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Local Option Sales Tax (LOST) Policy on the Urban Fringe

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Abstract. Many state legislatures grant local governments the authority to enact sales taxes on retail sales transactions that occur within local jurisdictions. Local government reliance on these local option sales tax (LOST) revenues is increasing. In many states, including Oklahoma, municipal governments are unrestricted as to the LOST rate that can be imposed. The ability to generate LOST revenues, however, may depend on many factors outside a local government's domain, including proximity to large, urban retail centers, and tax competition from other localities. This paper investigates aspects of LOST policy for municipal governments located on the urban fringe using all Oklahoma municipalities that imposed a LOST from 1990 to 2001. An important finding is that the revenue impact of increasing LOST rates (i.e., the LOST tax elasticity) depends on the urban influence measure. The implications are important for guiding nonmetropolitan municipal governments in the determination of LOST policy

1. Introduction

A distinctive feature of state-local fiscal policy since the 1970s has been the decreasing reliance on local property taxes and an increasing reliance on local taxes, mainly local sales taxes and income taxes.[2] When authorized by state government, a local option sales tax (LOST) is applied to all qualified sales (sales subject to sales tax) occurring within a local jurisdiction at the sub-state level including county, municipal, or special district designations. In 1970 only 23 states authorized local option sales taxes compared with 33 states in 1997 (NCSL 1997, page 7).

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[2] See the National Conference of State Legislatures (NCSL 1997), particularly the discussion on page 7, for an overview of state-local fiscal policy trends and details about local option taxes.

The degree of local determination of LOST structure is at the discretion of state governments and varies considerably across states (Rogers 2001). Four states—Washington, California, Illinois and Utah—allow no local determination of LOSTs by imposing a uniform tax base and rate (which begs the notion of calling these "optional" taxes). Ten states allow a limited degree of local determination of rates by limiting rates or taxes per transaction or per item. In seven states (Alabama, Alaska, Arizona, Illinois, Kansas, North Dakota, Oklahoma), LOST rates are unrestricted and determined through local elections.[3] The majority of the states authorizing LOSTs, require the taxable base to be uniform and similar to that of the state sales tax. The self-determination of LOST structure, even when the base is uniform, has led to a diverse landscape of LOST structures within and across states. The implications of this diversity on the effectiveness of LOST policy are not well understood.

LOST revenues are vital for funding local public goods. They are also seen as viable policy tools for promoting local economic growth. The ability to effectively raise revenue through LOST policy, however, may depend on many factors outside a local government's domain, including proximity to large, urban retail centers, tax competition from other localities, and even the degree of self-determination of LOST structure, itself. The previous literature identifies important factors determining the tax rate-base relationship and, to a lesser extent, the tax rate-revenue relationship. It highlights the importance of border-city issues that cause tax rate differentials to erode a metropolitan city's tax base. It also suggests that rural municipalities may be limited in their ability to effectively use LOSTs to raise revenue. Very little, however, is understood about the implications of tax rate differentials and revenue potential of LOST policy for cities on the urban fringe, cities in nonmetropolitan areas that are functionally related to metropolitan areas. Accordingly, an important and unique contribution of this investigation is the consideration of urban influence factors on LOST policy impacts.

This paper investigates aspects of LOST policy using a panel of Oklahoma municipalities from 1990 to 2001. It makes several contributions to the literature. First, it allows for a cross section, time series analysis at the municipal level, which is absent in the current literature. Second, given that an overwhelming majority of Oklahoma communities imposing a LOST, the data set includes a large number of communities (over 450) compared with single community or relatively small sets of communities used in other studies. Third, the data allow for a glimpse of LOST revenue impacts even for very small communities, an investigation which is absent from the current empirical literature. Fourth, the LOSTs in Oklahoma have a relatively uniform base which reduces most, but not all, issues associated with differential

[3] Illinois also imposes a general (non-optional) local sales tax. The optional sales tax is at the discretion of local jurisdictions and its rate is only limited to be in .25% increments.

bases. Finally, having a large concentration of counties in the urban fringe makes Oklahoma ideal for analyzing tax policies on the rural-urban nexus.

The investigation offers some interesting insights into LOST policy on the urban fringe. It highlights the value of classifying communities according to urban influence and county seat categories. County seats have higher revenues on average, but smaller incremental impacts from LOST rate increases. Furthermore, communities on the urban fringe appear to have different abilities to use LOST policy to generate additional revenues compared with their more metropolitan and rural counterparts. Non-county seat communities in the counties with the least urban influence are predicted to generate an extra 1 percent in revenues when the LOST rate is increased from 1 percent to 2 percent. But similarly situated county seat communities would be expected to increase revenues by only .08 percent when the LOST rate is increased from 4 percent to 5 percent. The analysis supports conclusions from previous investigations about the importance of market dominance and proximity to large, urban retail shopping districts.

2. Review of LOST Policy Literature

A large body of general tax literature relates to LOST policy. Many studies, for example, focus on general efficiency and equity issues common to any sales tax.[4] The overwhelming majority of articles addressing LOST policy in particular focus on the implications of tax rate differentials across neighboring jurisdictions. This line of research follows directly from the considerable literature on interjurisdictional tax competition.[5] The general argument is that an increase of a tax in one jurisdiction causes consumers to substitute purchases in a neighboring, lower tax jurisdiction. In particular, the problem faced by cities bordering states with different state sales tax rates is analogous to that of municipalities bordering other municipalities with different LOST rates (i.e., the border-city problem).

Researchers and policymakers alike have recognized the border-city aspect of LOSTs since their inception. For example, Hamovitch (1966) reviews two survey-based analyses performed by government agencies in California and Colorado in the 1950s. In addition, Mikesell (1970) reviews early work by Maliet (1955) and McAllester (1961). Walsh & Jones (1988) use county-wide panel data to examine the effects of a tax differentials between West Virginia counties and border counties on retail sales. They find evidence of cross-border shopping. Fox (1986) also finds evidence of cross-border shopping in his analysis of three metropolitan areas that cross state borders. With

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[4] For example, Ghaus (1995) derives a spatial, general equilibrium model to analyze optimal local sales tax policies.

[5] See for example The Federal Reserve Bank of Boston (1997).

the increasing reliance on LOST revenue sources, the border-city issue continues to be a salient concern for policymakers. The State of Arkansas, for instance, tries to minimize the border-city effects by limiting total local sales tax rates for cities that spillover state borders.

