Changes in Oklahoma Municipal Government Costs from Industrial Development and Growth

Bulletin B-748 November 1979
AGRICULTURAL EXPERIMENT STATION • OKLAHOMA STATE UNIVERSITY

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The authors appreciate the assistance of Gerald Doeksen, Dr. Luther Tweeten, and Evan Drummond for their work and guidance during the research process as well as for the many helpful suggestions and insights they provided through review of the manuscript. Of course, the authors are solely responsible for the contents of this publication.

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Changes in Oklahoma Municipal Government Costs From Industrial Development and Growth

H. L. Goodwin and James R. Nelson*

Introduction

Many residents of rural communities see industrial development as a solution to problems of too few local jobs for young people and declining availability of local retail services. These people are willing to encourage industrial location in their communities. Others oppose manufacturing type employment coming to their town and bringing some of its associated "problems" (Green, et al.; Weber and Savage).

Research has been conducted to measure the attitudes of rural citizens toward industrial development. In a survey of Chamber of Commerce and women's club members, university students and other residents in a West Texas community, Green, et al. found that most of those surveyed approved of industrialization as a means of developing a more stable economic base.

Smith and Tweeten conducted a study to detect the feelings of rural Oklahomans concerning industrialization. Their results indicated that most rural Oklahoma residents believe new jobs would benefit their community, with 83 percent of those surveyed indicating that industrial development would be a desirable solution to their job scarcity dilemma. Nearly one-half said they would take an additional job if available to supplement their income, and commuting workers said they would drive up to 30 miles if jobs were available in that radius.

To counter the problem of economic decline of rural communities and loss of population to urban centers, major thrusts for rural-based industry were initiated in Oklahoma in the early 1960's. These efforts were not without success. Of the 468 new plants locating in Oklahoma in the period 1963-1971, 241 located in communities of less than 10,000. Data show that 13,711 new jobs, 47 percent of the total employment created by the 468 plants, were created in communities of this size. Existing plant expansions in rural communities accounted for an additional 5,904 jobs, 20 percent of the state's total expansion created jobs, bringing the total for all new rural manufacturing jobs to 19,615 (Childs and Doeksen).

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Research conducted with funds available under Title V of the Rural Development Act of 1972 and under Oklahoma Station Project No. 1626.

These rural jobs impacted on rural communities. Population in nonmetropolitan (Non Standard Metropolitan Statistical Area - Non-SMSA) Oklahoma increased by 6.6 percent over the five year period of July 1, 1970 to July 1, 1975, compared with 4.1 percent growth in metropolitan Oklahoma over the same five years. Forty-five nonmetropolitan Oklahoma counties experienced net in-migration (Lage, et al.).

New industry can benefit a community by causing new employment and higher incomes and by creating new and better business services. But the influx of population and industry may pose serious problems for the public sectors (municipal governments) in growing communities. Rapid influxes of population and development can potentially strain the fiscal situations of small communities by causing increased demands on public services where there may be inadequate tax base to support them, particularly if tax concessions have been made to attract industry.

The burden of deciding whether to encourage continued development of manufacturing based employment falls directly upon the leaders of a community. More often than not, these leaders must make decisions based on, at best, rough estimates of the public and private impacts of new industry on their community. Leaders of many small communities have neither the information nor the expertise to ascertain the effects of industrial development on the cost structure of service provision in their towns. Extension and substate planning district personnel, both of which work closely with small town leaders, convey that what these decision makers really want to know is, "What will the prospective industry cost the municipal government in terms of direct or primary costs in dollars?"

Direct dollar costs of service provision are readily understood by both local government decision makers and general citizens. Such information can be useful as evaluations are conducted of future maintenance and operation costs, and possible expansion or construction of new community facilities.

Objectives

The primary objective of this study was to develop a means useful to rural development professionals[1] working with leaders of communities in Oklahoma with populations under 10,000 in determining the effects on community expenditures of industrial development. This objective was accomplished by the development and testing of econometric models, using economic and demographic data for various non-SMSA communities with populations of 1,000 to 10,000, to explain public costs of community services. Specifically, the research involved:

1. Development and testing of general econometric models relating total operation and maintenance costs of municipal governments to economic and demographic characteristics of small rural Oklahoma towns.
2. Development and testing of models for identifying operation and maintenance costs associated with specific types of community services based on local economic and demographic characteristics.
3. Development and testing of models relating total operation and maintenance costs of municipal governments to particular types of local industrial development.

[1]Extension personnel, multi-county planning district staff and other public agency personnel concerned with economic development of rural Oklahoma communities.

Study Area

The study area considered in this research consists of all of rural Oklahoma. U.S. Highway 81 was arbitrarily chosen to divide Oklahoma into two regions, as it cuts the state approximately in half from north to south. Certain characteristics of the state indicate that this highway is an important dividing line. Elevation in Oklahoma increases from the southeast to the northwest, rising from 500 feet in the extreme southeastern corner of Oklahoma to 5,000 feet in the Panhandle. Average rainfall amounts vary by more than 40 inches. The Ouachita Mountain Region (southeast) receives nearly 60 inches per year while certain areas of the Panhandle receive only 15 inches annually. In general, it can be said that the portion of Oklahoma west of Highway 81 averages 20 inches of rain or less per year and the portion east of it averages from 30-50 inches per year. The topography of the two regions is also varied. With only a few exceptions, western Oklahoma is characterized by low rolling hills to flat, upland prairies. In the eastern part of the state, however, the face of the land varies from the flood plains of numerous creeks and rivers to prairie to hilly, wooded, near mountainous regions of the Ozark, Ouachita and Arbuckle areas.

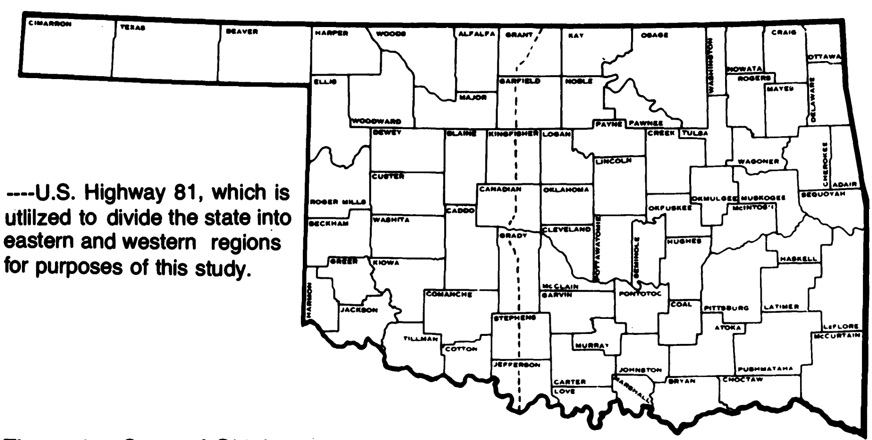

Figure 1. State of Oklahoma

Eighty Oklahoma communities were selected for analysis in this research. None of the communities were in Standard Metropolitan Statistical Areas (SMSA's). SMSA communities were excluded from consideration for a number of reasons. Substantial structural differences exist between the economies of SMSA and non-SMSA communities. Many municipalities which are located in metropolitan areas are "bedroom communities" for commuters working elsewhere in the SMSA. Many supportive industries, industries which produce materials for other nearby manufacturing firms, locate in SMSA communities. Relatively small towns located within SMSA's may offer small supportive industries advantages of relatively inexpensive land, taxes and labor with close proximity to markets (larger SMSA manufacturers). Another factor justifying the exclusion of SMSA communities from this study is their dependency, in many instances, on the larger cities for community services. Water, sewer and sanitation are often services which are provided, for a fee, to smaller communities by large ones.

