

**The Contribution of Local Government Financing  
to Rural Hospitals and Health Systems:  
Marginal Benefit or Safety Net?**

*Working Paper Series*

*Anthony Wellever, M.P.A.*

*Tiffany Radcliff, B.S.*

Rural Health Research Center  
Division of Health Services Research and Policy  
School of Public Health  
University of Minnesota

Working Paper #25

November, 1998

Support for this paper was provided by the Office of Rural Health Policy, Health Resources and Services Administration, PHS Grant No. CSR 000002-03-0.

## **Acknowledgment**

The authors would like to thank Sarah Krein, Ph.D. and Richard Reeder (U.S. Department of Agriculture, Economic Research Service) for their invaluable assistance in preparing this paper.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	ii
INTRODUCTION.....	1
DATA AND METHODS .....	2
LOCAL GOVERNMENT REVENUES.....	4
PATTERNS OF HEALTH CARE SPENDING BY LOCAL GOVERNMENTS ON RURAL HEALTH SERVICES.....	11
MULTIVARIATE ANALYSIS .....	20
Analytic Approach .....	20
Findings .....	22
Probit Estimation .....	22
OLS Estimates .....	26
CONCLUSION.....	30
REFERENCES.....	33
APPENDIX A.....	34
APPENDIX B.....	39

## EXECUTIVE SUMMARY

Local governments are a key source of funding for rural health systems. They support local health departments and hospitals and pay for care provided to medically indigent patients. Included in the term “local governments” are counties, municipalities, towns, townships, and hospital and health districts. In 1992, rural local governments nationally contributed \$10.8 billion to support local health infrastructure.

The amounts that local governments have available to spend are constrained in many states by limits on the taxing authority of local governments and by requirements that budgets be balanced. These constraints make it difficult for county governments to react quickly in times of emergency or economic downturn. Consequently, they must reallocate funds to the areas of greatest need or the areas whose return is considered greatest.

This report examines local government spending for rural hospital and other health services during a period of substantial economic turmoil, 1977 to 1992. The period of study includes two recessions, a time of double-digit inflation and interest rates, and a farm debt crisis. It also encompasses the implementation of New Federalism, transferring responsibility for some public services from the federal government to state and local governments. The purpose of this report is to provide insights into possible future behavior of local governments in rural areas in times of economic stress. Furthermore, the findings of this study might suggest how rural health systems ? particularly rural hospitals ? were able to weather the financial crises of the 1980s.

The study uses data from the Census of Counties, produced every five years by the U.S. Census Bureau. The Census contains revenues and expenses for local governments aggregated to the county level. Using these data for four years (1977, 1982, 1987 and 1992), we calculated ratio indicators for each county, expressed in per capita or percentage terms. Financial variables were deflated to constant 1982 dollars using the City Medical Price Index compiled by the U.S. Bureau of Labor Statistics. These ratio indicators were then compared across time.

In addition to analyses of trends in rural local government expenditures, the factors that influence local government spending and the level of hospital expenditures for all U.S. counties between 1982 and 1992 were also examined using multivariate techniques. To gain a better understanding of how various factors interact in predicting the expenditures of local governments on rural hospital services, a set of multivariate analyses were conducted. We posed two questions in formulating these analyses:

1. What factors predict whether a county government has expenditures on hospital services?
2. For the counties with local government expenditures on hospital services, what factors predict the level of these expenditures?

During the study period, 1977 to 1992, the structure of local government revenues changed substantially. Local governments at the end of the period were less reliant on property taxes and intergovernmental transfers than they were at the beginning of the period. The declines in these income sources resulted from national political trends, beyond the control of local government leaders. New Federalism of the early 1980s and the tax limitation movement required local governments to make up losses in income from property tax and intergovernmental transfers by raising taxes in other areas and instituting user fees. These new taxes and user fees, however, did not offset the declines in property taxes and intergovernmental transfers. In the last year of the study rural local governments collected less revenue per person in constant dollar terms than they did in the earlier years of the study.

Our analyses demonstrated that rural local government spending on health care does not mirror these overall trends in revenue. On the contrary, per capita spending by rural local governments on hospitals, on average, was lower in the first year of the study period than in any subsequent year. Rural local government spending on other (i.e., non-hospital) health services increased significantly during the period, growing an average of four percent per year in constant dollar, per capita terms.

The fact that revenues are declining at the same time that spending on rural health services by local governments is increasing means that proportion of money spent on health care services is increasing. Approximately one dollar out of every ten, on average, is spent by rural local governments on health care services.

Hospital expenditures by far dominate local government spending on health. The amount spent on hospitals is four times greater than that spent by local governments for all other health services. Three factors greatly influence whether local governments spend money on hospitals: 1) local public ownership of a hospital, 2) the proportion of households with females as head; and 3) the proportion of the population over age 65. These findings make intuitive sense: Local governments are more likely to support a hospital on an annual basis if they own that hospital, and local governments are more likely to support vulnerable populations, especially poor children and the elderly, if they compose a sizeable segment of the community. The dollar amount that local governments spend on hospitals is associated with local government ownership, size of the hospital, and Medicare Part A payment rates.

The behavior of rural local governments in 1982, arguably the worst year economically of the four studied, is particularly interesting. In this year, rural local government spending overall was 1.7 percent greater than 1977, but spending on health services was 27.4 percent greater than the measurement taken five years earlier. This may indicate, as some have suggested, that rural communities rally around their hospitals in times of economic stress. There are however, limitations on the largesse of rural local governments. With the advent of the prospective payment system in (PPS) 1984, many rural hospitals closed (117 in the first four years of PPS alone compared to 44 in the previous four years). The financial losses at these hospitals were apparently too great for their local governments to forestall closure by increasing payments.

This finding seems to indicate the marginal nature of local government support for hospitals. Despite the capacity to move hospitals with modest operating losses from the red into the black and to pay for some level of uncompensated care, most rural local governments lack sufficiently deep pockets to rescue rural hospitals from profound financial losses.

## INTRODUCTION

Despite the attention focused on the actions and finances of the federal government, state and local governments bear the major responsibility for providing non-defense services such as education, roads, welfare, police, sanitation, public health and hospitals (Aronson and Hilley, 1986). These entities spend more than two and one-half times as much as the federal government on civilian services.

Local governments constitute a key source of funding for rural health systems. In 1992, they contributed \$10.8 billion to support local health departments and hospitals in rural areas and to finance care provided to medically indigent rural patients.

Many state and local governments are sensitive to shifts in the economy that reduce revenues because state constitutions and local charters limit deficit spending and the ability to raise taxes. State and local governments cannot cope with declines in revenue by simply reducing proportionately the amount spent on all services. The fixed costs of many public services cannot be cut quickly and require that state and local governments maintain spending levels for these services. Furthermore, the need for certain social services rises when economies experience downturns, increasing the cost of these services (Pogue, 1996). Because funding levels must be maintained for some services and increased for others, state and local governments must set new priorities within their budgets and reallocate their expenditures across governmental services when revenues decline.

How do local governments respond to economic downturns? How do they reorder their spending priorities? Little is known about the spending behavior of local governments but anecdotal evidence suggests that local governments *increase*

spending to rural hospitals and health systems in the wake of declining revenues. Thus at least some local governments provide more support to rural health in times of financial stress rather than less (U.S. Senate Special Committee on Aging, 1988).

In this report we track local government spending for rural hospital and other health services during a period of substantial economic turmoil, 1977 to 1992. This period includes two recessions, a period of double-digit inflation and interest rates, a farm debt crisis, and the implementation of New Federalism, which transferred responsibility for some public services from the federal government to state and local governments.

The apparent robustness of the current economy notwithstanding, there can be little doubt that the U.S. economy will slow eventually and economic indicators will reverse their present upward trend<sup>1</sup>. The purpose of this report is to examine trends in local government funding of health services during past times of stress to provide possible insights into the future behavior of local governments in rural areas.

Furthermore, the findings of this study might suggest how rural health systems ? particularly rural hospitals ? were able to weather the financial crises of the 1980s.

## **DATA AND METHODS**

While there is only one federal government and only fifty state governments in the United State, there are literally thousands of local governments. In 1992, the number of county governments stood at 3,043. County governments were joined by 19,279 municipality governments, 16,656 town and township governments, 14,422 school districts, and 31,555 special districts, including hospitals districts (U.S.

---

<sup>1</sup>Indeed, evidence from the Upper Midwest suggests that a new farm crisis may be looming on the horizon. According to the U.S. Department of Commerce, farm income in Minnesota fell an alarming 38 percent between 1996 and 1997 (Minge, 1998).



Census, 1992). Multiple layers of local government often overlap in the same geographical space.

Every five years, the U.S. Census Bureau conducts a census of governments. The census of governments is the only data source that provides comprehensive fiscal information on rural governments. The census provides data on revenues, expenditures, and debt for all counties, municipalities, towns, townships, school districts, and special districts. These local governments are then aggregated to the county level. The latest available census of governments data is for fiscal year 1992.

Using these data for the years 1977, 1982, 1987 and 1992, ratio indicators were calculated for each county, expressed in per capita<sup>2</sup> or percentage terms. Financial variables were deflated to constant 1982 dollars using the City Medical Price Index compiled by the U.S. Bureau of Labor Statistics. Unweighted means of individual county indicators were calculated for all counties within each rural and urban category. Using unweighted means gives equal weight to each county regardless of size or population density. These ratio indicators were then compared across time.