Despite the continued appreciation of the problem, empirical investigations of interjurisdictional tax competition of local governments *within* a state have been limited.[6] The earliest publications were by Hamovitch (1966) and Levin (1966), both of which focused on the impact of New York City's sales tax rates on its base. The subsequent studies in the 1970s and 1980s focused on specific geographic areas (Fisher 1980, and Mikesell and Zorn 1986) or on metropolitan areas (Mikesell 1970). Mikesell and Zorn (1986) consider a unique case of a relatively small community with a 1980 population of 7,891. They find a small but definite negative impact of an increase in the LOST rate on the sales tax base.

As noted by Snodgrass and Otto (1990, p. 35) the consequences of LOST rate differentials across rural communities has not been "thoroughly explored." The previous studies that include a cross section, time series of nonmetropolitan areas focus on counties. Both Wong (1996) and Love (1992) emphasize the importance of market dominance in determining the impact of sales tax rate differentials. Based on his county level analysis of the LOST rate-base relationship in Kansas, Wong (1996) concludes that tax rate differentials in rural communities lacking regional market dominance will cause substantial erosion in retail sales.

The research by Snodgrass and Otto (1990) investigates LOST rate differentials for 75 communities in Oklahoma. It stands out by providing a city-level, cross-sectional analysis of LOST rate differentials. Using data from nonmetropolitan communities with populations from 2,500 to 50,000, they find a significant (negative) relationship between tax rate differentials and tax revenues for the subset of communities with relatively higher tax rates but not for the overall sample. They conclude that small tax rate differentials are not very important for determining tax revenues for the nonmetropolitan communities.

My analysis builds on Snodgrass and Otto's (1990) by constructing and analyzing a panel of all Oklahoman municipalities that imposed a LOST during the 1990 to 2001 period. In addition to using cross section, time series data for a more recent period, my analysis is distinct from previous investigations by including both very small and totally rural communities. Another distinguishing feature of the analysis is the use of the United States Department of Agriculture's (USDA) Economic Research Service (ERS) urban influence (UI) classification scheme to define cities that lie on the urban fringe. An advantage of using the UI codes is that they distinguish between metropolitan, nonmetropolitan but urban, and rural communities (both nonmetro-

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[6] Fisher (1980) and Love (1992) provide brief reviews of previous literature.

politan and non-urban). As such, the UI codes provide a convenient measure of urban influence that reflects aspects of complex retail gravity indices employed in previous literature. Notably, urban influence proves to be a salient factor in the estimation of the LOST tax rate-tax revenue relationship.

3. Background on LOST Implementation in Oklahoma

Oklahoma law authorizes incorporated cities and towns to levy sales taxes for general and specific purposes of municipal government. Local tax ordinances must be approved by a majority vote in a citywide election. At the present, there is no maximum local rate that may be levied by municipalities. The municipal LOST is levied in addition to applicable county sales taxes, which may not exceed 2 percent, and the 4.5 percent state sales tax.

Oklahoma sales taxes (state, county, and municipal) are levied as a percentage of gross receipts from the sale or rental of tangible personal property and from the provision of certain services. In general, most retail sales as well as some business purchases of non-retail items are included in the tax base. There are also exemptions for motor vehicle sales, agricultural sales, sales subject to the Federal Food Stamp exemption, sales to tax-exempt organizations, and nontaxable services (labor).

The legal definition of sales subject to the sales tax (the LOST base) is locally determined. Even if the LOST base were completely uniform, however, the scope of the LOST tax base would vary across communities. This may be more pertinent for smaller rural communities since the LOST base typically excludes gasoline sales and labor on car repairs. Such variations, however, are likely to remain stable over time. Accordingly, using a cross section, time series analysis is important when analyzing LOST structure for localities of different sizes and degrees of urban influence.

In Oklahoma, as in most states allowing local option sales taxes, local tax collections are remitted to the state. The local portion is subsequently returned to the municipality of collection. The Oklahoma Tax Commission reports the local tax data in its annual reports, *State Payments to Local Governments*. In recent years an appendix table, "City Sales Tax Collections Returned to Cities and Towns," provides the rates and fiscal year total tax collections. A municipality's sales tax base can be computed by dividing the tax collections by the tax rate.

In cases where a jurisdiction changed rates during the fiscal year, collections associated with all rates as well as the number of months each rate was applied are listed. Revenues for these years equal the sum of the partial year collections. Similarly, the applicable tax base is computed as the sum of the tax collections divided by the associated rate for the partial year periods.

Computing a yearly tax rate for mid-year changes is more complicated. A simple procedure for computing a weighted average rate is as follows:

$$\textit{weighted average rate} = r_1 * m_1/12 + r_2 * m_2/12,$$

where m_1 and m_2 are the number of months that the corresponding tax rates, r_1 and r_2, were in effect during the year. This adjustment does not accurately reflect the seasonality of LOST revenues. In a tourism-dependent community, for example, summer months may have higher retail sales compared with winter months. In this case, the weighting scheme would put too much weight on the rate in effect during the winter months. Proper adjustments of the weighted average are not likely to be that important in the analysis that follows given the small number of mid-year rate changes compared with the total number of observations. Furthermore, using the simple weighted average will bias results only to extent that it produces systematic error in the estimation. There is no reason to think that this is the case, *a priori*. Investigations into alternative weighting schemes are left for future research.

In 1966, 13 cities implemented the first LOSTs in Oklahoma at a rate of 1 percent. Other municipalities quickly followed suit. By 1970, 215 communities levied a 1 percent LOST rate. The number of communities adopting a LOST steadily increased during the decade from 1970 to 1980. By 1980 a LOST was levied in 405 Oklahoma communities. From 1990 to 2001, 26 Oklahoma communities imposed new LOSTs. In 2001, 492 of Oklahoma's municipalities imposed a LOST.

Figure 1 and the corresponding Table 1 show the distribution of Oklahoma places by 2000 Census population and LOST status.[7] These graphics highlight the overwhelming acceptance of LOST revenues by local governments in Oklahoma. All 20 of the cities with populations of 20,000 or more impose a LOST. The coverage varies from 93 percent to 97.6 percent for places in the 400 to 700 and 5,000 to 20,000 ranges, respectively. The representation of places imposing a LOST drops for places with populations less than 400. About half the places with populations from 100 to 200 impose a LOST compared with only 30 percent of the places with a population of less than 100.

