words, the extent of tax competition pressures on a state depends on the effective mobility of its tax base. To empirically test the relationships, several different regressions are estimated. The baseline results include the simultaneous estimations of the two tax measures and the net migration rate of the state without the interaction term, and are presented in Tables 2.3 and 2.4.[50]

Before discussing specific result, some general findings emerge. First, as presented in Table 2.3 the overall state tax burdens are never correlated with the tax burdens of neighboring states. Specifically, the coefficient estimate on the neighbor's overall tax burden does not have a significant relationship with a state's own tax burden indicating that states do not behave strategically when setting overall tax burdens. Similar to Rork (2003) but contradictory to Esteller-More and Sole-Olle (2002), the neighbor's personal income tax rate has a negative and significant relationship with a

[50] Appendix Tables 2.1 and 2.2 include estimates of the two literatures described above: the empirical strategic interaction literature and the capital mobility literature, respectively. Specifically, results in Appendix Table 2.1 mimic the majority of the tax competition literature by regressing a state's tax burden and personal income tax rates on the average of the neighbors' tax burdens and personal income tax rates (as described above), respectively. Results conform to those in the previous empirical studies literature. Appendix Table 2.2 presents results that are intended to parallel the empirical literature that examines how the reduction in capital flow restrictions affects capital tax rates. Again, any results conform to that in the previous empirical literature.

state's own personal income tax rate indicating that states behave as strategic substitutes when setting personal income tax rates (Table 2.4). Second, the attachment of the population to the state generally has a positive and significant relationship with a state's tax measure even with the inclusion of the neighbor's rate in the model.

State Tax Burden

As mentioned above, the sign on the neighbor's state tax burden personal income tax rate coefficient estimate is not significant in any specification that includes the net migration rate of the state.[51] Also of interest to this research is the effect of the net migration rate on the overall state tax burden. As examined by Slemrod (2004), Bretschger and Hettich (2002) and Rodrik (1997), decreasing the restrictions on capital movement forces to governments to set lower tax rates on capital to attract the capital to the jurisdiction. Analogously, a state that is able to easily attract and maintain residents does not face the pressures to decrease the tax to attract and maintain residents. As predicted, attractive states are able to maintain higher state tax burdens in two of the three weight specifications when allowing for strategic interaction.

The remaining control variables reveal several consistent determinants of a state tax burden. States with higher per capita government expenditures are found to have higher overall tax burdens. States with a Democratic majority in the lower house and a Democratic governor tend to have lower overall state tax burdens while a state with a Republican majority in the lower house and a Republican governor tend to have higher overall state tax burdens.

[51] It should be noted that the sign on the neighbor's state tax burden personal income tax rate coefficient estimate is positive and significant in two of the three specifications in Appendix Table 2.1, which excludes the net migration of the state from the estimation.

Personal Income Tax Rate

As mentioned above and seen in Table 2.4, the sign on the neighbor's personal income tax rate coefficient estimate is negative and significant in one of the neighbor specifications, consistent with Rork (2003) and similar to Chernick (2005) who finds that a neighbor's progressivity is negatively correlated with a state's own progressivity. A one percentage point increase in the average of a state's neighbors' personal income tax rates is associated with a decrease of nearly 0.10 percentage points.[52]

It is also noted that the coefficient estimate of the net migration rate term is positive and significant in all models that allow for strategic interaction. Similarly to the state tax burden specifications, a state that is able to easily attract and maintain residents does not face the pressures to decrease the tax to attract and maintain residents, thus the positive and significant coefficient estimate on the net migration rate in all three weight specifications.

Results of the control variables are generally as expected with exception to the dummy variable for whether the lower house of state government is majority Republican and the governor is Republican. The coefficient estimate is positive and significant in the personal income tax rate equation, which is contrary to the general finding that Democratic led states have higher personal income tax rates or a more progressive tax system (Esteller-More and Sole-Olle (2002) and Chernick (2005)).

[52] Even with the prevalence of a negative sign on the strategic interaction term in the empirical literature and the theoretically ambiguous, the empirical literature is not settled on the reason for the negative sign. Chernick (2005) offers the possibility of tax havens as reasons for the negative spatial correlation.

Net Migration Rate

Tables 2.3 and 2.4 include the regression results of net in-migration rate equation from the simultaneous procedure. The state tax burden of a state and that of its neighbors does not have a significant impact on net migration rates in any of the weight specifications. The state's personal income tax rate has a negative and statistically significant effect on net in-migration in the simple contiguity weight specification only. Interestingly, the neighbors' personal income tax rate also has a negative and statistically significant effect on the own state's net migration rate in two of the weight specifications. The lack of consistent findings in these models is not unusual given the discussion above regarding the potential for capitalization.

As discussed above, the attractiveness of the state may affect the strategic interaction. This is explored by examining the model with the interaction term (Table 2.5).[53] To properly examine how the attractiveness of the state may affect the strategic interaction, the coefficient estimates of the neighbor's tax rate are studies. In the contiguity interaction model, the reaction is given by

$$\frac{\partial t_i}{\partial t_j} = -0.1180 + 0.2223(M_i).$$

To properly investigate the reaction function, certain values of the net migration rate must be used. A common approach involves beginning with the mean of the net migration rate, 0.1837. Plugging this mean into the above equation then indicates that the average net migration state reduces its personal income tax rate by nearly 0.08 percentage points

[53] Net migration equations are omitted in the simultaneous equations with the interaction term for brevity. Results largely remain similar to those in Tables 2.3 and 2.4.

due to an increase of one percentage point in the average state's neighbors' rates, as displayed in Table 2.6.