The four years selected for analysis reflect different economic and political conditions. The first year, 1977, predates the high inflation rates of the late 1970s and experiments with New Federalism. The year 1982 marks the end of a two-year recession, the beginning of New Federalism, and the height of the farm debt crisis. By 1987, inflation was slowing and the worst of the farm crisis had been weathered, and in

---

<sup>2</sup>Some counties, due to data collection methods, include the expenses for many other counties along with their data. This problem of aggregation of expense leads to uncomparable measures for some variables over time, prohibiting the use of these counties in per capita trend analysis. To address this problem, the entire county observation was omitted.

1992, the country was experiencing the final year of a three-year recession. Tables of the all indicators by year, urbanicity, and region are included in Appendix A.

We examined trends in two types of indicators: local rural government revenues and expenses. Although revenues are important ? there is no spending without the collection of revenues ? this report focuses on local government expenditures for rural health. In addition to tracking trends in rural government expenditures devoted to health care expenditures, the factors that influence local government spending and the level of spending for health services were also investigated using multivariate techniques. A description of the analytic approach, the study variables, and the findings of the multivariate analysis follows the analysis of spending trends.

## **LOCAL GOVERNMENT REVENUES**

Approximately two-thirds of local government revenues in rural areas derive from two sources, property taxes and intergovernmental transfers. The remaining revenue is raised from user fees and other taxes. Property tax is by far the dominant local tax, accounting for 78 percent of all rural local tax revenue in 1992. Other tax options, such as local income taxes, sales taxes, or business taxes, are used sparingly ? especially in rural areas ? because political leaders fear that such taxes might erode the tax base and eventually harm the locality.

The role that property tax plays in local government financing is steadily diminishing. In 1977, local property taxes accounted for 30 percent of all local rural government revenues. By 1992, the percent of revenues attributable to property tax fell to 26 percent (see Table 1). The decrease in the importance of property tax resulted

**Table 1**

**Mean Proportion of Property Tax to Total Rural  
Local Government Revenue, 1977-1992**

<b>Census Region</b>	<b>1977</b>	<b>1982</b>	<b>1987</b>	<b>1992</b>
Northeast	33%	35%	35%	38%
Midwest	35%	30%	30%	28%
South	23%	21%	22%	22%
West	34%	27%	28%	24%
Total U.S.	30%	26%	27%	26%

Sources: U.S. Census Bureau, *Census of Governments, 1977, 1982, 1987, 1992*.

largely from two phenomena: 1) the farm crisis of the early and mid-1980s that resulted in declining property values, and 2) the revenue and expenditure limitation movement, epitomized by California's Proposition 13 which passed in 1978. The farm crisis reduced property tax revenues in farm-dependent counties because property values comprise the assessment base of property tax. Between 1982 and 1986, the value of farm real estate fell by 28.3 percent (Murdock and Leistritz, 1988). By 1986, thirty-six states, had set limits on property tax rates and nineteen states had restricted property tax levies (Aronson and Hilley, 1986).

The contribution of property tax to the total revenues of local governments varied somewhat across regions of the country. In 1977, rural governments in the South relied far less heavily on property tax than did other regions of the country. Approximately one-fourth of all revenues of rural local governments in the South came from property tax, while in the other three census regions, property tax contributed approximately one-third of all revenues. By 1992, the property tax contribution to local rural governments in the Midwest and West had declined to approximately one-quarter of total revenues. The Northeast is the only census region to experience an increase in the importance of property tax revenue to local governments over the time of the study.

Local governments do not depend solely on their own resources to fund their operations. They also rely on grants, or intergovernmental transfers, from the federal and state governments. Federal intergovernmental transfers to state and local governments exploded in the 1970s, growing by 80 percent on a constant dollar basis. In the early 1980s, the Reagan administration reversed this trend, and between 1980 and 1984 federal grants to state and local governments fell by 14 percent in constant

dollars<sup>3</sup> (Aronson and Hilley, 1986). The decline in federal grants to local governments was accompanied by declines in state intergovernmental transfers to local governments in most regions of the country during the period 1977 to 1992.

The mean proportions of intergovernmental transfers to total rural local government revenue is shown in Table 2. In all regions the proportion of federal intergovernmental transfers fell. In the Northeast, the census region with the most dramatic decline, federal grants fell from seven percent of local government revenues to only one percent. The mean proportion of state intergovernmental transfers to total rural government revenues in each census region except the West display a consistent pattern, falling slightly from their 1977 levels in 1982 and 1987 and returning to their 1977 levels in 1992.

In summary, the proportion of local government revenues from both property tax and intergovernmental transfers during the study period show an overall decline in these traditional sources of funding. In 1977 these sources accounted for 70 percent of all rural government revenue, but in 1992, they accounted for only 63 percent, a ten percent decline in the proportion. The falloff in property tax and intergovernmental transfer was replaced partially by sizeable increases in user fees and other taxes ? especially in 1982, the height of the farm crisis and the final year of a two-year nationwide recession. Moreover, in constant, per capita dollars, total rural local government revenues were lower in 1992 than in 1977 after spiking to a fifteen-year high 1982 (see Table 3). Figure 1 shows the variation in local rural government revenue sources by Census Region over the period.

---

<sup>3</sup> Federal grants to states are often a source of state grants to local governments.

Table 2

**Mean Proportion of Intergovernmental Transfers to Total Rural  
Local Government Revenue, 1977-1992**

	1977	1982	1987	1992
<b>Northeast</b>				
Proportion Federal Transfers	7%	5%	3%	1%
Proportion State Transfers	37%	34%	34%	35%
<b>Midwest</b>				
Proportion Federal Transfers	5%	4%	3%	2%
Proportion State Transfers	31%	28%	29%	32%
<b>South</b>				
Proportion Federal Transfers	7%	5%	3%	2%
Proportion State Transfers	39%	37%	36%	38%
<b>West</b>				
Proportion Federal Transfers	6%	5%	4%	4%
Proportion State Transfers	32%	33%	32%	35%
<b>Total U.S.</b>				
Proportion Federal Transfers	6%	5%	3%	2%
Proportion State Transfers	34%	32%	33%	35%

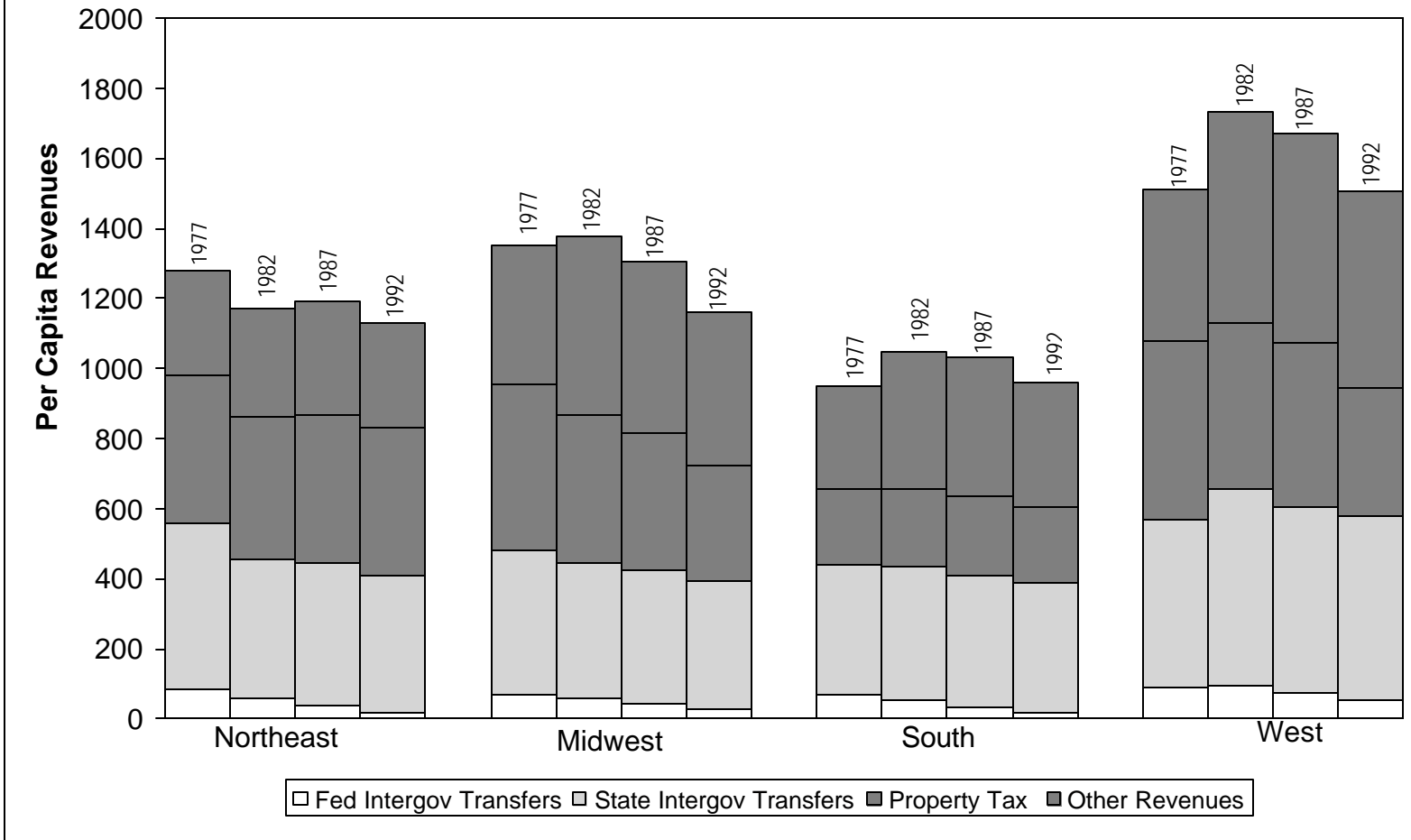
Sources: U.S. Census Bureau, *Census of Governments, 1977, 1982, 1987, 1992.*

Table 3

**Mean Per Capita Revenues of Rural Local Governments, 1977-1992  
(Percent Change in 5-Year Period)**

	1977	1982	1987	1992
All revenue	\$1189	\$1269 (6.7%)	\$1228 (-3.2%)	\$1119 (-8.9%)
Property tax	\$362	\$336 (-7.2%)	\$328 (-2.4%)	\$287 (-12.5%)
Federal transfers	\$71	\$62 (-12.7%)	\$41 (-33.9%)	\$25 (-39.0%)
State transfers	\$408	\$410 (1.2%)	\$402 (-2.0%)	\$393 (-2.2%)
Other taxes and user fees	\$351	\$461 (31.3%)	\$457 (-0.9%)	\$414 (9.4%)

**Figure 1**  
**Per Capita Revenue of Rural Local Governments, 1977-1992**





Rural governments responded to the cutbacks of intergovernmental transfers by increasing taxes and user fees to maintain or increase certain services and capital expenditures. Why would local rural governments increase taxes and spending in the midst of a re-evaluation of the roles of government and in the middle of a recession?