The significance of the decision to levy a LOST is more relevant for the very small communities. Small communities that do not rely on LOST levies are likely to be systematically different from those that do. The differences may be related to the impact of the imposition of the LOST, particularly in terms of the rate-revenue relationship. In contrast, the potential endogeneity of the decision to levy a LOST, however, is not problematic for the largest communities, especially those with populations of at least 20,000, since all such communities impose a lost. For the remaining communities, the en-

[7] The coverage includes all census designated places (CDP) with populations recorded for 2000.

dogeneity of the take up decision may remain. However, this is not likely to bias sample estimates of the rate-revenue relationship when only communities with a LOST are included in the analysis.

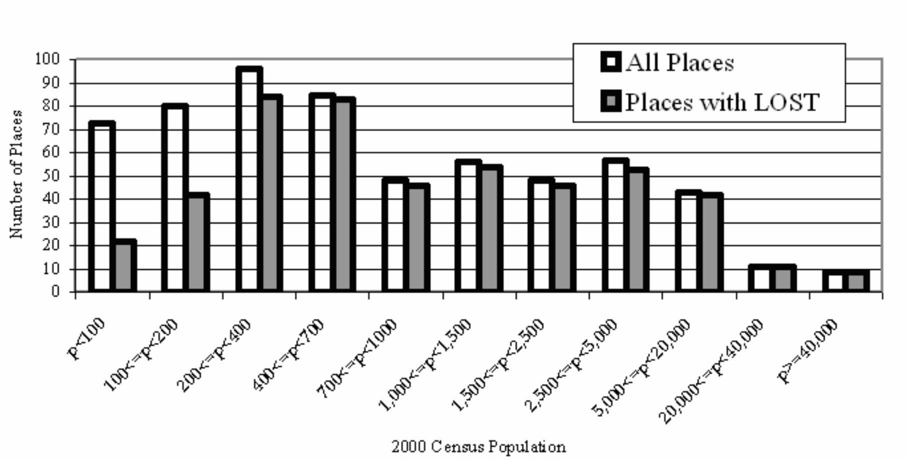

Figure 1. Oklahoma Places By 2000 Census Population and LOST Imposition

Table 1. Oklahoma Places by 2000 Census Population & LOST

	All Cities*	Cities Imposing LOST**	
Population Range	N	N	% of All
pop <100	73	22	30.14%
100<=pop<200	80	42	52.50%
200<=pop<400	96	84	87.50%
400<=pop<700	85	83	97.65%
700<=pop<1,000	48	46	95.83%
1,000<=pop<1,500	56	54	96.43%
1,500<=pop<2,500	48	46	95.83%
2,500<=pop<5,000	57	53	92.98%
5,000<=pop<20,000	43	42	97.67%
20,000<=pop<40,000	11	11	100.00%
pop>=40000	9	9	100.00%
Total	606	492	81.19%

* All US census designated places with 2000 population greater than 0.
**All places that imposed LOST at any time during the period from 1990 to 2001.

Figure 2 and the corresponding Table 2 show the distribution of LOST rates in Oklahoma from 1990 to 2001. The dominant rate is 3 percent, which is levied by about half of the places with a LOST. The second most common LOST rate for the period, 2 percent, steadily lost prominence over the period. In contrast a rate of 4 percent gained in popularity, particularly in the late 1990s. A few communities levied a LOST rate as high as 5 percent by 2001. These data demonstrate the continued variability in the range of rates across Oklahoma's communities over the 1990 to 2001 period as well as the trend toward an increasing average LOST rate.

Figure 3 displays the relationship between LOST rates and population (in logs) of Oklahoma places. Each diamond on the graph represents a community that levies a LOST rate in Oklahoma. With a correlation coefficient of .3, the rates do not appear to be highly correlated with population. Except for the 1 percent rate, which is imposed by only relatively less populated places, a range of population is associated with each LOST rate. Notably, the highest rates are not imposed by the most populated places. These observations suggest that the self-determination of LOST rates is not primarily driven by population size, but by other factors. The next section investigates the degree to which urban influence is associated with LOST rate determination.

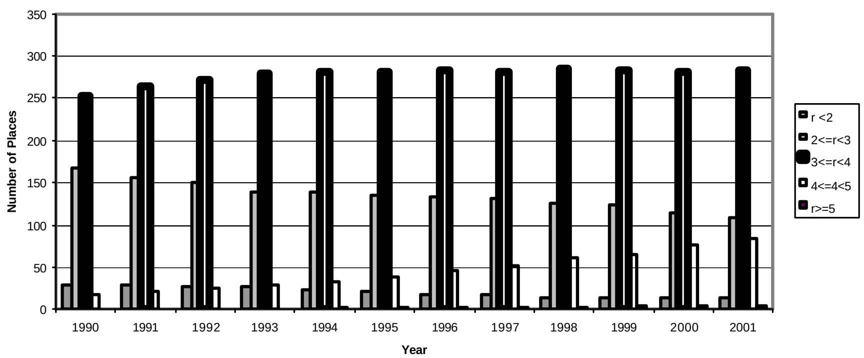

Figure 2. LOST Rates in Oklahoma, 1990-2001

Table 2. Rate distribution for all Places Levying a LOST from 1990-2001

RATE	***1990***	***1991***	***1992***	***1993***	***1994***	***1995***	***1996***	***1997***	***1998***	***1999***	***2000***	***2001***
0.5												1
1	28	28	25	25	21	19	16	16	12	12	11	11
1.5										1	1	1
1.75	1	1	1	1	1	1	1	1	1	1	1	1
2	162	153	146	136	135	130	126	123	117	115	102	98
2.125							1					
2.25								1	1	1	1	1
2.5	4	2	3	2	1	4	4	4	3	4	6	5
2.75	1				1	1	2	2	3	3	3	4
2.85		1										
2.875			1	1				1	2	1	2	
2.95					1							
3	243	253	259	265	261	260	261	259	261	253	248	243
3.25	1	2	2	3	3	3	5	4	4	5	5	8
3.333						1	1					
3.375												1
3.5	7	7	9	9	13	14	13	15	19	22	27	29
3.75	2	2	2	2	3	2	1	1	1	1	1	2
3.875				1	2	2	2	2	1	2	1	1
4	18	21	24	28	32	37	45	50	59	62	76	82
4.25						1				1		1
4.5							1	1	2	1	1	1
5					1	1	1	1	1	3	4	3
Total	467	470	472	473	475	476	480	481	487	488	490	493