To then investigate how a more attached population affects a state's strategic interaction, consider a net migration rate that is one standard deviation above the mean, roughly 0.88. This reveals that a more attractive state (or one with more monopoly power) will respond to an increase in its neighbors' rates by *increasing* its rate by 0.08 percentage points in response to an increase in the average of its neighbors' personal income tax rates. This key result suggests that the attractiveness of the state has substantial effects on strategic interaction. A state with more monopoly power from its ability to attract and maintain individuals responds differently than a state that does not possess the monopoly power, indicating states face different risks for the feared race to the bottom.

2.F Conclusion

While much of the theoretical literature has recognized the importance of mobility on tax rates, the empirical literature has generally either tested for strategic interactions between states in setting tax rates or investigated whether capital tax rates are affected by the relaxation of capital controls. Results generally indicate that states do not set tax rates in isolation and decreased capital controls are associated with lower capital tax rates. This research set out to inform both bodies of literature.

Controlling for the simultaneous nature of the migration response and the tax rate decision, a positive relationship is found between the net in-migration of a state and the state personal income tax rate and the total state tax burden, indicating that a more

attractive state is able to impose higher tax rates on its residents. In addition, there is evidence that the attractiveness of the state affects the strategic behavior of the state. A more attractive state responds differently to a change in its neighbors' personal income tax rates than a state that is not attractive.

State policymakers have long been concerned with the potential for their state's tax policy to drive away residents and prevent non-residents from locating in the state. If individuals are responsive to the personal income tax rates, it seems the policymakers have reason to be concerned given the free interstate mobility that exists in the U.S. and most other developed countries. This free mobility is thought to force state policymakers to reduce rates with the intention of attracting and maintaining residents. In response, other states will follow by keeping their tax rates low in order to remain competitive.

While individuals do have the ability to move freely between states, these movements are not necessarily costless. Non-pecuniary costs, such as psychological costs of leaving friends and family, are incurred as well as pecuniary costs. Recent studies have investigated the role that these non-pecuniary costs have on subnational tax policies. It is hypothesized in this study that a state that easily maintains and attracts residents is thought to have some monopoly power that would allow the state to not be as concerned about the race to the bottom in tax rates. The relative high cost of leaving the attractive state coupled with the relative low cost to enter the attractive state provides the attractive state with the ability to not feel the same pressure to lower tax rates to attract and maintain individuals. In addition, the state with monopoly power will not feel the same competitive pressures in setting tax rates, as it does not face the same concerns with the race to the bottom.

While concerns of the race to the bottom are not unfounded, there are most likely attractions that factors have for certain jurisdictions that are outside the realm of public policy. These attractions serve to lessen the mobility of the factors, thus changing the race to the bottom pressures faced by states. Attractive states are able to maintain a higher tax rates on individuals than unattractive states are, but an unattractive may compete more aggressively for individuals. A tax rate gap that is sufficiently large will result in individuals moving; therefore the attractive state will have to decrease its rate as well. Results in this research indicate that attractive states are able to maintain higher rates than unattractive states but both rates may face increased downward pressures as the unattractive state increases its competition for individuals.

Essay 2: References

Brennan, Goeffrey and James Buchanan. 1980. *The Power to Tax: Analytical Foundations of a Fiscal Constitution,* Cambridge: Cambridge University Press.

Bretschger, Lucas and Frank Hettich. 2002. "Globalization, Capital Mobility and Tax Competition: Theory and Evidence for OECD Countries." *European Journal of Political Economy* 18: 695-716.

Brueckner, Jan K. 2003. "Strategic Interaction Among Governments: An Overview of Empirical Studies." *International Regional Science Review* 26: 175-188.

Case, Anne C, Harvey S Rosen, and James R Hines, Jr. 1993 "Budget Spillovers and Fiscal Policy Interdependence." *Journal of Public Economics* 52: 285-307.

Cebula, Richard J. 1979. "Survey of the Literature on the Migration-Impact of State and Local Government Policies." *Public Finance* 34: 69-83.

Charney, Alberta H. 1993. "Migration and the Public Sector: A Survey." *Regional Studies* 27: 313-326.

Chernick, Howard. 2005. "On the Determinants of Subnational Tax Progressivity in the U.S." *National Tax Journal* 57: 93-112.

Conway, Karen and Andrew Houtenville. 1998. "Do the Elderly 'Vote with Their Feet?'" *Public Choice* 97: 663-685.

Conway, Karen and Jonathan Rork. 2006. "State 'Death' Taxes and Elderly Migration – The Chicken or the Egg?" *National Tax Journal* 59: 97-128.

Cushing, Brian. 1993. "The Effect of the Social Welfare System on Metropolitan Migration by Income Group, Gender and Family Structure." *Urban Studies* 30: 325-337.

Cushing, Brian and Jacques Poot. 2004. "Cross Boundaries and Borders: Regional Science Advances in Migration Modeling." *Papers in Regional Science* 83: 317-338.

Duncombe, William, Mark Robbins and Douglas A. Wolf. 2001. "Retire to Where? A Discrete Choice Model of Residential Location." *International Journal of Population Geography* 7: 281-293.