Two hypotheses have been suggested:

A competitive level of public spending is critical [to rural areas]. Areas that are struggling to survive and grow must remain competitive in the services they provide; otherwise, they will lose population. As industrial location studies have shown, public education and other local services and amenities are important factors in attracting business investment. Rural governments are trying to remain competitive (Reeder, 1988, p. 3).

During recessions, revenue growth slows and may even be negative. Spending to provide public services, however, does not grow more slowly during downturns; and instead of decreasing, welfare and other safety-net outlays increase. The result is a widening gap between expenditure growth and revenue growth that builds pressure for tax increases...(Pogue, 1996, p. 81).

The next section reviews the spending behavior of rural local governments, focusing on expenditures for hospital and health services.

### **PATTERNS OF HEALTH CARE SPENDING BY LOCAL GOVERNMENTS ON RURAL HEALTH SERVICES**

In 1982, total revenues for rural local governments increased in three of four Census Regions. Total spending patterns, however, varied greatly among regions. The Northeast's per capita spending dropped by 11.9 percent from its 1977 level, while the West increased per capita spending by 13.6 percent. The Midwest spent approximately six percent less per person in 1982 than in 1977, and the South spent approximately six percent more.

Total per capita spending, in constant dollars, remained reasonably stable between 1982 and 1987, but there was a decline in spending in all regions except the Northeast

between 1987 and 1992. In 1992, rural local governments were spending slightly more per person in constant dollars than they were in 1977. Local rural governments in the Northeast and the Midwest spent less per capita in 1992 than in 1977, the greatest falloff occurring in the Midwest, where per capita spending dropped by 15.1 percent during the period. Table 4 lists the mean per capita expenditures of rural local governments by Census Region and notes the percentage change between years.

Despite falling per capita expenditures on all services, rural local government spending on health services increased during the period. Per capita spending on health by local governments increased by almost one-quarter between 1977 and 1982. In 1987, approximately one-half of that gain had been erased, and per capita funding for health services remained virtually unchanged between 1987 and 1992. In 1992, rural local governments, on average, spent \$102.17 per person on health services.

Local government spending on health services in rural areas was led by hospitals. Slightly more than eight dollars of every ten spent by rural local governments on health services is spent on hospitals (see Table 5). These expenditures are generally of two types: annual appropriations and payments to cover care for indigent patients. Counties, municipalities, and hospital districts that own rural hospitals typically make annual appropriations of tax monies intended for the upkeep of the building and the ongoing operations of the facility. These contributions are considered non-operating revenues by hospitals because they are not related directly to the patient care mission

**Table 4**  
**Mean Per Capita Expenditures of Rural Local Government, 1977-1992**  
**(Percent Change in 5-Year Period)**

Census Region	1977	1982	1987	1992
Northeast	\$1256	\$1105 (-11.9%)	\$1107 (0.1%)	\$1144 (3.3%)
Midwest	\$1217	\$1145 (-5.9%)	\$1090 (-4.8%)	\$1033 (-5.2%)
South	\$843	\$895 (6.2%)	\$893 (-0.2%)	\$859 (-3.8%)
West	\$1380	\$1567 (13.6%)	\$1521 (-2.9%)	\$1435 (-5.7%)
Total U.S.	\$1073	\$1091 (1.7%)	\$1082 (-0.8%)	\$1092 (0.9%)

Sources: U.S. Census Bureau, *Census of Governments, 1977, 1982, 1987, 1992.*

**Table 5**

**Mean Per Capita Rural Local Government Expenditures for Total Health, Hospital,  
and Other Health Services, 1977-1992  
(Percent Change in 5-Year Period)**

	<b>1977</b>	<b>1982</b>	<b>1987</b>	<b>1992</b>
All health expenditures	\$91.45	\$116.47 (27.4%)	\$101.95 (-12.5%)	\$102.17 (0.2%)
Hospital expenditures	\$79.20	\$99.18 (25.2%)	\$84.30 (-15.0%)	\$82.82 (-1.85%)
Other health expenditures	\$12.25	\$17.29 (41.1%)	\$17.65 (2.1%)	\$19.35 (9.6%)

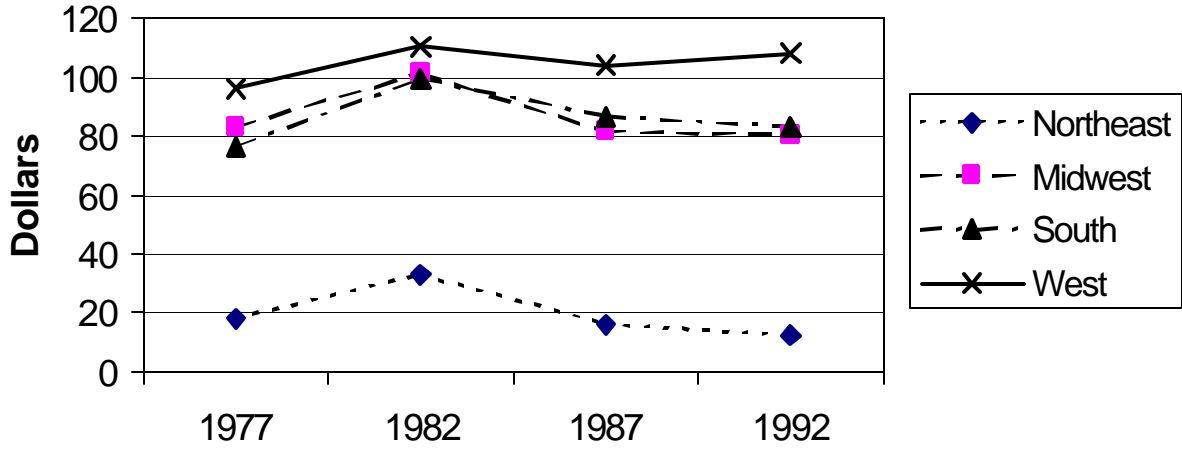
Sources: U.S. Census Bureau, *Census of Governments, 1977, 1982, 1987, 1992.*

of the hospital. Some local governments also make full or partial payment for hospital services provided to residents who are medically indigent, i.e. patients who cannot afford to pay for their hospital care and who are not covered by or eligible for private health insurance or other public health insurance programs. Some of these payments may be made to hospitals in urban areas. Local governments in rural counties where a publicly owned hospital is located spent an average of \$197 per capita on hospital expenditures. In contrast, average per capita hospital expenditures of rural local governments in counties without a publicly owned hospital were only \$24.

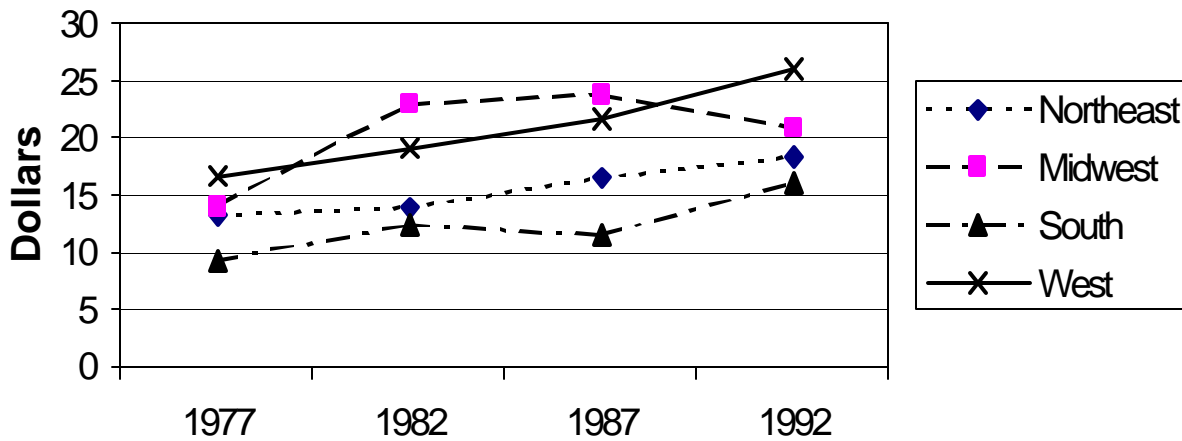
The pattern of rural local government per capita spending on hospitals is strikingly similar across Census Regions. Figure 2 shows a marked increase in spending on hospitals in 1982, and a falloff in subsequent years, except in the West, where per capita spending on hospitals rebounds in 1992 to near-1982 levels. Part of the decline in spending on hospitals may be attributable to the closure of hospitals. Between 1982 and 1987, 141 rural counties had hospitals within their borders close. In the five-year period between 1987 and 1992, 208 rural counties lost hospitals.