As of July 1, 1975, there were 176 communities in Oklahoma with populations of 1,000-10,000. Fifty-eight of these communities were within the boundaries of one of the four Oklahoma SMSA's and were therefore eliminated from inclusion in the sample. An additional 16 communities had incomplete expenditure data (costs of services) so they were also excluded. Twenty-two other communities reported no manufacturing employment. These 22 communities were omitted from the sample because the primary objective of this study is to determine the effects of rural industrialization on costs of community service provision.

The Models

For purposes of this study, community service costs were functionally specified as follows:

$$CS = f(P, Y, M, LD),$$

where CS = Municipal government operation and maintenance costs, including labor, of community service provision,
P = Population of the community,
Y = Per capita income in the community,
M = Total manufacturing based employment in the community, and
LD = Location dummy to identify whether the community is in eastern Oklahoma or western Oklahoma.

Additional models to describe effects of individual services and manufacturing types on costs of services can be formulated as follows:

$$CS_i = f(P, Y, M, LD),$$

where CS_i = Municipal government operation and maintenance costs of provision of a specific community service
i = Community service type,
P = Population of the community,
Y = Per capita income in the community,
M = Total manufacturing based employment in the community, and,
LD = Location dummy to identify whether the community is in eastern Oklahoma or western Oklahoma;

and:

$$CS = f(P, Y, M_j, LD),$$

where CS = Municipal government operation and maintenance costs of community service provision,
P = Population of the community,
Y = Per capita income in the community,
M_j = Total employment of a specific type of industry,
j = Industry type, and
LD = Location dummy to identify whether the community is in eastern Oklahoma or western Oklahoma

The Variables

Each independent variable included in the above specified basic models is discussed below. Discussion centers around the expected influence of independent variables on the dependent variable, based on economic theory.

Population

Applying basic supply-demand theory, it can be seen that an increase in a community's population would cause an upward shift in total demand for costs of services. The increased demand must be met by an increase in the total level of services supplied if the current level of community services per capita is to be maintained. As a community strives to meet this increased demand, total costs will increase.

One would expect the independent variable, population, to have a substantial effect on the dependent variable, "cost of service." A positive coefficient is expected to appear for the population variable, as increases in population cause increases in total costs of services.

Per Capita Income

The expected effects of community per capita income on total costs of community services can also be explained by supply-demand theory. Increases in per capita incomes imply higher standards of living. Acquisition of appliances such as dishwashers and washing machines increase the strain on water and sewer systems. Wealthier citizens desire higher quality police and fire protection. Better streets are desired to improve the appearance and comfort of the city traffic-ways. Improved parks for recreation are desired. All these things cause increases in demand for community service provision. Assuming services are improved or increased to meet increased demands, changes in total community service costs will be positively correlated with per capita income.

Manufacturing Employment

Effects on costs of services from manufacturing stem from three basic sources. The industry itself demands services. New residents brought into the community by the industry cause more services to be consumed. Additionally, commuting workers affect service use.

As before, the supply-demand framework can be used to predict the algebraic sign of the coefficient of the manufacturing employment variable. Bearing in mind the relationships of new industry, new residents and commuting workers, the coefficient should be positive, with increases in any of these three factors causing an increase in service demand, and therefore, an increase in total operation and maintenance costs of service provision.

Location Dummy

This variable was included due to the possible effects of community location in Oklahoma on costs of services. Substantial differences exist in the economic, demographic and physical characteristics of the eastern and western parts of Oklahoma.

Water and sewer services were expected to have lower operation and maintenance costs in water-rich eastern Oklahoma than in the more arid western region. Sanitation service costs were expected to be less in western Oklahoma due largely to topographical characteristics which make operation and maintenance of land fills less expensive in that part of the state. Street maintenance was also expected to be less costly in the west, due again to topography and also to the drier weather. Police protection costs were anticipated to be lower in the west because of sociodemographic and cultural differences between the two areas of the state. The eastern part has a higher incidence of poverty and minority groups as well as more densely populated land area, factors which generally contribute to the need for more law enforcement personnel.

The authors had no expectations concerning the relationships between costs for fire protection, parks and recreation and general administration, respectively, and community location. It is not clear how costs of these community services should relate to community location, if they relate at all.

Data

An effort was made to estimate both the general models specified above and also selected sub-models based on these general models, from 1975 data. As is often the case in socioeconomic research, reality does not conform to the ideal circumstances set forth in the initial structuring of the research. Some of the data needs specified could not be perfectly satisfied, so it was necessary to seek next best alternatives.

Population

All population data were obtained from U.S. Bureau of Census sources. Population figures for 1975 were taken from a supplemental census publication, *Current Population Reports, Population Estimates and Projections* (U.S. Bureau of Census, 1975). These figures were estimates based on net migration, tax returns, school enrollment and licensing of automobiles. Further details on the exact methodology used to derive the population estimates employed for analysis may be obtained by referring to the aforementioned publication.

Per Capita Income

Per capita incomes for the 80 sample communities are available from U.S. Bureau of Census (1975) publications. The same data source used for population, *Current Population Reports, Population Estimates and Projections* (U.S. Bureau of Census, 1975), provided the necessary per capita income figures for the analysis of the models using 1975 data for other independent variables. Per capita income information for all 80 sample communities found in the latter publication was based on Internal Revenue Service tax return forms of 1973 and 1974. This allowed all observations to be included in the emperical analysis of the general models.

Manufacturing Employment

Data on manufacturing employment are available, as needed, for 1975. Such data were obtained from the Oklahoma Industrial Development and Parks Department's *Directory of Manufacturers and Products.* The directory divides industries into 19 broad categories based on two-digit SIC codes, with very specific four-digit codes dividing manufacturers by product produced. For each industry in each community in Oklahoma which has any manufacturing-based employment, a complete listing including names of companies, managers, numbers of employees (temporary and permanent), and products produced can be found. Information on manufacturing employment in the study area communities was aggregated into seven categories as follows:

M1 = Petroleum - SIC 13 and 29

M2 = Foods - SIC 20

M3 = Textiles - SIC 22 and 23

M4 = Wood and Wood Products - SIC 24, 25 and 26
M5 = Miscellaneous Light Industry - SIC 27, 31, 38 and 39
M6 = Metals and Metal Works - SIC 33, 34, 35, 36 and 37
M7 = Chemicals, Glass and Cement - SIC 28 and 32

Location

Communities located on or east of Higway 81 were assigned a location dummy variable (LD) value of zero. Communities west of Highway 81 were assigned a location dummy variable value of one.