Esteller-More, Alejandro and Albert Sole-Olle. 2002. "Tax Setting in a Federal Setting: The Case of Personal Income Taxation in Canada." *International Tax and Public Finance* 9: 235-257.

Feldstein, Martin and Marian Vaillant Wrobel. 1998. "Can State Taxes Redistribute Income?" *Journal of Public Economics* 68: 369-396.

Fischel, William A. 1975. "Fiscal and Environmental Considerations in the Location of Firms in Suburban Communities." in *Fiscal Zoning and Land Use Controls* (Edwin S. Mills and Wallace E. Oates, eds.) Lexington, Mass.: Heath-Lexington.

Fletcher, Jason and Matthew N. Murray. 2006. "Competition Over the Tax Base in the State Sales Tax." *Public Finance Review* (Forthcoming).

Fredriksson, Per G., John A. List and Daniel L. Millimet. 2004. "Chasing the Smokestack: Strategic Policymaking with Multiple Instruments." *Regional Science and Urban Economics* 34: 387-410.

Fredriksson, Per G. and Daniel L. Millimet. 2002. "Strategic Interaction and the Determination of Environmental Policy across U.S. States." *Journal of Urban Economics* 51: 101-122.

Gale, Lewis R. and Will Carrington Heath. 2000. "Elderly Internal Migration in the United States Revisited." *Public Finance Review* 28: 153-170.

Gelbach, Jonah B. 2004. "Migration, Life Cycle, and State Benefits: How Low is the Bottom?" *Journal of Political Economy* 112: 1091-1130.

Goodspeed, Timothy J. 2000. "Tax Structure in a Federation." *Journal of Public Economics* 75: 493-506.

Greenwood, Michael J. 1985. "Human Migration: Theory, Models and Empirical Studies." *Journal of Regional Science* 25: 521-544.

Greenwood, Michael J. 1997. "Internal Migration in Developed Countries." *Handbook of Population and Family Economics* 1B: 647-720.

Hayashi, Masayoshi and Robin Boadway. 2001. "An Empirical Analysis of Intergovernmental Tax Interaction: The Case of Business Income Taxes in Canada." *Canadian Journal of Economics* 34: 481-503.

Hindriks, Jean. 1999. "The Consequences of Labour Mobility for Redistribution: Tax vs. Transfer Competition." *Journal of Public Economics* 74: 215-234.

Hindriks, Jean. 2001. "Mobility and Redistributive Politics." *Journal of Public Economic Theory* 3: 95-120.

Kanbur, Ravi and Michael Keen. 1993. "Jeux Sans Frontieres: Tax Competition and Tax Coordination When Countries Differ in Size." *American Economic Review* 83: 877-892.

Kelejian, Harry and Ingmar Prucha. 1998. "A Generalized Spatial Two-Stage Least Squares Procedure for Estimating a Spatial Autoregressive Model with Autoregressive Disturbances." *Journal of Real Estate Finance and Economics* 17: 99-121.

Maddala, G.S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics,* Cambridge: Cambridge University Press.

Mansoorian, Arman and Gordon M. Myers. 1993. "Attachment to Home and Efficient Purchases of Population in a Fiscal Externality Economy." *Journal of Public Economics* 52: 117-132.

McKinnish, Terra. 2005. "Importing the Poor: Welfare Magnetism and Cross-Border Welfare Migration." *Journal of Human Resources* 40: 57-76.

Moffitt, Robert. 1992. "Incentive Effects of the U.S. Welfare System: A Review." *Journal of Economic Literature* 31: 1-61.

Nelson, Forrest and Lawrence Olson. 1978. "Specification and Estimation of a Simultaneous-Equation Model with Limited Dependent Variables." *International Economic Review* 19: 695–709.

Plane, David A. 1993. "Demographic Influences on Migration." *Regional Studies* 27: 375-383.

Razin, Assaf, Efraim Sadka and Phillip Swagel. 2002. "Tax Burden and Migration: A Political Economy Theory and Evidence." *Journal of Public Economics* 85: 167-190.

Rork, Jonathan C. 2003. "Coveting Thy Neighbors' Taxation." *National Tax Journal* 56: 775-87.

Slemrod, Joel. 2004. "Are Corporate Tax Rates, or Countries, Converging?" *Journal of Public Economics* 88: 1169-1186.

Tiebout, Charles. . "A Pure Theory of Local Expenditures." *Journal of Political Economy* 64: 416-424.

Wallace, Sally. 2002. "The Effect of State Income Tax Structure on Interstate Migration." Georgia State University, Andrew Young School of Policy Studies, FRP Report No. 79.

Wallace, Sally. 1993. "The Effects of State Personal Income Tax Differentials on Wages." *Regional Science and Urban Economics* 23: 611-628.

Wellisch, Dietmar. 1994. "Interregional Spillovers in the Presence of Perfect and Imperfect Household Mobility." *Journal of Public Economics* 55: 167-184.Keen, Michael and Maurice Marchand. 1997. "Fiscal Competition and the Pattern of Public Spending." *Journal of Public Economics* 66: 33-53.

Wildasin, David E. 1994. "Income Redistribution and Migration." *Canadian Journal of Economics* 27: 637-656.

Wildasin, David E. 1991. "Income Redistribution in a Common Labor Market." *American Economic Review* 81: 757-774.