Three of the four Census Regions spend similar amounts per capita on hospital services. Rural governments in the Northeast spend less than one-third of the amount per person that local governments in the other regions spend. This low level of spending is due largely to the small proportion of publicly owned hospitals in the Northeast. Only four percent of rural counties in the Northeast have at least one publicly owned hospital in comparison to 30 percent in the Midwest, 35 percent in the South, and 43 percent in the West.

**Figure 2**  
**Per Capita Hospital Expenditures by Rural Local Governments, 1977-1992**



**Figure 3**  
**Per Capita Other Health Expenditures by Rural Local Governments, 1977-1992**



Were the bulk of payments to rural hospitals by local governments in 1982 (the most economically troubled of the four years for which measurements are available) intended to shore up the infrastructure, as suggested by the first hypothesis (Reeder, 1988)? Or were they allocated to pay for health care services associated with the economy at large, as the second hypothesis by Pogue (1996) suggests? We know only that in this economically troubled year, rural local governments not only spent more on hospitals, but also spent a greater proportion of their total expenditures on hospitals.

In constant dollars, per capita spending on other health services by rural local governments showed steady growth throughout the period of study. Nationally, the amount spent by rural governments on other health services increased by 58 percent between 1977 and 1992. Other health services include local public health departments and payments made to non-hospital providers for medically indigent residents. Figure 3 shows the patterns of per capita spending on other health services by region. The level of per capita spending by rural local governments in the Midwest on other health services fell off rather abruptly in 1992 after substantial gains during the period 1977 to 1987. All other regions show a reasonably steady increase in per capita spending on other health care services, averaging approximately four percent per year.

Local government leaders annually determine which public services they will provide. These decisions are bounded by their budgets. Revenues are constrained by the government's ability to tax, and expenditures are bound by the number of worthy contenders vying for a piece of the pie. Budget-making is the quintessential political act: It is, in the words of one observer, an inventory of the values of a government and,

by extension, the constituents it serves (Jones, 1984). In any year, there are winners and losers as policymakers choose among various expenditure alternatives.

Health services, as a proportion of total per capita spending, were a winner in the budget battles of rural governments during the study period (see Table 6). In all regions of the country, the proportion of local government spending on health care was lowest in 1977, the base year. The increases in 1982 were particularly notable. In the Northeast, the proportion of health spending increased by approximately 70 percent between 1977 and 1982; the proportion spent on hospitals more than doubled. During the same period, the proportion of total health spending in the Midwest increased by more than one-third. While the change in the proportion of spending on health was more modest in the South and the West, the trend was still positive. The proportion of spending on health services dipped somewhat in 1987 and rebounded modestly in 1992. Overall, total health expenditures (and the component parts: hospital expenditures and other health expenditures) held claim to a larger portion of the total budgets of rural local governments in 1992 than they had in 1977.

The increased spending in 1982 (and the modest spending increase in 1992) seem to validate the anecdotal observation made in 1988 that local governments spend more on their health systems in times of financial stress (U.S. Senate Special Committee on Aging, 1988). Rural decision makers appear to value health care services and place them ahead of other services in the ordering of spending priorities. It appears that rural local governments spend more on health services during economic downturns, but it is not possible to determine from the available data whether local



Table 6

**Proportion of Health Expenditures of Rural Local Governments to  
Total Expenditures, 1977-1992  
(Percent)**

	1977	1982	1987	1992
<b>Northeast</b>				
All health expenditures	2.5	4.2	3.0	2.7
Hospital expenditures	1.4	3.0	1.6	1.1
Other health expenditures	1.1	1.3	1.5	1.6
<b>Midwest</b>				
All health expenditures	8.0	10.9	9.7	9.8
Hospital expenditures	6.9	8.9	7.5	7.8
Other health expenditures	1.2	2.0	2.2	2.0
<b>South</b>				
All health expenditures	10.2	12.5	11.0	11.6
Hospital expenditures	9.1	11.1	9.7	9.7
Other health expenditures	1.1	1.4	1.3	2.2
<b>West</b>				
All health expenditures	8.2	8.3	8.3	9.3
Hospital expenditures	7.0	7.1	6.9	7.5
Other health expenditures	1.2	1.2	1.4	1.8
<b>Total U.S.</b>				
All health expenditures	8.5	10.7	9.6	10.0
Hospital expenditures	7.4	9.1	7.9	8.1
Other health expenditures	1.1	1.6	1.7	1.9

Sources: U.S. Census Bureau, *Census of Governments, 1977, 1982, 1987, 1992*

governments spend more on health services to protect infrastructure, whether they spend more on direct patient care services, or whether the increase represents some combination of the two reasons.

## **MULTIVARIATE ANALYSIS**

In addition to analyzing trends in rural county government expenditures, we also used multivariate techniques to examine the factors that influence local government spending and the level of hospital expenditures for all rural U.S. counties between 1982 and 1992.<sup>4</sup> To gain a better understanding of how various factors interact in predicting the expenditures of rural local governments on hospital services, we conducted a set of multivariate analyses posing two questions:

1. What factors predict whether a local government in a rural county has expenditures on hospital services?
2. For the rural counties with local government expenditures on hospital services, what factors predict the level of these expenditures?

### **Analytic Approach**

To address the question, a Probit regression technique was employed. To answer the second question, a standard Ordinary Least Squares (OLS) regression was used. The two questions were analyzed independently of each other. An argument might be made that the answer to question two is conditional on questions one. However, the infrastructure of the vast majority of counties remains unchanged over time. A local government that owns a hospital in 1982, for example, is likely to own the hospital in 1987 and 1992 as well. Thus, there will be persistence in a base level of

---

<sup>4</sup> We excluded all data for urban counties, all counties in Alaska and Hawaii and a few outlier cases for 1992. This leaves 2356 rural counties in 1982, 2360 in 1987, and 2234 counties in 1992 remaining in the analysis.

expenditures over time for many local governments. This implies that the decision of *whether* to spend is distinct from the question of *how much* to spend.<sup>5</sup>

The same independent or explanatory variables are used in both the OLS and Probit models. They include area, economic, geographic, and population characteristics from the Area Resource File as well as other government expenditure and revenue characteristics from the Census of Governments data set. Cross-sectional factors that affect all counties are captured by the year (1982, 1987, and 1992) variables. In addition, since observations are likely to be correlated for a single county over time, Huber-White robust variance corrections based on the FIPS county identifier were created for the OLS regression.

The conceptual model from which the results are derived is based on factors thought to be associated with government expenditures. The model of local government expenditures per capita on hospitals includes four major factors, captured by 25 variables (summary statistics for the variables are included as Appendix B):

**Area Characteristics:** Variables for this factor include county population, population density, land area, number of farms, percent of land used for farming, the region of the U.S. and the Rural/Urban Continuum Code.

**Economic Characteristics:** Variables include the unemployment rate, percent of workers in agriculture, percent of workers in construction, percent of workers in health services, percent of workers in manufacturing, percent of households with a female head, per capita income, and median home values.

**Health Characteristics:** Hospital beds per capita, whether local governments within a county own a hospital, the infant mortality rate, the proportion of the

---

<sup>5</sup>Another approach to this analysis would be to estimate a Tobit regression model with a truncated lower bound. Had we been interested in potential expenditures rather than actual expenditures, the Tobit model would have been used to adjust the regression coefficients for the large number of zero expenditure observations. As is, the analysis focuses on the factors that affect *actual* county government expenditures for hospitals and factors that influence whether a county spends any of its government resources on hospitals.

population over age 65, and Medicare Part A and Part B annual per capita payment amounts are included as variables for this factor.

**Local Government Financial Characteristics:** We include per capita property tax revenues, per capita direct federal support of the county, and per capita direct state support as variables associated with this factor.

The data set used for the regression analysis contains 6,950 observations. Data from 1977 are excluded due to missing Area Resource File (ARF) variables for that year. The large sample size, although helpful in ensuring precise estimates, implies that most tests of significant differences over time will be positive. Therefore, careful *a priori* selection of variables to produce meaningful regression models and tests of mean differences was necessary.

Note that all financial variables were deflated to constant 1982 dollars using the City Medical Price index, compiled by the U.S. Bureau of Labor Statistics. The year 1982 is used as the reference time period. All data sets used in the analysis C including the Census of Governments, Area Resource File, and American Hospital Association Annual Survey of Hospitals C were merged into a single analytic data set using the FIPS (state and county code) identifier for each county.

## Findings

### Probit Estimation

To make predictions about the level of hospital expenditures in rural areas, it is important to predict factors that influence whether a county government has any hospital expenditures at all. For this analysis, a Probit regression of whether each rural county has expenditures greater than zero was conducted. This regression includes all 6,950 observations. The major distinction of Probit (Logit) is that the error term is assumed to have a normal distribution, a reasonable assumption for this analysis.

Results from the Probit regression analysis are listed in Table 7 below. The coefficients for this regression can be interpreted as marginal changes in the probability (between zero and one) of a particular rural county having hospital expenditures. For example, the local government ownership variable is highly predictive of positive local government expenditures. The probability of local government hospital expenditures increases by 57 percent when a local government entity owns a rural hospital. The z-score of 39.30 for this coefficient suggests that this variable is significant at the 0.01 percent level of confidence.

Additionally, those rural counties with more female heads of household (associated with AFDC and other social program eligibility criteria) are slightly more likely to have expenditures greater than zero. Increases in per capita property tax revenue to the local government are significantly associated with increased probability of government expenditures on rural hospitals. Increasing by one the number of beds per thousand (which would translate into a large absolute increase in beds for most counties) increases the probability of a rural county having positive hospital expenditures by one percent.

