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A Retail Sales / Sales Tax Paradox

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Abstract

Small communities experiencing slow to negative growth sometimes increase their local sales tax rate in order to maintain or expand public services. A cross-sectional, time series model is used to investigate possible unintended consequences. Negative elasticities are found for tax rates above the norm, resulting in reduced retail trade.

Introduction

Many non-metropolitan communities have faced and continue to face challenges in recent decades. For many, population growth has been slow or negative. Employment growth has followed a similar, if not more severe, path. Commuting to jobs in other communities is increasing. Greater mobility and e-commerce have resulted in increased out-shopping. Many downtown shopping areas have withered as shoppers turn to regional trade centers and super-stores for lower prices, more variety, and one-stop shopping. Small communities experiencing these economic phenomena suffer not only the loss of trade activity, but also the loss of tax revenue to support local public services and infrastructure. Property tax and sales tax are the primary sources of local government revenue. An Oklahoma Municipal League survey of cities' 2000-2001 budgets reveals that the largest revenue source (36%) is sales tax revenue. Both sales and property tax depend upon the level of local economic activity and wealth.

Despite declining economic conditions in many communities, the people of these communities want to maintain their community. Community services such as law enforcement, road maintenance, and public education require local funding from property and sales taxes. If property values and taxable retail sales are not growing, maintenance of local public services may require a tax rate increase. Property taxes seem to be especially unpopular as a tool for raising additional revenue and, in some instances, such as in Oklahoma, tax rates are fixed by the state constitution. Sales tax rates may be the

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only politically viable option. Yet, as sale tax rates rise, the effective price of taxable goods rise. Classical economic theory indicates that rising prices will result in less quantity demanded and / or substitution effects. Hence, a rising sales tax may have both income and substitution effects. The greater the price increase, the greater the effects. This paper seeks to address the question: will a local sales tax increase risk a decline in sales tax revenue? In other words, is there a point at which the tax rate is so large as to have the unintended effect of reducing local retail trade and sales tax revenue levels?

Background

The goal of this paper is to shed some light on the consequences of increasing local sales tax rates, particularly in non-metropolitan counties. This is similar to Mikesell's objective for central cities. Several studies have found decreased local retail trade in communities' whose local sales tax rate exceeds that of surrounding communities (Fisher, Love, Mikesell, Snodgrass and Otto, Walsh and Jones). Other studies have explored the factors affecting the relative level of retail activity, measured by pull-factors, in rural areas (Ebai and Harris, Gale, Gruidl and Andrianocos, Yanagida, et al.). Here, the questions are aimed at the closely related questions of local government revenue generation. The specific objective is to test the hypothesis that the addition of a county sales tax may actually decrease local retail trade, hence being counter-productive.

Dauffenbach shows that the average city sales tax rate in Oklahoma has increased from 2.1% in 1980 to 3.2% in 1999. Authority for county government sale taxes was granted in 1984. Four counties adopted a county sales tax that year. Today sixty-two of seventy-seven counties levy a county sales tax. Counties have increasingly looked to the sales tax as the only option for raising significant sums. Maximum property tax rates were placed in the state constitution in the 1930s and every county has been levying the maximum rate for decades. Local government (city + county) sales tax rates vary from 1% to 6%. City rates vary from 1% to 5% while county rates range from zero to 2%. The state sales tax rate is 4.5%.

On average, city sales tax rates have increased by almost the same amount over the last twenty years without regard to city population (Dauffenbach). Among counties, a larger proportion of smaller population counties have adopted a sales tax and smaller counties adopted sales taxes sooner than large counties (Lansford). Furthermore, a relatively large proportion of the small counties adopting a sales tax are also losing population.

Method

The econometric models use total taxable sales as the dependent variable. Taxable sales are a proxy for local retail sales. (Models using per capita retail sales give parallel results except for the coefficient on population.) The independent variables include per capita personal income, population, sales tax rate, and USDA's rural-urban continuum code. Socio-economic variables, such as age groups, are not included. The primary reason for their exclusion is the lack of time series data for these variables. A second reason is that these may not be needed in order to test the tax rate hypotheses. The model is not attempting to explain all variability but is focused on variability due to rate changes. The data is annual data for 68 rural Oklahoma counties over 1984 – 1998. The econometric model is estimated using the SAS PROC REG and PROC MIXED procedures. Heteroskedasticity is indicated and corrected in both cases. PROC MIXED finds the maximum likelihood estimates assuming error components and heteroskedasticity.