Cost of Services

Oklahoma state law requires each municipality with total expenditures in excess of $12,000 to file an approved audit with the Oklahoma Equalization Board. This information facilitated the collection of fiscal year 1975-76 costs of services data for each of the communities studied. Community expenditures on services were categorized as follows:

CS1. Water and Sewer
CS2. Sanitation
CS3. Streets
CS4. Police Protection
CS5. Fire Protection
CS6. Parks and Recreation
CS7. General Administration

The cost data includes payments for personnel and maintenance and operation for each of the public services provided and for the general administrative costs of local government. The various service categories differ due to community size, accounting procedures, or the existence of a municipal authority which administers a part of the services provided. In the latter instance, no expenditures were recorded. Sinking funds or specially created funds also do not appear in the expenditure figures. Water and sewer system cost observations were the most inconsistent, with this service being provided by an authority of some nature in 40 of the 80 communities. This problem was handled by a dummy variable which was assigned a value of one for municipalities providing water and sewer services and a value of zero for communities having private water and sewer authorities.

The accounting systems for most municipalities are different from those of private firms. Most cities and towns use the fund system of accounting, often showing expenditures for individual services from two or more funds. Capital outlay for equipment, buildings and the like are not amortized over the life of the purchase but shown as an expenditure only in the year of purchase. Depreciation is seldom shown as a cost. Interest paid is seldom separated from principle payments. As a result, services costs considered in this study include only those costs incurred in the operation and maintenance of providing the services.

Revenue sharing funds are included in the costs of services for each community which actually received such funds and used them for non-capital expenditures. Records of expenditures from revenue sharing were handled in several fashions. In some cases, a breakdown of these expenditures by use (labor, operation and maintenance, capital outlay) for each service was reported. In such cases, expenditures, excluding capital outlays, were attributed to the respective service. In other cases, total revenue sharing expenditures were reported by use. Revenue sharing data for these communities were included in "total costs of services," again excluding capital outlays. In still other instances, only a lump sum figure was recorded for revenue sharing expenditures. For these observations, the entire amount was attributed to "costs of services." The small number of communities reporting in this fashion and the nature of expenditures of revenue sharing funds in other communities (largely spent on operation and maintenance) warranted handling the data in this manner.

Empirical Results

In searching for the specific models which serve best as estimators, 190 different regression model formulations were created and tested. The estimation procedure selected for analysis of each model was the Statistical Analysis System (SAS) computer routine developed by Barr and Goodnight. Statistical summaries of 72 of the models tested are presented in Appendix A.

On the basis of theoretical considerations and results of empirical testing, the following three basic models of community service costs were selected for discussion:

I. CS = f(P, Y, M, LD)
II. CS = f(P, Y, M)
III. CS = f(P)

where CS = annual municipal government operation and maintenance cost of community service provision,

P = population of the community,

Y = per capita income in the community,

M = total manufacturing based employment in the community, and

LD = locational dummy. LD = 1 if the community lies west of U.S. Highway 81; LD = 0 if the community lies east of U.S. Highway 81.

Complementary to these basic models are other models with somewhat different structures. Narratives relating to these model variations and their results will be contained within the sections corresponding to their related equations.

Results of Aggregate Models

The application of basic model I (above) and of two variations of basic model I to data from the study yielded the results shown for equation (1a) in Table 1. Equation (1b) in Table 1 is the logarithmic form of model I. Equation (1c) in Table I is a linear equation of Model I with the addition of a dummy variable (WDUM) to account for the fact that water and sewer service in some communities is provided by authorities (WDUM = 0), while in other communities such service is provided by local government (WDUM = 1).

The R^2-values of .89, .82 and .91 for equations (1a), (1b) and (1c), respectively, indicate that substantial portions of the variation about the mean are explained by the models as specified.

The intercept term, as well as all explanatory variable coefficients were significant at the .25 level or better in two of the three models, the logarithmic form (1b) being the exception. Coefficients of the variables population, per capita income and manufacturing employment variables were consistent with theoretical expectations, all three having positive signs, which would indicate that increases in population, per capita

Table 1. Summary of Equations for Aggregate Models Of Community Service Costs for Rural Oklahoma Communities[a]

Equation	Intercept ($)	P^c ($)	Y^d ($)	M^e ($)	LD^f ($)	$WDUM^g$ ($)	R^2
(1a)	-276354.41	113.41	74.66	65.02	-39480.72		.89
	(.0001)	(.0001)	(.0001)	(.2485)	(.1296)		
(1b)[b]	-5.0191	1.20	.98	.01	-.09		.82
	(.0115)	(.0001)	(.0002)	(.8171)	(.4057)		
(1c)	-252223.07	112.01	54.76	68.20	-26815.19	89878.82	.91
	(.0001)	(.0001)	(.0018)	(.1769)	(.2583)	(.0001)	
(2a)	-262192.24	112.44	67.11	78.02			.89
	(.0001)	(.0001)	(.0002)	(.1657)			
(2b)[b]	-4.5736	1.20	.92	.02			.82
	(.0162)	(.0001)	(.0003)	(.6686)			
(2c)	-241949.36	111.32	49.04	77.72		92998.75	.91
	(.0001)	(.0001)	(.0033)	(.1247)		(.0001)	
(3a)	-40540.64	121.40					.86
	(.0682)	(.0001)					
(3b)[b]	2.1802	1.30					.78
	(.0007)	(.0001)					
(3c)	-85899.81	118.77				108319.30	.90
	(.0001)	(.0001)				(.0001)	

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" values.
[b]Logarithmic form of equation.
[c]Population.
[d]Per capita income.
[e]Total manufacturing employment.
[f]Location dummy. "1" if community is west of U.S. Highway 81, "0" if community is on or east of U. S. Highway 81.
[g]Water dummy. "1" if municipally operated water and sewer service, "0" if privately operated.

income and manufacturing employment result in increases in total operation and maintenance costs of service provision. The location dummy had a negative sign in all three instances. This indicates that Oklahoma communities west of U.S. Highway 81 have lower annual service provision costs than communities east of U.S. Highway 81.

Based on equation (1a), each additional person becoming a part of a community will increase expected annual total service costs by $113.40. Each dollar increase in per capita income results in a $74.66 increase in total costs per year, while each additional manufacturing job increases total costs by $65.02 per year. Location of the community in western Oklahoma decreases total costs by an average of $39,480.72 per year.

The logarithmic model (1b) failed to improve on the linear model (1a). Significance levels of the manufacturing employment and location dummy variables were lowered to a level below acceptance.

It was hypothesized that a difference would exist in community service expenditures for communities in which the municipal government provided water and sewer services and those in which a private authority provided them. Model (1c), which includes the dummy variable WDUM, facilitates the testing of this hypothesis. Significance levels of better than .30 for all variables and the intercept term were maintained. It is important to note that the "water dummy" tested significant to the .0001 level. This, coupled with the improved R^2-value of equation (1c), lends support to the inclusion of the "water dummy" in the analysis. This equation yields annual effects on costs by each variable similar to those of equation (1a). Based on equation (1c) it would be expected that a new community resident increases community service costs by $112.01, each one dollar increase in per capita income increases community service costs by $54.76, and each new manufacturing job increases community service costs by $68.20. A $26,815.19 reduction in costs results if the community is west of U.S. Highway 81. The expected effect on community service costs is an $89,878.83 increase if the municipal government provides water and sewer services.

The second basic model to be tested involved the use of only population, per capita income and manufacturing employment as independent variables in estimating total costs of service for the communities (basic model II). This model yielded equations (2a), (2b) and (2c) in Table 1.