As the percentage of elderly in a rural county increases, there is a significantly increased chance of positive hospital expenditures. Higher Medicare Part A annual per capita payment amounts and median home values are associated with local governments that have no hospital expenditures. Higher Medicare Part B payment amounts, however, have roughly the same effect in the opposite direction - yielding ambiguity regarding the substitution of local funds for funds from other government sources.

Table 7

**Probit Estimates of Whether a Rural County Has Hospital Expenditures  
(n = 6,950)**

Variable	dF/dx	z-score	P> z
Unemployment rate	-0.0036	-1.69	0.092
Short-term hospital beds, per capita	11.9024	6.51	0.000
Local government owns hospital	0.5669	39.30	0.000
Population	0.0000	1.47	0.141
Percent working in agriculture	0.0013	1.02	0.306
Percent working in construction	-0.0106	-2.91	0.004
Percent working in health services	-0.0033	-1.00	0.317
Percent working in manufacturing	0.0042	4.36	0.000
Population density	-0.0010	-3.03	0.002
Land area	0.0000	1.94	0.052
Number of farms	0.0001	2.07	0.039
Percent of land used in farming	-0.0006	-1.58	0.114
Percent of female-headed households	0.0054	2.44	0.015
Infant mortality rate	-0.0012	-0.69	0.489
Per capita property tax revenue (logged)	0.1046	7.65	0.000
Per capita federal aid revenue (logged)	0.0123	1.59	0.112
Per capita state aid revenue (logged)	-0.0299	-1.62	0.106
Per capita income (logged)	0.0080	0.22	0.829
Median home value (logged)	0.0078	0.24	0.814
Medicare Part-A annual per capita payment amount (logged)	-0.2028	-4.88	0.000
Medicare Part-B annual per capita payment amount (logged)	0.2247	5.13	0.000
Percent of population age 65 or older	0.0082	3.62	0.000
Rural/Urban Continuum Code 4	0.0508	1.03	0.302
Rural/Urban Continuum Code 5	0.1592	3.63	0.000
Rural/Urban Continuum Code 6	0.0907	3.59	0.000
Rural/Urban Continuum Code 7	0.1259	5.51	0.000
Rural/Urban Continuum Code 8	0.0278	1.00	0.317
1987	-0.1467	-6.35	0.000
1992	-0.1898	-6.26	0.000
Region 2 (Midwest)	0.0888	2.31	0.021
Region 3 (South)	0.0096	0.25	0.805
Region 4 (West)	0.0045	0.10	0.919

	chi2(32)	= 2789.20
	Prob > chi2	= 0.0000
Log Likelihood = -3418.4193	Pseudo R2	= 0.2898

Rural counties with higher unemployment rates and with higher percentages of workers in construction are less likely to have positive hospital expenditures by local government, but there is a slight increase in the likelihood of hospital expenditures associated with a higher percentage of workers in manufacturing. Rural counties in the Midwest have significantly higher probabilities of positive hospital expenditures than those in the Northeast, perhaps reflective of a greater local tax base in this region of the country.

Rural counties with greater area and more farms are slightly more likely to have government hospital expenditures, but counties with increased percentages of land devoted to farming have lower odds of hospital expenditures. This result could indicate that counties with greater numbers of family farms are more likely to devote resources to hospitals, whereas counties with more corporate farming are less inclined to do so.

As the omitted rural/urban continuum category of "9" represents those counties that have the smallest populations and which are most isolated from urban areas, it is not surprising that the coefficients for the included categories are positive. This suggests that rural counties with greater population are associated with higher probability of local government hospital expenditures. Counties with populations greater than 20,000 non-adjacent to urban areas and counties with 5,000-20,000 population, regardless of urban proximity, are the geographic types of rural counties associated with significantly higher likelihood of local government hospital expenditures.

The year variables ? 1987 and 1992 ? are both negative and significantly associated with lower probability of government hospital expenditures. A sensitivity

analysis adjusting for rural hospital closures since 1982 yielded the same findings ?  
lower expenditures in both 1987 and 1992.

### OLS Estimates

Since we are interested in the factors that contribute to variation in local government expenditures on rural hospitals, only the non-zero observations are included in the OLS regression estimation. Factors that predict whether a rural county government will have non-zero hospital expenditures are described above. The sample size is 3,598 counties with 1,549 distinct FIPS codes, versus a sample size of 6,950 if all rural counties were included for all three years. Approximately one-half of the rural counties in any given year had no local government expenditures on hospitals. There is consistency across these counties: 610 rural counties had no expenditures in all three years (1992, 1987, and 1982) while 857 rural counties had no expenditures in 1987 and 1982.

Logs were taken of the financial variables (including the dependent variable) to increase linearity and minimize skewness. Huber-White corrections for robust estimators were calculated due to indications of heteroskedasticity. The final OLS regression results are included below. The coefficients, taking into account the log transformations, are interpreted following the regression results listed in Table 8.

The unlogged coefficients can be interpreted as percentage changes in expenditures associated with a *change* in each independent variable. For the logged independent variables, we can interpret the coefficients as elasticities B percentage changes in expenditures associated with *percentage change* in the logged independent variables.



Table 8

**OLS Regression with Robust Standard Errors of  
Rural County Government Expenditures on Hospital Services  
(n = 3,598)**

Variable	Coefficient	Trans. Coeff.	t-score	P> t
Unemployment rate	0.0090		1.135	0.257
Short term hospital beds per capita	63.8019		6.378	0.000
Local government owns a hospital (1=yes, 0=no)	1.7050	4.5014	21.991	0.000
County population	0.000		-2.814	0.005
Percent of workforce in agriculture	-0.0059		-1.017	0.309
Percent of workforce in construction	-0.0175		-1.088	0.277
Percent of workforce in health services	0.0372		2.253	0.024
Percent of workforce in manufacturing	0.0081		1.819	0.069
Population density	0.0067		4.101	0.000
County land area	0.0001		2.184	0.029
Number of farms	0.0002		1.388	0.165
Percent of land that is used for farming	-0.0001		-0.060	0.952
Percent of households with female as head	-0.0154		-1.864	0.062
Infant mortality rate	-0.0152		-2.083	0.037
(Log) per capita revenues from property taxes	0.0212		0.324	0.746
(Log) federal aid revenues per capita	0.0445		1.529	0.126
(Log) state aid revenues per capita	0.4685		5.180	0.000
(Log) per capita income	0.1581		0.685	0.494
(Log) median home value	-0.0259		-0.158	0.874
(Log) Medicare part A annual per capita payment amount	0.7225		3.486	0.001
(Log) Medicare part B annual per capita payment amount	-0.1278		-0.621	0.535
Percent of Population aged 65 or older	-0.0040		-0.369	0.712
Region2 B Midwest	1.4213	3.1425	4.920	0.000
Region3 B South	2.0249	6.5754	7.002	0.000
Region4 B West	1.7560	4.7892	5.638	0.000
Rural/Urban Continuum Code 4	-0.0967	-0.0922	-0.392	0.695
Rural/Urban Continuum Code 5	-0.1120	-0.1060	-0.507	0.613
Rural/Urban Continuum Code 6	-0.0300	-0.0296	-0.257	0.797
Rural/Urban Continuum Code 7	0.1682	0.1832	1.682	0.093
Rural/Urban Continuum Code 8	0.1427	0.1534	0.964	0.335
1987	0.1166	0.1237	1.421	0.156
1992	0.1838	0.2018	1.495	0.135
Constant	-8.6450		-2.925	0.003

F( 32, 1548) = 33.48  
 Prob > F = 0.0000  
 R-squared = 0.3748  
 Root MSE = 1.4201

Number of clusters (fips) = 1549

Note that many of the t-scores indicate significant association with the dependent variable. Due to the large sample size, this finding is not surprising. In order of magnitude, the most-significant predictor of expenditures is local government ownership of a hospital, with a t-score of 22 and a >raw = coefficient of 1.71. Using the Halvorson and Palmquist (1980) approach to interpretation of dummy variables under a semi-log model, we can interpret this coefficient by transforming it as follows:

$$\frac{\Delta y / \Delta x}{y} = \frac{\exp(a_0 + a_1(1) + u) - \exp(a_0 + a_1(0) + u)}{\exp(a_0 + a_1(0) + u)}$$

Which simplifies to:  $\frac{\Delta y / \Delta x}{y} = e^{a_1} - 1$

So, for the variable “own”, we find that the effect of ownership (changing from non-ownership to ownership) is associated with increased rural county government hospital expenditures of 4.5 percent per capita. This effect, aggregated across an entire county population, is large. Other categorical variables included in the regression are the Census regions, urbanicity codes, and year indicators. Using the Northeast as the reference category, we find that rural county governments in the other three regions of the U.S. have significantly higher per capita expenditures on hospitals. For example, the expenditures per capita are 6.58 percent higher in Region 3 (the South) than in Region 1 (the Northeast).

None of the urbanicity indicator variables in the model are significantly different from that of the reference category of completely rural counties (Rural/Urban Continuum Code=9). However, an F-test of the group of urbanicity codes suggests that these

variables do add to the prediction of the model. In addition, population density increases are associated with higher per capita expenditures on hospitals.

The regression summary lists the re-transformed coefficient values for all of the indicator variables, as well as the coefficients for the continuous untransformed variables and logged variables. Short-term hospital beds per capita, with a coefficient value of 63.80 suggests that increasing short-term hospital beds per capita in the rural county by one would be associated with increased hospital expenditures by the county government of 63.80 percent per person. Although the magnitude of this coefficient appears large at first glance, consider that the average number of short-term hospital beds per capita across all rural counties was less than 0.005. Thus, increasing the number of beds per thousand population by one would result in a 0.063 percent increase in expenditures per capita.