A log-log model is used of the form:

$$\text{Retail} = \text{Mrate} + (\text{Mrate})^2 + \text{Crate} + \text{Pop} + \text{Mpci} + \sum_{i=1}^{6} RU_i + \sum_{j=1}^{14} DYR_j + \varepsilon$$

Where Retail = the natural log of taxable monthly municipal retail sales

Mrate = the natural log of the municipal sales tax rate[2]

$(\text{Mrate})^2$ = the square of the natural log of the municipal sales tax rate

[2] Raw sales tax rates are expressed in decimal form, hence 3% = .03, the natural log of which is –3.51.

Crate = the county government sales tax rate, if any

Pop = the natural log of estimated municipal population by BEA[3] or the Census[4]

Mpci = natural log of municipal per capita income based on the 1990 census and scaled to other years using the implicit price deflator, gross national product.

RU = Rural-urban continuum dummies are based on the rural-urban continuum code defined by ERS USDA[5] and takes into account county populations and county location relative to urban areas. The base dummy is "urbanized adjacent" and is defined as counties with urban population of at least 20,000 and located adjacent to a metropolitan area.

DYR = Year dummies are included for each year with 1998 being the base year.

Error terms of a specific community may be high or low year after year. The correlation within the cross-section across time is captured with a random effects model. The model is estimated using PROC MIXED in SAS.

Data

Sales tax collections for every city municipality (city or town) and county that collected a sales tax from 1984 – 1998 are included with a few exceptions. The Cities of Tulsa and Oklahoma City plus their counties are excluded due to their relatively massive size relative to other cities in the state. Data for four small towns were excluded due to missing population or per capita income estimates. The final data set includes 478 municipalities and a total of 5,383 observations. Because a county or city may change their sales tax rate in any month in any year, the Oklahoma Tax Commission reports annual collections by rate by number of months. Tax collections at a given rate were divided by the number of months a given rate was in effect to calculate the monthly average collections for each city or county at a given rate. Dividing monthly collections by the applicable rate produces the monthly, taxable retail sales. Footnotes to the model equation provide further information on sources of data.

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[3] BEA is the Bureau of Economic Analysis, U.S. Department of Commerce.
[4] Census is the U.S. Bureau of the Census.
[5] Economic Research Service, United States Department of Agriculture.
http://www.ers.usda.gov/briefing.rural/data/index.htm.

Table 1 gives descriptive statistics for the data set. Monthly sales tax collections are the basis for the retail sales estimates. The populations of the 478 communities range from 16 to 65,140 with an average population of 2,479. The median population is only 950. Monthly sales tax collections range from $18 in a small town to almost $1.5 million. Municipal tax rates range from 1% to 5% with the average being 2.56%. The median, however, is 3.0% and 50% of cities and towns have a sales tax rate of 3.0%. Per capita incomes range widely over the 1984 – 1998 period with the average being $8,698.

The rural-urban continuum, devised in 1993, indicates 8% of the communities are classified as urbanized[6] and adjacent to a metropolitan area (Ghelfi and Parker). The largest proportion (48%) of communities are categorized as "Less urban adjacent.[7]" Thus, most counties are physically adjacent to either an Oklahoma metropolitan area or a metropolitan area such as Fort Smith, Arkansas or Sherman-Denison, Texas. Another 26% of the observations come from "Less urban non-adjacent" counties.

Results

The model appears to have a reasonably good fit. F tests and Chi-square tests for the OLS and random effects models, respectively, are highly significant. The OLS model R-square is 0.95. All coefficient estimates are significant at the 95% level with the exception of a few "year" dummies. Because estimated coefficients are very similar in both, discussion will focus on the random effects model results.

At first blush the sales tax rate coefficients appear to have unexpected signs. The Mrate coefficient might be expected to be positively signed and the $(\text{Mrate})^2$ coefficient negatively signed. However, when you consider that the natural log of tax rates ranging from 0.01 to 0.05 will be negative numbers, the signs on the coefficients make sense. In fact, the quadratic form then takes on the usual behavior. All other things constant, the model indicates retail sales increasing at the lower end of the range of sales tax rates.

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[6] "Urbanized" denotes counties with at least 20,000 urban residents.
[7] "Less urbanized" denotes counties with 2,500 to 19,999 urban residents.