Wilson, John. 1999. "Theories of Tax Competition." *National Tax Journal* 52: 269-304.

Wilson, John and David Wildasin. 2004. "Capital Tax Competition: Bane or Boon?" *Journal of Public Economics* 88: 1065-1091.

Appendices

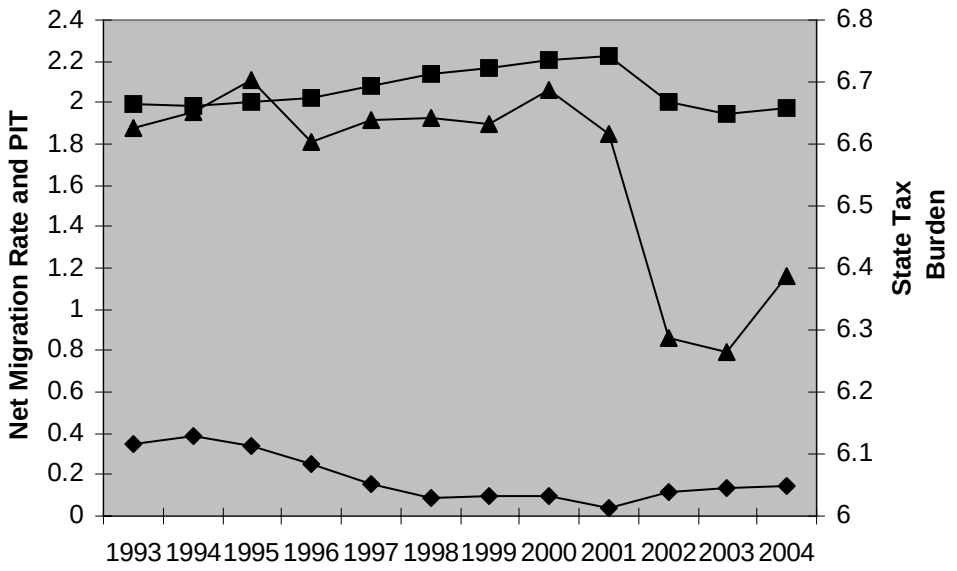

Figure 2.1: Net Migration Rate and State Tax Measures

Net Loss in Migration	Rates	Net Gain in Migration	Rates
New York	-1.117	Nevada	2.902
Massachusetts	-0.918	Arizona	1.489
Illinois	-0.561	Florida	1.470
New Jersey	-0.521	Idaho	0.923
Kansas	-0.436	Delaware	0.701
California	-0.407	Montana	0.677
Michigan	-0.362	South Carolina	0.586
Utah	-0.325	North Carolina	0.548
Connecticut	-0.307	Georgia	0.513
Nebraska	-0.298	Maine	0.434
Ohio	-0.272	Tennessee	0.398
North Dakota	-0.216	Arkansas	0.368
Louisiana	-0.168	Virginia	0.349
Minnesota	-0.167	New Mexico	0.315
Rhode Island	-0.143	Wyoming	0.271
Colorado	-0.139	Washington	0.259
Oklahoma	-0.131	New Hampshire	0.242
Maryland	-0.109	South Dakota	0.190
Iowa	-0.105	Kentucky	0.187
Indiana	-0.050	West Virginia	0.183
Pennsylvania	-0.006	Alabama	0.177
		Mississippi	0.136
		Texas	0.125
		Missouri	0.088
		Wisconsin	0.058
		Oregon	0.055
		Vermont	0.036

Figure 2.2: Migration Rankings by State, 2004

Table 2.1: Variable Description and Source Notes

Variable Name	Description	Source
Migration Rate	$((\text{Inmigration}_t - \text{Outmigration}_t)/\text{Population}_{t-1})*100$	Census Bureau
State Tax Burden	(Total State Tax Revenue divided by Total State Personal Income)*100	Census Bureau
State and Local Tax Burden	(Total State and Local Tax Revenue divided by Total State Personal Income)*100	Census Bureau
Neighbor's Avg State Tax Burden	Average of Neighbors' State Tax Burden	Author's Calculation
Neighbor's Avg State and Local Tax Burden	Average of Neighbors' State and Local Tax Burden	Author's Calculation
Avg PIT	(Personal Income Tax Revenue divided by Total Personal Income)*100	Census Bureau
Neighbor's Avg PIT	Average of Neighbors' Average PITs	Author's Calculation
Sales Tax Rate	General sales tax rate	*State Tax Handbook*
Corporate Income Tax Rate	Highest marginal corporate income tax rate	*State Tax Handbook*
% Pop from age 5-17	Percent of state population between the ages of 5 and 17	Census Bureau
% Pop Over 65	Percent of state population over the age of 65	Census Bureau
Unrate	State Unemployment Rate	Bureau of Labor Statistics
Per Capita Income (scaled by 1000)	State Per Capita Income scaled by 1000	Bureau of Economic Analysis
% Pop with College Degree	Percent of state population with a college degree	Census Bureau
Per Capita Intergovernmental Grant	State per capita intergovernmental grant	Census Bureau
Per Capita Govt Expenditures	State per capita government expenditures	Census Bureau
Same Govt Dummy (1=Republican)	Dummy Variable equal to one if the lower house of state government is majority Republican and the governor is Republican	Author's Calculation
Same Govt Dummy (1=Democrat)	Dummy Variable equal to one if the lower house of state government is majority Democrat and the governor is Democrat	Author's Calculation
Per Capita Debt	State per capita debt	Census Bureau
Population (scaled by 1000)	State population scaled by 1000	Census Bureau
Crime Index	Criminal offenses known to police per 100,000 population	Federal Bureau of Investigation
Poverty Rate	Percent of state population under the Census defined poverty rate	Census Bureau
Energy Prices	Estimate of energy costs for all forms of energy, measured per million Btu.	U.S. Dept of Energy