The R^2-values for these equations are .89, .82 and .91, respectively. Once again a relatively high amount of the variation about the mean is explained by the selected independent variables. Virtually no difference in R^2-values resulted from omitting location as a factor in the analysis.

The independent variables employed in equation (2a), (2b) and (2c) were significant at a level better than .20 for all variables except the manufacturing variable in the log-form equation. The intercept, population and per capita income coefficients were significant at the .003 level or better in all equations. Coefficients of the explanatory terms were consistent with theoretical expectations in that all terms are positively correlated with costs of services, increases in any of the terms resulting in an increase in the dependent variable.

In equation (2a), effects of population, per capita income and manufacturing employment can be seen to be similar to those in equation (1a). Based on equation (2a), each additional person in a community increases operation and maintenance costs for community services by $112.44. An increase in per capita income of one dollar raises community service costs by $67.11, while each manufacturing job added will increase such costs by $78.02.

The logarithmic form of basic model II (equation 2b) does not yield results as reliable as the linear forms. The coefficient of the manufacturing variable is not significant. Coefficients for the intercept, population and per capita income terms are significant, but the R^2 -value is relatively low.

Equation (2c), including the water dummy, shows population to cause an annual increase in costs of $111.32 per person. Per capita income, on a per dollar basis, raises costs by $49.04 per year. Addition of each manufacturing job adds $77.72 to total annual expenditures by the municipal government for service provision. The presence of a municipally operated water and sewer system increases costs by $92,998.75 annually, an amount differing by about $3,000 from that indicated in equation (1c).

The third of the basic models uses population as the primary explanatory variable (Table I). The linear (3a) and logarithmic (3b) forms of this model yielded R^2 -values of .86 and .78, respectively. Equation (3c), including both population and the water dummy as independent variables, yielded an R^2 -value of .90. Positive correlation again existed between the independent and dependent variables. Population is a major determinant in predicting community service expenditures of municipal governments, an implication that is logical in view of the population oriented nature of community services themselves.

Results of Service Models

A major fiscal concern of leaders of rural municipalities is *total* operation and maintenance costs incurred in the provision of public services to the residents of the community, and rightly so. Provision of services accounts for the majority of a municipal government's annual expenditures. While total costs of service provision draw the most attention from rural leaders, information about expected changes in individual service costs as other factors in the community change would be useful to them. Due to the diverse nature of individual community services (sanitation is necessarily very different in nature from fire protection) it was hypothesized that there might be discernable differences in the ways that costs of the seven different types of community services considered are affected by community characteristics. To test this hypothesis, several models were developed to explain the costs of providing these specific services.

Two basic model formulations were selected for empirical analysis of industrial service costs. They were of the forms:

IV. $CS_i = f(P, Y, M, LD)$

V. $CS_i = f(P)$

Results of applying these two models to data gathered on costs of specific services for study area communities are shown in Table 2. All communities surveyed did not report costs for each of the services considered. The number of observations available for analysis of each service type are designated in the table. Specific service models based on model (IV) are labeled as models (4a), (4b), (4c), (4d), (4e), (4f) and (4g). Specific service models based on basic model (V) are labeled as models (5a), (5b), (5c), (5d), (5e), (5f) and (5g). For each of the types of community service considered, the model including population as the only variable explains almost as much variation in service costs as the model with more independent variables. And, in most cases, independent variables other than population are not significant. There are some notable exceptions to this, however.

Per capita income is a relatively significant variable for explaining water and sewer costs, street costs, parks and recreation costs and general administration costs (Table 2). Regression coefficients are positive in each of these cases. This implies that residents of wealthier communities are more desirous of quality water and sewer services, better streets, more and better parks and recreational facilities and more and better governmental administrative talent.

Table 2. Summary Of Equations For Services Models Of Community Service Costs For Rural Oklahoma Communities[a]

Model	Dependent Variable	Number of Observations	Intercept	P^b	Y^c	M^d	LD^e	R^2
(4a)	Water and Sewer Costs	40	-92171.88 (.1584)	29.1869 (.0002)	23.7618 (.2044)	19.228 (.7640)	1314.82 (.6177)	.58
(5a)	Water and Sewer Costs	40	-10438.50 (.6008)	32.0628 (.0001)				.55
(4b)	Sanitation Costs	48	10532.94 (.5216)	13.3958 (.0001)	-3.9224 (.5529)	-4.6404 (.8108)	5103.11 (.5766)	.61
(5b)	Sanitation Costs	48	903.74 (.8903)	12.8151 (.0001)				.60
(4c)	Street Costs	62	-34783.00 1(.1081)	12.0962 (.0001)	12.6207 (.0493)	28.0497 (.1816)	-14436.87 (.1042)	.61
(5c)	Street Costs	62	3879.00 (.5873)	14.5417 (.0001)				.56
(4d)	Police Protection Costs	62	-7645.75 (.6063)	18.4524 (.0001)	.8325 (.8475)	3.4769 (.8037)	-1745.42 (.7698)	.84
(5d)	Police Protection Costs	62	-5154.22 (.2628)	18.6763 (.0001)				.84
(4e)	Fire Protection Costs	62	-29398.45 (.0218)	15.8089 (.0001)	2.6332 (.4732)	-.4109 (.9722)	-6697.16 (.1870)	.84

Table 2 (Continued)

Model	Dependent Variable	Number of Observations	Intercept	P^b	Y^c	M^d	LD^e	R^2
(5e)	Fire Protection Costs	62	-21456.32 (.0001)	15.6504 (.0001)				.83
(4f)	Parks and Recreation Costs	49	-28087.95 (.0277)	6.5932 (.0001)	5.5523 (.1108)	-4.2829 (.7024)	-164.21 (.9702)	.59
(5f)	Parks and Recreation Costs	49	-8414.14 (.0277)	6.3821 (.0001)				.56
(4g)	General Administration Costs	62	-40375.05 (.2981)	18.726 (.0001)	16.930 (.1406)	6.7172 (.8551)	1972.26 (.8999)	.49
(5g)	General Administration Costs	62	14806.41 (.2360)	20.440 (.0001)				.46

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" values.
[b]Population.
[c]Per capita income.
[d]Total manufacturing employment.
[e]Location dummy. "1" if community is west of U.S. Highway 81, "0" if community is on or east of U.S. Highway 81.

Manufacturing employment has a positive and significant relationship to costs of street maintenance (Table 2). This is probably due to the fact that manufacturing industries often locate in industrial parks or other designated areas of communities with special access roads which can serve industry. For a rural community, the maintenance of roadways in such an industrial area can make up a substantial portion of the community's budgeted expenditures for streets.

The location dummy variable exhibited negative and fairly significant coefficients in the equations relating to street costs and fire protection costs. These coefficients indicate that such costs tend to be lower in western Oklahoma communities than in comparably sized eastern Oklahoma communities. An obvious explanation for lower street maintenance in the western part of the state is the drier weather common to that region. Extended periods of wet winter weather, characteristic of eastern Oklahoma, can leave streets in conditions of substantial disrepair. The explanations for the lower fire protection costs indicated in western Oklahoma are that the area has a much higher proportion of cultivated land and much lower population density. Cultivated land does not burn easily, and people cause fires.

