Local Government's Choice of Taxes in Ohio

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ABSTRACT

In Ohio, counties have two main choices for revenues. Counties can levy property taxes and sales taxes. This thesis study investigates the determinants of local taxation choice between sales taxes and property taxes in Ohio. Economic theory will be used as a basis and an econometric model will be used to test economic theory for the eighty-eight counties in Ohio. The thesis will determine if counties in Ohio follow economic theory. The results may be used by policy makers in Ohio to determine the effects of making certain policy changes in counties in Ohio.

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It's been a long journey. I started working on my Masters of Arts in Economics in 1998 after having just finished my undergraduate degree in engineering. I completed all of the course work for my Masters by the end of 1999. Having a full time job combined with my knack for procrastination delayed my total devotion to the thesis project until April of 2002. Since then I have been working on this thesis with passion – pouring through books, writing, and conversing with anyone who I thought might be able to thrust me even the slightest step forward toward completion. Although it would have been unintentional, I may have forgotten to thank some very important people along the way. I would like to take time to do that now.

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Thanks,

Table of Contents

1. Introduction

Every fund raising body must make a decision of how to raise income and this very same decision exists for the counties of Ohio. This decision is simplified because counties in Ohio have only two tax revenue resources at their disposal. These resources are sales taxes and property taxes. It will be assumed that each county will attempt to maximize its capacity to raise funds. The question will be how do counties in Ohio decide between property taxes and sales taxes as sources of income. That is, what portion of income raised will come from property taxes and what portion will come from sales taxes?

It is expected that several factors will influence a county's revenue choice. For example, an Ohio county located within reasonable driving distance from a location in another state that does not support the same type of sales tax may suffer mitigating effects if the additional costs of a good due to the sales tax differential is greater than the cost of transportation. Likewise surrounding areas as a choice of residence could appear more appealing for an individual because property tax rates are lower. Counties will then attempt to consider all the factors that will influence an individual's decision to shop or reside in a particular county.

The project will examine the choice between the sales tax and the property tax by examining behavior of Ohio counties. An econometric model using tax-mix as the dependent variable will be estimated using data from 88 counties in Ohio over an eleven-year period. The independent variables will be those variables that economic theory has predicted to have a major influence in the choice of tax-mix. The results of the model will provide some insight as to whether the actual decisions made by the counties are consistent with economic theory.

2. Literature Review

In tax theory officials are assumed to take in consideration the preference of its residents and residents are assumed to display their preference through voting. The government will attempt to raise taxes to supply public goods and services and residents will determine and vote appropriately regarding the benefits of the supplied public goods and services versus the cost (Hettich and Winer, 1988). This theory suggests that benefits from the good, b(G), must be greater than the cost from lost of income, c(I). Governments will then attempt to maximize the sum of b(G) – c(I) across all voters and all taxes. In this way, the maximum residential support for the government will be achieved.

There are several studies that explore the determinants of the maximization of voter support. One clear-cut idea to increase the value of b(G) – c(I) is to reduce the amount of income lost by voters to the public sector. This reduction in income loss in large part comes from the federal government's allowance of local tax deduction from federal income tax statements. This theory implies that residents will have greater support for taxes that are tax deductible at the federal income tax level. An example of such taxes would be property taxes. Therefore, an area with a relatively low level of tourism but a high level of homeowners would be predicted to rely more heavily on property taxes. This would ultimately maximize benefits received from local public goods and services. It does not go unnoticed by economists that local tax deductibility on federal income taxes essentially amounts to a federal subsidy and is tax exporting. These ideas are explored by several economists: Gade and Adkins (1990), Inman (1989), Feldstein and Metcalf (1987).

Gade and Adkins (1990) create a model for tax revenue. Centered at the core of this model is the use of burden prices. Burden prices are an attempt to measure the cost from loss of income due to a particular tax. One thing to take into consideration is that every voter does not itemize taxes. Therefore, the tax subsidy from deductibility benefits only those who itemize taxes. Gade and Adkins (1990) define burden prices as

$$P = p(1 - v) + (1 - p) = 1 - pv$$

where p is equal to the amount of tax deducted divided by the capacity to deduct the tax or the amount of tax that could have been deducted if every individual itemized his or her taxes; and v is the average federal marginal tax rate. Clearly, if there are any individuals that itemize, the burden price will be less than one; and unless every individual itemizes the tax will not equal one minus the tax rate, 1 – v. The burden price is the percentage of the tax actually paid by residents. The Gade and Adkins (1990) study uses cross-sectional data from fifty states for five years to estimate the tax revenue variables of income, general sales, selective sales, motor fuels, licenses, and corporate taxes. The independent variables include burden price variables for income taxes, general sales taxes, and motor fuels taxes. Other independent variables are tourism, manufacturing, mining, total real per capita revenues, and state's share of total revenue of the combined state and local revenue raised. The tourism variable measures a states ability to attract outside shoppers. The manufacturing and mining variables measure a state's value-add

to manufacturing and mining. The total real revenue per capita variable accounts for administrative and other demands of a larger government.

The results of the Gade and Adkins (1990) study suggest that as a burden price increases, states tend to use that particular tax less. For example as the percentage of income taxes paid by residents increases, the less states use income taxes, and the more states use general sales and motor fuels taxes. The study also finds that the greater a state's ability to mine, the less likely the state is to use sales and income taxes. The results for tourism contradict theory somewhat in that they suggest that highly toured states rely more heavily on license taxes and less heavily on general sales and income taxes. It would be expected that highly toured states would rely more heavily on sales taxes and motor fuel taxes. The results for the total real per capita tax revenue show that as additional revenues are required, the percentage of revenues coming from income and sales taxes increases while the percentage of revenues coming from license, motor fuel, and excise taxes decreases. Therefore, income and sales taxes are classified as being superior sources of revenues while license, motor fuel, and excise taxes are classified as being inferior sources of revenues.

While the previous study was an investigation of the decision to tax by states, the study by Inman (1989) covers forty-one cities over a twenty-five year period using a panel dataset from 1961 to 1986. Inman (1989) views a city's decision to tax to be the responsibility of the mayor to balance three competing influences. First, there is city council, which would like to provide government goods and services at the smallest tax rate possible. City council's utility increases with an increase in goods and services and decreases with an increase in the tax rate. Second, there are city agencies that want to provide agency services with smallest amount of fees possible. The preference of the administering agency increases with an increase in services and decreases with an increase in fees. Finally, there are the competitive taxpayer coalitions interested in minimizing their tax liability. It is assumed that there is an optimum burden share for each taxpayer that will result in the maximum amount of revenues raised by the government. The mayor controls burden shares for individual taxpayers by manipulating aggregate tax rates and fees. The mayor attempts to maximize the sum of each political agent's respective interests. The maximization of each of these competing interests is subject to the budget constraint: $g + cq + I = rB + fq + A + ug$, where g defines cost of government goods, cq defines the total cost of q government services, I defines interest payments, rB is tax-based revenue raised and fq is fee-based revenue, A defines state aid, and ug defines matching grants.

The maximization of these three preferences should result an optimum tax and fee rates for the dependent variables. The dependent variables for this study are total property tax revenues, total fee revenues, and selective sales tax revenues. The independent variables include the rate of subsidy for property taxation which is similar to the burden price variable used in the Gade and Adkins (1990) study, percentage of non-commercial property, level of federal and state grants, average resident income, percent of commuting workforce, number of manufacturing jobs, and the ratio of city to suburban income. Inman (1989) finds that as the uniform subsidy to residential property taxation from commercial industry property decreases the reliance on property taxation decreases also. This means that as the percentage of commercial property decreases and the

percentage of residential property increases, the reliance on property taxes decreases. Likewise, it is expected and found that as the percentage of the work force that commutes to the city from outside the city increases the reliance on property tax will decrease and the reliance on selective sales taxes and fees will increase. Also, of interest is that manufacturing jobs per capita increase the reliance on property taxation and selective sales taxation but decrease the reliance on fees. This result is consistent with theory because taxing manufacturing property is a way of exporting taxes and theory predicts that local governments will rely more heavily on those taxes that can be exported to non-residents. Another independent variable of interest is the ratio of city income to suburban income. Inman (1989) finds that there is an optimal level of city to suburban income. Inman (1989) call this ratio RSCI. If the level of city to suburban income is too high or too low, city officials will tend to spend more because of lack of competition. For example when the value is low, this signifies that the residents that are left are too poor to leave the city and therefore government officials do not feel the competitive influences of the suburbs. However, a value of RCSI that is relatively high would indicate relatively small suburbs in comparison to the city and these suburbs would be unable to significantly compete for the cities resources.

Perhaps the most interesting finding in the Inman (1989) study is the effect of the average property tax subsidy resulting from deducting local taxes from federal income tax statements. Inman (1989) finds that as the average property tax subsidy from income tax deductibility decreases, governments decrease the use of sales taxes and fees and increases the use of property taxes. These results are counter-intuitive, but Inman (1989) argues that the results do follow redistribution theory. His argument is that the rich prefer property taxes to selective sales taxes and fees and that when the average property tax subsidy decreases, the property tax burden of the rich increases because the rich are the ones who primarily benefit from the tax subsidy. Therefore, to realign the tax burden, reliance on fees is decreased and reliance on property taxes is increased because the rich prefer property taxes to fees. This result conflicts with the results obtained by Gade and Adkins concerning other taxes, such as income and general sales taxes. It would be expected that property taxes would follow the same theory and Feldstein and Metcalf (1987) analyze these conflicting results in an additional study investigating the determinants of local taxation.

Feldstein and Metcalf (1987) find fault with the results of Inman's study. Intuitively, it would be expected that as the property tax subsidy decreases, there would be less reliance on that tax and greater reliance on sales and other taxes. First, it appears that Inman used inaccurate data (albeit the best he had) to estimate the federal tax prices for individuals. These tax prices should have included the marginal tax rates and itemizers' status for individuals. Second, as noted above, Inman focused on city budgets; however, the distribution of spending between city and state level governments varies tremendously among states. For example, some states prevent cities from setting income or sales tax rates and therefore cities are forced to rely totally on property taxes: an example of such a state is Massachusetts. To avoid this problem Feldstein and Metcalf (1987) use data from a cross section of the forty-eight contiguous states to estimate the effects of the federal tax price; and they analyze the effect on both state and local personal taxation. There are three fiscal variables under question in their study:

combined state and local revenue from personal deductible taxes, all other state and local revenue, and spending financed from state and local resources. Among the independent variables are federal tax prices, pupils per capita, road mileage per capita, adjusted gross income, percentages of urban, nonwhite, poverty, and aged population, and percentage of homeowners.

The results of the Feldstein and Metcalf (1987) study indicate that an increase in the federal tax price, which is a decrease in the tax subsidy, will also decrease the reliance on personal taxes (income, sales, and property). This result of course conflicts with the results from Inman. However, they are unable to show conclusively with the data that this would increase the reliance on other taxes. Thus, this is not completely clarifying the problem of the Inman study. However, one key finding is that as the percentage of homeowners increases there is a decrease in the reliance on personal (income, sales, and property) taxes and a greater reliance on other taxes. It is difficult to interpret these results because Feldstein and Metcalf (1987) combine all of the property, sales and income taxes into an aggregate category and it can not be said conclusively that as the percentage of homeowners increases the reliance on property taxes decreases.

However, Metcalf (1993) provides additional insight into the decision to tax using a dataset from forty-eight states over a nine-year period from 1980 to 1988. The Tax Reform Act of 1986 eliminated the ability to deduct sales taxes from the federal income tax returns. This reduction in the ability to deduct sales taxes essentially raises the federal tax price for sales taxes to unity. Most economists would predict that there would be a decreased reliance on sales taxes but this is not what the data shows as states have not reduced their reliance on sales taxes. Metcalf takes a closer look at this situation in an attempt to explain why. Here Metcalf notes that there was a trend towards an increased reliance on sales taxes and property taxes. Therefore, the lack of a decrease in the reliance on sales taxes might be explained by there might have been an even higher reliance on sales taxes if not for TRA86. Metcalf creates a model that includes two types of tax exporting: exporting through federal tax returns and exporting through non-residents. The dependent variables for this study are personal income, general sales, selective sales, charges and licenses, corporate income, and other taxes. The independent variables are income tax price, sales tax price, exporting (Sales Activity Index), age distribution, and change in the unemployment rate. The age variable captures the variation in spending between age groups. Residents between 18 and 44, and 65 and older are higher consumption individuals and are expected to prefer lower sales taxation.

The results of the Metcalf (1993) study indicate that an increase in the tax price for income taxes would decrease the reliance on income taxes. Also, an increase in the tax price for sales taxes would increase the reliance on income taxes. However neither the income tax price variable nor the sales tax price variable have the expected impact on general sales taxes. The age demographic variables indicate some interesting results. It seems that individuals from 18 thru 44 would prefer a reduction in all tax categories except the other category. However, the elderly seem to prefer sales taxes to income taxes although Metcalf expected both groups be high spenders and prefer lower sales taxes and higher income taxes. Unemployment acts as expected and tends to decrease all taxes collected and is highly significant for income, sales, and license tax revenues. Yet, it seems that the exporting variable has little effects on rates, but it is positive and highly

significant for general sales. Metcalf believes this is because businesses pay a large percentage of the sales taxes and export them to nonresidents.

Metcalf in the end concludes that Inman may be correct. This conclusion stems from additional regressions based on different income groups, similar to the Inman argument. He concludes that different incomes appear to be concerned with different taxes. High-income groups appear to be more concerned with variations in income taxes while middle-income groups seem to be more concerned with sales taxes. For example, high-income groups will strongly prefer a decrease in the use of income taxes if the federal tax price for income increases. Likewise middle-income groups will strongly prefer a decrease in the use of sales taxes if the tax price for sales taxes rises. Metcalf suggests that politicians link income taxes to services benefiting high-income groups and sales taxes to services benefiting middle-income groups.

Ghaus (1995) investigates how sales tax revenues vary with the sales tax rate. He evaluates this question considering sales taxes to follow a Laffer curve. The Laffer curve indicates that there is an optimal tax rate that yields the maximum revenues. Raising rates beyond this optimum rate will not increase revenues but decrease them. Ghaus examines sales tax rates from a local perspective as opposed to a global perspective. Unlike previous articles that examined the influences on tax revenues through federal tax deductions and tax exporting, Ghaus investigates the local forces that influence the sales tax rate. For example, there are three possible responses to a change in the tax rate. Consumers may change where they shop, consumers may change residence as in the Tiebout-type world, or employers may increase wage rates to compensate for the increase in taxes. Ghaus simulates a model with key independent variables of distance from the central city, share of land cost in housing, share of housing in total household expenditure, the rate of return of government securities as opportunity cost of capital, rental cost of land in the urban periphery, transport cost, the share of land in residential use, and the property tax rate.

The results of the simulation indicate that there is an optimum sales tax rate. The optimum sales tax rate for total revenues is about five percent while the optimum sales tax rate for sales tax revenues is about six percent. This very interesting point demonstrates the dynamics of increasing the sales tax rate. As the sales tax rate increases, residents leave the city and the city becomes smaller. This in turn causes a decrease in the property tax revenues. The sales tax rate and the property tax rate are intertwined. If a city is functioning at the optimum level, increasing either tax rate will require a decrease in the other tax rate to maintain the maximum revenues. Other key results are that the optimal sales tax rate is sensitive to housing preferences, housing technology, and to some extent income levels. Increases in income and the share of land in the cost of housing increase the sales tax rate. Additionally, the optimal sales tax rate is sensitive to the elasticity of labor demand. A large elasticity of demand for labor will require lower sales tax rates because employers will not be compensating workers for the increase in sales taxes paid.

Arnott and Grieson (1981) provide a good summary of what to expect from local governments in terms of fiscal policy. First, local government services are enjoyed by two groups: residents and nonresidents. Local governments will attempt to minimize the

amount of taxes that are required from its residents. For example, this idea is expressed by Gade and Adkins (1990), Inman (1989), and Feldstein and Metcalf (1987) under the central theme of tax exporting thru federal income tax deductions and tourist who visit the area. Arnott and Grieson (1981) point out that an example of this can be seen in the reliance on taxing hotel services, restaurant meals, and entertainment items, which are consumed mostly by nonresidents, but less reliance on groceries, which are mostly consumed by residents. Also, an increase in the sales tax rates will cause consumers to look for alternative areas to purchase goods ceteris paribus. This idea was captured by Ghaus (1995) and is noted that this causes a contraction in the city's size as well. The elasticity of demand for the good taxed will affect the rate also. Inman (1989) discusses this in principle for cities with a very large or very small ratio of suburbs to city income. Citizens of cities with small incomes are not able to relocate and change their demand significantly from the goods taxed.