Table 2.2: Summary Statistics

	1993				2004			
Variable Name	**Mean**	**Std Dev**	**Min**	**Max**	**Mean**	**Std Dev**	**Min**	**Max**
Migration Rate	0.35	0.81	-1.26	2.63	0.14	0.64	-1.12	2.90
State Tax Burden	6.63	1.12	3.93	10.00	6.39	1.09	4.22	8.95
Neighbor's Avg State Tax Burden	6.54	0.59	3.93	7.52	6.28	0.56	4.22	7.50
State and Local Tax Burden	10.51	1.12	8.71	14.53	10.07	0.95	8.15	13.12
Neighbor's Avg State and Local Tax Burden	10.44	0.70	9.14	12.00	9.97	0.55	8.26	11.15
Avg PIT	2.00	1.05	0.00	3.88	1.98	1.01	0.00	3.88
Neighbor's Avg PIT	2.02	0.61	0.14	3.46	1.99	0.59	0.11	3.16
Sales Tax Rate	4.69	1.72	0.00	7.00	4.93	1.77	0.00	7.00
Corporate Income Tax Rate	6.75	3.04	0.00	12.00	6.61	3.00	0.00	12.00
% Pop from age 5-17	18.90	1.75	16.20	25.66	17.83	1.01	15.62	21.24
% Pop Over 65	12.86	1.77	8.84	18.48	12.65	1.53	8.69	16.83
Unrate	6.26	1.40	2.80	10.40	5.16	0.90	3.50	7.30
Per Capita Income (scaled by 1000)	20.30	2.85	15.29	28.98	31.89	4.62	24.38	45.51
% Pop with College Degree	21.05	4.15	12.20	30.20	26.84	4.85	15.30	36.70
Per Capita Intergovernmental Grant	760.43	192.29	458.64	1515.96	1438.82	502.75	696.61	3906.33
Per Capita Govt Expenditures	2935.20	545.28	2112.00	4113.40	4823.94	895.96	3441.53	7107.06
Same Govt Dummy (1=Republican)	0.19	0.39	0.00	1.00	0.29	0.46	0.00	1.00
Same Govt Dummy (1=Democrat)	0.42	0.50	0.00	1.00	0.27	0.45	0.00	1.00
Per Capita Debt	1709.81	1187.59	374.90	5132.90	2649.26	1515.21	607.66	7957.10
Population (scaled by 1000)	5321.83	5720.44	469.03	31147.21	6066.31	6577.45	505.89	35842.04
Crime Index	4925.19	1236.08	2533.00	8351.00	3794.84	981.75	1996.00	5844.60
Poverty Rate	14.34	4.19	8.50	26.40	12.12	2.92	5.40	18.60
Energy Prices	8.3279	1.3893	5.47	11.73	11.55	2.11	7.64	17.13

State and Local Tax Burden entries are listed for 2004 or for 2002 because of availability

Neighbor's averages are calculated according to the simple contiguity weight specification

Table 2.3: 2SLS Results

	Contiguity Weights		City-Contig Weights		Pop-Contig Weights	
	Migration	**Tax Rate**	**Migration**	**Tax Rate**	**Migration**	**Tax Rate**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Net Migration Rate		**0.7551***		0.6405		**0.7670***
		(0.4151)		(0.4201)		(0.4101)
State Tax Burden	-0.0419		-0.0215		-0.0565	
	(0.1510)		(0.1474)		(0.1488)	
Neighbor's Avg State Tax Burden[1]	0.1106	0.0875	0.0763	0.0621	-0.0404	-0.1761
	(0.0674)	(0.0973)	(0.0582)	(0.0900)	(0.0762)	(0.1119)
% Pop from age 5-17	**0.1565*****	-0.0975	**0.1575*****	-0.0813	**0.1596*****	-0.0874
	(0.0275)	(0.0662)	(0.0275)	(0.0668)	(0.0284)	(0.0656)
% Pop Over 65	**-0.1014***	0.0874	**-0.0985***	0.0766	-0.0853	0.0859
	(0.0523)	(0.0874)	(0.0522)	(0.0864)	(0.0519)	(0.0865)
Unrate	**-0.2229*****	0.1029	**-0.2222*****	0.0767	**-0.2277*****	0.1128
	(0.0248)	(0.0998)	(0.0248)	(0.1005)	(0.0252)	(0.1008)
Per Capita Income (scaled by 1000)	**0.0805*****	-0.0193	**0.0807*****	-0.0097	**0.0822*****	-0.0261
	(0.0155)	(0.0406)	(0.0156)	(0.0409)	(0.0157)	(0.0411)
% Pop with College Degree	0.0019	0.0090	0.0020	0.0101	0.0029	0.0114
	(0.0083)	(0.0122)	(0.0083)	(0.0119)	(0.0084)	(0.0122)
Per Capita Intergovernmental Grant	**0.0003****	0.0002	**0.0003****	0.0002	**0.0003****	0.0002
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Per Capita Govt Expenditures (t-1)	**0.0002*****	0.0002	**0.0002****	**0.0002***	**0.0002*****	0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Same Govt Dummy (1=Republican)		**0.1409***		**0.1296***		**0.1420****
		(0.0732)		(0.0726)		(0.0708)
Same Govt Dummy (1=Democrat)		**-0.1520****		**-0.1396****		**-0.1512****
		(0.0667)		(0.0659)		(0.0671)
Per Capita Debt		-0.0000		-0.0000		-0.0000
		(0.0001)		(0.0001)		(0.0001)
Population (scaled by 1000)		**-0.0002****		**-0.0002****		**-0.0002****
		(0.0001)		(0.0001)		(0.0001)
Crime Index	0.0001		0.0001		0.0001	
	(0.0000)		(0.0000)		(0.0000)	
Poverty Rate	**-0.0169****		**-0.0168****		**-0.0172****	
	(0.0077)		(0.0077)		(0.0078)	
Energy Prices	**0.0505*****		**0.0495*****		**0.0499*****	
	(0.0156)		(0.0155)		(0.0157)	
Constant	**-5.7714*****	**5.7764****	**-5.7046*****	**5.3509****	**-5.1451*****	**7.2344*****
	(1.0906)	(2.7147)	(1.0975)	(2.7127)	(1.1901)	(2.6683)
Observations	576	576	576	576	576	576
R-squared	0.888	0.882	0.889	0.889	0.887	0.881