Results of Industry Models

Many diverse types of manufacturing plants exist within the sample communities identified in this study. These manufacturing plants, different as they are, demand different types and levels of community services. For example, a food processing plant has a different demand for community services than does a shirt factory or a pipe casting plant. In order to test the hypothesis that individual industry types actually cause total service expenditures to react differently, a basic model was specified, as follows:

VI. $CS = f(P, Y, M_j, LD)$

Each of the seven industrial groupings specified earlier was analyzed under the framework of the above model. Simple least squares regression again served as the method of econometric analysis. Summaries of the analyses are shown in Table 3.

Regression results indicate that for only two of the seven types of manufacturing considered are the coefficients of change in community service costs even marginally significant. The coefficient for the food products manufacturing employment variable in equation (6b) is significant at better than the .30 level (Table 3). This coefficient indicates that total annual municipal costs of community services can be expected to increase by $526.18 for every new employee in the food products manufacturing sector. This estimated change in total annual service costs per new food products employee is substantially greater than the $70 change estimated for manufacturing employees in general (Table 1.) The large difference in estimated costs is likely to be due to the fact that food products manufacturers tend to be very high users of water and sewer services.

The coefficient for miscellaneous light industry manufacturing employment in model (6e) also tests to be somewhat significant. However, the coefficient is negative. As estimated, this coefficient implies that total community service costs decline as the number of employees working in miscellaneous light industries increase. Such an occurrence is not consisent with the authors' theoretical expectations. They feel that in this case, rejection of the null hypothesis would constitute a type I error.

Economies of Size

An effort was made to detect the existence of economies or diseconomies of size in community service provision. Logarithmic models (Table I and Appendix A) and per

Table 3. Summary Of Equations For Industry Type Models Of Community Service Costs For Rural Oklahoma Communities[a]

Model	Number of Observations	Intercept	P[b]	Y[c]	M[d]	LD[e]	R^2
(6a)	20	-397433.83	137.0414	85.6932	422.8267	12343.21	.92
		(.0407)	(.0001)	(.1045)	(.3516)	(.8427)	
(6b)	42	-375105.42	115.7715	109.677	526.1823	09042.14	.88
		(.0043)	(.0001)	(.0026)	(.2876)	(.0266)	
(6c)	31	-368912.49	115.4386	105.1311	90.2143	-65523.88	.89
		(.0067)	(.0001)	(.0113)	(.4769)	(.1841)	
(6d)	20	-161817.58	105.8147	51.4107	-54.979	26667.31	.95
		(.1390)	(.0001)	(.1190)	(.4860)	(.6199)	
(6e)	73	-257481.74	121.1246	69.6369	-481.684	40941.49	.89
		(.0003)	(.0001)	(.0007)	(.2314)	(.1483)	
(6f)	50	-312031.02	116.9054	85.4862	73.4144	-47961.65	.86
		(.0071)	(.0001)	(.0104)	(.6675)	(.2773)	
(6g)	48	-323022.22	118.4469	85.181	351.3605	-55481.25	.88
		(.0032)	(.0001)	(.0032)	(.4229)	(.1336)	

[a]Numbers appearing in parentheses represent the observed significance levels of the variables as determined by the "student-t" values.
[b]Population.
[c]Per capita income.
[d]Manufacturing employment by industry type as follows:
Model 6a. M = Manufacturing employment, petroleum.
Model 6b. M = Manufacturing employment, food products.
Model 6c. M = Manufacturing employment, textiles.
Model 6d. M = Manufacturing employment, wood and wood products.
Model 6e. M = Manufacturing employment, miscellaneous light industry.
Model 6f. M = Manufacturing employment, metals and metal works.
Model 6g. M = Manufacturing employment, chemicals, glass, and cement.
[e]Location dummy. "1" is community if west of U.S. Highway 81, "0" if community is east of U.S. Highway 81.

capita cost models (Appendix A) were empirically tested in the aggregate and by service and industry type. Signs on the coefficients of both the logarithmic and per capita models indicate diseconomies of size may exist with respect to the independent variables of population and per capita income.[2] However, regression coefficients were not generally significant and the R^2-values of the equations were very low.

Summary

The primary objective of this study was to develop a means useful to rural development professionals working with leaders of rural communities in Oklahoma with populations under 10,000 in determining the effects on community expenditures of industrial development.

Specific objectives of the research reported herein were:

1. Development and testing of general econometric models relating total operation and maintenance costs of municipal governments to economic and demographic characteristics of small rural Oklahoma towns.
2. Development and testing of models for identifying operation and maintenance costs associated with specific types of community services based on local economic and demographic characteristics.
3. Development and testing of models relating total operation and maintenance costs of municipal governments to particular types of local industrial development.

Summary of Aggregate Model Results

Numerous aggregate models were formulated to achieve the first of the three specific objectives. Nine of these models were discussed and summarized in this report. Of these nine, three are felt to serve best as predictive tools for use by various municipalities under 10,000 population in Oklahoma. Population, per capita income, manufacturing employment and location variables are included in these models along with a water system variable to account for the fact that local government provides water and sewer services in some communities while private authorities provide them in others.

The first of the three aggregate models, which involves the use of all the variables previously mentioned, tested quite well statistically, with an R^2-value of .91 and significance levels equal to or better than .25 for all terms involved. Increases in operation and maintenance costs to municipalities for provision of services were shown to result from increases in population, income and manufacturing employment. The location coefficient indicated that municipalities west of U.S. Highway 81 could expect costs to be less than those east of this line.

The second of the three aggregate models thought to be especially significant did not consider the community's location as a factor in cost determination. Despite the exclusion of the location dummy, the fit of the estimated regression line was not noticeably affected. (R^2-value is .91 for both when rounded to two digits.) Significance levels for the intercept and independent variables remained at virtually the same levels (better than .20 for all terms), with the intercept, population and per capita income

[2] Diseconomies of size for community service provision for small towns (populations from 1,000 to 10,000) can be explained by the fact that more complete and more sophisticated services tend to be provided in the larger of these towns than in the smaller. Fire departments in Oklahoma towns of near 1,000 population tend to be operated by volunteers. Fire departments in Oklahoma communities of near 10,000 population tend to be professionally staffed. Similar relationships exist for other types of services. There is evidence that economies of size in community service provision exist for much larger communities (Morris).

terms being significant to the .003 level or better. Increases in costs of service provision were shown to result from per unit increases in population, average per capita income and manufacturing employment. These relationships are similar to those indicated by the first aggregate model tested.

The third basic model was constructed to test the capability of population to explain community service costs. This simple formulation resulted in a highly significant population coefficient and an equation with an R^2-value of .90.

Summary of Service and Industry Model Results

Population is the only variable considered which was consistently significant in explaining costs of specific services. Per capita income is a relatively significant variable for explaining water and sewer costs, street costs, parks and recreation costs and general administration costs. Manufacturing employment was estimated to have a positive and somewhat significant relationship to costs of street maintenance. Coefficients of location indicated that street maintenance and fire protection costs tend to be lower in western Oklahoma than in eastern Oklahoma.

Regression results were inconclusive in suggesting different costs of community services associated with employment in different industry types. Only for food products and manufacturing was a reasonable and somewhat significant coefficient of community service costs estimated. The relatively large value of this coefficeint does suggest, however, that community service costs per employee are substantially greater for food products manufacturing than for manufacturing in general.