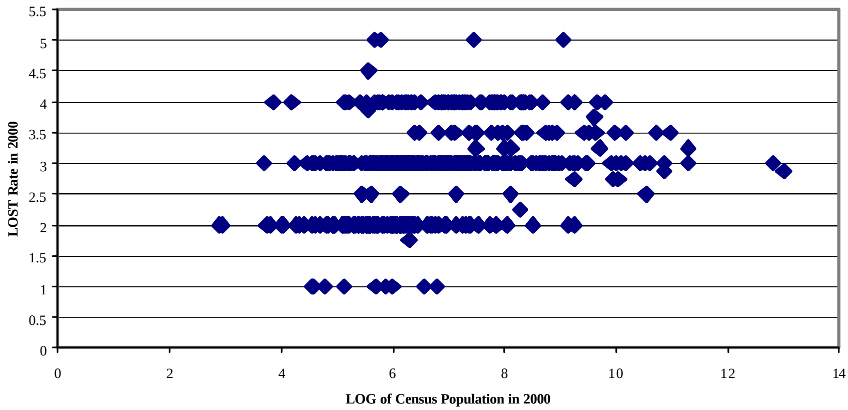

Figure 3. Oklahoma Population and LOST Rates in 2000.

4. Urban Influence and LOST Rates

A central focus of this exploration is LOST policy along the rural-urban nexus. Accordingly, it is important to delineate urban from non-urban areas. My analysis relies on Urban Influence (UI) classification scheme developed by the USDA ERS.[8] As described in Table 3, the 9 UI categories classify United States counties using the 1993 Office of Management and Budget definition of Metropolitan Statistical Areas (MSAs). The two metropolitan categories, M_L and M_S, are based on the size of the MSA. The nonmetropolitan categories are determined by adjacency to MSAs and size of largest city in the county. A community is designated as adjacent to a small (large) metropolitan county, AS (AL), if at least 2 percent of its employed labor force commutes to central counties of a small (large) metropolitan area. Adjacent counties are further divided into those with (AS_C or AL_C) and without (AS_NC or AL_NC) part or all of a city with at 10,000 people. Nonadjacent counties (NA) are divided into three categories, those with a city of at least 10,000 (NA_C), those with a "town" of 2,500 to 9,000 people (NA_T), and those without a city or town (NA_R).

[8] The UI codes were last updated in 1993 and were revised 12/96. They complement the ERS Rural-Urban Continuum Codes. See Ghelfi and Parker (1997) for details of the classifications.

Table 3. Urban Influence Codes

(Code)	*Description [Abbreviation]*
Metropolitan:	
(1)	Large - Central & fringe counties of MSAs of 1 million population or more [ML]
(2)	Small - Counties in MSAs of fewer than 1 million population [MS]
Nonmetropolitan:	
	Adjacent to a large MSA
(3)	- with a city of 10,000 or more [AL_C]
(4)	- without a city of at least 10,000 [AL_NC]
	Adjacent to a small MSA
(5)	- with a city of 10,000 or more [AS_C]
(6)	- without a city of at least 10,000 [AS_NC]
	Not adjacent (NA) to a MSA
(7)	- with a city of 10,000 or more [NA_C]
(8)	- with a town of 2,500 to 9,999 population [NA_T]
(9)	- with no city or a city with less than 2,500 pop [NA_R]

Table 4. Distribution of Oklahoma and US Counties by UI Codes

	UI Type	Number		%	
		OK	US	OK	US
Metropolitan					
In Large MSA	ML	0	311	0%	9.90%
In Small MSA	MS	14	525	18.18%	16.71%
Nonmetropolitan					
Adjacent to large MSA					
With a city of >= 10,000	AL_C	0	63	0%	2.01%
Without a city	AL_NC	0	123	0%	3.92%
Adjacent to small MSA					
With a city of >= 10,000	AS_C	10	188	12.99%	5.99%
Without a city	AS_NC	22	627	28.57%	19.96%
Not Adjacent to a MSA					
With a city of >=10,000	NA_C	7	234	9.09%	7.45%
With a town of 2,500-9,999	NA_T	15	555	19.48%	17.67%
Without city or town	NA_R	9	515	11.69%	16.40%
Total		77	3141	100.00%	100.00%

The distribution of Oklahoma's counties is described in Table 4. Since Oklahoma has no large metropolitan areas, it has no counties classified as

LM, AL_C, or AL_NC. There are 14 counties in small MSAs in the state, including 6 in the Oklahoma City MSA, 5 in the Tulsa MSA, and 1 each in Enid, Lawton, and the Ft. Smith (Arkansas) MSAs. At 59.7 percent and 58.5 percent, respectively, Oklahoma and the United States as a whole have a very similar proportion of counties linked to MSAs (i.e., counties of type ML, MS, AL and AS or codes 1 through 6). In Oklahoma, however, this is driven by the relatively large concentration of counties in the urban fringe (nonmetropolitan counties adjacent to metropolitan areas—AS_C and AS_NC). The large concentration of counties in the urban fringe makes Oklahoma ideal for analyzing tax policies on the rural-urban nexus.

For this analysis, Oklahoma places are classified according to the UI code of the county in which they lie. In some cases, cities cross the borders of several counties, i.e., Oklahoma City, for example, includes all of Oklahoma County and parts of Cleveland, McLaine, Canadian, and Pottawatomie counties.[9] This doesn't matter for identifying the appropriate UI category since all the counties that a city overlays will have the same UI code (e.g., MS).

Figure 4 shows the distribution of Oklahoma Places by 2000 LOST rates (r) and UI code. It shows that 3 percent is the dominant rate for all classifications. For the places either in or adjacent to metropolitan counties (type MS, AS_C, and AS_NC), there are about as many LOST rates in the 2 to 3 percent range as in the 4 to 5 percent range. However, as urban influence diminishes (AL changes to NL, and C changes to NC, T, and R), places have fewer proclivities toward the 3 percent rate. For places in nonmetropolitan, nonadjacent counties with towns (type NA_T), the 2 percent rate is almost as popular as the 3 percent rate. The places with the least urban influence (type NA_R) also have lower LOST rates on average compared with places with greater urban influence.