Table 1. Descriptive Statistics, Oklahoma Communities, 1984 - 1998

Variable	Mean	SD	Min.	Max.
Monthly Sales Tax Collections	40,621	113,142	18	1,449,772
Retail $, Monthly Retail Sales Estimate	1,430,682	3,797,739	455	36,980,711
Mrate, Municipal Sales Tax Rate	0.0256	0.0069	0.0100	0.0500
log(Mrate)	-3.7063	0.3097	-4.6052	-2.9957
Crate, County Sales Tax Rate	0.0036	0.0050	0.0000	0.0200
Pop, Municipal population	2,479	5,190	16	65,140
Mpci, Municipal per capita income	8,698	2,190	2,503	19,818
RU_1, urbadj, Urban adjacent	0.0799	0.2711	0	1
RU_2, urbnadj, Urban non-adjacent	0.0516	0.2213	0	1
RU_3, lurbadj, Less urban adjacent	0.4798	0.4996	0	1
RU_4, lurbnadj, Less urban non-adjacent	0.2556	0.4362	0	1
RU_5, ruradj, Rural adjacent	0.0424	0.2014	0	1
RU_6, rurnadj, Rural non-adjacent	0.0907	0.2871	0	1
Rural-Urban Continuum Code	6.4009	1.2049	4.0000	9.0000
DYR_1, 1984	0.0684	0.2524	0	1
DYR_2, 1985	0.0615	0.2402	0	1
DYR_3, 1986	0.0635	0.2439	0	1
DYR_4, 1987	0.0646	0.2459	0	1
DYR_5, 1988	0.0663	0.2489	0	1
DYR_6, 1989	0.0654	0.2472	0	1
DYR_7, 1990	0.0676	0.2511	0	1
DYR_8, 1991	0.0669	0.2498	0	1
DYR_9, 1992	0.0672	0.2505	0	1
DYR_{10}, 1993	0.0680	0.2518	0	1
DYR_{11}, 1994	0.0678	0.2514	0	1
DYR_{12}, 1995	0.0682	0.2521	0	1
DYR_{13}, 1996	0.0682	0.2521	0	1
DYR_{14}, 1997	0.0671	0.2502	0	1
1998	0.0693	0.2540	0	1

Table 2. Regression Results, Weighted to Correct for Heteroscedasticity

	OLS		Random Effects Model		
Variable	Estimate	t Value	Estimate	DF	t Value
Intercept	-11.3069	-12.14	-11.2865	477	-12.17
Mrate	-2.9909	-6.44	-2.9912	4635	-6.52
$(\text{Mrate})^2$	-0.3944	-6.44	-0.3960	4635	-6.54
Crate	3.7152	2.54	4.0790	4635	2.79
Pop	1.2899	207.13	1.2923	4635	197.38
Mpci	1.0268	24.77	1.0254	4635	24.45
urbnadj	-0.1726	-4.20	-0.1972	4635	-4.72
lurbadj	0.1741	6.14	0.1577	4635	5.46
lurbnadj	0.1230	4.23	0.1085	4635	3.67
ruradj	0.1487	2.76	0.1535	4635	2.82
rurnadj	0.1882	4.75	0.1794	4635	4.46
1984	-0.1153	-2.92	-0.1096	4635	-2.78
1985	-0.1004	-2.37	-0.0823	4635	-1.95
1986	-0.1866	-4.76	-0.1825	4635	-4.67
1987	-0.2943	-8.10	-0.2739	4635	-7.57
1988	-0.2102	-5.48	-0.1991	4635	-5.21
1989	-0.2343	-6.06	-0.2206	4635	-5.73
1990	-0.0838	-2.26	-0.0652	4635	-1.76
1991	-0.0961	-2.59	-0.0953	4635	-2.58
1992	-0.1070	-3.05	-0.0986	4635	-2.82
1993	-0.1900	-6.18	-0.1876	4635	-6.13
1994	-0.0733	-2.02	-0.0794	4635	-2.19
1995	-0.0420	-1.21	-0.0414	4635	-1.20
1996	0.0122	0.39	0.0137	4635	0.44
1997	-0.0284	-0.79	-0.0246	4635	-0.69
Adjusted R^2		0.95	Residual Log Likelihood		-4,474.5
F		4,026	Chi-Square		93.89

Table 3. Elasticity of Retail with Respect to Various Municipal Sales Tax Rates

Rate	0.01	0.015	0.02	0.025	0.03	0.035	0.04	0.045	0.05
Elasticity	**0.66**	**0.33**	**0.11**	**-0.07**	**-0.21**	**-0.34**	**-0.44**	**-0.54**	**-0.62**

However, sales increase at a decreasing rate. Specifically, the model indicates increasing sales as the sales tax rate increases from 1% to approximately 2.3%. At higher rates retail sales decrease. Since the average municipal sales tax rate is 2.46%, the model's estimates make sense. Other things equal, communities with lower rates would tend to attract more shoppers and experience greater sales volume. Communities with higher rates would have relatively higher prices and tend to receive a lower proportion of sales.