Also worth mentioning is that complementary goods can also influence the tax choice. Taxing one good might cause a decrease in the consumption of another good. While not discussed directly here, this is a good point. For example, an increased reliance on property taxes will not only reduce the amount of housing purchased but also all of the associating equipment that homeowners purchase. This could in turn have an effect on the amount of sales taxes collected. This idea is somewhat expressed by Ghaus (1995) as we have seen increasing sales tax rates causes a decrease in property tax revenues because increasing sales tax rates increases the cost of living and causes people to choose alternative areas as a place of residence. Finally, both Metcalf (1993) and Inman (1989) provided a group theory perspective. Governments tend to apply broad based taxes across groups and different groups tend to prefer different taxes. For example, Metcalf (1993) found that high-income groups prefer sales taxes to income taxes. From these studies, some key variables seem to be income, tourism, type of area – urban or rural, age distribution, federal tax price, and unemployment. The theoretical section will hone in on these variables as they relate to counties in Ohio.

3. Institutional Issues

Ohio is bordered by five states: Michigan, Indiana, Kentucky, West Virginia, and Pennsylvania. Each of these five states collects some form of sales taxes. Indiana, Kentucky, and West Virginia set a statewide tax rate for all counties. The sales tax rate is five percent in Indiana, and six percent in Kentucky and West Virginia. Michigan also sets a statewide tax rate but has reduced rates for sales of certain types of foods. The primary sales tax rate in Michigan is six percent. Pennsylvania basically has a statewide tax rate of six percent except for Alleghney county and Philadelphia city that have a one percent additional rate yielding a seven percent tax rate in those locations.

Ohio is therefore unique when compared with these five states in that counties in Ohio have some control over the sales tax rate imposed within their borders. Ohio sets a five percent sales tax rate statewide but allows individual counties to collect taxes at a rate up to one and a half additional percentage points in quarter point increments. The state also permits transit authorities to levy sales taxes at a rate up to one and a half percentage points in quarter point increments. The state permits counties to levy a one percent permissive sales tax and an additional half percent sales tax subject to voter approval. The one percent permissive tax began in 1982 and does not require voter approval. The half percent additional tax began in 1986 and is subject to voter approval and can be levied by the counties for the purposes: (1) payment of bonds issued for a convention facility, (2) revenue for a transit authority, (3) additional general county revenue, (4) revenue for permanent improvements, (5), implementation and operation of a 9-1-1 system. However, if the levy is for general county revenues, it can be levied by the commissioners pursuant to a resolution (according to determination of the county commissioners), but it is subject to repeal by the majority vote of the county electorate. In 1974, the state authorized transit authorities to levy an additional one and a half percent for the purpose of providing revenues for public mass transit; subject to voter approval. Sales tax rates in Ohio can therefore vary from county to county from five to eight percent. As of September 2002, Stark County held the lowest sales tax rate at five and a quarter percent. The highest rate was only seven percent and occurred in Cuyahoga County. Thirty-six of the eighty-eight counties in Ohio, had a rate set at six percent, and twenty-eight counties had a rate set at six and a half percent (See Appendix 10.).

In contrast to the sales tax, the bordering states yield substantially more latitude to its counties for the setting of property tax rates. This latitude in regards to property taxes but not sales taxes in some respects makes for a difficult decision. The decision is difficult because there is only one tax that local authorities can levy, and therefore increases may be viewed negatively by all residents. The alternative is to not raise property tax rates and obtain the necessary additional revenue from the state government. The state may provide this additional revenue by in turn raising sales tax rates. Therefore counties in these other states will still have a mix of taxes but the mix will not necessarily follow economic theory.

To decide between raising the property tax rates and relying on state aid, counties in the bordering states of Ohio will probably attempt to identify the advantages and disadvantages of the property tax. First as an advantage, property taxes are deductible from federal income taxes and this in turn provides tax exporting. Second, the property tax can be used to focus on higher income groups. The people who are most likely to

own property are the people most likely to have the most money. However, taxing property can also be disadvantageous. First, taxing property produces a deterrent for owning property. Therefore, taxing property heavily can prevent lower-income groups from owning a home. Second, property taxes are based on the market value of the property and this produces a deterrent for improving one's property.

To provide a more specific example of the tax choice in the neighboring states, a review of the neighboring state of Michigan and West Virginia's local taxation policy is provided. Starting with Michigan, from the period of 1970 to 1994 Michigan's property tax as a percentage of personal income averaged 4.7 percent. Voter influence forced the property tax ratio down in 1994 to 3.1 percent. The resulting decrease in local revenues needed to be recovered through some other form of fund raising. The choice was then made to raise sales tax rates from 4.0 percent to 6.0 percent. Metcalf (1993) argued that high-income groups prefer sales taxes while Inman (1989) argued that high-income groups prefer property taxes. If high-income groups prefer sales taxes, then in effect, high-income groups succeeded in exporting some portion of this tax burden to low-income groups. Quite possibly Michigan was just performing a necessary redistribution of the tax burden because from the period of 1970 thru 1993, Michigan was substantially above the national average in its reliance on property taxes both as a percentage of personal income and as a percentage of the tax mix. If indeed Michigan was realigning its tax mix to optimize its revenues, it provokes the question of why there would be a twenty-three year time delay to make the adjustment.

In contrast to Michigan, West Virginia has consistently had lower property tax rates in comparison to its neighbors. West Virginia is a state that would appear to be able to and need to raise its property tax rates but finds it very difficult to do so because of various political reasons. First, like Michigan, counties in West Virginia cannot set sales tax rates. In many cases, the voters also discourage raising property tax rates, which does not leave politicians many options for raising revenues. The lack of options causes local governments to rely on state aid. The state subsidizes the local governments in part through sales tax revenues. There is also no incentive for assessors to raise assessments since this would result in a decrease in state aid. West Virginia also faces problems in regards to property classification. In West Virginia, a large portion of property is wrongly assessed as agricultural property or residential property when it is not in its entirety of this type. A classification of property as agricultural is highly favorable for the property owner since this in general considerably reduces the amount of taxes to be paid.

Compared to the sales tax, the property tax provides the benefits of being a consistent source of revenues because property valuations do not change drastically from year to year. They provide a method to focus on high-income groups, although they may not provide enough incentives for low-income groups to own property, and a portion of the tax is exportable through federal tax deductions. Additionally, when the property is commercial, residents of the states may not even be the payers of the tax, if the owners live outside the states. With all these advantages there are extreme political pressures in these two neighboring states of Ohio to reduce property taxes and rely on sales taxes in spite of the regressive nature of sales taxes, and their lack of exportability through federal income taxes. These examples show that in spite of the obvious needs to make tax mix adjustments, it may be difficult for local economies to make such adjustments for one

reason or another. In the state of Michigan, there seems to be a twenty-three year delay. In the state of West Virginia, local political pressures discourage raising property tax rates.

In the state of Ohio, optimum levels may be more easily achieved, since local authorities have more ability to control local sales taxes. However, Ohio still faces all of the same pressures as the previously cited states, and the state reduces the burden of property tax payers by granting a 10 percent reduction in each taxpayer's property tax bill, and in addition, a 2.5 percent reduction is allowed for owner-occupied dwellings. The state reimburses local governments for this deduction, and as seen in the previous examples, these funds must come from other sources. Ohio also has classifications for residential, commercial, agricultural, industrial, and other types of property. The average millage rate for Ohio in the year of 1999 was 78.25 mills. The Ohio constitution limits the property tax rates that can be imposed without voter approval to 10 mills. A mill is $1 for each $1000 of taxable value. In Ohio, taxable value is 35 percent of market value.

There are several techniques used to make comparisons of property tax rates between states. Using the median home value technique assesses the median home property value and the amount of taxes paid. The following report is provided from the Ohio Department of Taxation for the year of 1998. As can be seen for the neighboring states of Ohio,

Table 3.1: PROPERTY TAXES AS A PERCENTAGE OF MEDIAN HOME VALUES, 1998

State	Median Home Value (Largest City)	Property Tax on Median Home	Percentage
Pennsylvania	49,400	1,304	2.64
Ohio	65,500	1,094	1.67
Indiana	61,200	1,016	1.66
West Virginia	65,700	604	0.92
Michigan	25,600	599	2.34
Kentucky	44,300	501	1.13
Average State	51,950	853	1.73

Source: Ohio Department of Taxation, 1990 Census Data, Department of Finance and Revenue

Pennsylvania and Michigan had the highest rates as a percentage of the median home value in the largest cites. West Virginia and Kentucky have very low rates in comparison. Ohio and Indiana are just about equal and are just below the average of 1.73 percent. An alternative technique is to measure property tax as a percentage of income as shown in The Michigan Property Tax Real and Personal report. Included here are only the neighboring states of Ohio for the year of 1999. Using this method for the year of 1999,

Table 3.2: PROPERTY TAX AS A PERCENTAGE OF INCOME, 1999

State	Property Taxes (Thousands)	Personal Income (Thousands)	Property Taxes % of income	Rank
Indiana	5,177,129	152,486,000	3.40	19
Kentucky	1,666,329	89,717,000	1.86	44
Michigan	8,810,590	273,308,000	3.22	22
Ohio	9,334,354	298,387,000	3.13	23
Pennsylvania	9,659,064	337,058,000	2.87	30
West Virginia	811,771	37,150,000	2.19	42
Average State	5,909,872	198,017,000	2.78	

Source: Michigan Property Tax Real and Personal Report, Bureau of Census, U.S. Dept. of Commerce

Ohio, Michigan, and Indiana are above the average, while West Virginia and Kentucky are below the average. It is interesting to observe the trends for each state. Curiously,

Table 3.3: TREND OF PROPERTY TAX AS A PERCENTAGE OF INCOME, 1993, 1999

State	Property Taxes % of income (1993)	Property Taxes % of income (1999)	Percent Change
Indiana	3.22	3.40	5.59
Kentucky	1.73	1.86	7.51
Michigan	4.60	3.22	-30.00
Ohio	2.94	3.13	6.46
Pennsylvania	2.95	2.87	-2.71
West Virginia	1.95	2.19	12.31
Average State	2.90	2.78	-4.08

Source: Michigan Property Tax Real and Personal Report, Bureau of Census, U.S. Dept. of Commerce

Pennsylvania is the only state decreasing its property taxes as a percentage of income besides Michigan. The overall trend is decreasing only because the state of Michigan made a drastic change in its laws in 1994. The final way of comparing property taxes involves property tax share. Table 3.4 shows property taxes as a percentage of total revenues as well as a percentage of just tax revenues. Total revenues include state and federal aid and fees. Local revenues include revenues from all local governments, such as cities and counties. The local revenues included in Table 3.4 include more than just sales and property taxes. Table 3.4 also includes property tax revenues from school districts. Local governments in Ohio, Kentucky, and Pennsylvania rely less heavily on property taxes than in the other states, but the reliance by local governments on property taxes as a choice of tax revenues is greater than fifty percent in every state.

Table 3.4: PROPERTY TAX AS A PERCENTAGE OF REVENUES, 1999

	Total Revenues			Taxes		
State	**State/Local**	**State**	**Local**	**State/Local**	**State**	**Local**
Indiana	22.3	0.0	52.1	33.2	0.0	88.6
Kentucky	11.7	3.8	28.9	17.1	5.0	53.9
Michigan	20.5	5.6	48.2	29.5	7.2	89.8
Ohio	20.8	0.1	44.6	28.9	0.1	66.0
Pennsylvania	19.8	0.6	46.9	27.4	0.8	69.7
West Virginia	12.8	0.1	42.5	19.0	0.1	82.8

Source: Michigan Property Tax Real and Personal Report, Bureau of Census, U.S. Dept. of Commerce

However, except for Indiana, property taxes are less than fifty percent of total local revenues, which has the relatively low statewide sales tax rate of five percent. These data give a clearer picture of what goes on in a state in regards to property taxes. For example, for the state of West Virginia property taxes are a low percentage of total income at forty-two percent but are a high percentage of its local governments' tax revenues at eighty-two percent because local administrations have limited sources in regards to tax revenues.

4. Theoretical Model

The tax-mix model for Ohio's counties focuses on sales tax revenues and property tax revenues as dependent variables. These variables will be introduced in the form of a ratio and the ratio will be the property tax share of the total tax revenues collected from the sum of both property tax and sales tax: Tax Mix = Property Tax/(Sales Tax + Property Tax). The explanation of the variation in these revenues will come from several different independent variables. The following is a list of the independent variables that should have a major influence in the variation of the dependent variables. The availability of data to represent some of these variables may present a problem and in that case, a proxy variable or indicator will be used if possible.

Tax price of Property Taxes – Tax price is the actual price that taxpayers pay for a given tax. The tax price for property taxes is less than one because homeowners can deduct this tax from their federal income taxes and the tax price is further reduced if non-residents own a portion of the land. An increase in the tax price for property tax will be expected to cause a decrease in property tax revenues and rates. It will however cause an increase in the sales tax rates and revenues to compensate for this reduction from property tax revenues and will cause a decrease in the tax mix ratio. Feldstein and Metcalf (1987) and Gade and Adkins (1990) compute the federal tax price. Feldstein and Metcalf find the federal tax price for Ohio to be 0.93 in 1979 with twenty-three percent of the population itemizing their federal income taxes, and of those who itemized the federal tax price was 0.71 in 1979. So in 1979 residents in Ohio received a seven percent deduction from the total property tax bill.

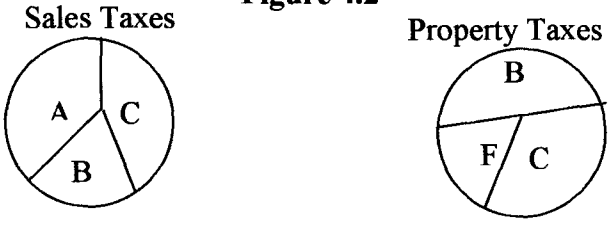
Personal Income per capita – Deciding which tax will dominate the tax mix when there is an increase in income per capita involves analyzing the competing influences on politicians. To provide a demonstration of this, consider the case of a county with only two people – person A and person B, where property taxes are not deductible from federal income taxes. Person A's income is less than person B's income and person A is not a homeowner while person B is a homeowner. Person A will be assumed to purchase less than person B because person A's income is less. Clearly, person A will favor property taxes because in this event person A will not be required to pay any taxes because person A does not own property[1]. Person B will favor sales taxes because this will result in a reduced tax obligation on person B's behalf as shown in Figure 4.1.

Figure 4.1

[1] If the supply of land does not vary, then the supply curve for land is inelastic and person A will not share any burden of the tax. Property taxes are the burden of incumbent landowners. Future landowners will calculate the cost of property taxes in the price of the land. Tenants do not bare the burden of property taxes either. See section 10. Appendix and Rosen's *Public Finance* (486-495).

Now, to increase income per capita, person C is added to the county as a homeowner and with income equivalent of person B. The income per capita has increased in the county and it is possible to examine the effects of this increase. Person B and C will out number person A and can win a vote against property taxes in favor of sales taxes. Person B and person C will make their decision comparing the amount of taxes they would pay under each tax. The decision persons B and C will make is not clear because persons B and C can deduct a portion of the tax from their federal income tax returns. However, the decision for person A is clear because person A can still eliminate the tax obligation by choosing property taxes over sales taxes as shown in Figure 4.2.

Figure 4.2



One clear result is that neither person A, B, or C will be in favor of a mix of taxes if they are all trying to minimize taxes paid. If person B and C's total tax will be less using property taxes, then they would not choose any sales taxes. Likewise consider person C to be a big spender and that person C's tax bill would be less under property taxes, then persons A and C would vote for property taxes and there would be no sales taxes. Therefore, the model must assume that there are other factors causing politicians to choose a tax mix, specifically revenue diversity. The chief drivers for this diversity are lack of information and revenue maximization. Politicians in general do not have exact information on voter preference and therefore to decrease the repercussions of choosing all sales taxes when voters prefer property taxes or vice versa, politicians will diversify tax revenues to lessen the affects of choosing the wrong tax. In addition, diversity will assist in tax revenue maximization. Consider a politician who chooses all sales taxes, then if person C decides to reduce spending, government revenues will be sharply affected. Likewise, consider that person C decides to not be a property owner, either by renting land from person B or through some other method, tax revenues will be sharply affected.