Implications

Models used to test certain hypotheses of rural industrialization's effect on the cost of community service provision incurred by municipal governments have been presented. Results have been presented both in detailed and in summarized forms. The implications of this research for policy and for further research are discussed below.

Implications for Policy

As was previously stated, the prime objective of this study was to develop a means useful to rural development professionals and leaders of rural communities that would enable them to more accurately estimate the effects of rural industrialization on service provision costs. The coefficients developed in this study represent estimates of changes in total service provision costs associated with unit changes in community population, per capita income and manufacturing employment. Application of these models to specific community situations could result in the formation of definite community policies on industrialization.

Great care should be exercised in deriving general policies for all rural communities based on this research. Each community is unique. The set of circumstances which will determine the impacts resulting from rural industrialization are different for each. By acting from a well informed position based on close scrutiny of the municipality's situation, citizens, as well as decision-makers, can influence the direction their community will take with regard to economic development. Trade-offs between effects of industrial development and quality of life can be considered.

More directly related to this study, community leaders can weigh the alternatives of increased levels of services demanded against needed increases in fees or taxes to support these services. Guidelines may also be set concerning the amount of industry a particular community may wish to attract. These types of decisions could affect the actual fiscal structure of a rural municipality. As a matter of course, budgets must be created at the beginning of each fiscal year. By use of aggregate model (1c), a community anticipating the location of a plant which would raise per capita income $10, employ 100 persons and attract an additional 200 persons as a result of families and other spin-off jobs, could expect expenditures for operation and maintenance of service provision to increase $20,970 per year, on the average. Using this as a starting point, leaders of a community can consider several alternatives: 1) Can the municipal government absorb an increase in budget of this nature by relying on increases in revenues or by budget realignment in other areas of government? 2) If it is apparent that they cannot, would it be better to raise taxes or cut back services? 3) If they decide to do neither, can bonds be floated to take care of increased yearly expenditures? 4) Are present service provision systems operating at full capacity? 5) If so, what will it cost in terms of capital outlay to improve systems in order to handle the increased demands placed upon them as a result of the industrial location?

Implications for Research

The development of a reliable and economically sound model for the estimation of overall effects to all sectors of a community resulting from rural industrialization would be of great value. One potential use of this study by other researchers would be to incorporate findings herein into broader analyses to estimate the total impacts of rural industrialization on communities. The depth with which this study handles costs could enhance the ability of other models to give an accurate and reliable account of overall community situations. The combination of private sector oriented input-output and multiplier type analyses with this regression-based analysis could yield results with widespread applicability to rural communities.

This study could serve as a basis for further research into fiscal structuring of rural municipalities. There is a possibility of improving both the accounting systems and the overall service efficiency of municipal governments by using the specific cost information offered herein to develop techniques municipal officials could apply to local situations. With more data (particularly on capital expenditures) and more observations (perhaps of the time-series nature) greater insight into identifying the actual cost functions of municipal governments could be gained from employing the same type of regression procedure used in this study.

Limitations of the Study

One major limitation of this study was lack of reliable capital cost information. In any complete evaluation of service costs, capital outlay information would necessarily be required in order to get an accurate picture of total costs. Attempts were made to obtain these cost figures by searching municipal audits on file in the Oklahoma Equalization Board office. However, only lump sum recordings of capital expenditures were available, and often the particular items for which these expenditures were made were not recorded. No amortizations of costs or recordings of yearly depreciation of capital assets were available. There was no way to detect the quality or expected life of the capital equipment purchased. It was thought that bonded indebtedness or ad valorem tax collections could serve as a proxy for capital outlay figures, but problems with completeness of data and with theoretical interpretation of resultant coefficients prohibited this course of action.

Another limitation was the necessity to use a cross-sectional rather than a time-series data analysis approach. Due to lack of a series of yearly audits for each community and lack of complete population and income data for each year, there seemed to be no viable alternative to analysis of community service costs with cross-sectional data. Certainly availability of data for a greater number of years would improve upon the quality of predictive equations which resulted from analysis of the basic theoretical models presented in this study.

Overall lack of data for all communities for non-census years and for communities less than 2,500 population for some variables in census years posed another limitation. Originally it was intended that a comparison of costs in 1972 and 1975 be made for the respective communities, but the unavailability of per capita income data for 1972 for communities less than 2,500 prevented this. Incorporation of population density into the analysis as an effective variable was also prevented by data limitations.

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APPENDIX A

Statistical Summary Of Cost Of Services Models Tested

Model	Number of Observations	R^2	P>F	Intercept	P	Y	M	Density	LD	WDUM
Aggregate Models;										
Linear Form:										
CS = P , Y , M , LD	80	.891	.0001	−276354.41	113.41	74.66	65.02		−39580.12	
				(.0001)	(.0001)	(.0001)	(.2485)		(.1296)	
CS = P , Y , M , D, LD	37	.840	.0001	−330665.05	107.46	106.82	111.64	−22.61	−43644.03	
				(.0322)	(.0001)	(.0091)	(.2474)	(.3743)	(.3657)	
CS = P , M , LD	80	.866	.0001	−38503.71	120.10		23.66		−9993.65	
				(.104)	(.0001)		(.6976)		(.7161)	
CS = P , Y , M	80	.887	.0001	−262192.24	112.44	67.11	78.02			
				(.0001)	(.0001)	(.0002)	(.1657)			
CS = Y , M , LD	80	.418	.0001	−334362.31		157.03	657.81		6926.42	
				(.0189)		(.0002)	(.0001)		(.9067)	
CS = P , LD	80	.865	.0001	−37362.65	121.60				−12257.43	
				(.1097)	(.0001)				(.6463)	
CS = P	80	.865	.0001	−40540.64	121.40					
				(.0682)	(.0001)					
CS = P , Y , M , WDUM	80	.910	.0001	−241949.36	111.32	49.04	77.72			92998.76
				(.0001)	(.0001)	(.0033)	(.1232)			(.0001)
CS = P , Y , M , D , WDUM	37	.879	.0001	−248216.24	109.86	57.97	108.05	−27.41		131519.55
				(.0624)	(.0001)	(.1161)	(.1940)	(.2115)		(.0025)
CS = P , Y , M , LD , WDUM	80	.912	.0001	−252223.07	112.01	54.76	68.92		−26815.17	89878.82
				(.0001)	(.0001)	(.0018)	(.1769)		(.2583)	(.0001)
CS = P , WDUM	80	.898	.0001	−85899.81	118.77					108319.39
				(.0001)	(.0001)					(.0001)