Note also that most of the coefficient values are less than one, implying impact on expenditures per capita of less than one percent. In interpreting logged variables (e.g., logged per capita property tax revenues), recall that these values are interpreted as elasticities. Elasticities less than one imply that there is an inelastic relationship between the variables. This means that a variation in one will result in less absolute variation of the other. The most elastic of these variables is that of the Medicare Part A payments. The coefficient value of 0.72 suggests that an increase in the annual Medicare hospital payment for the rural county of \$100 per capita is associated with a \$72 per person increase in local government expenditures on hospitals. For every additional dollar per capita transferred from state to local governments, we find that about 50 cents would be spent on local hospitals. These two elasticity estimates

suggest a positive correspondence between intergovernmental fund transfers and local government expenditures on hospitals.

In terms of expenditures over time, we find that after controlling for health care inflation, there was not significant real growth in rural hospital expenditures in both 1987 and 1992 compared with the reference year of 1982. The annualized real growth rate appears to remain constant over the decade at about two percent per year ? although we are unable to confirm this with a three-point data set.

## **CONCLUSION**

During the study period, 1977 to 1992, the structure of rural local government revenues changed substantially. Rural local governments at the end of the period were less reliant on property taxes and intergovernmental transfers than they were at the beginning of the period. The declines in these income sources resulted from national political trends, beyond the control of local government leaders. New Federalism of the early 1980s and the tax limitation movement required local governments to compensate for declines in property tax and intergovernmental transfer revenue by raising taxes in other areas and instituting user fees. These new taxes and user fees, however, did not offset the declines in property taxes and intergovernmental transfers. In the last year of the study, rural local governments collected less revenue per person in constant dollar terms than they did in the earlier years of the study.

Rural local government spending on health care does not mirror these trends in revenue. On the contrary, per capita spending by rural local governments on hospitals, on average, was lower in the first year of the study period than in any subsequent year. Rural local government spending on other (i.e. non-hospital) health services increased

significantly during the period, growing an average four percent per year in constant dollar per capita terms. Since revenues are declining while spending on rural health services by local governments is increasing, the proportion of money spent on health care services is increasing. Approximately one dollar out of every ten, on average, is spent by rural local governments on health care services.

Hospital expenditures by far dominate local government spending on health. The amount spent on hospitals is four times greater than that spent by local governments for all other health services. Three factors associated with whether local governments spend money on hospitals are: 1) local public ownership of a hospital, 2) the proportion of households with females as head; and, 3) the proportion of the population over age 65. These findings make intuitive sense: local governments are more likely to support a hospital on an annual basis if they own a hospital, and local governments are more likely to support vulnerable populations, especially poor children and the elderly, if they compose a sizeable segment of the community. The amount that local governments spend on hospitals is associated with local government ownership, size of the hospital, and Medicare Part A payment rates.

The behavior of rural local governments in 1982, arguably the worst year economically of the four studied, is particularly interesting. In this year, rural local government spending overall was 1.7 percent greater than 1977, but spending on health services was 27.4 percent greater than the measurement taken five years earlier. This may indicate, as has been suggested (U.S. Senate Special Committee on Aging, 1988), that communities rally around their hospitals in times of economic stress. There are however, limitations on the largesse of rural local governments. With the advent of

the prospective payment system in (PPS) 1984, many rural hospitals closed (117 in the first four years of PPS alone compared to 44 in the previous four years). The financial losses at these hospitals were apparently too great for their local governments to forestall closure by increasing payments. This finding seems to indicate the marginal nature of local government support for hospitals. While they have the capacity to move hospitals with modest operating losses from the red into the black and to pay for some level of uncompensated care, the pockets of most rural local governments are not sufficiently deep to rescue rural hospitals from profound financial losses.

## REFERENCES

Aronson, R. and J. Hilley, *Financing State and Local Governments* (fourth edition), Washington, D.C.: The Brookings Institution, 1986.

Halvorson, R. and R. Palmquist, "The Interpretation of Dummy Variables in Semilogarithmic Equations," *American Economic Review* 70:474-475, 1980.

Jones, C., *An Introduction to the Study of Public Policy* (third edition), Monterey, CA: Brooks/Cole Publishing Co., 1984.

Minge, D., "Today's Farm Crisis Must Be Addressed," *Minneapolis Star Tribune*, p. A19, June 24, 1998.

Murdock, S. and L. Leistritz (eds.), *The Farm Financial Crisis: Socioeconomic Dimensions and Implications for Producers and Rural Areas*, Boulder, CO: Westview Press, 1988.

Pogue, T., "Mounting Fiscal Pressures: How Can State and Local Governments Cope?" *Economic Forces Shaping the Rural Heartland*, Feral Reserve Bank of Kansas City, 1996.

Reeder, R., *Rural and Urban Government Fiscal Trends, 1977-82*, Agriculture and Rural Economy Division, Economic Research Service, U.S. Department of Agriculture, Staff Report No. AGES880210, May 1988.

U.S. Census Bureau, *Census of Governments*, 1977, 1982, 1987, 1992.

U.S. Senate Special Committee on Aging, *The Rural Health Care Challenge*, Staff Report Serial No. 100-N, Washington, DC: U.S. Government Printing Office, October 1988.

**APPENDIX A**

**Local Government Revenue and Spending by  
Year, Urbanicity, and Region**



## Changes in Local Tax Expenditures on Health, 1977-1992

Mean Per Capita Expenditures  
(% Change)

	1977		1982		1987		1992	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
<b>Northeast</b>								
All local government expenditures	1256	1528	1106*** (-12.0%)	1310** (14.3%)	1107 (0.1%)	1330 (1.5%)	1144 (3.3%)	1337 (0.5%)
All health expenditures	31.22**	55.39**	46.93* (50.3%)	48.78* (-11.9%)	32.66* (-30.4%)	47.88* (-1.8%)	30.43 (-6.8%)	45.88 (-4.2%)
Hospital Expenditures	17.94***	33.78***	32.98*** (83.6%)	30.30*** (-10.3%)	16.15*** (-51.0%)	28.52*** (-5.9%)	12.10*** (25.1%)	24.61*** (-13.7%)
Other health expenditures	13.28***	21.61***	13.95 (5.0%)	18.48*** (-14.5%)	16.51*** (18.4%)	19.37*** (4.8%)	18.33*** (11.0%)	21.27*** (9.8%)
<b>Midwest</b>								
All local government expenditures	1217	1161	1145*** (-5.9%)	1107* (-4.6%)	1090*** (-4.8%)	1075 (-2.9%)	1033 (-5.2%)	1027 (-4.5%)
All health expenditures	96.77***	72.99***	124.28*** (28.4%)	90.31*** (23.7%)	105.31*** (-15.3%)	77.58*** (-14.1%)	101.27*** (-3.8%)	75.02*** (-3.3%)
Hospital Expenditures	82.79	53.43**	101.34** (22.4%)	60.80*** (13.8%)	81.52*** (-19.6%)	51.04*** (-16.1%)	80.44*** (-1.3%)	47.65*** (-6.6%)
Other health expenditures	13.98***	19.56***	22.94*** (64.1%)	29.51*** (50.9%)	23.79*** (3.7%)	26.54*** (-10.1%)	20.83*** (-12.4%)	27.37*** (3.1%)
<b>South</b>								
All local government expenditures	843	867	895*** (6.2%)	919*** (6.0%)	893*** (-0.2%)	952*** (3.6%)	859 (-3.8%)	925*** (-2.9%)
All health expenditures	85.69***	77.83***	112.17*** (30.9%)	101.77*** (30.8%)	98.00*** (-12.6%)	91.75*** (-9.8%)	99.23*** (1.3%)	100.76*** (9.8%)
Hospital Expenditures	76.34***	66.89	99.73*** (30.6%)	88.77 (32.7%)	86.50** (-13.3%)	77.67 (-12.5%)	83.14*** (-3.9%)	82.11 (5.7%)
Other health expenditures	9.34***	10.94***	12.44*** (33.2%)	12.99*** (18.7%)	11.50*** (-7.6%)	14.08*** (8.4%)	16.09*** (39.9%)	18.65*** (32.5%)
<b>West</b>								
All local government expenditures	1380	1351	1567*** (13.5%)	1378*** (2.0%)	1521*** (-2.9%)	1378*** (0.0%)	1435*** (-5.7%)	1339*** (-2.8%)
All health expenditures	113.03***	87.07***	129.73*** (14.8%)	104.56*** (20.1%)	125.50*** (-3.3%)	95.93*** (-8.3%)	134.13*** (6.9%)	92.42*** (-3.7%)
Hospital Expenditures	96.32	58.33	110.60 (14.8%)	72.54 (24.4%)	103.79 (-6.2%)	64.14 (-11.6%)	108.09** (4.1%)	53.86*** (-16.0%)
Other health expenditures	16.71***	28.74***	19.12*** (14.4%)	32.02*** (11.4%)	21.72*** (13.6%)	31.69*** (-0.7%)	26.04*** (19.9%)	38.57*** (21.3%)
<b>Total U.S.</b>								
All local government expenditures	1073	1106	1091 (1.7%)	1082 (-2.2%)	1063 (-2.5%)	1092 (1.0%)	1017 (-4.3%)	1065 (-2.5%)
All health expenditures	91.45	73.77	116.47 (27.4%)	90.22 (22.3%)	101.95 (-12.5%)	81.23* (-10.0%)	102.17 (0.2%)	83.89 (3.3%)
Hospital Expenditures	79.20	56.89	99.18 (25.2%)	69.87 (22.8%)	84.30 (-15.0%)	61.01*** (-12.7%)	82.82 (-1.8%)	60.29 (-1.2%)
Other health expenditures	12.25	16.88	17.29 (41.1%)	20.35 (20.6%)	17.65 (2.1%)	20.22 (-0.6%)	19.35 (9.6%)	23.60 (16.7%)

t-test significance level noted by asterisks: \*\*\*p&lt;0.001; \*\*p&lt;0.01; \*p&lt;0.05