1 - Neighbor's rate lagged by one period in the average state burden regression

Standard errors in parentheses; *** significant at 1%; ** significant at 5%; * significant at 10%

Table 2.4: Simultaneous Tobit Model

	Contiguity Weights		City-Contig Weights		Pop-Contig Weights	
	Migration	**Tax Rate**	**Migration**	**Tax Rate**	**Migration**	**Tax Rate**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Net Migration Rate		**0.4443*** **		**0.4487*** **		**0.4448*** **
		(0.1606)		(0.1450)		(0.1424)
State Personal Income Tax	**-0.7324***		-0.4647		-0.7059	
	(0.4094)		(0.4138)		(0.4467)	
Neighbor's Avg State Personal Income Tax[1]	-0.1849	**-0.1080** **	**-0.2552***	**-0.1255*** **	**-0.3693*** **	**-0.0940** **
	(0.1552)	(0.0438)	(0.1402)	(0.0239)	(0.1001)	(0.0415)
% Pop from age 5-17	**0.1731*** **	**-0.0531** **	**0.1715*** **	**-0.0542** **	**0.1867*** **	**-0.0510** **
	(0.0285)	(0.0247)	(0.0292)	(0.0225)	(0.0289)	(0.0214)
% Pop Over 65	**-0.1466** **	-0.0247	**-0.1290** **	-0.0341	**-0.1505** **	-0.0268
	(0.0600)	(0.0251)	(0.0612)	(0.0286)	(0.0609)	(0.0279)
Unrate	**-0.2715*** **	0.0285	**-0.2559*** **	0.0295	**-0.2658*** **	0.0305
	(0.0352)	(0.0390)	(0.0353)	(0.0349)	(0.0364)	(0.0360)
Per Capita Income (scaled by 1000)	**0.0735*** **	**-0.0464*** **	**0.0720*** **	**-0.0460*** **	**0.0696*** **	**-0.0451*** **
	(0.0150)	(0.0151)	(0.0157)	(0.0143)	(0.0150)	(0.0132)
% Pop with College Degree	-0.0030	**-0.0117** **	-0.0024	**-0.0114** **	-0.0029	**-0.0105** **
	(0.0085)	(0.0049)	(0.0089)	(0.0047)	(0.0086)	(0.0044)
Sales Tax Rate (t-1)	**-0.1664** **	**-0.0925*** **	-0.1203	**-0.0870*** **	**-0.1520***	**-0.0981*** **
	(0.0812)	(0.0233)	(0.0797)	(0.0208)	(0.0857)	(0.0232)
Corporate Income Tax Rate (t-1)	0.0060	0.0074	-0.0002	0.0105	0.0058	0.0129
	(0.0215)	(0.0088)	(0.0213)	(0.0084)	(0.0223)	(0.0169)
Per Capita Intergovernmental Grant	**0.0004*** **	0.0000	**0.0003*** **	0.0000	**0.0004*** **	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Per Capita Govt Expenditures (t-1)	**0.0002*** **	**-0.0001** **	**0.0002*** **	**-0.0001** **	**0.0002*** **	**-0.0001** **
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Same Govt Dummy (1=Republican)		**0.0944*** **		**0.0931*** **		**0.0911*** **
		(0.0290)		(0.0272)		(0.0275)
Same Govt Dummy (1=Democrat)		-0.0199		-0.0168		-0.0203
		(0.0269)		(0.0254)		(0.0251)
Per Capita Debt		**0.0001*** **		**0.0001*** **		**0.0001*** **
		(0.0000)		(0.0000)		(0.0000)
Population (scaled by 1000)		0.0000		**0.0001** **		**0.0000** **
		(0.0000)		(0.0000)		(0.0000)
Crime Index	0.0001		0.0001		0.0000	
	(0.0000)		(0.0000)		(0.0000)	
Poverty Rate	**-0.0227*** **		**-0.0205*** **		**-0.0219*** **	
	(0.0080)		(0.0079)		(0.0080)	
Energy Prices	**0.0660*** **		**0.0611*** **		**0.0704*** **	
	(0.0178)		(0.0178)		(0.0181)	
Constant	-0.6861	**5.5255*** **	-1.5140	**5.3931*** **	-0.4651	**5.1755*** **
	(2.0353)	(0.7061)	(2.0516)	(0.7149)	(2.0998)	(0.6039)
Observations	576	576	576	576	576	576