Model	Number of Observations	R^2	P>F	Intercept	P	Y	M	Density	LD	WDUM
Aggregate Models; *Log Form:*										
LCS = LP, LY, LM, LD	80	.819	.0001	−5.0191	1.2034	.9754	.0091	−0853		
				(.0115)	(.0001)	(.0002)	(.8171)		(.4057)	
LCS = LP, LM, LD	80	.783	.0001	2.0480	1.3268		−.0208		.0180	
				(.0032)	(.0001)		(.6193)		(.8668)	
LCS = LP, LY, LM	80	.817	.0001	−4.5736	1.1968	.9196	.0163			
				−(.0162)	(.0001)	(.0003)	(.6686)			
LCS = LP, LD	80	.783	.0001	2.1742	1.2979			.0335		
				(.0008)	(.0001)				(.7431)	
LCS = LP	80	.782	.0001	2.1802	1.2985					
				(.0007)	(.0001)					
Aggregate Per Capita Models; *Linear Form:*										
CSP = P, Y, M, D, LD	37	.343	.0182	37.8584	−.0009	.0248	.0175	−.0069	−5.6461	
				(.1651)	(.6644)	(.0012)	(.3134)	(.1383)	(.5157)	
CSP = P, Y, M, D	37	.334	.0095	40.5643	−.0013	.0242	.0196	−.0074		
				(.1297)	(.5128)	(.0012)	(.2480)	(.1008)		
CSP = P, Y, M, LD	80	.282	.0001	−2.3301	.0026	.0284	.0028		−10.3153	
				(.9099)	(.2239)	(.0001)	(.8821)		(.2396)	
CSP = P, Y, LD	80	.282	.0001	−1.6911	.0028	.0282			−10.5118	
				(.9326)	(.1060)	(.0001)			(.2225)	
CSP = P, M	80	.070	.0613	88.3839	.0052		−.0314			
				(.0001)	(.0247)		(.5732)			
CSP = P, Y, MP, D, LD	37	.337	.0203	36,9760	.0002	.0248	71.8033	−.0074	−5.2645	
				(.2275)	(.9195)	(.0012)	(.3845)	(.1114)	(.5529)	
CSP = P, Y, MP, LD	80	.283	.0001	1.8023	.0028	.0276	−17.0852		−10.9452	
				(.9939)	(.1079)	(.0001)	(.6701)		(.2097)	
CSP = P, MP	80	088	.0293	92.8604	.0042		−59.0069			
				(.0001)	(.0272)		(.1685)			

Model	Number of Observations	R^2	P>F	Intercept	P	Y	M	Density	LD	WDUM
Aggregate Per Capita Models; *Log Form:*										
LCSP = LP , LY ,	37	.309	.0160	−.1819	.9810	.6835	.0318	−.0969		
LMP , LDENS				(.9223)	(.8819)	(.0042)	(.4686)	(.0941)		
LCSP = LP , LY ,	80	.302	.0001	−5.0191	.2125	.9754	.0091		−.0853	
LMP ,LD				(.0115)	(.0077)	(.0002)	(.8171)		(.4057)	
LCSP = LP , LY , LMP	80	.245	.0001	−4.5736	.2131	.9196	.0163			
				(.0162)	(.0074)	(.0003)	(.6686)			
LCSP = LY , LMP , LD	80	.232	.0002	−5.0183		1.1929	.0359		−.0879	
				(.0151)		(.0001)	(.3652)		(.4108)	
LCSP = LY , LMP	80	.225	.0001	−4.5590		1.1361	.0435			
				(.0211)		(.0001)	(.2593)			
LCSP = LP	80	.160	.0002	2.1802	.2985					
				(.0007)	(.0002)					
Services Models Aggregate; *Linear Form:*										
CS1 [b] = P , Y , M , LD	40	.581	.0001	−92171.88	28.19	23.76	19.23		13143.82	
				(.1584)	(.0002)	(.2044)	(.7640)		(.6177)	
CS2 [c] = P , Y , M , LD	48	.608	.0001	15032.94	13.40	−3.92	−4.64		−5103.11	
				(.5216)	(.0001)	(.5529)	(.8108)		(.5766)	
CS3 [d] = P , Y , M , LD	62	.609	.0001	−34782.79	12.10	12.62	28.05		−14436.87	
				(.1081)	(.0001)	(.0493)	(.1816)		(.1042)	
CS4 [e] = F , Y , M , LD	62	.839	.0001	−7645.75	18.45	.83	3.48		−1745.42	
				(.6063)	(.0001)	(.8475)	(.8937)		(.7698)	
CS5 [f] = P , Y , M , LD	62	.838	.0001	−29398.45	15.81	2.63	−.41	−6697.16		
				(.0218)	(.0001)	(.4723)	(.9722)	(.1870)		
CS6 [g] = P , Y , M , LD	49	.592	.0001	−28087.94	6.59	5.55	−4.28		−164.21	
				(.0307)	(.0001)	(.1108)	(.7024)		(.9702)	

Model	Number of Observations	R^2	P>F	Intercept	P	Y	M	Density	LD	WDUM
CS7 [h] = P, Y, M, LD	62	.486	.0001	−40735.05	18.73	16.93	6.72		1972.26	
				(.2981)	(.0001)	(.1493)	(.8551)		(.8999)	
CS1 = P	40	.552	.0001	−10438.50	32.06					
				(.6008)	(.0001)					
CS2 = P	48	.600	.0001	903.74	12.82					
				(.8903)	(.0001)					
CS3 = P	62	.557	.0001	3879.02	14.54					
				(.5873)	(.0001)					
CS4 = P	62	.838	.0001	−5154.22	18.68					
				(.2686)	(.0001)					
CS5 = P	62	.832	.0001	−21456.32	15.65					
				(.0001)	(.0001)					
CS6 = P	49	.562	.0001	−8414.14	6.38					
				−(.0277)	(.0001)					
CS7 = P	62	.464	.0001	14806.41	20.44					
				(.2360)	(.0001)					
Services Models, Aggregate; *Log Form:*										
LCS1 = LP, LY, LM, LD	40	.624	.0001	−8.1052	1.1724	1.2191	−.0212		−.1179	
				(.1158)	(.0001)	(.0714)	(.8571)		(.6473)	
LCS2 = LP, LY, LM, LD	48	.522	.0001	2.0487	1.4653	−.3219	−.1611		.0023	
				(.7225)	(.0001)	(.6581)	(.1964)		(.9934)	
LCS3 = LP, LY, LM, LD	62	.601	.0001	−5.0039	.9586	.9575	.0367		−.1081	
				(.1431)	(.0001)	(.0339)	(.6244)		(.5339)	
LCS4 = LP, LY, LM, LD	62	.787	.0001	.6480	1.1581	.1330	−.0442		−.0643	
				(.7618)	(.0001)	(.6315)	(.3482)		(.5489)	
LCS5 = LP, LY, LM, LD	62	.674	.0001	−13.5690	2.1136	.8533	−.1186		−.3038	
				(.0116)	(.0001)	(.2108)	(.3038)		(.2489)	
LCS6 = LP, LY, LM, LD	49	.484	.0001	−26.7741	1.9137	2.5916	−.2397		.3313	
				(.0070)	(.0002)	(.0355)	(.2979)		(.4497)	
LCS7 = LP, LY, LM, LD	62	.516	.0001	−3.3746	.8544	.9286	.0195		−.1268	
				(.3415)	(.0001)	(.0464)	(.8014)		(.4750)	