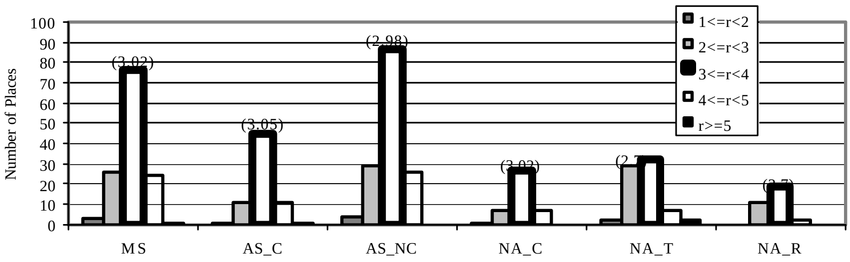

Figure 4. Oklahoma LOST Rates (r) and UI Coee, 2000.

[9] Similarly, the City of Tulsa includes all of Tulsa County and parts of Osage County. Bartlesville, includes all of Washington County and parts of Osage County. Information about city-county correspondence can be obtained from the Oklahoma Department of Commerce.

The series of graphs in Figure 5 show the distribution of LOST rates for communities in the urban fringe (UI types AS_C and AS_NC) and the associated metropolitan counties. For this comparison, the counties in categories AS_C and AS_NC are matched with the relevant metropolitan area. Some fringe counties were adjacent to more than one metropolitan area. In some cases, the relevant metropolitan area was easily identified. In other cases, a fringe county was assigned to more than one metropolitan area. Accordingly, counties may be included in more than one of the fringe areas in the analysis. Summary data corresponding to the figure are given in Table 5.

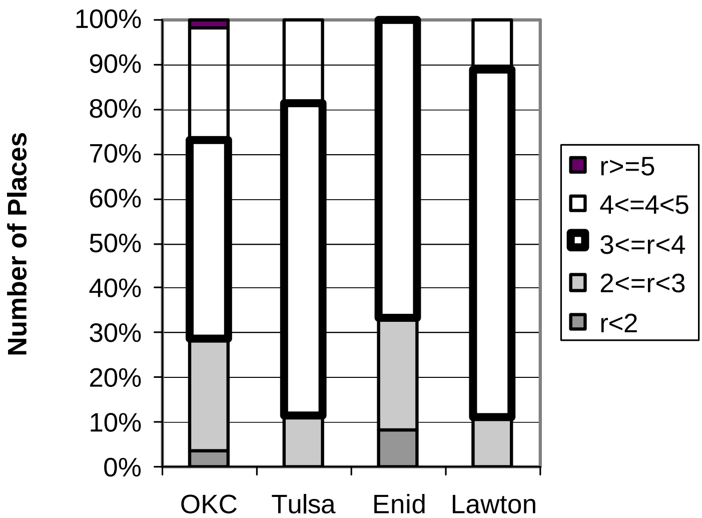

Figure 5. Distribution of 2002 LOST Rates: Metro Places (MS)

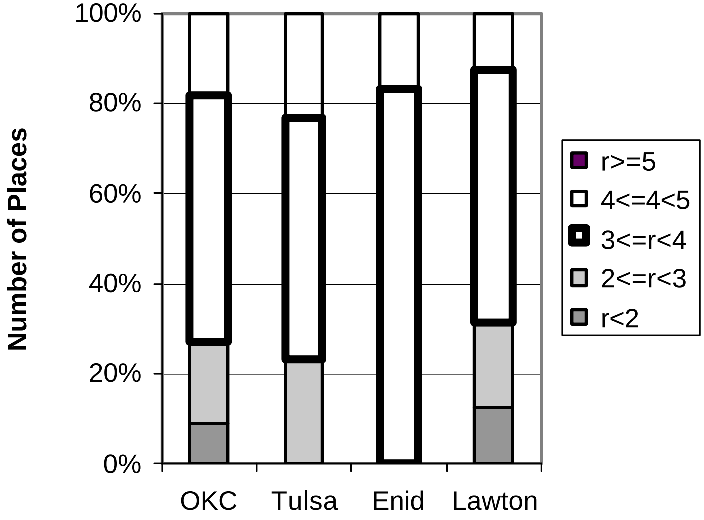

Figure 5. Distribution of 2002 LOST Rates: Urban Fringe with City (AS_C)

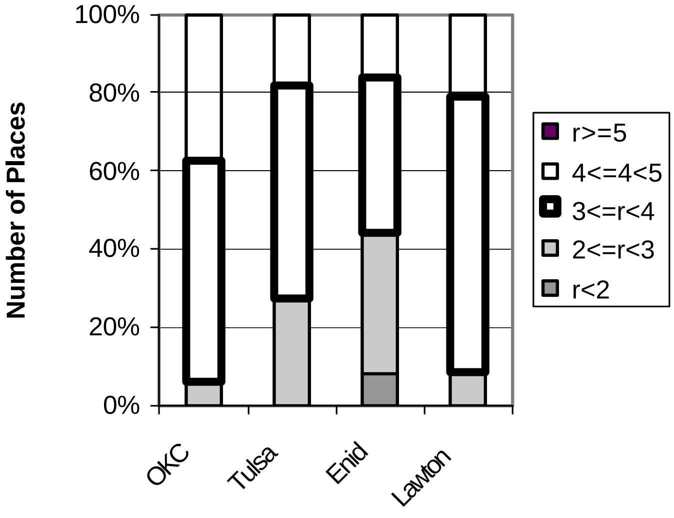

Figure 5. Distribution of 2002 LOST Rates: Urban Fringe without City (AS_NC)

Table 5. Summary of 2000 LOST Rates by Metropolitan Area

	n	Mean Rate	St. Dev	Min	Max
OKC					
MS	56	3.058	0.831	1	5
AS_C	22	2.898	0.840	1	4
AS_NC	51	3.392	0.577	2	4
Tulsa					
MS	43	3.134	0.568	2	4
AS_C	26	3.067	0.684	2	4
AS_NC	44	2.963	0.690	2	4
Enid					
MS	12	2.625	0.711	1	3.5
AS_C	6	3.167	0.408	3	4
AS_NC	25	2.650	0.866	1	4
Lawton					
MS	9	3.028	0.507	2	4
AS_C	16	2.859	0.904	1	4
AS_NC	24	3.188	0.548	2	4