**Changes in Local Tax Revenue, 1977-1992**

**Mean Per Capita Tax Revenue  
(% Change)**

	1977		1982		1987		1992	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
<b>Northeast</b>								
All tax revenues	1277	1605*	1169 (-8.4%)	1411 (-12.1%)	1190 (1.8%)	1463 (3.7%)	1127 (-5.3%)	1369 (-6.4%)
Federal contribution	84**	121*	59 (-30.1%)	78 (-36.0%)	38 (-35.8%)	52 (-32.7%)	17*** (-55.6%)	26 (-49.5%)
State contribution	472*	515*	395 (-16.5%)	456 (-11.5%)	407 (3.1%)	448 (-1.7%)	391 (-4.0%)	416 (-7.2%)
Property tax contribution	422*	595*	408*** (-3.5%)	497*** (-16.5%)	420*** (3.1%)	498*** (0.2%)	425*** (1.1%)	512*** (2.9%)
<b>Midwest</b>								
All tax revenues	1350***	1254	1375*** (1.9%)	1255 (0.0%)	1302** (-5.4%)	1220 (-2.8%)	1161 (-10.8%)	1085 (-11.1%)
Federal contribution	66*	83	58 (-12.5%)	73 (-12.2%)	41 (-3.0%)	43 (-40.2%)	24 (-40.8%)	26 (-41.2%)
State contribution	414	419	388*** (-6.3%)	382 (-9.0%)	383*** (-1.2%)	374 (-1.9%)	371*** (-3.1%)	334 (10.8%)
Property tax contribution	473***	405***	418*** (-11.7%)	364*** (-10.0%)	390*** (-6.7%)	246** (-4.9%)	329*** (-15.5%)	324 (-6.6%)
<b>South</b>								
All tax revenues	949***	985***	1045*** (10.1%)	1088*** (10.5%)	1031*** (-1.3%)	1124*** (3.3%)	962*** (-6.7%)	1031** (-8.3%)
Federal contribution	69	89	55 (-20.6%)	71 (-20.0%)	32*** (-42.1%)	43 (-40.0%)	18*** (-41.7%)	27 (-37.6%)
State contribution	369***	310***	382*** (3.4%)	320*** (3.3%)	376*** (-1.6%)	318*** (-0.6%)	370*** (-1.5%)	298*** (-6.4%)
Property tax contribution	218***	221***	220*** (0.9%)	219*** (-1.0%)	225*** (-2.3%)	229*** (4.6%)	214*** (-4.9%)	229*** (0.1%)
<b>West</b>								
All tax revenues	1512***	1517***	1732*** (14.6%)	1666*** (9.8%)	1668*** (-3.7%)	1693*** (1.6%)	1503*** (-9.9%)	1397*** (-17.5%)
Federal contribution	88***	106	94*** (7.2%)	87 (-18.2%)	72*** (-23.6%)	62 (-28.1%)	53*** (-26.7%)	32 (-48.3%)
State contribution	480***	465***	563*** (17.4%)	561*** (20.8%)	532*** (-5.5%)	552*** (-1.6%)	523*** (-1.7%)	504*** (-8.7%)
Property tax revenue	511***	476	470*** (-8.0%)	327 (-31.3%)	468*** (-0.5%)	319 (-2.3%)	368*** (-21.3%)	280*** (-12.3%)
<b>Total U.S.</b>								
All tax revenues	1189	1215	1269 (6.7%)	1246 (2.6%)	1228 (-3.3%)	1266 (0.3%)	1119 (-8.8%)	1140 (-9.9%)
Federal contribution	71	94	62 (-13.4%)	74 (-21.3%)	41 (-33.6%)	47 (-6.2%)	25 (-38.1%)	27 (-42.2%)
State contribution	405	390	410 (1.2%)	384 (-1.4%)	402 (-2.1%)	380 (0.2%)	393 (-2.2%)	349 (-8.0%)
Property tax revenue	362	359	336 (-7.1%)	315 (-12.1%)	328 (-2.3%)	314 (-0.1%)	287 (-12.4%)	307 (-2.4%)

t-test significance level noted by asterisks: \*\*\*p<0.001; \*\*p<0.01; \*p<0.05

**Changes in Local Tax Revenue by Rural/Urban Continuum Code, 1977-1992**  
**Mean Per Capita Tax Revenue**  
**(% Change)**

**Rural/Urban Continuum Code**

	<b>Total</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>1977</b>											
All tax revenues	1195	2231**	1161	1138*	1118**	1193	1251	1068***	1222	1057***	1298***
Federal contribution	77	272**	68	87*	84	87	89**	64***	73	59***	73
State contribution	402	618	354***	388	368**	402	393	401	402	418	411
Property tax contribution	361	620***	423***	315***	295***	318**	312***	283***	343	329	502***
<b>1982</b>											
All tax revenues	1264 (6%)	2093** (-6%)	1191** (3%)	1158*** (2%)	1212 (1%)	1207 (1%)	1354* (8%)	1148*** (8%)	1330* (9%)	1112*** (5%)	1360** (5%)
Federal contribution	65 (-16%)	208** (-24%)	53*** (-22%)	64 (-26%)	74** (-12%)	63 (-28%)	82*** (-7%)	54*** (-15%)	63 (-13%)	51** (-13%)	66 (-10%)
State contribution	404 (1%)	586* (-5%)	355*** (0%)	375** (-3%)	376** (2%)	395 (-2%)	401 (2%)	397 (-1%)	410 (2%)	424 (2%)	422** (3%)
Property tax contribution	331 (-8%)	455* (-27%)	377** (-11%)	282*** (-10%)	268*** (-9%)	275*** (-13%)	279*** (-11%)	272*** (-4%)	321 (-7%)	328 (0%)	454*** (-10%)
<b>1987</b>											
All tax revenues	1237 (-2%)	2231** (-2%)	1190 (7%)	1175** (0%)	1209 (1%)	1198 (0%)	1287 (-1%)	1119*** (-5%)	1295* (-3%)	1089*** (-2%)	1294 (-5%)
Federal contribution	42 (-35%)	138** (-35%)	32*** (-34%)	38** (-40%)	49 (-41%)	36 (-34%)	48 (-42%)	31*** (-42%)	45 (-29%)	34* (-35%)	46 (-30%)
State contribution	397 (-2%)	558 (-2%)	343*** (-5%)	372** (-3%)	376 (-1%)	390 (-0%)	392 (-1%)	391 (-2%)	410 (0%)	406 (-4%)	403 (-5%)
Property tax contribution	325 (-2%)	467** (-2%)	377*** (3%)	280*** (0%)	267*** (-1%)	269*** (0%)	270*** (-2%)	268*** (-3%)	314 (-2%)	329 (0%)	438*** (-4%)
<b>1992</b>											
All tax revenues	1124 (-9%)	1429** (-36%)	1003*** (-16%)	1045*** (-11%)	1082 (-11%)	1148 (-4%)	1161*** (-10%)	1033** (-8%)	1182** (-9%)	993*** (-9%)	1209** (-7%)
Federal contribution	26 (-39%)	42 (-70%)	12*** (-63%)	24 (-37%)	28 (-43%)	21** (-41%)	36*** (-24%)	20 (-37%)	29 (-35%)	17*** (-50%)	30 (-35%)
State contribution	382 (-4%)	375 (-33%)	330*** (-4%)	330*** (-4%)	369 (-2%)	377 (-4%)	369 (-6%)	384** (-2%)	398 (-3%)	400 (-1%)	409** (2%)
Property tax contribution	292 (-10%)	434*** (-7%)	303 (-20%)	303 (-20%)	245*** (-8%)	257** (-5%)	250*** (-8%)	245 (-9%)	276 (-12%)	271 (-18%)	384*** (-12%)

t-test significance level noted by asterisks: \*\*\*p<0.001; \*\*p<0.01; \*p<0.05

Changes in Local Government Health Expenditures by Rural/Urban Continuum Code, 1977-1992

Mean Per Capita Tax Revenue  
(% Change)