There are three perspectives to consider when analyzing this situation. First, as income per capita increases, the number of homeowners increases, which increases the tax base from which politicians can apply a more diverse tax policy, and take advantage of the fact that land valuations do not change drastically from year to year and that changing the decision to own property is not a decision that can be made hastily. Second, if the median voter is not a homeowner and does not itemize the federal income taxes, then the median voter clearly prefers property taxes. Third, as income per capita increases, the number of homeowners increases, which may provide political opposition to raising revenues through the property tax instrument or if the ability to export part of the tax through federal income tax deductibility is great enough, it will provide political support for the property tax by the new homeowners. The decision of the person whose income is well above that of the median voter is not clear because sales taxes can be

considered regressive. A useful way to consider this point is to consider the cost of living. For example, if the cost of living is $15,000, then for a person who earns $30,000 fifty percent of the earnings are definitely taxed through the sales tax. However for a person who earns $100,000, less than fifty percent of the income is taxed through the sales tax unless this person who earns $100,000 spends an additional $35,000. In this case the sales tax is classified as regressive because as the income increases, sales taxes paid as a percentage of income decreases. Therefore, a negative sign generated by income per capita will indicate that tax deductibility is not sufficient to cause homeowners to prefer property taxes, while a positive sign will indicate the positive effects of diversity and tax deductibility. Inman (1989) found that property taxes revenues increase as average income increases.

Total Tax Revenues per Capita – The argument that the relative size of the county's public sector can influence the tax mix is argued by Gade and Atkins (1990). This variable indicates the relative size of the government and if the coefficient of this variable is zero, it will indicate that government size is not a factor for tax mix in Ohio. If the sign is positive, it indicates that as counties require additional revenues, property taxes as a percentage of county revenues increases and property taxes are classified as a superior source of revenues. Likewise, if the sign is negative it indicates that as counties require additional revenues, property taxes as a percentage of county revenues decreases and the property tax is classified as an inferior source of revenues.

Tourism and Tax price of Sales Taxes – Tourism revenues in this study are classified as revenues collected directly from non-resident shoppers and allow counties to export the tax burden to outsiders. Exporting the taxes to outsiders reduces the portion paid by residents and the associating tax price. Therefore, a county that is visited frequently may rely more heavily on sales taxes and charge higher sales rates as agued by Gade and Adkins (1990) high tourism should result in consumption-based taxes. This attraction could be the result of several things, state parks or shopping malls with larger varieties than in the home location for example. Sales tax revenues and rates will increase and the reliance on property tax rates and revenues will decrease and will cause a decrease in the tax-mix ratio.

Agricultural Property – Strong opposition to property taxes will be expected from farmers and therefore decrease the reliance on property taxes. The resultant decrease in property taxes will require an increase in the reliance on sales taxes and cause increases in the sales tax rates and will produce a decrease in the tax mix ratio.

Natural Resources – Natural resources should increase the demand for property and therefore increase the reliance on property taxes and property tax rates and decrease the reliance on sales taxes and sales tax rates and will cause a increase in the tax mix ratio as discussed by Gade and Adkins (1990). In addition, if the mineral land is not owned by residents, there may be an increased reliance than if the land is owned by residents.

Transportation cost – The cost of transportation such as gasoline will influence a shopper's decision to shop in alternative areas. Increases in the cost of gasoline will

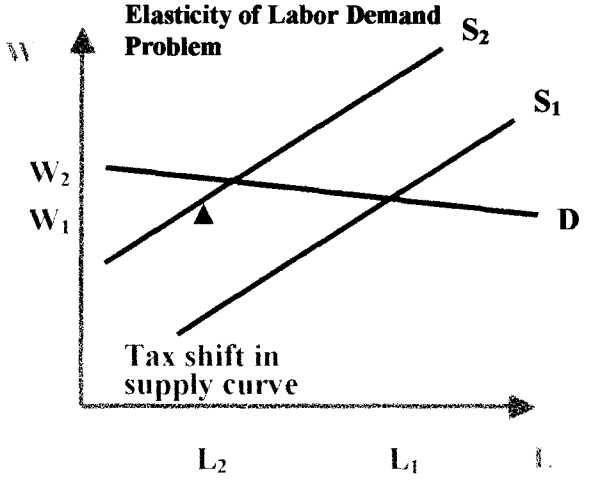
decrease the likelihood of a shopper traveling to neighboring areas with lower sales tax rates. This result comes from the total cost of the purchased good: Total cost = Price + Tax + Transportation Cost. As the transportation cost increases the total cost for the good increases as well. Increases in transportation cost will increase the reliance on sales taxes and increase sales tax rates and will cause a decrease in the tax mix ratio. Ghaus (1995) finds that an increase in the sales tax rate will cause a contraction in the sales tax base and that through a Bertrand equilibrium type process the limits set on the price differential between neighboring locations due to the sales tax rate differential in the long run will equal the cost of transportation. It seems important to note that such a calculation must also include the cost of time to travel to the neighboring location.

Aged percentage – The elderly population are more likely to have fixed incomes and in general will have relatively higher assets than income and therefore this group will most likely discourage property taxes. In addition the fixed income will to some extent prevent them from increasing their property values substantially from remodeling or purchasing newer homes. This lack of growth in property values will force the government to rely more heavily on sales taxes. This will shift the tax burden to sales taxes partially paid by tourist to the community and decrease the tax mix ratio. Indeed Metcalf (1993) finds that the aged population also prefers sales taxes to income taxes.

Unemployment rate – As the unemployment rate increases, revenues from retail sales will decrease, shifting the tax burden to property taxes and increasing the tax mix ratio. The demand for housing may decrease slightly but property valuations will not change drastically in the short run. However, sales tax revenues will drop immediately. Metcalf (1993) shows that as the unemployment rate increases sales tax revenues decrease.

Elasticity of Labor Demand - A highly elastic demand for labor will require a lower set of sales tax rates because an increase in sales tax rates will effectively lower the real wages earned by workers. The new sales tax rates will cause a shift in the supply for labor and fewer workers will be willing to work at this new tax rate. If the demand for labor were inelastic, there would be no change in the quantity of laborers supplied because employers would be willing to pay extra wages to compensate for the increase in taxes. However, with an elastic demand for labor, workers are forced to bear the majority of the increase in taxes. This effectively reduces their salary and they respond to the new tax rate by shifting their willingness to work at any give wage rate. This can be seen in the Figure 4.3.

Figure 4.3
Elasticity of Labor Demand Problem



The resultant effect if this were to happen would be an increase in unemployment and a reduction in sales tax revenues. Therefore, as argued by Ghaus (1995) the elasticity of labor demand to some extent places limits on the sales tax rates, and increasing rates beyond these limits will not increase revenues but decrease them. If politicians take note of this fact and adjust policy accordingly, there will be less reliance on sales taxes and more reliance on property taxes and an increase in the tax mix ratio.

Assistance funds – Ohio's state government provides assistance funds to the individual counties. These funds are comprised of state sales tax, use tax, personal income tax, public utility excise tax, and corporate franchise tax. The amount supplied to each county is based upon the county's population compared to the total state population. As argued by Inman (1989) assistance funds will increase services provided by the government. However because for counties in Ohio these funds are provided in proportion to the population, they provide no new information in regards to tax mix. The total tax revenues per capita should capture the effects of increasing the size of government.

5. Description of the Data

The theoretical model section discussed variables that should explain the variation in sales tax revenues, property tax revenues, and the mix of the two, but the availability of data for those variables may present a challenge in some cases. Some of these variables may require proxies and some may not be available at all. This section will explain the type, source, and statistical characteristics of the data chosen to estimate the theoretical model.

Inflation - The values for all monetary variables are adjusted for inflation using 1989 as a base year. The data for inflation is available from the Federal Reserve Bank of Cleveland in the form of Median CPI values. The Median CPI values attempt to eliminate problems of noise occurring from price fluctuations in products such as food and energy.

Real Personal Income per capita – Data for this variable is available from the Bureau of Economic Analysis. Evaluating this data over the years from 1990 thru 2000, the values of income per capita vary from $10,431 in Noble County in 1998 to $25,179 in Delaware County in 1999; the average is $16,143 with a standard deviation of $2,812. Figure 5.1 and companion Table 5.1 show the frequency distribution for the years 1990 thru 2000 for the eighty-eight counties.

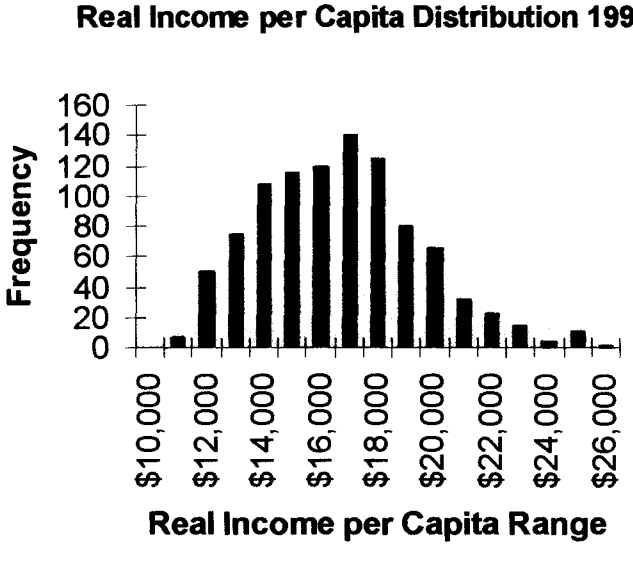


Figure 5.1

Table 5.1

Interval ($)	Freq.
10000-11000	6
11000-12000	50
12000-13000	75
13000-14000	108
14000-15000	116
15000-16000	119
16000-17000	140
17000-18000	124
18000-19000	80
19000-20000	65
20000-21000	32
21000-22000	22
22000-23000	15
23000-24000	4
24000-25000	11
25000-26000	1

To gain an understanding of the variation from year to year, the years 1990, 1995, and 2000 are examined individually. In the year 1990, income per capita ranges from $10,653 in Adams County to $22,038 in Cuyahoga County. The average is $15,401, and the standard deviation is $2554. Figure 5.2 and companion Table 5.2 show the frequency distribution for the year 1990 for the eighty-eight counties.

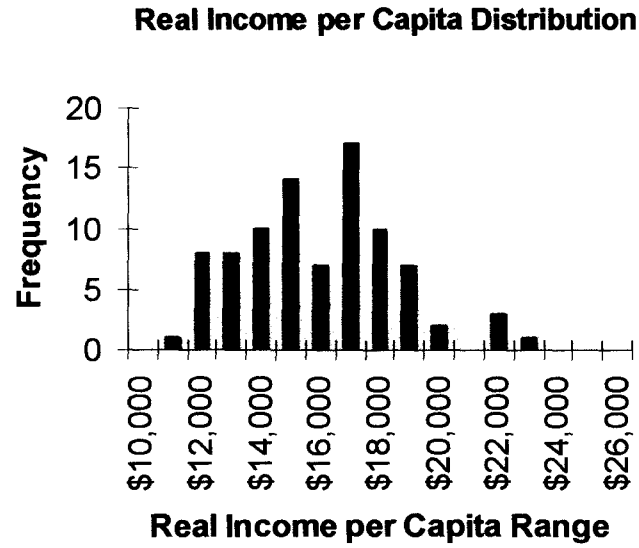


Figure 5.2

Table 5.2

Interval ($)	Freq.
10000-11000	1
11000-12000	8
12000-13000	8
13000-14000	10
14000-15000	14
15000-16000	7
16000-17000	17
17000-18000	10
18000-19000	7
19000-20000	2
20000-21000	0
21000-22000	3
22000-23000	1
23000-24000	0
24000-25000	0
25000-26000	0

In the year 1995, the income per capita ranges from $11,178 in Adams County to $24,226 in Delaware County; the average is $16,039, and the standard deviation is $2,791. Figure 5.3 and companion Table 5.3 show the frequency distribution for the year 1995 for the eighty-eight counties.

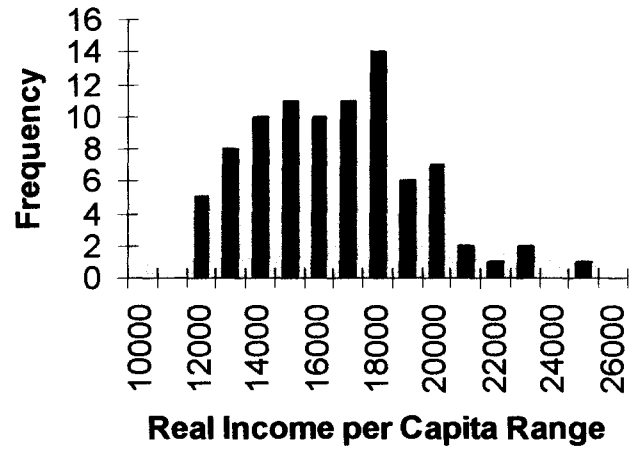


Figure 5.3

Table 5.3

Interval ($)	Freq.
10000-11000	0
11000-12000	5
12000-13000	8
13000-14000	10
14000-15000	11
15000-16000	10
16000-17000	11
17000-18000	14
18000-19000	6
19000-20000	7
20000-21000	2
21000-22000	1
22000-23000	2
23000-24000	0
24000-25000	1
25000-26000	0

In the year 2000, the income per capita ranges from $10,871 in Noble County to $24,957 in Geauga County. The average is $17,154, and the standard deviation is $3,014. Figure 5.4 and companion Table 5.4 show the frequency distribution for the year 2000 for the eighty-eight counties.

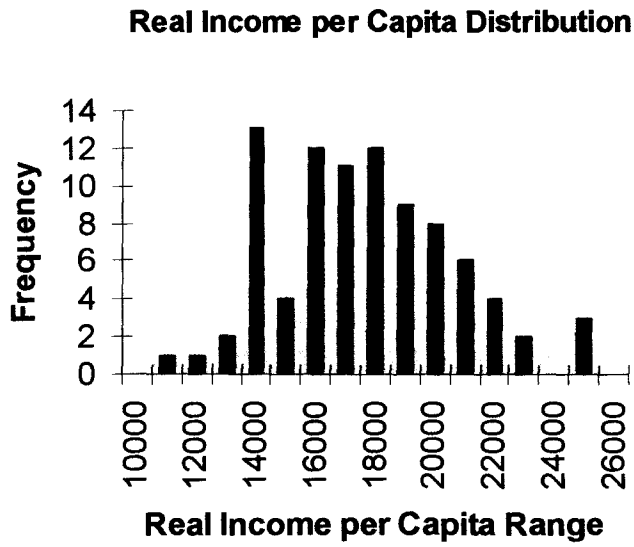


Figure 5.4

Table 5.4

Interval ($)	Freq.
10000-11000	1
11000-12000	1
12000-13000	2
13000-14000	13
14000-15000	4
15000-16000	12
16000-17000	11
17000-18000	12
18000-19000	9
19000-20000	8
20000-21000	6
21000-22000	4
22000-23000	2
23000-24000	0
24000-25000	3
25000-26000	0

Tax Mix – The proportion of property taxes of the combined total of property tax and sales tax revenues is used as the dependent variable in this study: Tax Mix = Property Tax/(Sales Tax + Property Tax). The data for both property tax and sales tax revenues is obtainable from the Ohio Department of Taxation. Sales tax data is available for the years 1990 thru 2000. The range of sales tax revenues for the years 1990 thru 2000 is from 0 dollars in Adams County in 1990 to 162 million dollars in Cuyahoga County in 2000. The average sales tax revenues are 8.86 million dollars. The range of property tax revenues for the years 1990 thru 2000 is from 1.8 million dollars in Hardin County in 1990 to 1.785 billion dollars in Cuyahoga County in 1992. The average property tax revenues are 99.4 million dollars.