Looking across a panel of Figure 5 shows how the distribution of rates varies for the different metropolitan areas, holding the UI type constant. Comparing a given column over the three panels highlights how the places in the urban fringe compare with places in the corresponding metropolitan counties. The figure demonstrates the variability of rates within and across the metropolitan areas as well as across the fringes of the urban areas. The places in the metropolitan counties of the Oklahoma City Metropolitan have the greatest variability in LOST rates, ranging from 1 percent to 5 percent. Enid and Lawton have smaller rate ranges. Of the places in metropolitan counties, Enid has the lowest average LOST rate at 2.625 percent compared with over 3 percent in the other areas. Enid also has the lowest average LOST for the fringe areas that do not have a city (AS_NC). Another notable observation is that that average rates for the Oklahoma City Metropolitan fringe communities in counties lacking a town (AS_NC) is higher than that of the places with more urban influence. This is also true of Lawton, but to a lesser extent.

This series of graphs concerning the UI distribution in Oklahoma suggests that the differences in the LOST rates across UI categories are not driven by the peculiarities of a single metropolitan area in the state. Accordingly, it is appropriate to pool communities from all metropolitan and fringe areas in the analysis that follows.

5. Empirical Specification of Rate-Revenue Relationship

This section investigates the empirical relationship between LOST rates and LOST revenues. The analyses that follow employ a panel of all 467 municipalities that imposed a LOST in Oklahoma from 1990 to 2001. The 26 places that began to levy a LOST tax after 1990 are excluded to retain a balanced panel.[10]

A municipality's LOST revenue (*REVENUE*) in year *t* is a function of the tax rate (*RATE*) and the total sales subject to taxation (*BASE*), which is a function of the rate:

$$REVENUE = RATE_{it} * BASE_{it}(RATE_{it}) \qquad (1)$$

The overall rate-revenue relationship depends on the direct rate-revenue relationship, determined by the change in the rate applied to the base, as well as the rate-base relationship, determined by the impact of the rate change on the base. Policy changes in the tax rate or base definition will impact behavior leading to changes in the tax base. Determining the impact of tax policy changes on the base, however, is problematic since nontax policy factors, which are likely to be unobserved, may also influence the tax base. Given that we have administrative data for REVENUE and RATE (but not BASE), we focus on the overall rate-revenue relationship.

The rate-revenue relationship may be nonlinear. Investigation into the appropriate polynomial form suggests that *RATE* and $RATE^2$ should be included in the specification. Given the panel nature of the data, place-specific and time-series heterogeneity are likely to be important. Accordingly, the relationship between revenue and rate can be specified as follows:

$$ln(REVENUE_{it}) = b_o + b_1 RATE_{it} + b_2 RATE_{it}^2 + GYEAR_t + PPLACE_i + e_{it}, \qquad (2)$$

where *YEAR* is a vector of year dummy variables for 1991 through 2001 using 1990 as the omitted category, *PLACE* is a vector of community-specific dummy variables, and the error term is assumed to be normally distributed with mean zero. Under this specification, the *b* coefficient estimates provide a prediction of the impact of a 1% increase in *RATE* on *REVENUE* (in log form) holding the other variables constant.[11]

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[10] The results without these exclusions are essentially the same as those reported below.

[11] Notably there rate-revenue relationship may be endogenous if rates are increased (decreased) when revenues are low (high). Such endogeneity would cause the errors to be inconsistent. Lacking proper instruments, however, it is not possible to correct for such potential bias in the estimates.

The first set of estimates in Table 6 shows the results of the fixed effects (FE) OLS regression of equation (2). As expected, the positive coefficient on *RATE* and the negative coefficient on $RATE^2$ suggest that *REVENUE* increases with *RATE* but at a decreasing rate. A simulated increase in RATE from 1% to 2% would generate an increase in predicted REVENUE (in logs) of .52 (or about half a percent). The marginal increases in REVENUE associate with increase in RATE from 2-3%, 3-4%, and 4-5% are .42, .32, and .23, respectively. The R-squared is very high (.99) and the F-statistic suggests that we can reject the joint null hypothesis that all of the estimated estimates are zero.

The second set of estimates in Table 6 corresponds to the random effects (RE) GLS regression analogue of equation (2). Instead of estimating place-specific coefficients, Π, place-specific error components are specified such that $e_{it} = a_i + u_{it}$. The a_i terms are assumed to be randomly drawn from a known distribution (Gaussian, in this case) and independent of the other explanatory variables. Using the RE specification, the coefficient estimates of *RATE* and $RATE^2$ are very close in magnitude to the FE estimates and the impact estimates of simulated increases in RATE are nearly identical. According to the Hausman specification test, if the model is correctly specified and the explanatory variables are uncorrelated with the cross-sectional component of the error term (the a_is) then the coefficients estimated by both FE and RE estimators should not statistically differ.[12] Indeed, the null hypothesis that the FE and RE coefficient estimates are the same cannot be rejected. The RE estimator offers two advantages over the FE estimator--it produces more efficient standard errors and allows for the addition of time-invariant (fixed) factors in the model. Accordingly, we employ the RE technique for exploring the role of urban influence on the rate-revenue relationship.

The third set of results in Table 6 includes additional explanatory variables in the RE specification of equation (2). While the coefficients on *RATE* and $RATE^2$ are very similar to the previous estimates, the estimates of the additional coefficients are noteworthy. Accounting for whether a municipality is a county seat (via a dummy variable) is important given that the tax base composition is likely to differ considerably for communities that are county seats versus other communities. In particular, county seats are able to export a greater portion of their tax base to nonresidents. As expected, the estimates suggest that county seats have a considerably higher (3.32 percent) revenues on average compared with non-county seats. This makes sense due to the exportability of their tax bases to nonresidents and the likely larger populations. The estimated coefficient on the term interacting *RATE* with *COUNTY SEAT* (which is simply *RATE* times *COUNTY SEAT*) suggests that

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[12] Interpretation of the Hausman specification test for cross-section time series models are discussed in relation to the xtreg command in the Stata Reference Manual (StataCorp 1999).

county seats receive .06 percent less of a boost in revenues from a 1 percent increase in *RATE* compared with non-county seats. This follows since non-resident taxpayers are more able to avoid or minimize tax rate increases by shopping elsewhere compared with resident shoppers. An implication is that the revenue-rate curves will be higher but have flatter slope in county seat communities compared with non-county seats.