The coefficient estimate for Crate, the county sales tax rate, is more troublesome to interpret. It is positively signed rather than negatively signed as hypothesized. Note further that, due to many observations with Crate = 0, it was not placed in log form.

Table 3 provides an evaluation of retail sales elasticity with respect to municipal sales tax rates. Inelasticity is shown over the entire range of observed sales tax rates. At rates 2.5% or more, the elasticity turns negative, indicating reduction in retail sales as rates rise.

A coefficient greater than one on population indicates the expected agglomeration or economies of size effect. Larger towns and cities will have more retail stores and a greater selection of merchandise. Consumers will tend to shop for basics near home but for higher priced durable goods and non-essentials they will often allocate more time for shopping. Hence, larger population municipalities, especially regional trade centers will typically have larger retail sales volume relative to their population. Similarly, the parameter estimate on per capita income is positive and greater than one indicating that higher income populations will spend more on normal economic goods.

Coefficients on the rural-urban continuum indicator variables are statistically significant but most have signs contrary to expectations. For example, it is expected that communities located adjacent to metropolitan areas will experience a loss of retail sales due to the convenience of shopping at the adjacent metropolitan area. By contrast, it was expected that non-adjacent areas would have relatively larger retail sales due to relatively remote location. The model results, however, show a negatively signed coefficient for urban non-adjacent (urbnadj) communities. This implies that their retail sales were less than those of urbanized areas adjacent to metropolitan areas. Part of this may be explained by urban sprawl. As metropolitan areas grow, one result of their growth is the "urbanization" of the surrounding areas. This urbanization spills into adjacent counties stimulating growth of suburban shopping areas. This may explain some of the results.

The year dummy variables capture structural changes in the overall economy such as inflation, economic expansion, changes in interest rates, and so on. Since 1998 was the base year, it was expected that earlier years would be negatively signed. For years 1995 through 1997, the coefficients were not statistically significant. Their insignificance is not of particular concern. These years, close to the base year, were years of relatively low inflation, and occur during a time of relative stability in the general economy.

Results, Model 2

The Crate parameter in the first model implies that increasing the county sales tax rate will increase local retail sales volume and directly conflicts with the results for the municipal sales tax rate. Since community taxpayers face a local tax rate equal to the municipal rate plus the county rate, it seems prudent to combine them into a single local rate and re-estimate the model equation parameters. The results are shown in Table 4. Trate is the variable name assigned to the sum of Mrate and Crate.

The two regression procedures again provide very similar parameter estimates and fit the data reasonably well. All parameter estimates except those on the last two dummy variables are significant at the alpha level of 5%. As with the previous results, the parameters for the random effects model will be discussed. The parameter of interest is the total local tax rate, Trate.

As the total local tax rate increases, it is expected that retail sales will decrease. The elasticities of sales volume (in dollars) with respect to local tax rate is displayed in Table 5. The table shows the actual range of combined city and county rates being used across the state. As in the previous model, there is positive inelasticity at lower sales tax rates. As rates approach the average rate of 2.9%, the elasticity approaches zero. It becomes negative at approximately 3.2%. Hence, as a community increases its sales tax rate above the norm, it risks losing retail sales and the accompanying sales tax revenue.

Table 6 provides an illustration of the results for a selected set of sales tax rates at the median city population and all other variable values at the averages. Population of 1,000 was selected as it is near the median population of 950. Tax rates of 2%, 3%, and

3.5% are the first quartile, median, and third quartile rates of the observations. Retail sales are shown to slightly decline when the rate moves from 3% to 3.5%. Actual community experience will surely vary. When consumers confront a new sales tax rate, it is unlikely they will fully react to it immediately. Therefore, trade would not be expected to decline immediately but over time. The evidence, however, does show that consumers do change their behavior. How rapidly, we do not know.