Rural/Urban Continuum Code

	Total	0	1	2	3	4	5	6	7	8	9
<b>1977</b>											
Total health expenditures	87	154**	62***	64***	80	78	102	82	114***	58***	83
Hospital expenditures	74	115	47***	48***	66	62	91	71	103***	45***	70
Other health expenditures	13	39***	15	17**	14	16*	12	11***	11	13	14
<b>1982</b>											
Total health expenditures	110 (26%)	158 (3%)	80*** (30%)	80*** (26%)	98 (23%)	104 (33%)	136 (32%)	110 (34%)	140*** (23%)	79*** (36%)	103 (24%)
Hospital expenditures	92 (25%)	123 (7%)	61*** (30%)	62*** (30%)	78 (18%)	81 (31%)	118 (30%)	94 (31%)	124*** (21%)	62*** (38%)	85 (22%)
Other health expenditures	18 (35%)	35*** (-10%)	20 (31%)	19 (13%)	20 (46%)	23* (43%)	18 (52%)	16 (48%)	17 (46%)	17 (29%)	18 (31%)
<b>1987</b>											
Total health expenditures	97 (-12%)	156 (-1%)	68*** (-15%)	70*** (-13%)	87 (-11%)	97 (-7%)	128* (-6%)	90 (-18%)	125*** (-11%)	69* (-12%)	91 (-12%)
Hospital expenditures	79 (-15%)	118 (-3%)	48*** (-21%)	51*** (-17%)	69 (-12%)	75 (-7%)	109* (-7%)	75 (20%)	109*** (-12%)	51* (-18%)	71 (-17%)
Other health expenditures	18 (-1%)	37*** (7%)	20 (3%)	19 (1%)	18 (-8%)	22 (-5%)	22 (-5%)	15*** (-7%)	17 (1%)	18 (7%)	20 (9%)
<b>1992</b>											
Total health expenditures	98 (1%)	93 (-40%)	73** (7%)	78** (11%)	91 (4%)	121 (25%)	117 (-9%)	93 (3%)	135*** (7%)	47*** (-32%)	95 (5%)
Hospital expenditures	77 (-2%)	62*** (-47%)	53* (10%)	56** (10%)	69 (0%)	94 (24%)	97 (-11%)	74 (-1%)	115*** (6%)	32*** (-38%)	76 (7%)
Other health expenditures	20 (12%)	31*** (-17%)	22 (15%)	22 (15%)	22 (19%)	28** (27%)	19 (2%)	19 (26%)	20 (18%)	15*** (-14%)	19 (-4%)

t-test significance level noted by asterisks: \*\*\*p<0.001; \*\*p<0.01; \*p<0.05

## **APPENDIX B**

### **Summary Statistics of Variables Used in Multivariate Analysis**

Table B-1

## Variables from the Census of Governments

Per capita values were calculated using each county's population data from the Area Resource File.

Variable	Description	Type	Uses
Per capita local government hospital expenditures	N=12246 Mean=80.65 Min=0.00 Max=1920.09	Continuous	Trend analysis
Per capita local government other health expenditures	N=12246 Mean=17.48 Min=0.00 Max=529.42	Continuous	Trend analysis
Per capita total local government expenditures on health	N=12246 Mean=98.13 Min=0.00 Max=1929.40	Continuous	Trend analysis
Per capita total local government expenditure	N=12246 Mean=1067.17 Min=61.43 Max=15695.61	Continuous	Trend analysis
Percent of local government expenditures on hospitals	N=12246 Mean=6.86 Min=0.00 Max=75.05	Continuous [0,1]	Trend analysis
Percent of local government expenditures on other health services	N=12246 Mean=1.66 Min=0.00 Max=75.41	Continuous [0,1]	Trend analysis
Percent of local government expenditures on total health	N=12246 Mean=8.52 Min=0.00 Max=75.42	Continuous [0,1]	Trend analysis

Table B-1 (continued)

Variable	Description	Type	Uses
Local government expenditures greater than zero (rural only)	N=6950 Mean=0.5177 Min=0 Max=1	Indicator 0=no 1=yes	Probit Regression – dependent variable
Logged per capita local government hospital expenditures (rural only)	N=3598 Mean=4.35 Min=0.0067 Max=7.5606	Continuous transformed to minimize skewness	OLS Regression – dependent variable
Property tax revenues per capita	N=9178 Mean=315.97 Min=1.45 Max=4983.78	Continuous	Regression and Trend analysis
Federal government aid to the local government per capita	N=9178 Mean=44.27 Min=0 Max=2290.46	Continuous	Regression and Trend analysis
State government aid to the local government per capita	N=9178 Mean=394.43 Min=0 Max=4810.75	Continuous	Regression and Trend analysis

**Table B-2**

**Area Resource File Variables for Each County**

<b>Variable</b>	<b>Description</b>	<b>Type</b>	<b>Uses</b>
Rural/urban continuum code	N=9174 Mean=5.75 0=major MSA 9=most rural	Categorical  Reference Category=0	Regression and Trend analysis
Short-term hospital beds per capita	N=6950 Mean=0.0043 Min=0.00 Max=0.0495	Continuous	Regression
Population	N=6950 Mean=23301 Min=100 Max=201900	Continuous (discrete)	Regression
Percent of workers in agriculture	N=6950 Mean=12.36 Min=0.00 Max=71.8	Continuous [0,100]	Regression
Percent of workers in construction	N=6950 Mean=7.00 Min=0.00 Max=30.9	Continuous [0,100]	Regression
Percent of workers in health services	N=6950 Mean=7.08 Min=0.00 Max=32.7	Continuous [0,100]	Regression
Unemployment rate	N=6950 Mean=8.77 Min=0.00 Max=39.2	Continuous [0,100]	Regression



Table B-2 (continued)

<b>Variable</b>	<b>Description</b>	<b>Type</b>	<b>Uses</b>
Percent of workers in manufacturing	N=6950 Mean=18.99 Min=0.00 Max=61.5	Continuous [0,100]	Regression
Population density (people per square mile)	N=6950 Mean=37.99 Min=0.149 Max=833.82	Continuous	Regression
Land area	N=6950 Mean=1014.20 Min=470 Max=186190	Continuous	Regression
Farmland acres	N=6950 Mean=647.02 Min=0 Max=3580	Continuous	Regression
Percentage of land held as farms	N=6950 Mean=55.89 Min=0 Max=100	Continuous [0,100]	Regression
Percent of families with a female head of household	N=6950 Mean=11.02 Min=0 Max=39.0	Continuous [0,100]	Regression
Infant mortality rate	N=6950 Mean=9.68 Min=0 Max=74.1	Continuous [0,100]	Regression

Table B-2 (continued)

Variable	Description	Type	Uses
Census region	N=9178 Mean=2.65 Min=1 (NE) Max=4 (West)	Categorical 1=Northeast 2=Midwest 3=South 4=West	Regression and Trend analysis
MSA	N=9178 Mean=.23 Min=0 (non-MSA) Max=1 (MSA)	Categorical	Trend analysis
Per capita income	N=6950 Mean=8907.01 Min=0 Max=31180.54	Continuous	Regression
Median home value	N=6950 Mean=30732.61 Min=7890.06 Max=384320.60	Continuous	Regression
Percent of population over age 65	N=6950 Mean=15.19 Min=1.61 Max=47.08	Continuous [0,100]	
Medicare Part A (hospital) annual per capita payment amount	N=6950 Mean=10298.11 Min=0 Max=29396.32	Continuous	Regression
Medicare Part B (physician) annual per capita payment amount	N=6950 Mean=5685.74 Min=0 Max=15152.22	Continuous	Regression

Two of the categorical variables, the Rural/Urban Continuum Code and MSA, are of direct relevance to the analytic questions regarding whether rurality has any effect on local government health expenditures. A more detailed explanation of these variables is therefore warranted. For precise definitions, we relied on the user documentation describing the criteria required for a county to be classified as an MSA or a particular Rural/Urban Continuum Code in the Area Resource File (Bureau of Health Professions, 1997):

An area is defined by as an MSA if there is a city with a population of at least 50,000 or if there is an urbanized area of at least 50,000 population with a total metropolitan population of at least 100,000. In addition to the county containing the central city, an MSA may include additional counties having close economic/social ties to the central county. MSAs comprise entire counties, except for the six New England states, where towns/cities are the units of definition because of the lack of county governments. Except for this base unit, the same criteria are applied to define MSAs in New England as in the rest of the country (p.7).

The Rural/Urban Continuum Codes are from *Rural/Urban Continuum Codes for Metro and Nonmetro Counties*, U.S. Department of Agriculture. The codes form a classification scheme that distinguishes metropolitan counties by size and non-metropolitan counties by degree of urbanization or proximity to metropolitan areas. All U.S. counties and county equivalents are grouped according to the official metropolitan status announced by the Office of Management and Budget. The 1995 codes are defined as follows (p.10-11):

Metropolitan Counties (0-3)

- 00 Central counties of metropolitan areas of 1 million population or more
- 01 Fringe counties of metropolitan areas of 1 million population or more
- 02 Counties in metropolitan areas of 250,000 to 1,000,000 population
- 03 Counties in metropolitan areas of less than 250,000 population

Non-metropolitan Counties (4-9)

- 04 Urban population of 20,000 or more, adjacent to metropolitan area
- 05 Urban population of 20,000 or more, non-adjacent to metropolitan area
- 06 Urban population of 2,500-19,999, adjacent to metropolitan area
- 07 Urban population of 2,500-19,999, non-adjacent to metropolitan area
- 08 Completely rural (no places with population of 2,500 or more) adjacent to a metropolitan area
- 09 Completely rural (no places with population of 2,500 or more) non-adjacent to metropolitan area

Since the regional variable is also used to categorize health expenditures over time, we list the states included for each region.

1. Northeast: Maine, Vermont, Massachusetts, New Hampshire, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania
2. Midwest: Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, South Dakota, North Dakota
3. South: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Florida, Kentucky, Georgia, Tennessee, Mississippi, Alabama, Arkansas, Louisiana, Texas, Oklahoma
4. West: Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Idaho, Nevada, Washington, Oregon, California

**Table B-3**  
**Other Variables Used in the Analysis**

<b>Variable and Variable Name</b>	<b>Source</b>	<b>Description</b>	<b>Type</b>	<b>Uses</b>
State & county identification code (FIPS)	All datasets	N=9178	Categorical	Linking data and identification of county units
Local government ownership of hospital	AHA Survey of Hospitals (1992)	N=9178	Categorical 0=no 1=yes	Regression
Year	ARF and Census of Governments	N=9178	Categorical 1977 1982 1987 1992	Regression (1982-1992)  Trend analysis (all years)