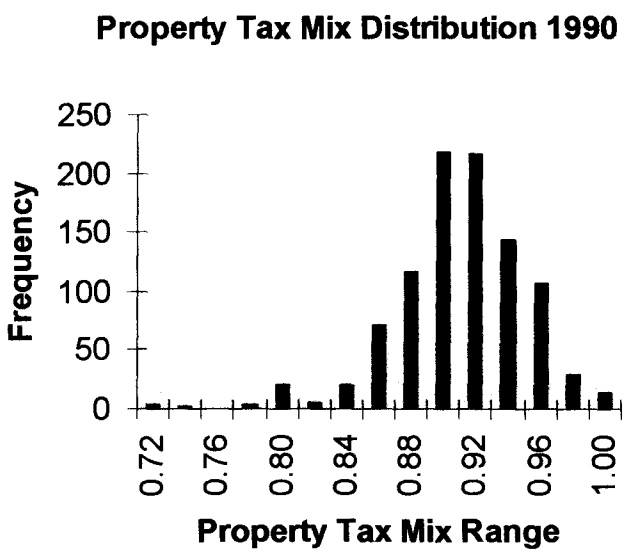


Figure 5.5

Table 5.5

Interval TM	Freq.
0.61-0.72	3
0.72-0.74	1
0.74-0.76	0
0.76-0.78	4
0.78-0.80	20
0.80-0.82	5
0.82-0.84	20
0.84-0.86	71
0.86-0.88	117
0.88-0.90	218
0.90-0.92	216
0.92-0.94	144
0.94-0.96	107
0.96-0.98	28
0.98-1.00	14

Figure 5.5 and companion Table 5.5 show the tax mix distribution for years of 1990 – 2000. Tax mix varies from 0.62 to 1.0. The average tax mix ratio is 0.90 with a

standard deviation of 0.04. Observing the data, there are only four observations of tax mix below 0.74 and all of these observations are from Hardin County. These observations are 0.66 in 1990, 0.63 in 1991, 0.62 in 1992, and 0.73 in 1994. The absolute maximum tax mix ratio of 1.000 occurs in Adams County in 1990 since in that year Adams County had no sales tax revenues.

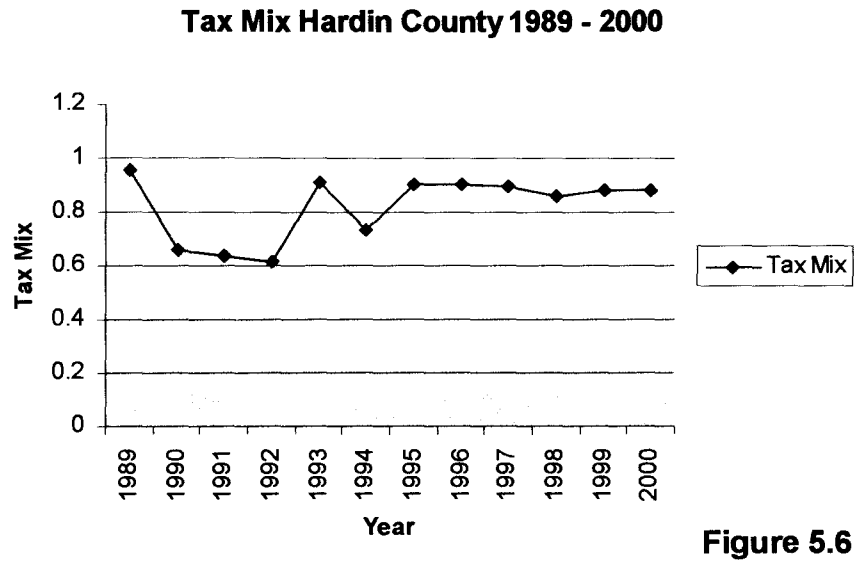


Table 5.6

Year	TM
1989	0.96
1990	0.66
1991	0.63
1992	0.61
1993	0.91
1994	0.73
1995	0.90
1996	0.90
1997	0.89
1998	0.86
1999	0.88
2000	0.88

Figure 5.6

Figure 5.6 and Table 5.6 show how the tax mix varies in Hardin County over time. In 1989 the tax mix is relatively high at 0.96 and then in 1990 it drops to 0.66. It rises to 0.91 in 1993 but then falls again to 0.73 in 1994, but then in 1995 it rises to 0.90 and from 1996 to 2000 it ranges from 0.86 to 0.90. Reviewing the data, it is noticed that the property tax rates dropped in 1990, but for the years 1991, 1992, and 1994 the property tax rates are not available for comparison. These outliers from Hardin County are pointed out because they may present a problem when the model is estimated.

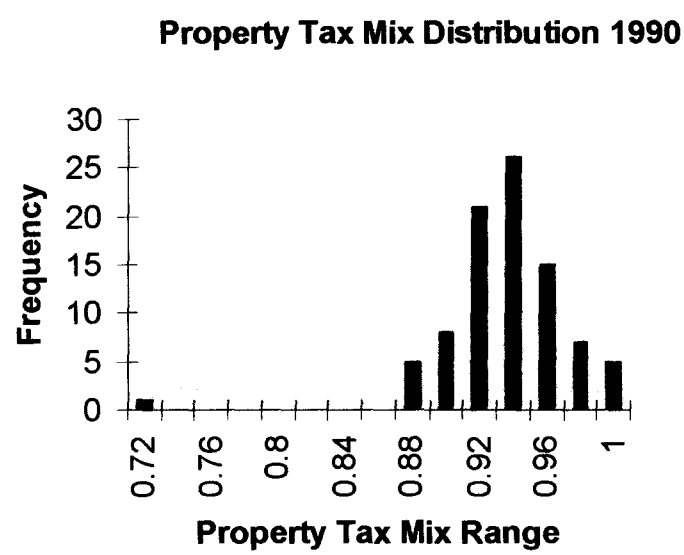


Table 5.7

Interval TM	Freq.
0.61-0.72	1
0.72-0.74	0
0.74-0.76	0
0.76-0.78	0
0.78-0.80	0
0.80-0.82	0
0.82-0.84	0
0.84-0.86	0
0.86-0.88	5
0.88-0.90	8
0.90-0.92	21
0.92-0.94	26
0.94-0.96	15
0.96-0.98	7
0.98-1.00	5

Figure 5.7

Figure 5.7 and companion Table 5.7 show the tax mix distribution for 1990 for the eighty-eight counties in Ohio. In 1990, the tax mix ranges from 0.66 in Hardin County to 1.0 in Adams County. The average is 0.93 with a standard deviation of 0.04.

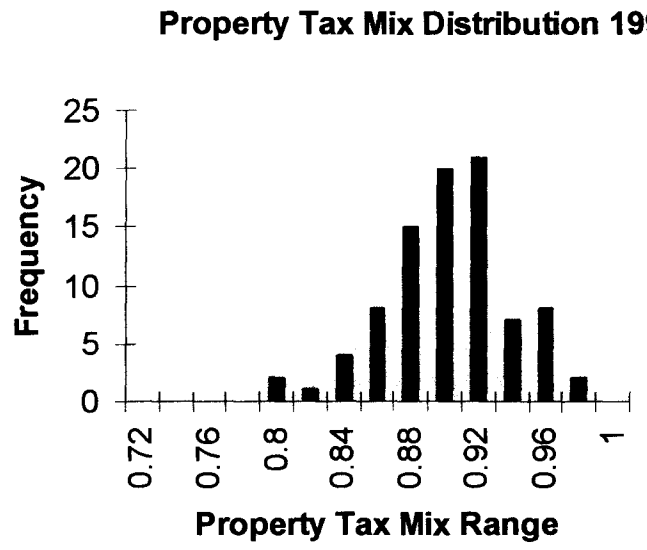


Figure 5.8

Table 5.8

Interval TM	Freq.
0.61-0.72	0
0.72-0.74	0
0.74-0.76	0
0.76-0.78	0
0.78-0.80	2
0.80-0.82	1
0.82-0.84	4
0.84-0.86	8
0.86-0.88	15
0.88-0.90	20
0.90-0.92	21
0.92-0.94	7
0.94-0.96	8
0.96-0.98	2
0.98-1.00	0

Figure 5.8 and the companion Table 5.8 show the tax mix distribution for 1995 for the eighty-eight counties. The tax mix ranges from 0.79 Muskingum County to 0.97 in Stark County. The average is 0.89 with a standard deviation of 0.04.

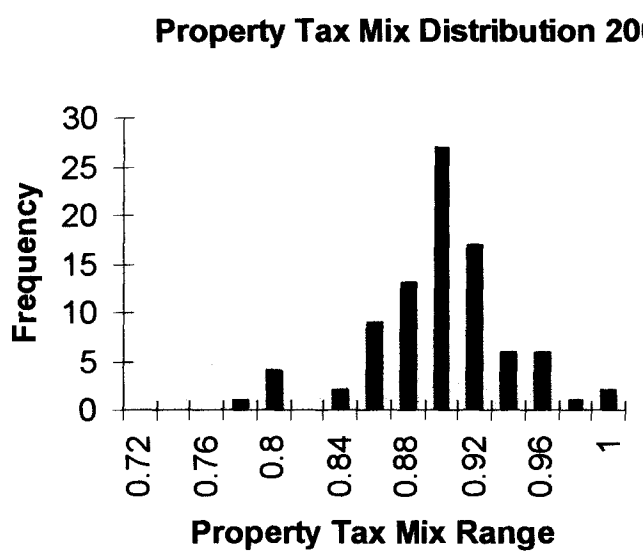


Figure 5.9

Table 5.9

Interval TM	Freq.
0.61-0.72	0
0.72-0.74	0
0.74-0.76	0
0.76-0.78	1
0.78-0.80	4
0.80-0.82	0
0.82-0.84	2
0.84-0.86	9
0.86-0.88	13
0.88-0.90	27
0.90-0.92	17
0.92-0.94	6
0.94-0.96	6
0.96-0.98	1
0.98-1.00	2

Figure 5.9 and companion Table 5.9 show the tax mix distribution for the year of 2000 for the eighty-eight counties. The tax mix ranges from 0.77 in Lawrence County to 1.0 in Columbiana County. The average is 0.89 with a standard deviation of 0.04. These frequency distributions indicate that both the property tax mix ratio and personal income

per capita approach normal distributions. Figure 5.10 and companion Table 5.10 show the average property tax mix ratio of the eighty-eight counties over time.

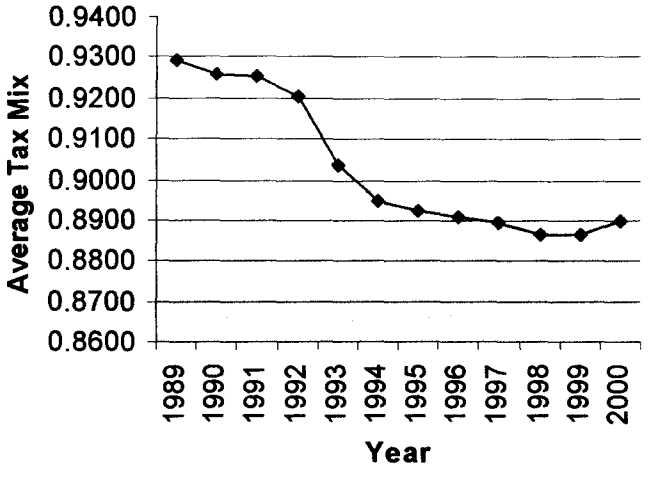


Table 5.10

Ave. TM	Year
0.9291	1989
0.9259	1990
0.9251	1991
0.9206	1992
0.9037	1993
0.8948	1994
0.8922	1995
0.8911	1996
0.8896	1997
0.8863	1998
0.8864	1999
0.8897	2000

Figure 5.10

Observing the tax mix ratio, it is noticed that the ratio is always above fifty percent indicating that property tax revenues dominate the tax mix ratio. A first thought is that this is a result of the fact that the state limits the sales tax rate that a county can impose to 1.5 percentage points. However, only twenty-eight of the eighty-eight counties have ever imposed the maximize tax rate of 1.5 percent allowed by the state. A sales tax rate distribution is provided for the year of 2000. Figure 5.11 shows that the majority of counties use a sales tax rate of one percent for this year. This in fact may be correlated with the fact that voters are required to approve a rate increase beyond one percent.

Table 5.11

Rate	Freq.
0	2
0.25	0
0.5	8
0.75	3
1	44
1.25	9
1.5	22

Figure 5.11

However, nine counties were able to get approval for a 1.25 percent tax rate and twenty-two counties were able to get approval for 1.50 percent tax rate. Examining 968 rate change observations from the years 1989 to 2000, there were one hundred year-to-

year rate changes. The maximum value of the year-to-year rate changes is one percent. The sales tax rate decreased one percentage point in Butler County in 1994 and in Columbiana County in 1999. There was one observation of a 0.75 decrease, there were sixteen observations of a 0.5 decrease, twelve of a 0.25 decrease, 868 with no change, nineteen of a 0.25 increase, forty-four of a 0.5 increase, two of a 0.75 increase, and four of a 1.0 increase. On average, the sales tax rate increased 0.019 percentage points.

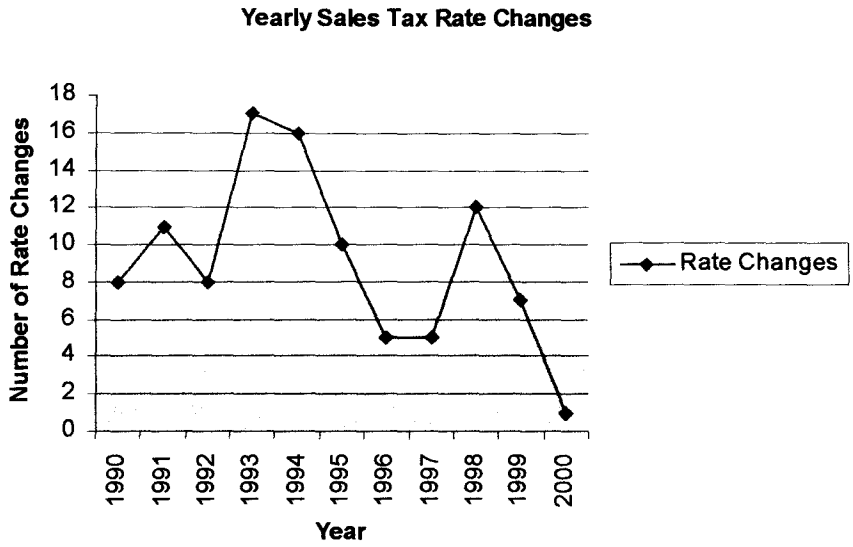


Figure 5.12

Figure 5.12 indicates that counties are able to change their rates from year to year. These year-to-year rate changes are somewhat common – occurring 10.3 percent of the time. The year-to-year decreases and the relatively small percentage of counties levying sales taxes at the maximum rate indicate that the state set sales tax rate limit may not be the cause of the one-sided reliance on property taxes. As discussed in the theoretical section it may just be that property taxes are a superior source of revenues.

Although the majority of counties have not imposed the maximum rate, twenty-eight of the eighty-eight counties have at some time imposed the maximum rate and it is not possible to discern if these counties would have increased the rate beyond 1.5 if the state were to permit it. This sales tax rate truncation can create a problem for the tax mix distribution because once a county reaches the sales tax rate of 1.5; the county has no choice but to increase property tax rates if it requires more revenues. Figure 5.13 shows the problem that can be encountered when attempting to estimate the sales tax rates. If the data representing sales tax rates from 0 to 1.5 is used, then the regression line will predict values lower than the actual values. If only the data representing sales tax rates from 0 to 1.25 is used, the truncation problem in theory is avoided as shown in Figure 5.13. Using the parameter estimates will predict relatively accurate values in the area from 0 to 1.25 and will predict values greater than the actual values when the sales rate is 1.50. Any value predicted greater than 1.50 will indicate that the actual value set by the county will be 1.50 and the problem in theory is avoided. The problem is still not avoided in its entirety because the state imposes a law that requires voter approval to go beyond a rate of 1.0. Therefore, a county will probably have to build up some momentum to go beyond this point. The distribution of counties around sales tax rates of

1.00 and 1.50 can be seen in Figure 5.15. The inordinate concentration of observations around the sales tax rate of 1.00 can present an additional problem when the model is estimated.