Table 4. Model 2 Regression Results, Weighted to Correct for Heteroscedasticity

	OLS		Random Effects Model		
Variable	Estimate	t Value	Estimate	DF	t Value
Intercept	-4.4559	-5.64	-4.5722	477	-5.77
Trate	-0.9012	-2.19	-0.9886	4635	-2.42
$Trate^2$	-0.1310	-2.33	-0.1435	4635	-2.57
Pop	1.3269	210.10	1.3276	4635	203.06
Mpci	0.6981	17.24	0.6955	4635	16.97
urbnadj	-0.1676	-4.45	-0.1947	4635	-5.08
lurbadj	0.1666	6.25	0.1479	4635	5.43
lurbnadj	0.1445	5.28	0.1276	4635	4.59
ruradj	0.2430	4.83	0.2448	4635	4.81
rurnadj	0.2531	6.82	0.2438	4635	6.47
1984	-0.2460	-6.31	-0.2375	4635	-6.09
1985	-0.1354	-3.70	-0.1318	4635	-3.61
1986	-0.2296	-5.88	-0.2264	4635	-5.83
1987	-0.2765	-7.22	-0.2721	4635	-7.14
1988	-0.2638	-7.38	-0.2589	4635	-7.26
1989	-0.2797	-7.63	-0.2716	4635	-7.44
1990	-0.1576	-4.50	-0.1437	4635	-4.13
1991	-0.1542	-4.65	-0.1584	4635	-4.80
1992	-0.1038	-2.93	-0.1077	4635	-3.05
1993	-0.1935	-6.20	-0.1953	4635	-6.31
1994	-0.0994	-2.89	-0.1061	4635	-3.11
1995	-0.0692	-2.04	-0.0741	4635	-2.21
1996	-0.0505	-1.50	-0.0545	4635	-1.63
1997	-0.0412	-1.31	-0.0383	4635	-1.23

Table 5. Elasticity of Retail Sales with respect to Various Local Sales Tax Rate Levels

Rate	0.01	0.02	0.025	0.03	0.035	0.04	0.045	0.05	0.06
Elasticity	**0.33**	**0.13**	**0.07**	**0.02**	**-0.03**	**-0.06**	**-0.10**	**-0.13**	**-0.18**

Table 6. Estimated Retail Sales per Month at the Median Population and Selected Rates

	Sales Tax Rates		
Pop.	2.0%	3.0%	3.5%
1,000	322,278	332,359	332,137

Summary and Conclusions

This analysis focuses on the relationship between retail sales and local sales tax rates. Fifteen years of sales tax information (collections and rates) for all non-metropolitan counties is employed. Cities and towns are largely dependent upon sales tax receipts for financing their services. In the specific time period considered, county governments were increasingly employing the sales tax since it is the only viable alternative for significant sums. At the same time, many rural communities have experienced population decline similar to that found in many other states. Dwindling population and stagnant or declining tax base has motivated numerous rural communities to ask their citizens to approve a sales tax increase so that local public service can be maintained and/or expanded. The question to be addressed is whether or not sales tax increases might be counter-productive, both in terms of revenue collections and local economic retail trade activity.

The strengths of the current analysis include the number of years and inclusiveness of he observations. The statistical tests show relatively high statistical significance and the models appear to provide a good fit. Some drawbacks are the unexpected signs on some variables such as the county sales tax rate. Future research may also benefit by inclusion of specific socio-economic variables such as demographic groups. Additional trade area information would be of use. Specifically, factors such as distance to regional trade centers and relative sales tax rate within a trade area could be helpful. Defining trade areas, however, may present a challenge. Nevertheless, it seems clear that alternative measures to the “rural-urban continuum code” need to be found.

Another strategy for addressing the question of whether or not and how rapidly community consumers react to a sales tax increase is with an event study. Selected communities that have changed their rates can be examined over time. This was part of the authors' original goal but has not yet been achieved.

In conclusion, this analysis strongly suggests that increasing the local sales tax rate above the average sales tax rate will have a negative effect on taxable retail sales and on sales tax collections (all other things being equal). The elasticity of retail sales with respect to sales tax level is negative at higher levels of sales tax. Increasing the local sales tax significantly above the state average (or perhaps above the predominant rate within a local trade area) will reduce local retail activity and sales tax revenue. Larger population and personal income also increase the level of trade. Therefore, smaller population communities that tend to have lower income levels face the additional challenge of collecting less per capita than larger communities having the same sales tax rate.

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