1 - Neighbor's rate lagged by one period in the average state burden regression

Standard errors in parentheses; *** significant at 1%; ** significant at 5%; * significant at 10%

Table 2.5: Interaction Models

	Contiguity Weights		City-Contig Weights		Pop-Contig Weights	
	Sburd	PIT	Sburd	PIT	Sburd	PIT
	(1)	(2)	(3)	(4)	(5)	(6)
Net Migration Rate	**1.2644****	**0.0552*****	**1.1360****	**0.2078*****	**1.4522*****	**0.1903*****
	(0.9025)	(0.1761)	(0.9052)	(0.1724)	(0.9296)	(0.1710)
Neighbor's Avg State Tax Measure (t-1)	0.1290	**-0.1180*****	0.0623	**-0.0867*****	**-0.2793***	**-0.0793*****
	(0.1026)	(0.0617)	(0.0940)	(0.0374)	(0.1472)	(0.0424)
Migration * Neighbor Tax Interaction	-0.0749	**0.2223*****	-0.0635	**0.1448*****	-0.0874	**0.1163*****
	(0.0762)	(0.0402)	(0.0759)	(0.0361)	(0.0792)	(0.0379)
% Pop from age 5-17	-0.0111	**-0.0465***	-0.0125	**-0.0441***	0.0146	**-0.0468****
	(0.0595)	(0.0239)	(0.0573)	(0.0234)	(0.0648)	(0.0230)
% Pop Over 65	0.1246	-0.0076	0.1287	-0.0112	0.1519	-0.0169
	(0.0980)	(0.0342)	(0.0953)	(0.0333)	(0.1025)	(0.0259)
Unrate	0.1569	0.0350	0.1377	0.0374	0.1954	0.0297
	(0.1353)	(0.0392)	(0.1348)	(0.0394)	(0.1398)	(0.0375)
Per Capita Income (scaled by 1000)	-0.0085	**-0.0609*****	-0.0040	**-0.0592*****	-0.0270	**-0.0474*****
	(0.0363)	(0.0151)	(0.0351)	(0.0154)	(0.0409)	(0.0146)
% Pop with College Degree	0.0034	-0.0053	0.0046	-0.0063	0.0051	**-0.0091****
	(0.0143)	(0.0046)	(0.0139)	(0.0046)	(0.0151)	(0.0044)
Sales Tax Rate (t-1)		**-0.0957*****		**-0.1160*****		**-0.0820*****
		(0.0182)		(0.0216)		(0.0204)
Corporate Income Tax Rate (t-1)		**0.0285*****		0.0205*		0.0088
		(0.0103)		(0.0108)		(0.0077)
Per Capita Intergovernmental Grant	**0.0004****	0.0001	**0.0004****	0.0001	**0.0004****	0.0000
	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Per Capita Govt Expenditures (t-1)	0.0001	**-0.0001****	0.0001	**-0.0001****	0.0001	**-0.0001****
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Same Govt Dummy (1=Republican)	0.1548	**0.1086*****	0.1492	**0.1114*****	**0.1642***	**0.0984*****
	(0.0965)	(0.0286)	(0.0948)	(0.0286)	(0.0942)	(0.0274)
Same Govt Dummy (1=Democrat)	**-0.2125*****	-0.0175	**-0.2025****	-0.0160	**-0.2234*****	-0.0121
	(0.0808)	(0.0266)	(0.0795)	(0.0264)	(0.0843)	(0.0257)
Per Capita Debt	0.0000	**0.0001*****	-0.0000	**0.0001*****	-0.0000	**0.0000***
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Population (scaled by 1000)	**-0.0002***	**0.0001*****	**-0.0002***	**0.0001*****	-0.0001	**0.0001*****
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Constant	2.9724	**4.9861*****	**3.2456***	**5.0925*****	**5.0585****	**5.2270*****
	(1.9994)	(0.6985)	(1.9322)	(0.6904)	(2.1473)	(0.6689)
Observations	576	576	576	576	576	576

Standard errors in parentheses; *** significant at 1%; ** significant at 5%; * significant at 10%
Signifance of Net Migration Rate and State Tax Measure coefficient estimates
are based on joint signifance with the interaction term

Table 2.6: Interaction Interpretations

	Contiguity	City-Contiguity	Pop-Contiguity
Effect of increasing neighbor's PIT rate by one			
with mean net migration rate	-0.0772	-0.0601	-0.0579
if migration rate up one standard deviation	0.0781	0.0410	0.0233
if migration rate down one standard deviation	-0.2324	-0.1612	-0.1392