Table 6. Summary of Results (n*t=467*12, Dependent Variable = ln(REVENUES))

	Fixed Effects Regression			Random Effects GLS Regression					
Variable	Estimate	Std. Err.		Estimate	Std. Err.		Estimate	Std. Err.	
Constant	8.6480	0.0866	***	9.9500	0.1035	***	9.8024	0.1287	*
RATE	0.6688	0.0421	***	0.6879	0.0423	***	0.7422	0.0466	*
RATE²	-0.0493	0.0074	***	-0.0516	0.0075	***	-0.0558	0.0077	*
COUNTY SEAT							3.3264	0.1978	*
RATE*COUNTY SEAT							-0.0626	0.0282	*
AS_C Dummy							-0.2836	0.2197	
AS_N Dummy							-0.5271	0.1405	*
NA_T Dummy							-0.9270	0.1772	*
NA_R Dummy							-1.4605	0.3066	*
RATE*AS_C							-0.0048	0.0288	
RATE*AS_NC							-0.0628	0.0235	*
RATE*NA_T							0.0319	0.0323	
RATE*NA_R							-0.0929	0.0521	*
Year Dummies	yes			yes			yes		
PLACE Dummies	yes			re			re		
R-squared^	0.9899			0.1854			0.4695		
F-Value / P-val	1043.89	0							
Wald chi2 / P-val				4808.81	0		5222.87	0	

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.
^The random effects model generates R-squared equivalents, calculated as correlations squared in second round regressions. They do not share the properties of FE R-squareds and are not directly comparable. See Stata (1999 ,page 425) for details.

Aspects of urban influence are also pertinent to the rate-revenue relationship. A dummy variable is created for each of the relevant UI categories, MS, AS_C, AS_NC, NA_C, NA_T, and NA_R. Since only seven of the 40 places in the AS_C category are county seats, it is difficult to empirical identify it as a separate group when *COUNTY SEAT* is included in the analysis. Accordingly, the MS and AS_C categories are combined and designated as the omitted category. Each dummy variable is interacted with *RATE* to investigate the influence of urban influence on the tax rate-revenue relationship.

As shown in the third set of estimates in Table 6, all of the estimated coefficients on the UI dummies are negative, and all except the coefficient on AS_C are significant at the 1 percent level. This suggests that communities with less urban influence have lower LOST revenues on average compared with communities in metropolitan counties and those in nonmetropolitan counties with a city of at least 10,000 people. This is particularly true for towns and rural communities in counties that are not adjacent to metropolitan areas (NA_T and NA_R). As expected, towns on the urban fringe (AS_C and AS_T) have higher revenues on average compared with the less urban communities but less revenues than communities in metropolitan counties. These differences reflect the larger population density and retail market areas on the urban fringe.

To interpret the implications of urban influence on the rate-revenue relationship, it is necessary to consider the coefficients on the UI dummies as well as UI-RATE interaction terms. Figures 6 and 7 show the predicted revenues associated with simulated values for RATE and UI type for county seat and non-county seat communities, respectively. In both figures, the communities in more metropolitan counties have higher predicted revenue at all rates. The rate-revenue relationship appears to be more influenced by the city size in a county than by adjacency. Notably being in an adjacent community with a city of at least 10,000 (AS_C) is associated with higher predicted revenues compared with being in an adjacent community without such a city (AS_NC). Where as at a simulated rate of 5 percent communities in nonadjacent counties with a town (NA_T) have the same predicted revenue as communities in adjacent counties without a city (AS_NC). Communities in counties lacking a city or town (NA_R) clearly lag in terms of predicted revenues, probably due to lower population bases.

Table 7 shows the marginal predicted impacts associated with increasing rates by 1 percent for each of the UI types by county seat status. As expected given the estimated coefficients on *RATE* and $RATE^2$, the marginal impacts decline as rates are increased in all cases. The county seat communities have smaller predicted impacts associated with the simulated rate changes for all UI types. Again, the county seats serve a larger population of nonresidents who may be prompted to avoid higher LOST rates by shopping at home or somewhere else along the way home.