However, limiting the dataset creates two additional problems: (1) reduction in sample size, (2) decrease in variation. Using data from 1990 to 2000, there are 968 total observations and 180 of those observations have a sales tax rate of 1.5. Excluding these 180 observations only limits the dataset to 788 observations, but it will reduce the variation significantly because 556 of the 968 total observations have a sales tax rate of

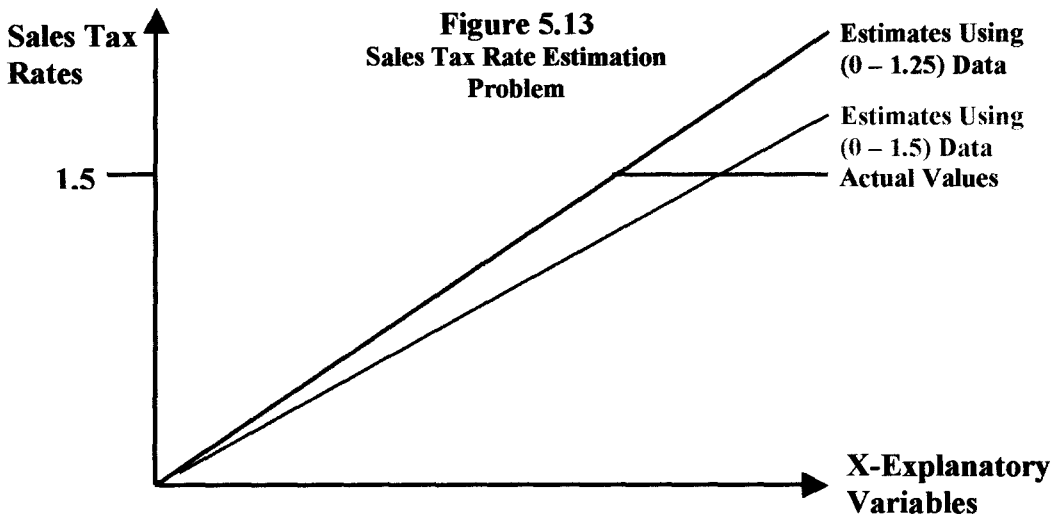


Figure 5.13
Sales Tax Rate Estimation Problem

1.0 and only 66 observations have a sales tax rate of 1.25. Therefore, excluding data that represents sales tax rates of 1.5 reduces the percentage of data that do not represent sales tax rates of 1.0 from forty-three percent to twenty-nine percent. Figure 5.14 shows that once a county reaches the maximum sales tax rate of 1.5 its tax mix will increase if additional revenues are required. Neither regression line will predict this increase.

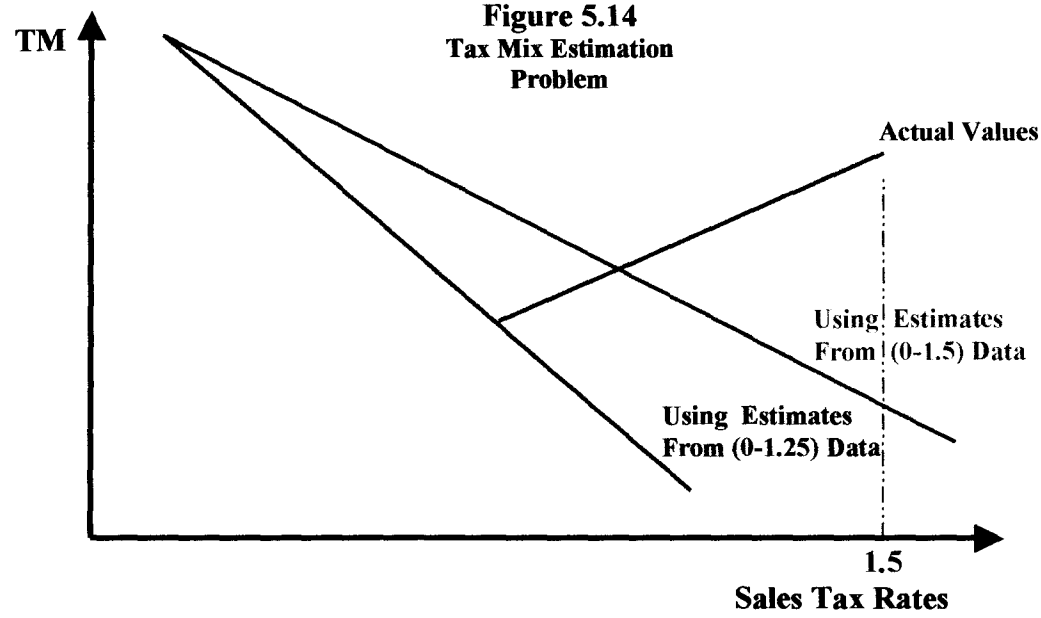


Figure 5.14
Tax Mix Estimation Problem

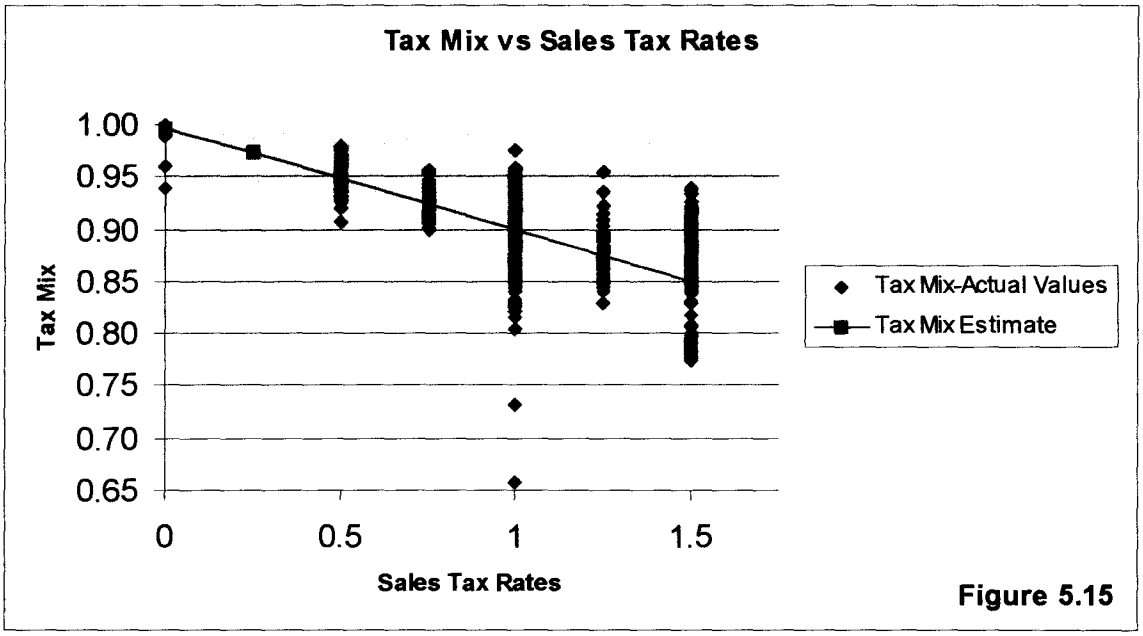


Figure 5.15

In Figure 5.15, the actual values of tax mix are plotted versus sales tax rates for the years of 1990 thru 2000, and then a regression line is plotted on top of the actual values. Figure 5.14 shows that the truncation problem should cause upward trend in the tax mix around the sales tax rates of 1.5. Comparing Figure 5.15 with Figure 5.14 a slight upward trend is noticed around the sales tax rate of 1.5, but it is not dramatic enough in the picture to conclude that the problem is severe. Figure 5.15 also shows the relatively large frequency of data points around sales tax rates of 1.0 and 1.5 but low relatively low frequency around the other sales tax rates. In Figure 5.15 it is also possible to see the outliers from Hardin County more clearly.

Tax Price of Property Taxes – Data for the property tax price as a result of property tax deductions from income tax statements is not available for this study. The data type

would be a percentage of range from zero to one. The value of the tax price indicates the portion of the tax paid directly by the taxpayers in the county. In Metcalf's (1993) study, this value is computed using National Bureau of Economic Research (NBER) TAXSIM model and data obtained from Statistics of Income from the Internal Revenue Service (IRS) on individual federal income tax returns. In Gade and Atkins (1990), tax capacity measures are taken from Advisory Commission on Intergovernmental Relations (ACIR) publications and itemizer information is taken from Statistics of Income from the IRS. Inman (1989) computes the tax price using income levels and the percentage of itemizers at those income levels. Inman (1989) also includes residential property share as a measure of the tax price and data for residential property share is available in Ohio.

Data for residential property share is available from the Ohio Department of Taxation from the years of 1990 to 2000. Increases in the residential property share indicate decreases in the commercial property share and increases in the tax price for residents. If a county is dominated by commercial property, the percentage of the property tax revenues paid by residents will be less and property taxes become a more appealing source of income for the county. The values for residential property as a percentage of the total property values for each county are computed for the years 1990 thru 2000. The minimum residential property share is 0.34 in Adams County in 1990 and the maximum is 0.81 in Delaware County in 1997. The average is 0.64 with a standard deviation of 0.09.

Tourism – There is no official tourism variable collected at the county level, although at the state level, this is an important issue. The state decides how much money to invest in tourism to achieve maximum benefits from tourists. That is, the state performs a benefit cost analysis to make a decision on investments in gaining tourists. Therefore, tourism is viewed as a very important resource for government revenues. However, at the county level, it is necessary to use proxies to predict the attractiveness of an area to non-resident shoppers.

There are several variables that can be used to measure this characteristic of a community. Gade and Atkins (1990) measure the tourism variable using the state's share of national retail sales relative to its percentage of the national population. This same variable has been computed for the eighty-eight counties in Ohio measuring the county's share on state retail sales relative to its percentage of the state population. The minimum retail sales ratio is 0.20 in Vinton County in 2000 and the maximum is 1.89 in Franklin County in 1999. The average is 0.74 with a standard deviation of 0.24. Additional variables collected to measure county tourism are revenues from automotive service stations, hotels and lodging, and eating and drinking establishments. In general, traveling requires purchase of gasoline. Therefore, a county that receives large revenues from gasoline relative to other counties of the same type could be classified as having greater tourism. The range of real revenues for service stations per capita is from $39 in Vinton County in 1997 to $501 in Fayette County in 2000. The average is $173 with a standard deviation of $58. Tourists that stay overnight, in general spend the night in a hotel. Therefore, this should provide a good indicator of tourism. However, for relatively close counties one may not spend the night. There are people who travel from Michigan to Sandusky, Ohio to go to Cedar Point but they do not all spend the night, which means

this variable is not a good indicator of tourism for travelers from close by locations. In addition, although data is collected for hotels and lodging, some counties do not allow these figures to be reported directly although they are included in the totals for Ohio.

Of the obtainable data, real hotel revenues per capita range by county from $0 in Morgan County in 2000 to $197 in Erie County in 2000. The average revenues are $30 with a standard deviation of $29. In addition, eating and drinking establishments should provide a very good measure of travel to an area. In general, people traveling and shopping will have a meal in the location that they traveled to. Therefore, a location that is traveled to frequently will have a larger number of revenues per capita from eating and drinking establishments. Also, data for this variable are readily available. The range of real revenues per capita is from $27 in Vinton County in 1999 to $528 in Franklin County in 2000. The average is $205 with a standard deviation of $78.

Agriculture per capita - Data for this variable is available from two sources: number of farms is available from the Bureau of Economic Analysis and property values are available from the Ohio Department of Taxation. Examining the data over the years of 1990 thru 2000, the number of farms ranges from 111 farms in Cuyahoga County in 1992 to 2,305 farms in Darke County in 1990. The average is 951 with a standard deviation of 392. The range of agricultural property share is from 0.00007 in Cuyahoga County in 1991 to 0.43 in Noble County in 1990. The average is 0.15 with a standard deviation of 0.10.

Natural Resources - Data for natural resources is available from the Ohio Department of Taxation in the form of property values. There are forty-one counties that have zero natural resource property. The maximum property share is 0.067 and occurs in Noble County in 1992. The average natural resource property share is 0.004 with a standard deviation of 0.010.

Transportation cost – Cost of gasoline and alike are not available at the county level. Therefore, this variable will be omitted from this study. However, the tourism variables will give some feel of the willingness and magnitude of travel by residents of Ohio by focusing on the disproportionality of retail sales.

Aged percentage – Data on the aged population is not available from the Census Bureau on yearly basis. However, data on government payments to the aged population is available from the Bureau of Economic Analysis. This data will give an indication of the magnitude of residents on a fixed income and the limitations this causes on property tax revenue growth. The range of real payments per capita made is from $593 in Holmes County in 1990 to $1,765 in Belmont County in 1992. The average is $1221 with a standard deviation of $187.

Elasticity of Labor Demand - There is no data available for the elasticity of labor demand. Therefore this variable will be omitted from this study.

Unemployment – Unemployment rate data is available from the U.S. Department of Labor's Bureau of Labor Statistics. This data is available from the years of 1990 thru

2000. The range of unemployment rates for these years is 1.8 in Delaware County in 2000 to 15.0 in Guernsey County in 1992. The average is 6.3 with a standard deviation of 2.4.

Figure 5.16

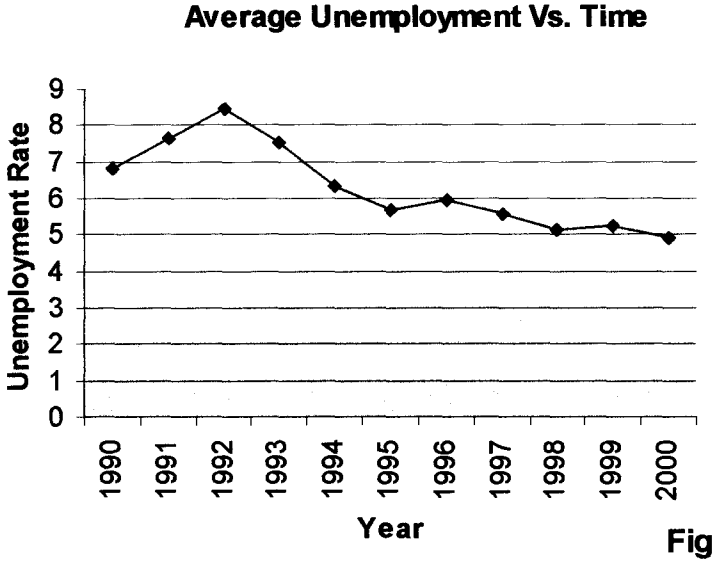


Figure 5.17

Figure 5.15 shows a distribution of unemployment rates for counties in Ohio from 1990 to 2000 and Figure 5.16 plots the average unemployment rate for Ohio over time for 1990 thru 2000.

Total Revenues per Capita – Values for real total revenues per capita are computed using the sales and property tax revenue data from the Ohio Department of Taxation. The range for real total revenues per capita is from $85 in Hardin County in 1990 to $1355 in Lake County in 1990. The average is $560 with a standard deviation $173.

Population – Population estimates from the Bureau of Economic Analysis are used to calculate per capita values. The range is from 11,099 in Vinton County in 1990 to 1,427,000 in Cuyahoga County in 1993. The average is 126,883 with a standard deviation of 215,397.

Table 5.12 shows the summary statistics for these variables and Table 5.13 shows the yearly averages overtime for the Tax Mix variable and the independent variables.

Table 5.12: SUMMARY STATISTICS OF DEPENDENT AND INDEPENDENT VARIABLES 1990 - 2000

Variable	Mean	Std. Dev.	Min.	Max	Min	Year	Max	Year
Agricultural Property	0.15	0.10	0.00	0.43	Cuyahoga	1991	Noble	1990
Eating and Drinking	$205	$78	$27	$528	Vinton	1999	Franklin	2000
Hotels & Lodging	$30	$29	$0	$197	Morgan	2000	Erie	2000
Natural Resource	0.004	0.009	0.000	0.067			Noble	1992
Number of Farms	951	392	111	2305	Cuyahoga	1992	Darke	1990
Payments to Aged	$1,221	$187	$593	$1,765	Holmes	1990	Belmont	1992
Personal Income 1990 - 2000	$16,143	$2,812	$10,431	$25,179	Noble	1998	Delaware	1999
Personal Income 1990	$15,401	$2,554	$10,653	$22,038	Adams	1990	Cuyahoga	1990
Personal Income 1995	$16,039	$2,791	$11,178	$24,226	Adams	1995	Delaware	1995
Personal Income 2000	$17,154	$3,014	$10,871	$24,957	Noble	2000	Geauga	2000
Population	126,883	215,397	11,099	1,427,000	Vinton	1990	Cuyahoga	1993
Property Tax Mix 1990 - 2000	0.90	0.04	0.62	1.00	Hardin	1992	Adams	1990
Property Tax Mix 1989	0.93	0.03	0.87	1.00	Allen	1989	Adams	1989
Property Tax Mix 1990	0.93	0.04	0.66	1.00	Hardin	1990	Adams	1990
Property Tax Mix 1995	0.89	0.04	0.79	0.97	Muskingum	1995	Stark	1995
Property Tax Mix 2000	0.89	0.04	0.77	1.00	Lawrence	2000	Columbiana	2000
Residential Property	0.64	0.09	0.34	0.81	Adams	1990	Delaware	1997
Retail Sales Ratio	0.74	0.24	0.20	1.89	Vinton	2000	Franklin	1999
Service Station	$173	$58	$39	$501	Vinton	1997	Fayette	2000
Total Revenue	$560	$173	$85	$1,355	Hardin	1990	Lake	1990
Unemployment Rate	6.30	2.37	1.80	15.00	Delaware	2000	Guernsey	1992

Note: To the right of the descriptive statistics, the county that had the minimum or maximum and the year in which it occurred are given. For example, the minimum tax mix occurred in Hardin County in 1992.
All Values are real values adjusted for inflation.