Appendix Table 2.1: Strategic Competition Models

	Contiguity Weights		City-Contig Weights		Pop-Contig Weights	
	Sburd	**PIT**	**Sburd**	**PIT**	**Sburd**	**PIT**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Neighbor's Avg State Tax Measure (t-1)	**0.1699****	-0.0360	**0.1296***	**-0.0946*****	-0.1223	-0.0626
	(0.0802)	(0.0354)	(0.0750)	(0.0258)	(0.1009)	(0.0493)
% Pop from age 5-17	-0.0045	0.0021	-0.0009	-0.0019	0.0060	0.0047
	(0.0392)	(0.0149)	(0.0392)	(0.0139)	(0.0396)	(0.0148)
% Pop Over 65	0.0203	**-0.0731*****	0.0179	**-0.0697*****	0.0218	**-0.0851*****
	(0.0738)	(0.0191)	(0.0740)	(0.0211)	(0.0740)	(0.0209)
Unrate	**-0.0683****	**-0.0741*****	**-0.0682****	**-0.0741*****	**-0.0648****	**-0.0730*****
	(0.0310)	(0.0124)	(0.0311)	(0.0124)	(0.0315)	(0.0126)
Per Capita Income (scaled by 1000)	**0.0424****	-0.0116	**0.0431****	-0.0087	**0.0382***	**-0.0114***
	(0.0208)	(0.0078)	(0.0208)	(0.0074)	(0.0211)	(0.0068)
% Pop with College Degree	0.0129	**-0.0079***	0.0135	**-0.0074***	0.0160	-0.0072
	(0.0112)	(0.0044)	(0.0112)	(0.0045)	(0.0112)	(0.0046)
Sales Tax Rate (t-1)		**-0.1286*****		**-0.1223*****		**-0.1354*****
		(0.0196)		(0.0276)		(0.0144)
Corporate Income Tax Rate (t-1)		0.0124		0.0141		0.0156
		(0.0096)		(0.0164)		(0.0120)
Per Capita Intergovernmental Grant	**0.0004****	0.0001	**0.0004****	0.0001	**0.0004****	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Per Capita Govt Expenditures (t-1)	**0.0004*****	-0.0000	**0.0004*****	-0.0000	**0.0004*****	-0.0000
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Same Govt Dummy (1=Republican)	0.0547	**0.0447****	0.0565	**0.0429***	0.0603	**0.0434***
	(0.0520)	(0.0225)	(0.0520)	(0.0233)	(0.0520)	(0.0229)
Same Govt Dummy (1=Democrat)	**-0.0720****	0.0312	-0.0723	0.0311	-0.0680	0.0308
	(0.0467)	(0.0205)	(0.0468)	(0.0204)	(0.0468)	(0.0205)
Per Capita Debt	-0.0000	**0.0001*****	-0.0000	**0.0001*****	-0.0001	**0.0001*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Population (scaled by 1000)	**-0.0002*****	-0.0000	**-0.0002*****	-0.0000	**-0.0002*****	-0.0000
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Constant	2.3873	**4.1317*****	**2.6122***	**3.9334*****	**4.1133****	**4.0412*****
	(1.5518)	(0.4929)	(1.5465)	(0.4992)	(1.6103)	(0.4998)
Observations	576	576	576	576	576	576

Standard errors in parentheses; *** significant at 1%; ** significant at 5%; * significant at 10%

Appendix Table 2.2: Mobility Models

	Sburd	PIT
	(1)	(2)
Net Migration Rate	0.6254	**0.4094*** **
	(0.4050)	(0.1473)
% Pop from age 5-17	-0.0793	**-0.0492** **
	(0.0653)	(0.0227)
% Pop Over 65	0.0789	-0.0279
	(0.0844)	(0.0239)
Unrate	0.0721	0.0194
	(0.0979)	(0.0354)
Per Capita Income (scaled by 1000)	-0.0090	**-0.0425*** **
	(0.0395)	(0.0140)
% Pop with College Degree	0.0110	**-0.0106** **
	(0.0119)	(0.0045)
Sales Tax Rate (t-1)		**-0.0960*** **
		(0.0217)
Corporate Income Tax Rate (t-1)		0.0121
		(0.0110)
Per Capita Intergovernmental Grant	0.0002	0.0000
	(0.0002)	(0.0001)
Per Capita Govt Expenditures (t-1)	**0.0002***	**-0.0001** **
	(0.0001)	(0.0000)
Same Govt Dummy (1=Republican)	**0.1315***	**0.0917*** **
	(0.0696)	(0.0275)
Same Govt Dummy (1=Democrat)	**-0.1360** **	-0.0132
	(0.0656)	(0.0254)
Per Capita Debt	-0.0000	**0.0000***
	(0.0001)	(0.0000)
Population (scaled by 1000)	**-0.0002** **	**0.0001*** **
	(0.0001)	(0.0000)
Constant	**5.5770*** **	**4.9836*** **
	(2.1087)	(0.6515)
Observations	576	576

Standard errors in parentheses; *** significant at 1%; ** significant at 5%; * significant at 10%

Vita

Brian Christopher Hill was born on April 1, 1978 in Memphis, Tennessee. He graduated from high school in 1996 and proceeded to Auburn University to continue his academic pursuits. In June 2000, he received his B.S. with a major in economics. Brian then entered the Graduate School at the University of Tennessee, where in May 2004 he earned his M.A. in economics. Brian then continued at the University of Tennessee in pursuit of his Ph.D. in economics. He accepted an offer to join the Economics faculty beginning in the fall semester of 2006 at Salisbury University in Salisbury, Maryland after completing his Ph.D.