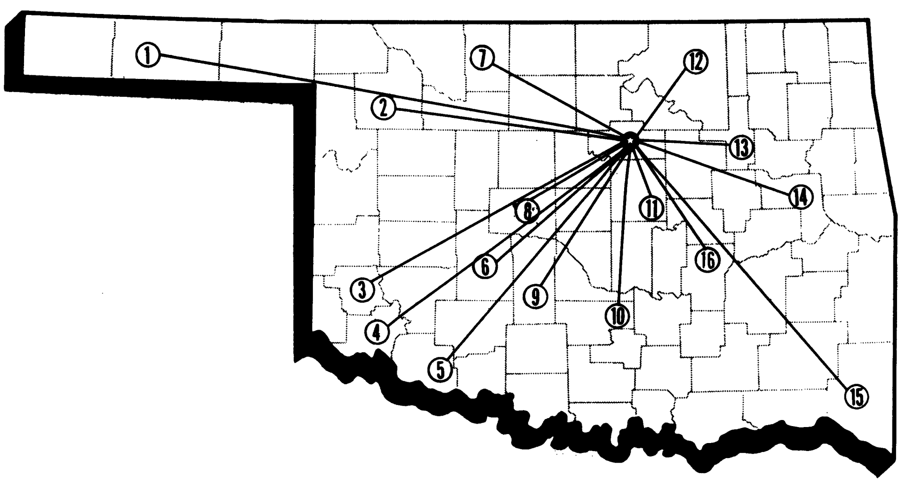
Model	Number of Observations	R^2	P>F	Intercept	P	Y	M	Density	LD	WDUM
Industry Models, Aggregate; *Linear Form:*										
CS = P , Y , M1 [i], LD	20	.925	.0001	−397433.83	137.04	85.69	422.83		−12343.20	
				(.0407)	(.0001)	(.1045)	(.3516)		(.8427)	
CS = P , Y , M2 [j], LD	42	.881	.0001	−375105.42	115.77	109.68	526.18		−90942.18	
				(.0043)	(.0001)	(.0026)	(.2876)		(.2876)	
CS = P , Y , M3 [k], LD	31	.889	.0001	−368912.49	115.44	105.13	90.21		−65523.88	
				(.0067)	(.0001)	(.0113)	(.4769)		(.1841)	
CS = P , Y , M4 [i], LD	20	.954	.0001	−161817.58	105.81	51.41	−54.98		−26667.30	
				(.1390)	(.0001)	(.1190)	(.4860)		(.6199)	
CS = P , Y , M5 [m], LD	73	.886	.0001	−257481.74	121.12	69.64	−481.68	−40941.49		
				(.0003)	(.0001)	(.0007)	(.2314)		(.1483)	
CS = P , Y , M6 [n], LD	50	.857	.0001	−312031.03	116.98	85.49	73.41		−47961.65	
				(.0071)	(.0001)	(.0104)	(.6675)	(.2773)		
CS = P , Y , M7 [o], LD	48	.884	.0001	−323022.22	118.45	85.18	351.36		−55481.25	
				(.0032)	(.0001)	(.0032)	(.4229)		(.1335)	
Industry Models, Aggregate; *Log Form:*										
LCS = LP , LY , LM1 , LD	20	.822	.0001	−1.4279	1.2124	.5388	−.0117	−.1220		
				(.8036)	(.0001)	(.4701)	(.9048)		(.6225)	
LCS = LP , LY , LM2 , LD	42	.882	.0001	−3.4828	1.0850	.9186	.0104		−.1666	
				(.1293)	(.0001)	(.0027)	(.8008)		(.0741)	
LCS = LP , LY , LM3 , LD	31	.890	.0001	−4.4168	1.1822	.9635	−.0422	−.2174		
				(.0709)	(.0001)	(.0044)	(.3368)		(.0553)	
LCS = LP , LY , LM4 , LD	19	.925	.0001	.4040	1.2091	.3247	−.0644		−.0261	
				(.9101)	(.0001)	(.5212)	(.1815)		(.8927)	
LCS = LP , LY , LM5 , LD	73	.818	.0001	−4.2574	1.2848	.8294	−.0710		−.0707	
				(.0407)	(.0001)	(.0018)	(.2163)		(.4824)	
LCS = LP , LY , LM6 , LD	50	.843	.0001	−3.7970	1.1135	.9192	.0058	−.0509		
				(.1258)	(.0001)	(.0052)	(.8554)		(.6592)	
LCS = LP , LY , LM7 , LD	50	.846	.0001	−3.5748	1.0403	.9469	.0829		−.1474	
				(.1254)	(.0001)	(.0017)	(.0547)		(.1314)	

Model	Number of Observations	R^2	P>F	Intercept	P	Y	M*	Density	LD	WDUM
Industry Models, Per Capita;										
Linear Form;										
CSP = P , Y , M1 , LD	20	.268	.2888	24.1258	.0048	.0185	.0201		−6.4297	
				(.6382)	(.1350)	(.2085)	(.8738)		(.7155)	
CSP = P , Y , M2 , LD	42	.254	.0245	7.9205	.0009	.0302	.0287		−19.3052	
				(.8168)	(.6669)	(.0027)	(.8324)		(.0835)	
CSP = P , Y , M3 , LD	31	.377	.0126	1.1894	.0017	.0309	.0002	−19.2121		
				(.9678)	(.4909)	(.0020)	(.9933)		(.0982)	
CSP = P , Y , M4 , LD	20	.478	.0344	30.9196	.0012	.0204	−.0325		−5.9579	
				(.3294)	(.5693)	(.0422)	(.1739)		(.7079)	
CSP = P , Y , M5 , LD	73	.248	.0008	8.7655	.0028	.0261	−.0696		−9.3223	
				(.6837)	(.1794)	(.0001)	(.5886)		(.3037)	
CSP = P , Y , M6 , LD	50	.196	.0396	9.9022	.0014	.0272	−.0030		−8.8793	
				(.7522)	(.5396)	(.0042)	(.951;)		(.4736)	
CSP = P , Y , M7 , LD	48	.331	.0018	−1.3983	.0022	.0284	.1088	−12.9298		
				(.9560)	(.1974)	(.0001)	(.3104)		(.1515)	

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" valves.

[b]CS1 = Water and Sewer Costs
[c]CS2 = Sanitation Costs
[d]CS3 = Street Costs
[e]CS4 = Police Protection Costs
CS5 = Fire Protection Costs
[g]CS6 = Parks and Recreation Costs
[h]CS7 = General Administration Costs
[i]M1 = Mfg. Employment, petroleum.
[j]M2 = Mfg. Employment, food products
[k]M3 = Mfg. Employment, textiles
[l]M4 = Mfg. Employment, wood and wood product
[m]ME = Mfg. Employment, miscellaneous light industry
[n]M6 = Mfg. Employment, Metals and metal works
[o]M7 = Mfg. Employment, chemicals, glass, and cement.

OKLAHOMA
Agricultural Experiment Station
System Covers the State



Main Station — *Stillwater, Perkins and Lake Carl Blackwell*

1. **Panhandle Research Station — *Goodwell***
2. **Southern Great Plains Field Station — *Woodward***
3. **Sandyland Research Station — *Mangum***
4. **Irrigation Research Station — *Altus***
5. **Southwest Agronomy Research Station — *Tipton***
6. **Caddo Research Station — *Ft. Cobb***
7. **North Central Research Station — *Lahoma***
8. **Southwestern Livestock and Forage Research Station — *El Reno***
9. **South Central Research Station — *Chickasha***
10. **Agronomy Research Station — *Stratford***
11. **Pecan Research Station — *Sparks***
12. **Veterinary Research Station — *Pawhuska***
13. **Vegetable Research Station — *Bixby***
14. **Eastern Research Station — *Haskell***
15. **Kiamichi Field Station — *Idabel***
16. **Sarkeys Research and Demonstration Project — *Lamar***