TABLE 5.13: YEARLY AVERAGES OF DEPENDENT AND INDEPENDENT VARIABLES

YEAR	TM	AGRIC	MIN	RP	AGE	ED	UN	INC	TR
1990	0.93	0.16	0.01	0.61	1138	178	6.81	15401	562
1991	0.93	0.16	0.01	0.62	1174	183	7.61	15113	576
1992	0.92	0.15	0.01	0.63	1216	198	8.44	15605	594
1993	0.90	0.16	0.01	0.63	1225	198	7.52	15663	513
1994	0.89	0.16	0.00	0.63	1244	204	6.30	16092	522
1995	0.89	0.15	0.00	0.64	1241	209	5.68	16039	539
1996	0.89	0.15	0.00	0.65	1244	214	5.96	16166	548
1997	0.89	0.14	0.00	0.66	1241	215	5.58	16635	560
1998	0.89	0.14	0.00	0.66	1229	215	5.14	16803	567
1999	0.89	0.14	0.00	0.67	1232	218	5.21	16906	582
2000	0.89	0.14	0.00	0.67	1245	222	4.93	17154	594

Note: TM = Tax Mix, AGRIC = Agricultural Property Share, MIN = Natural Resource Property Share, RP = Residential Property Share, AGE = Retirement and Disability Payments, ED = Eating and Drinking Revenues per capita, UN = Unemployment, INC = Income per capita, TR = Total Revenues per capita

All values are real values adjusted for inflation

6. Econometric Specification

An econometric specification is made using the theoretical model and the available data. The two models differ slightly and this section will point out those differences and discuss the reasons why they differ and how the econometric model attempts to account for those differences. First among the independent variables, the econometric model does not include the direct federal tax price variable for property tax and there is no direct way to accurately measure the reduction in the tax price due to income tax deductions. As precedence, Inman (1989) includes commercial property share, and city income as well as an estimate for the federal tax price for property tax. This model accounts for some of that relationship by including income per capita, labeled INC_POP_REAL, and the residential property share labeled RP_TOTAL. Tourism is included using revenues per capita from eating and drinking establishments and is labeled ED_POP_REAL. Agriculture is included by using the percentage of agricultural property and is labeled AGRIC_TOTAL. Natural resources is included by using the percentage of mineral property and is labeled MIN_TOTAL. The percentage of the population who is elderly is included using the retirement and disability payments per capita and is labeled RTDBPA_POP_REAL. The unemployment rate is included directly and is labeled UNEMPL_RATE. Total revenues per capita are included and are labeled TR_POP_REAL. The only variables that are completely excluded are transportation cost, elasticity of labor demand and assistance funds. Transportation cost and elasticity of labor demand are excluded because of data availability. The dependent variables under study are tax mix and sales tax rates with tax mix being the main variable. Sales tax rates as a dependent variable are included as an auxiliary in verifying the dynamics of changing the tax mix. The follow table summarizes the econometric specification.

Table 6.1: Variable Abbreviations	
AGRIC_TOTAL	%Agricultural Property
ED_POP_REAL	Eating Drinking Revenues per capita (real)
INC_POP_REAL	Income per capita (real)
MIN_TOTAL	%Mineral Property
RP_TOTAL	%Residential Property
RTDBPA_POP_REAL	Retirement Payments per capita (real)
UNEMPL_RATE	Unemployment Rate
TR_POP_REAL	Total Revenues per capita (real)
TM	Tax Mix = Property Taxes/(Sales Taxes +Property Taxes)
SR	Sales Tax Rates

In mathematical form the basic model becomes

$$TM = \alpha + X\beta + e_{tm}$$

$$SR = \varphi + X\delta + e_{sr}$$

Where, TM and SR are vectors of 968 by 1 of tax mix and sales tax rates across eighty-eight counties over an eleven-year period.

And X = [AGRIC_TOTAL ED_POP_REAL INC_POP_REAL MIN_TOTAL RP_TOTAL RTDBPA_POP_REAL UNEMPL_RATE TR_POP_REAL] is a 968 by 8 matrix containing the observations of each of the exogenous variables. The vectors α, β, φ, and δ represent unknown structural parameters associated with X. The vector e is a 968 by 1 vector of unobservable random errors with the $E(e) = 0$ and $E(ee') = \sigma^2 I$ and $e \sim (0, \sigma^2 I)$.

Now that the basic model has been specified, it is necessary to deal with the inherent problems the dataset presents. The problems to consider are how to handle the panel dataset, how to assess the damage caused by the outliers from Hardin County, and how to access the damage caused by the 1.5 maximum sales tax rate that counties can impose.

The panel dataset represents data over an eleven-year period for eighty-eight counties and there are various techniques that can be used to resolve issues of a panel dataset. The methods reviewed in this study are fixed effects and random effects. A fixed effects model by county is used to control for the political idiosyncrasies and geographic differences of each county. State laws have not changed drastically across time (referencing the Ohio Department of Taxation) and therefore no trend or fixed effects time method is used. The precedence for the fixed effects by county method is provided by Inman (1989), Gade and Adkins (1990), and Metcalf (1993). The fixed effects method allows the intercept term to vary for each county and account for county differences that the independent variables cannot explain. Therefore the models become

$TM = K\alpha + X\beta + e_{tm}$

$SR = K\varphi + X\delta + e_{sr}$

Where $K = I_N \otimes J_T$, and $J_T = [1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1]'$ and is an 11 by 1 vector (see Judge 1988) and α and φ are now each an 88 by 1 vector representing the intercept for each county and I_N is an identity matrix representing the eighty-eight counties.

To test the problem caused by the outliers from Hardin County, the model was run with and without Hardin County. The results should provide an indication of the distortion caused by these outliers. The 1.5 maximum sales tax rate set by the state prevents counties from decreasing the tax mix any further once this limit has been reached and therefore the data is truncated. To address this issue, a regression was run using observations with sales tax rates below the maximum of 1.5. Hardin County was omitted from this model. The results of this regression will be compared to the results of the regression run that included the data that represented sales tax rates of 1.50 and to the actual values of the dataset itself when the sales tax rate equals 1.5. Additionally, exclusions will of course modify the sizes of the matrices cited previously.

7. Estimation and Results

The tax mix and sales tax rates models were estimated for eighty-eight counties over an eleven-year period while first including Hardin County and then omitting Hardin County. The results are provided in Table 7.1.

Table 7.1: Estimation Results With and Without Hardin County

Dependent Variable	Tax Mix	Tax Mix	Sales Tax Rates	Sales Tax Rates
Independent Variable	Hardin Included	Hardin Omitted	Hardin Included	Hardin Omitted
AGRIC_TOTAL	0.09	-0.06	1.44	1.55
Agricultural Property Share	1.01	-0.89	2.14**	2.28**
RP_TOTAL	-0.09	-0.10	1.20	1.20
Residential Property Share	-1.65*	-2.13**	2.71***	2.7***
MIN_TOTAL	0.83	0.79	-7.48	-7.44
Mineral Property Share	2.95***	3.41***	-3.46***	-3.42***
UNEMPL_RATE	2.9E-03	5.1E-03	-1.5E-02	-1.7E-02
Unemployment Rate	3.77***	7.92***	-2.54***	-2.77***
ED_POP_REAL	-1.2E-04	-1.4E-04	6.8E-04	7.0E-04
Eating Drinking Revenues	-2.8***	-4.06***	2.11**	2.12**
RTDBPA_POP_REAL	-2.0E-04	-4.0E-05	3.4E-04	3.6E-04
Retirement Payments	-0.93	-3.1***	2.51***	2.63***
INC_POP_REAL	-7.2E-06	-4.7E-06	9.1E-07	-9.1E-07
Income	-4.42***	-3.48***	0.07	-0.07
TR_POP_REAL	1.4E-04	3.8E-05	1.9E-04	2.6E-04
Total Revenues	8.69***	2.64***	1.46	1.91*
R^2	0.74	0.80	0.73	0.73

Notes: Values given below estimates are t-scores.
*** Indicates significance at the 1percent level for a two-sided test.
** Indicates significance at the 5 percent level for a two-sided test.
* Indicates significance at the 10 percent level for a two-sided test.

Observing the results, the t-score for AGRIC_TOTAL in the tax mix regressions is not significant whether including or excluding Hardin County. The t-score for AGRIC_TOTAL in the sales tax rates regressions has the right sign, is significant, and indicates that the larger the percentage of agricultural property in a county the higher the sales tax rates. The sign for MIN_Total representing natural resources has the right sign and is significant for all four regressions. The positive sign in the tax mix regressions indicates that the larger the percentage of natural resource property values in a county the more likely that county is to rely on property taxes. The sales tax rates regressions indicate that counties with large percentages of natural resource property values will have lower sales tax rates. The estimates for unemployment are also very consistent with theory and indicate that as unemployment increases in a county that county will lower sales tax rates and rely more heavily on property tax revenues. The estimates for the tourism variable are also significant for all regressions. The results indicate that counties do monitor the level of tourism and compensate their residents by relying less heavily on property taxes and exporting their tax burden to non-resident shoppers. The variable

RTDBPA_POP_REAL used to measure the preference of the aged population is not significant in the tax mix regressions when it includes Hardin County; however, this estimate is significant in the tax mix regression when excluding Hardin county and is significant in both cases for the sales tax rates regressions. The results indicate that the aged population prefers sales taxes to property taxes. This result is expected because high property taxes could cause this group to have to sell their property.

Total revenues per capita in the tax mix regressions indicate whether the property tax is a superior, inferior, or neutral source of tax revenues. If the property tax is superior, property taxes as a percentage of tax revenues will increase as total tax revenues increase. If the property tax is inferior, property taxes as a percentage of total tax revenues will decrease as total tax revenues increase. The results indicate that the property tax is the superior tax when compared to the sales tax. The fact that the estimate is positive in the sales tax rate regression indicates that as the need for revenues increases all tax rates are raised including sales tax rates but that property tax revenues dominate the mix in this event. The results for RP_TOTAL are not surprising and indicate as the percentage of residential property increases in a county the less that county relies on property taxes. This follows because as the percentage of land dominated by residents increases the tax price of property taxes for residents increases also. The assumption is that counties will attempt to export the tax by taxing businesses heavier than its residents. Inman's results also indicate that as the percentage of residential property increases the reliance on property tax will decrease. The income variable INC_POP_REAL's results may be surprising to some. The results indicate that as income increases the tax mix decreases indicating a greater reliance on sales taxes. This is in direct contrast to what Inman (1989) found in his study. However, it is necessary to point out the differences between the Inman study and this study. First, Inman used data for forty-one cities from different states and took general sales tax rates as fixed. The variables that formed the tax mix were selective sales taxes, user fees, and property taxes. His results indicate that as income increases the reliance on property taxes and fees increases. His estimate for income in the selective sales tax regression was not significant and likewise the estimate for income in the general sales tax rates regression in this study is not significant. However, in the tax mix regression the estimate for income is significant at the ninety-nine percent level. As discussed in the theoretical discussion, it is not possible to predict which tax will dominate as income increases so this result seems to indicate that as income increases in counties in Ohio there will be less reliance on property taxes.

In regards to the outliers from Hardin County, the R-square is unaffected in the sales tax rates regressions and this is consistent because the outliers were caused by extremely low property tax rates during certain periods. However, the R-square for the tax mix regressions are affected by the outliers from Hardin County in that it rises from 0.7414 when Hardin County is included to 0.7998 when Hardin County is omitted. Additionally, the t-scores for several variables increase when Hardin County is omitted. The following regression analysis concerning the tax mix truncation caused by the 1.5 maximum sales tax rate will omit Hardin County because of the bias it produces in the estimates.

A hypothesis test was performed to verify the necessity of the fixed effects model using the data that includes Hardin County. An F-test is recommended for this test, which will be used to include or exclude all the dummy variables since excluding

individual dummies based upon the t-scores is not recommended (see Judge 1988). The results of the F-test indicate that the intercepts of the eighty-eight counties are not all the same[2].

Table 7.2 shows the results of the estimation when observations with sales tax rates of 1.5 were omitted. Although there is not a significant drop in the R^2 values, some of the estimates that were significant in the first regression are not significant in the second regression. The estimate for AGRIC_TOTAL is not significant in the sales tax rate regression. The estimate for MIN_TOTAL is not significant in the tax mix regression and has the wrong sign in the sales tax rate regression even though it is significant. The estimate for RP_TOTAL is now only significant at the ninety percent level in the tax mix regression. The remaining estimates differ somewhat between the two regressions but the signs are the same and the significance levels are strong for UNEMPL_RATE, ED_POP_REAL, RTDBPA_POP_REAL, INC_POP_REAL, and TR_POP_REAL.

Using the estimated parameters from the regression when observations representing sales tax rates of 1.5 were omitted, predictions were made for tax mix and sales tax rates when the sales tax rate is 1.5. In Figures 5.13 and 5.14, it was predicted that these estimates would predict values lower than the actual values for the tax mix and would predict values greater than the actual values for the sales tax rates. However, this is not what is observed when the estimates are compared with actual values and therefore it is not possible to make a prediction concerning the decision counties would make if the state increased the maximum allowable sales tax rate. The estimates for the tax mix are plotted with the actual values of the tax mix in Figure 7.1. The estimates are shown in green, the actual values are shown in blue, the regression line for the actual values is shown in purple, and the regression line for the estimated values is shown in yellow.

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[2] H_0: $\alpha 1 = \alpha 2 \ldots\ldots \alpha 87 = \alpha 88$, where $\alpha(I)$ represents the intercept for each county.
H_1: The α (I) are not all equal.
SSE_R = Error Sum of Squares – Restricted Model
SSE_U = Error Sum of Squares – Unrestricted Model
T = Number of years = 11
N = Number of counties = 88
NT = Total number of samples = 968
K' = Number of independent variables = 8

$$F = \frac{(SSE_R - SSE_U)(NT - N - K')}{SSE_U(N-1)}$$

The critical F-value is
F(87, 872) = 1.40, at the 1% level

The F statistic for tax mix regression including Hardin County is

$$F = \frac{(1.106 - .4264)(872)}{.4264(87)} = 15.9 > 1.40$$

When Hardin County is excluded the test is

$$F = \frac{(.944 - .2814)(862)}{.2814(86)} = 23.6 > 1.40$$

Therefore the null hypothesis is rejected and it is concluded that the D's are not all the same and therefore the intercepts of each county are not all the same.

Table 7.2: Estimation Results With and Without Omitted Sales Tax Data

Dependent Variable	Tax Mix	Tax Mix	Sales Tax Rates	Sales Tax Rates
Independent Variable	ST_Rates 0-1.25	ST_Rates 0-1.5	ST_Rates 0-1.25	ST_Rates 0-1.5
AGRIC_TOTAL	-0.01	-0.06	0.49	1.55
Agricultural Property Share	-0.091	-0.89	0.768	2.28**
RP_TOTAL	-0.08	-0.10	1.08	1.20
Residential Property Share	-1.7*	-2.13**	2.7***	2.7***
MIN_TOTAL	-0.36	0.79	7.76	-7.44
Mineral Property Share	-0.97	3.41***	2.34**	-3.42***
UNEMPL_RATE	4.0E-03	5.1E-03	-1.0E-03	-1.7E-02
Unemployment Rate	3.7***	7.92***	-0.18	-2.77***
ED_POP_REAL	-1.5E-04	-1.4E-04	1.0E-03	7.0E-04
Eating Drinking Revenues	-4.7***	-4.06***	2.29**	2.12**
RTDBPA_POP_REAL	-6.1E-05	-4.0E-05	4.4E-04	3.6E-04
Retirement Payments	-4.1***	-3.1***	3.27***	2.63***
INC_POP_REAL	-3.7E-06	-4.7E-06	-2.1E-06	-9.1E-07
Income	-2.9***	-3.48***	-0.18	-0.07
TR_POP_REAL	4.9E-05	3.8E-05	1.3E-04	2.6E-04
Total Revenues	3.7***	2.64***	1.1	1.91*
R^2	0.80	0.80	0.71	0.73

Notes: Values given below estimates are t-scores.
*** Indicates significance at the 1percent level for a two-sided test.
** Indicates significance at the 5 percent level for a two-sided test.
* Indicates significance at the 10 percent level for a two-sided test.