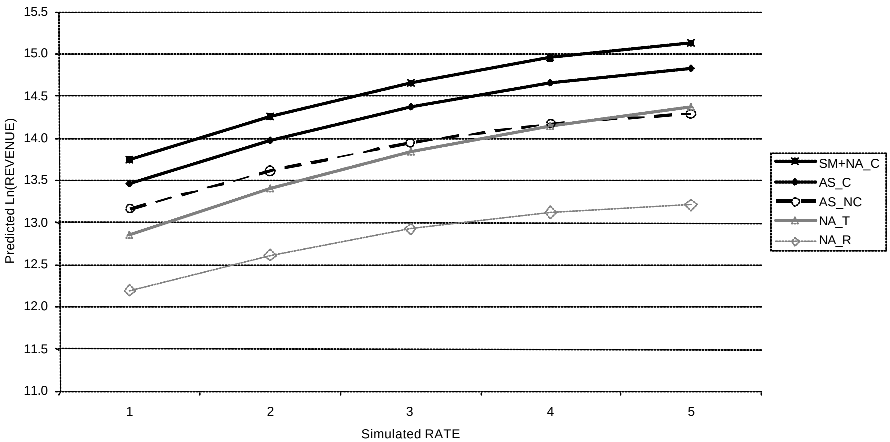

Figure 6. Predicted Revenues using Random Effects Results: County Seats

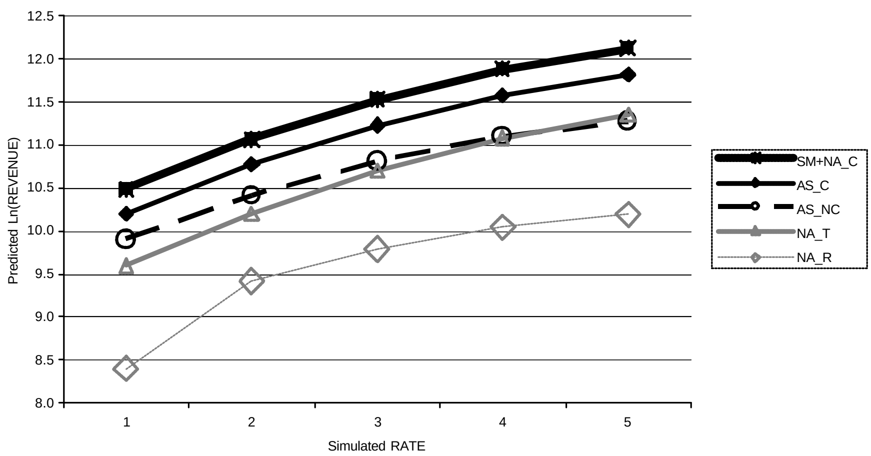

Figure 7. Predicted Revenues using Random Effects Results: Non-County Seats

The most striking differences in the simulated impacts across UI types occur when RATE is increased from 1 to 2 percent. The range of estimated impacts for county seat communities is from .41 to .51 percent. For the non-county seat communities the range is from .51 to 1.02 percent with the largest impact occurring for the least urban types, the nonadjacent counties without cities or towns (NA_R). The marginal impacts quickly dissipate as RATE is increased more, however. For the county seat counterparts, an increase in

RATE from 4 to 5 percent generates only a .08 percent increase in predicted revenues for the NA_R types.

Table 7. Predicted Marginal Impact of Increasing LOST *RATE*

	Marginal Impact by UI Type				
Simulated change in RATE	SM+NA_C	AS_C	AS_NC	NA_T	NA_R
County Seat Communities					
1% to 2%	0.5124	0.5076	0.4495	0.5443	0.4195
2% to 3%	0.4009	0.3960	0.3380	0.4328	0.3080
3% to 4%	0.2894	0.2845	0.2265	0.3213	0.1965
4% to 5%	0.1779	0.1730	0.1150	0.2098	0.0850
Other Communities					
1% to 2%	0.5749	0.5701	0.5121	0.6069	1.0221
2% to 3%	0.4635	0.4586	0.4006	0.4954	0.3706
3% to 4%	0.3519	0.3471	0.2891	0.3839	0.2591
4% to 5%	0.2404	0.2356	0.1776	0.2723	0.1475

The predicted marginal impacts for communities in counties having a city of at least 10,000 (MS+NA_C and AS_C) are very similar for both the county seat and non-county seat communities. These are larger compared with the predicted impacts for AS_NC types but smaller then those of the NA_T. Thus, the primacy of area is likely to determine the effectiveness of LOST policy in generating additional revenue sources. Towns without a functionally linked metropolitan area are more isolated than larger cities that are adjacent to metropolitan areas. Urban influence matters in the sense of what the competing influence is and not necessarily how large an area is in particular.

The analysis above does not investigate potentially important aspects of the data. First, observations are assumed to be independent across observations, which may not hold for cities that lie in the same county and are faced with essentially the same countywide shopping opportunities, and county tax rates, among other things. I investigated this issue by running the RE model using county-specific effects rather than city level. In general, the place-specific effects model performed superior. In the FE estimation, it would be desirable to correct for heterogeneity and dependence across the panels. Due to limited number of yearly observations relative to the number of communities, however, panel corrected standard errors estimation is not feasible. Serial autocorrelation could also be an issue. However, the investigation shows that the panel level effects accounted for most of the variation in the estimates as demonstrated by very high RHO values (which indicate the contribution of the panel variance to the overall variance). Coupled with a short time-period (only 12 years) relative to the cross section, time-series procedures are likely to have little import for the estimates presented in this analysis. Thus, despite these cautions, the basic influence of urban influence on LOST rates is likely to remain.

6. Conclusion

This research investigates LOST policy on the urban-rural nexus. It offers a unique investigation into LOST rates at the municipal level with particular attention paid to urban influence. FE with place-specific parameters and random effects GLS estimation techniques are employed on the panel of 467 communities from 1990 to 2001. While urban influence is not strongly related to LOST rates, it does appear to influence the relationship between LOST rates and revenues. In particular, places with little urban influence may have a greater ability to use LOST rate increases to generate additional revenues if current the RATE is very low (at 1 percent). On the other hand, if the RATE is already high (at 4 percent), then these same rural communities will generate very little extra revenue through a RATE increase. In terms of the urban-rural nexus, it appears that size of the cities within a county is more influential in determining impact differentials than is adjacency to metropolitan areas. Thus, within county urban influence is the pertinent factor. These results support the findings in the literature concerning the importance of tax rate differentials, agglomeration and regional market dominance on LOST policy effectiveness.

While the implications for LOST policymaking may not generalize to all other states, they are likely to be particularly applicable to states with similar LOST policy. In particular, states that allow some degree of self-determination of rates and have widespread adoption of LOSTs include Alabama, Alaska, Colorado, Louisiana, Missouri, Illinois, South Dakota, and Texas.[13] As in Oklahoma, very small communities in many of these states impose LOST rates. Accordingly, understanding the implications of urban influence on the ability to differentially set tax rates is a salient concern.

There has been considerable commentary regarding the future of the sales taxation. The consensus has been less robust growth in future compared with the past few decades (Brunori, 1998, Fox 1998). One reason for the poor prospects is the continued switch to service-oriented exchanges, which are typically not captured in LOST bases (Fox 1998). In addition, the proliferation of sales tax exemptions and state imposed limits on LOST structures will also decrease the tax base (Brunori 1998 and Fox 1998). Furthermore, the proliferation of electronic commerce may also reduce local government revenues (NCSL 1997). These dismal predictions about the sustainability of sales tax bases may be exacerbated by urban influence factors. Accordingly, such discussions reinforce the value of understanding factors that

[13] See Rogers (2002) Tables 1 and 2.

influence LOST policy effectiveness for governments on the rural-urban nexus.

There are many avenues for extensions of this work. The econometric approach could be extended to further exploit the panel structure of the data. Quasi-experimental control group methods could be explored. Future work could also include variables of tax rate differentials and market potential similar to previous research. Finally, a similar analysis could be conducted using LOST data from other states with similar LOST policies to test for robustness of the urban influence factors.

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