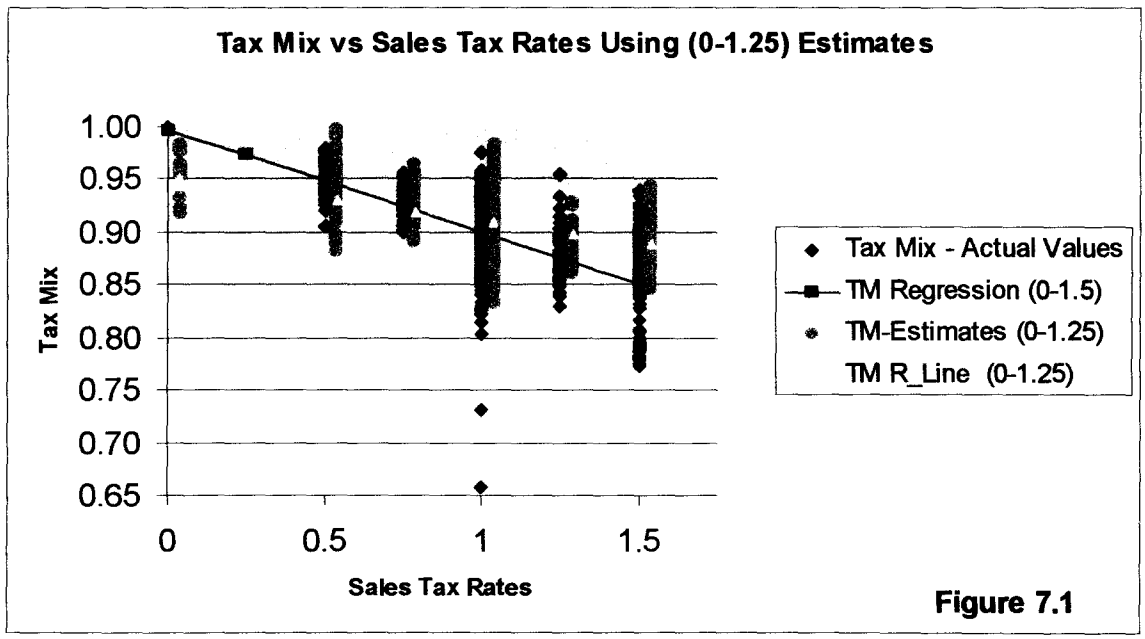


Figure 7.1

The regression line for the actual values is obtained by regressing the actual tax mix values against the actual sales tax rates using the full dataset. The regression line for the tax mix estimates is obtained by regressing the tax mix estimates against the actual sales tax rates. The estimates do not do a good job of predicting what happens when the sales tax rate is zero and the actual value of the tax mix is 1.0. Possibly because there is an additional truncation when the tax mix is 1.00 and sales tax rate is 0.00 and there are simply not enough counties that invoke a tax mix of 1.0 to supply enough weight in the regression when the sales tax rates are zero. When the sales tax rate is 0.50 to 0.75, the estimates on average make good predictions but the estimates have greater variation. When the sales tax rate is 1.0 the estimates predict values slightly greater than the actual values but have smaller variance than the actual values. When the sales tax rates are from 1.25 to 1.50, the estimates tend to over predict the actual values and have smaller variance than the actual values. Figure 5.14 showed that using these estimated parameters should predict tax mix values smaller than the actual values, but the results in Figure 7.1 do not show that. Possibly because when the data representing sales tax rates of 1.5 is omitted, there are not enough data points (only 66) with a sales tax rate greater than 1.0 to supply sufficient weight in the regression.

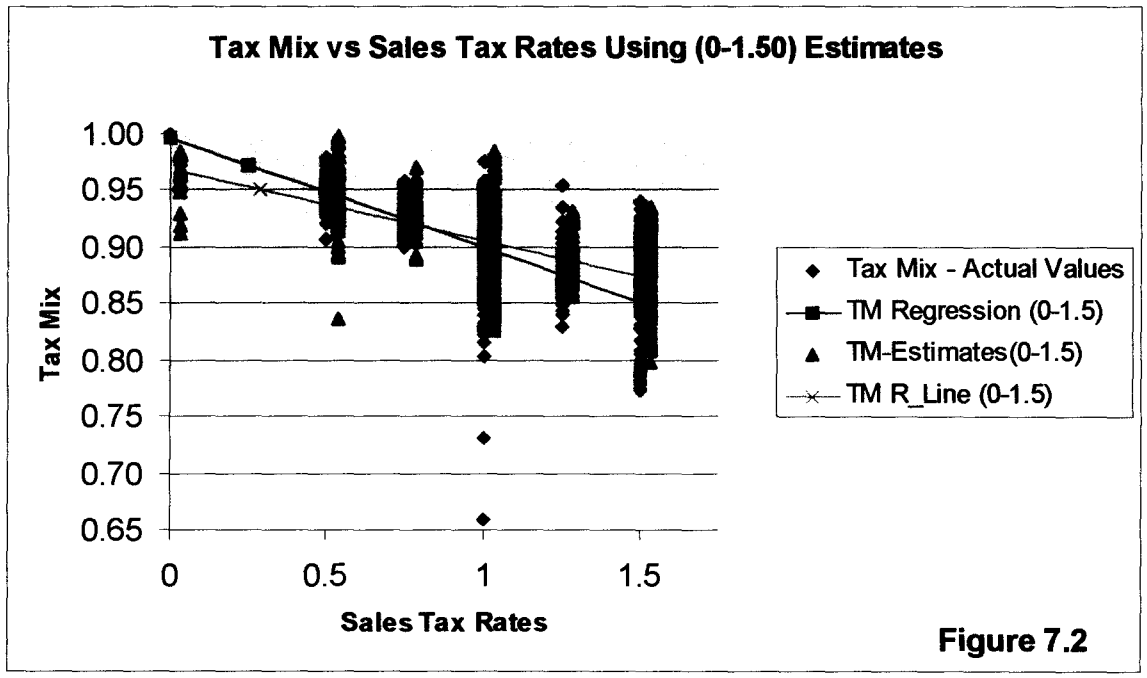


Figure 7.2

The tax mix estimates using the full dataset are plotted in Figure 7.2. The estimates are shown using red arrow tips, the actual values are shown in blue, the regression line for the actual values is shown in purple, and the regression line for the estimates is shown in light blue. The estimates still do not do a good job of predicting what happens when the sales tax rate is zero and the actual value of the tax mix is 1.0. It predicts values as low as 0.91 when the actual value is 1.0. There is some change of the characteristics of the prediction when the sales tax rate is 1.5 in that on average these estimates in Figure 7.2 do not overestimate the actual values as much as the estimates in Figure 7.1. For comparison purposes, the actual values are plotted with tax mix estimates using estimated parameters from both datasets. The most improvement occurs when the

sales tax rate is 1.50. There is not much difference between the two estimators when the sales tax rate is 0.00, 0.50, 0.75, 1.00, or 1.25.

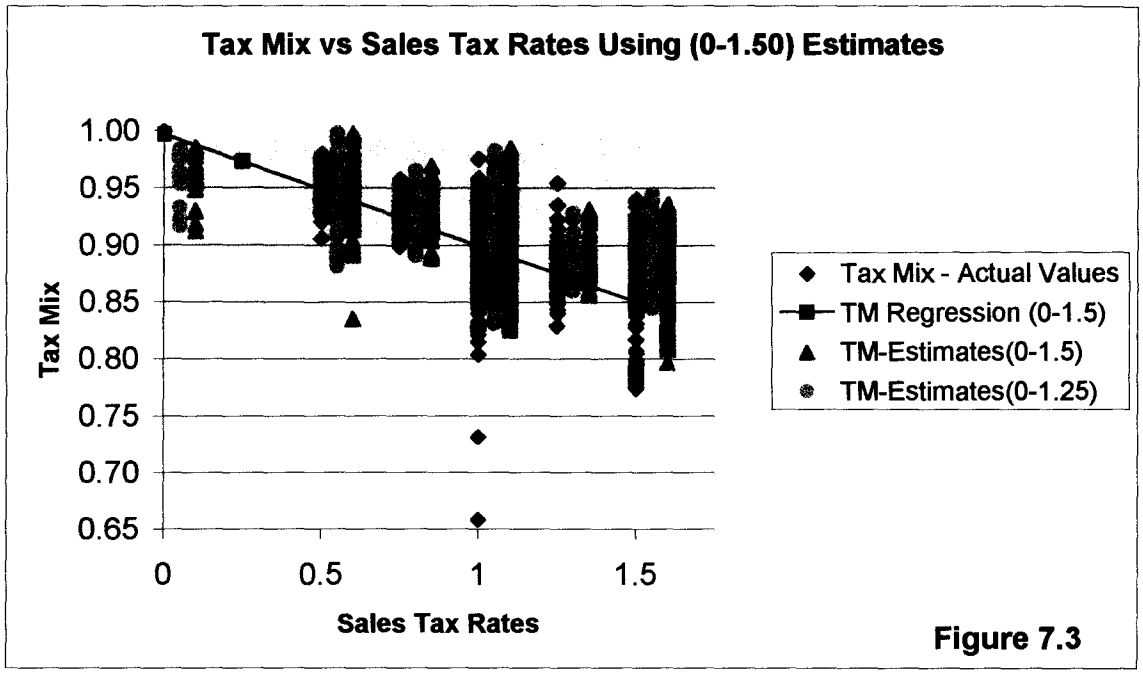


Figure 7.3

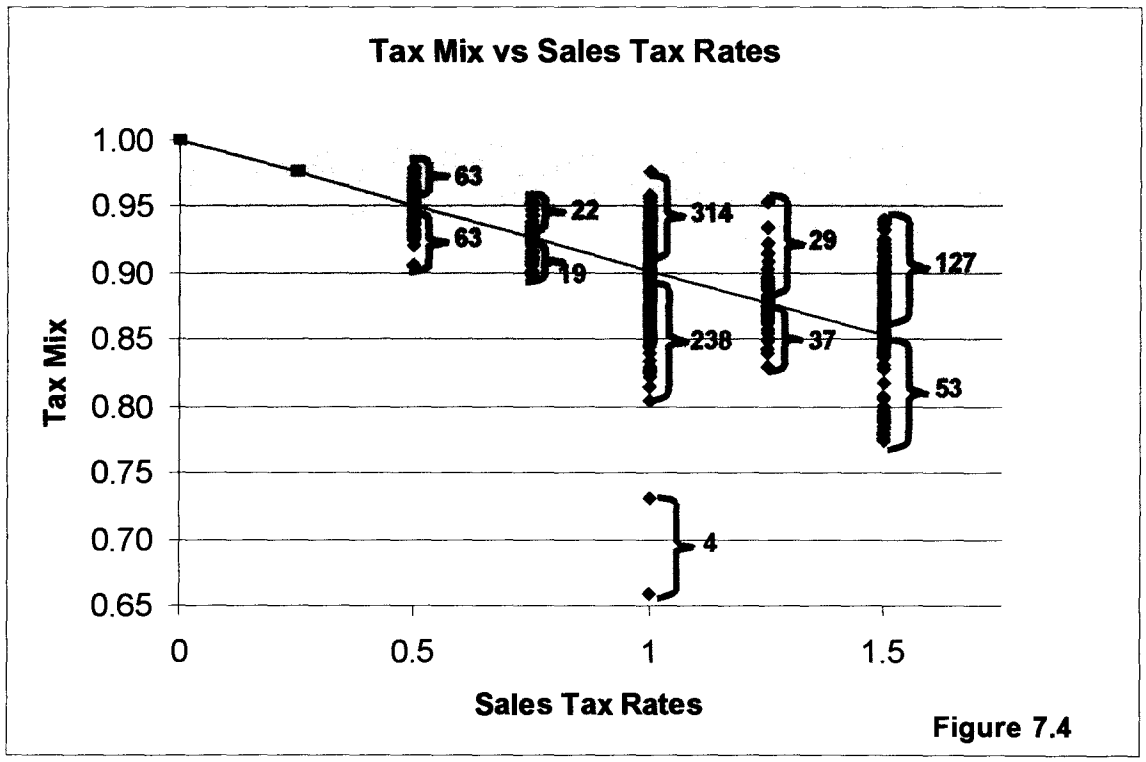


Figure 7.4

Figure 7.4 shows the number of counties above and below the regression line at each sales tax rate. For most sales tax rates the number of counties is about the same above and below the regression line. Yet when the sales tax rate is 1.50, the number of counties

above is 2.4 times as many as below indicating that the tax mix is being forced upward as a result of the 1.50 maximum sales tax rate set by the state. The regression line estimates an average tax mix of 0.85 when the sales tax rate is 1.50 and the average of the actual values when the sales tax rate is 1.50 is 0.87. This is slightly greater but there is no way to infer conclusively how much the state imposed limit affects the tax mix.

Figure 7.5 shows the growth in the number of counties invoking the maximum rate over time. Since 1998 exactly twenty-two of the eighty-eight counties have invoked the maximum rate.

Number Counties Using Maximum Sales Tax Rate

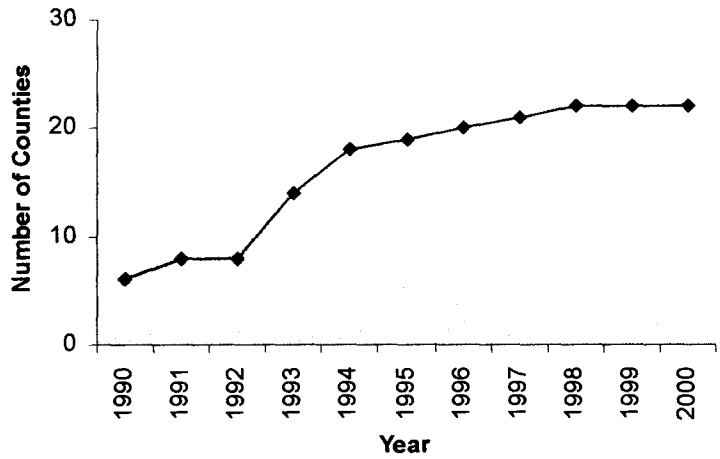


Figure 7.5

Figure 7.6 shows the number of counties using a sales tax rate of 1.00. Although the number of counties using a sales tax rate of 1.00 is decreasing, still fifty percent of the counties use the sales tax rate of 1.00.

Number Counties With Sales Tax Rate of 1.00

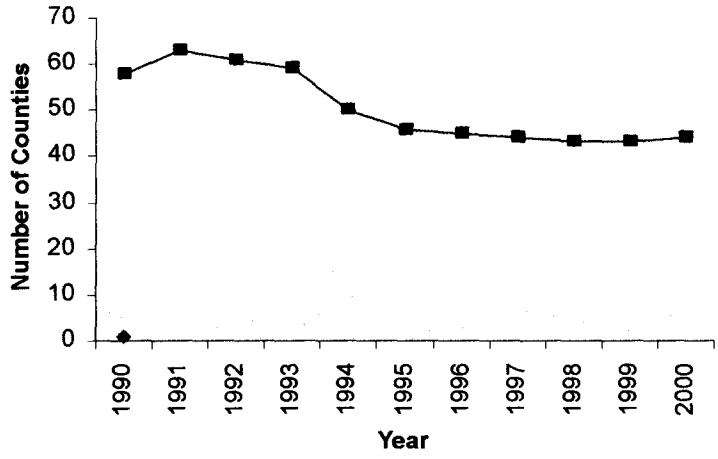


Figure 7.6

8. Useful Examples – *What's it all mean?*

Figures 7.1 thru 7.4 give an indication of how well the estimates predict the actual values and the type of variation of the actual values and the estimates at any given sales tax rate. These figures make it clear that knowing the sales tax rate is not enough information to predict the value of the tax mix. Although in some cases, changes in the independent variables will produce changes in the sales tax rates which in turn will cause changes in the tax mix. It seems important to remind the reader to reference Table 7.1 and review the R^2 values – the higher the R^2 the more confidence that can be put in the model. Figures 7.1 thru 7.4 also give an indication of how the model will diverge from the actual values. Yet with that stated, this type of model could be used to gain information about the effects of certain types of tax policy and the benefits or costs of certain types of investments in a county in Ohio.

For example referencing Table 5.12, in 1995 Stark County had the maximum tax mix for that year at 0.97. The sales tax rate was 0.5 in Stark County in 1995. By referencing Table 7.1, a prediction can be made about what increases or decreases in the independent variable would have done to Stark County's tax mix and sales tax rates at that time. For example, increasing its residential property share from 0.71 to 0.92 would cause its sales tax rates to increase from 0.50 to 0.75 and its tax mix to decrease from 0.97 to 0.95. As another example, suppose Stark County would like to reduce its tax mix by increasing its tourism. It makes investments in gaining tourist and its revenues per capita from eating and drinking establishments increase from $298 to $655 and its sales tax rates increase as well from 0.50 to 0.75. The tax mix then decreases from 0.97 to 0.93.

Although in both examples the sales tax rate increases from 0.5 to 0.75, the tax mix does not decrease by the same amount in both. In the first example sales tax rates increased as a result of an increase in residential property share, perhaps because of decrease in commercial property share. In this case, an increase in sales tax rates would cause a decrease in revenues from retail sales as discussed by Ghaus (1995). In the second example, the county busted tourism, which increased revenues from retail sales, and therefore the resultant effect on the tax mix is greater. The bust in tourism came as a result of investment and benefit cost analysis can be made by comparing the increase in sales tax revenues to the cost of investment in tourism.

As another example, in 1995 Muskingum had the lowest tax mix at 0.79, but its sales tax rates were at the 1.50 maximum. Suppose it were able to attract more businesses to the county and decrease its residential property share from 0.65 to 0.45. It could then decrease its sales tax rates from 1.50 to 1.25 and increase its tax mix from 0.79 to 0.81.

9. Conclusion

This study attempted to supply answers to the tax choice question – why property taxes or why sales taxes. The literature review and the theoretical section discussed exogenous variables that should cause changes in the tax mix. A model was estimated using the available data and the results indicate that counties in Ohio do follow economic theory. The resounding result is stated clearly in a quote by Woodrow Wilson taken from Inman's *Local Decision to Tax* (1989):

> What we do not like is that we are taxed – not that we are stupidly taxed. When we have gotten angry about it in the past our rulers have not troubled themselves to study political economy in order to find out the best means of appeasing us. Generally they have simply shifted the burden from the shoulders of those who complained, and were able to make things unpleasant, to the shoulders of those who might complain, but could not give much trouble.

Many of the things that seem to cause changes in the tax mix are those things that represent the portion of the tax paid by nonresidents – tourism and federal tax price for example. Clearly the results for the income, residential property, and age population variables reiterate Woodrow's opinion about the ability to complain and do something about it.

Some of the limitations for the model estimated are the same limitations for the county administrators – how to get accurate data. Perhaps in the future this problem will diminish as technology makes it more possible to collect data and store it in databases at relatively low cost. In this study, it was necessary to use a proxy for tourism dollars, but in the future more accurate data could be obtained with the aid of computers. As the percentage of individuals who use credit cards increases, it will be much easier to document where the individual is from who purchased the goods. Of course, the most explicit example of this is Internet shopping. In regards to the federal and state income tax prices, it would be definitely possible for the IRS and the state to calculate the tax price. In both cases, data publication should make model estimation more accurate.

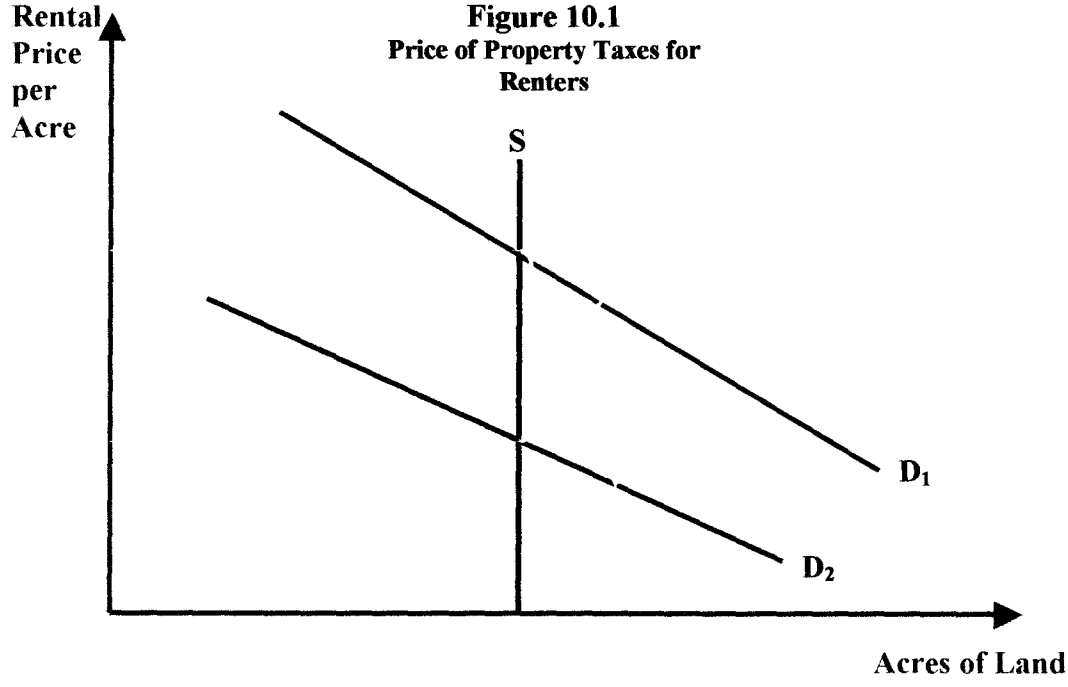
It was discovered that in Ohio's counties property taxes dominate the tax mix between sales taxes and property taxes. It was not found conclusively that this dominance is a result of the state set sales tax rate limit of 1.50. In fact eighty-one percent of the observations were from rates set below the maximum allowed. However, some of the results indicate that some counties may increase their rates should the state allow rates beyond 1.50 in the future. Since 1998, twenty-five percent of the counties set the sales tax rate at the maximum 1.50 allowed by the state.

10. Appendix

Property Tax Burden

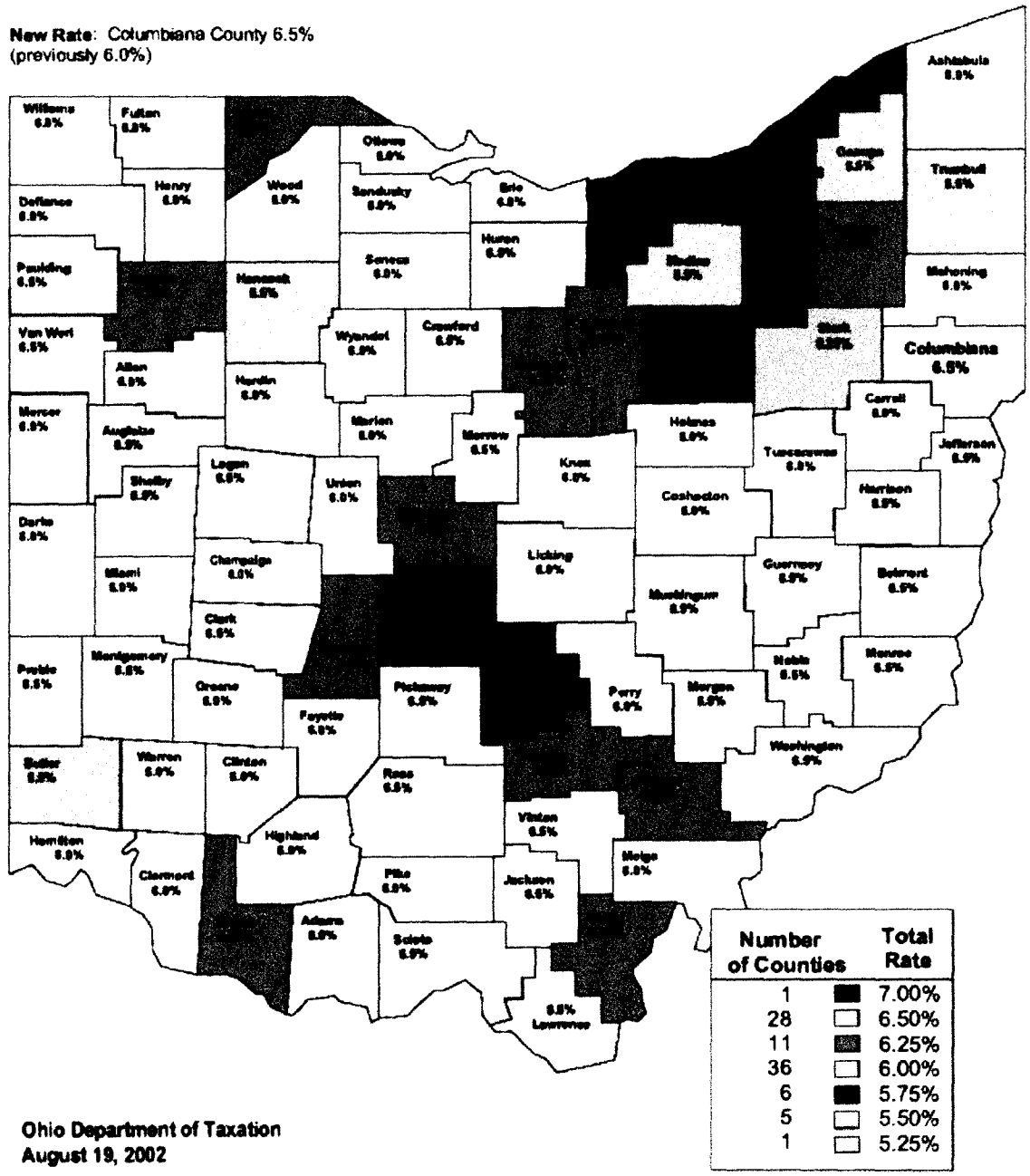
Rosen's *Public Finance* (486-495) argues that the burden of property taxes falls entirely on the incumbent landowners at the time of the tax. The reason for this can be seen in Figure 10.1. The supply curve for land is inelastic since land in general is not created or destroyed. In some cases viable land is destroyed or wasteland is regenerated, but for the most part the supply of land is constant and the resulting supply curve is perfectly vertical. If the supply curve is inelastic, then an increase in property taxes causes a shift in the demand curve for land and renters are willing to pay less for each acre of land. This reduces the rental price of land and the burden of the property tax falls entirely on the owners. However, it is important to note that this burden falls on the incumbent landowners at the time of the tax. Future landowners will compute the cost of the property tax in the purchase price of the property. Therefore, it is concluded that renters will prefer property taxes to sales taxes since property taxes are not passed on to renters in the rental price of the land.

Figure 10.1
Price of Property Taxes for Renters



Sales Tax Map

Total State and Local Sales Tax Rates, By County
Effective September 2002



Tax Analysis Division
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www.ohio.gov/tax/

STATE AND PERMISSIVE SALES TAX RATES BY COUNTY, SEPTEMBER 2002

County	County Tax Rate	Transit Tax Rate	Total State & Local Rate	County	County Tax Rate	Transit Tax Rate	Total State & Local Rate
Adams	1.50%	--	6.50%	Licking	1.00%	--	6.00%
Allen	1.00	--	6.00	Logan	1.50	--	6.50
Ashland	1.25	--	6.25	Lorain	0.75	--	5.75
Ashtabula	1.00	--	6.00	Lucas	1.25	--	6.25
Athens	1.25	--	6.25	Madison	1.25	--	6.25
Auglaize	1.50	--	6.50	Mahoning	1.00	--	6.00
Belmont	1.50	--	6.50	Marion	1.00	--	6.00
Brown	1.25	--	6.25	Medina	0.50	--	5.50
Butler	0.50	--	5.50	Meigs	1.00	--	6.00
Carroll	1.00	--	6.00	Mercer	1.00	--	6.00
Champaign	1.00	--	6.00	Miami	1.00	--	6.00
Clark	1.50	--	6.50	Monroe	1.50	--	6.50
Clermont	1.00	--	6.00	Montgomery	1.00	0.50%	6.50
Clinton	1.00	--	6.00	Morgan	1.50	--	6.50
Columbiana	1.50	--	6.50	Morrow	1.50	--	6.50
Coshocton	1.00	--	6.00	Muskingum	1.50	--	6.50
Crawford	1.50	--	6.50	Noble	1.50	--	6.50
Cuyahoga	1.00	1.00%	7.00	Ottawa	1.00	--	6.00
Darke	1.00	--	6.00	Paulding	1.50	--	6.50
Defiance	1.00	--	6.00	Perry	1.00	--	6.00
Delaware	1.25	--	6.25	Pickaway	1.50	--	6.50
Erie	1.00	--	6.00	Pike	1.00	--	6.00
Fairfield	0.75	--	5.75	Portage	1.00	0.25	6.25
Fayette	1.00	--	6.00	Preble	1.50	--	6.50
Franklin	0.50	0.25	5.75	Putnam	1.25	--	6.25
Fulton	1.00	--	6.00	Richland	1.25	--	6.25
Gallia	1.25	--	6.25	Ross	1.50	--	6.50
Geauga	0.50	--	5.50	Sandusky	1.00	--	6.00
Greene	1.00	--	6.00	Scioto	1.50	--	6.50
Guernsey	1.50	--	6.50	Seneca	1.00	--	6.00
Hamilton	1.00	--	6.00	Shelby	1.50	--	6.50
Hancock	0.50	--	5.50	Stark	0.00	0.25	5.25
Hardin	1.00	--	6.00	Summit	0.50	0.25	5.75
Harrison	1.50	--	6.50	Trumbull	0.50	--	5.50
Henry	1.00	--	6.00	Tuscarawas	1.00	--	6.00
Highland	1.00	--	6.00	Union	1.00	--	6.00
Hocking	1.25	--	6.25	Van Wert	1.50	--	6.50
Holmes	1.00	--	6.00	Vinton	1.50	--	6.50
Huron	1.50	--	6.50	Warren	1.00	--	6.00
Jackson	1.50	--	6.50	Washington	1.50	--	6.50
Jefferson	1.50	--	6.50	Wayne	0.75	--	5.75
Knox	1.00	--	6.00	Williams	1.00	--	6.00
Lake	0.50	0.25	5.75	Wood	1.00	--	6.00
Lawrence	1.50	--	6.50	Wyandot	1.00	--	6.00

NOTE: State rate is 5.0%. **August 19, 2002**

Description of Data

Table 10.1: Description of Data

VARIABLE	DESCRIPTION
TAX_MIX	Portion of property tax of total of property tax and sales tax combined
PT_REVENUES	Total Property Tax Revenues - combined residential, agricultural, personal, etc.
PT_RATES	Property Tax Rates for residential and personal property - net rates
ST_REVENUES	Sales Tax Revenues
ST_RATES	Sales Tax Rates
INC_POP	County Income
UNEMPL_RATE	County Unemployment Rate
TOTAL_POP	County Population
FARM_NUM	Farm employment - number of jobs
AI_POP	AUTO_INCOME per capita
EAT_DRINK	Private earnings: Eating and Drinking establishments
ED_POP	EAT_DRINK per capita
ASSFUNDS	State funds granted to county
AGRIC_TOTAL	Agricultural property share
RP_TOTAL	Residential property share
MIN_TOTAL	Mineral property share
RTDBA_POP	Retirement and disability payments

Table 10.2: Data Sources

VARIABLE	SOURCE	LINK
PT_REVENUES	Ohio Department of Taxation	http://www.state.oh.us/tax/publications.html
PT_RATES	Ohio Department of Taxation	http://www.state.oh.us/tax/publications.html
ST_REVENUES	Ohio Department of Taxation	http://www.state.oh.us/tax/publications.html
ST_RATES	Ohio Department of Taxation	http://www.state.oh.us/tax/publications.html
INC_POP	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
UNEMPL_RATE	Bureau of Labor Statistics	http://stats.bls.gov/data/home.htm
TOTAL_POP	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
FARM_NUM	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
AI_POP	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
EAT_DRINK	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
ED_POP	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
ASSFUNDS	Ohio Department of Taxation	http://www.state.oh.us/tax/publications.html
AGRIC_TOTAL	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
RP_TOTAL	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
MIN_TOTAL	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd
RTDBA_POP	Bureau of Economic Analysis	http://www.bea.doc.gov/bea/regional/reis/#dd

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