FISCAL STRESS AND LOCAL GOVERNMENT

IN OKLAHOMA, 1977 - 1987

By

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PREFACE

A model for estimating fiscal stress at the local government level in Oklahoma during the period of the energy boom and bust was developed. A tax effort index based on the concept of potential revenues was used to measure fiscal stress at both the county and municipal levels of government. This index was then regressed against several explanatory variables in an attempt to discover what attributes of a local jurisdiction might affect this index of stress. Finally, correlation and regression analysis were used to examine how these local governments adjusted expenditures in response to stress and how changes in various revenue bases affected the stress experienced by a jurisdiction. It was ultimately found that unlike the private sector, local governments in Oklahoma were relatively well insulated from stress during the energy boom and bust period. For counties, this insulation largely took the form of increased intergovernmental transfers from the state. Municipalities, on the other hand, were able to generate needed revenues through their power to tax.

I would like to express my gratitude to my major adviser, Dr. Larkin Warner, for his invaluable assistance on this project. I am also thankful to the guidance Dr. Ronald

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CHAPTER I

INTRODUCTION

Local governments provide many basic goods and services to their citizens. Policymakers are concerned with the fiscal condition of these jurisdictions, as fiscal viability has a direct impact on the jurisdiction's ability to provide citizens with the goods and services they desire. A study of Oklahoma local governments during the 1977 - 1987 time period provides a unique opportunity for analysts to observe how extreme changes in a state's economy can affect the fiscal condition of local governments. During this time period several major upheavals occurred which likely had a serious impact on the fiscal condition of county and municipal governments in Oklahoma.

First, throughout this period there were significant changes in the energy and agricultural sectors. For example, actions taken by OPEC caused the price of oil to increase from $10.24 per barrel in 1977 to $32.74 per barrel during the height of the oil boom in 1982. From 1982 to 1987 this price plummeted to $14.57 per barrel[1]. Natural gas prices were

[1]Center for Economic & Management Research, Statistical Abstract of Oklahoma: Oklahoma Department of Commerce, 1988.

subject to similar fluctuations. These large swings in price had significant impacts on private sector economic activity in the state. Wage and salary employment in oil and gas extraction was 43.7 thousand in January 1977. It rose to a peak of 114.1 thousand in March of 1982 and then declined to its 1977 level by January 1987[2]. These variations in price and employment should have had a significant impact on the fiscal condition of the state's local government sector.

The period of turbulence in the energy sector was accompanied by similar variations in economic activity in the agriculture sector. Farm income rose from $124 million in 1977 to $830 million in 1979. It then plummeted to $402 million by 1983[3]. Land values also showed a great deal of variation throughout this period. For example, the value of farm land in Oklahoma rose 64 percent between 1977 and 1982. By 1987, the value of this property had fallen to about 5 percent below its 1977 level[4].

Much of this turbulence in agriculture was a result of the policies undertaken by the federal government during the late 1970s. These policies produced significant inflation which led to increased land values. Farmers borrowed against

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[2]Oklahoma Employment Security Commission, Oklahoma Handbook of Employment Statistics, Vol. II, 1991, p. 5.

[3]U.S. Department of Commerce, Bureau of Economic Analysis, State Personal Income: 1929-87, Washington, D.C.: U.S. Government Printing Office, 1989, p. 209.

[4]Oklahoma Department of Agriculture, Oklahoma Agricultural Statistics, selected years.

the inflated value of their land. As inflation continued and farm exports became less competitive many farmers found it increasingly difficult to meet the financial obligations of their earlier actions and were forced out of the agricultural sector. In those jurisdictions in which agriculture is a major economic sector, this shift in economic activity must have had an impact fiscal health.

In addition to being buffeted by changes in the energy and agricultural sectors, many local governments felt pressure because of the significant drop that occurred in federal intergovernmental revenues during this period. Federal intergovernmental revenues as a percent of state-local government revenues peaked during the Carter administration and then began to fall.

Surprisingly, analysis of aggregate data such as that available in the U.S. Bureau of Census Governmental Finances annual statistical series suggests that Oklahoma local governments were relatively well insulated from the shocks that were rocking the state's private sector during the time period under consideration. For example, Table I at the end of the chapter shows that despite the turmoil experienced by the private sector in Oklahoma during this period, both county and municipal revenues continued to grow. (The only exception was a drop in county revenues during 1987.)

While aggregate data imply that local governments were able to maintain their fiscal viability throughout the period

of analysis, the tremendous instability of the Oklahoma economy that occurred from 1977 - 1987 makes it reasonable to question this inference. Aggregate data may allow the behavior of a few large jurisdictions to mask fiscal problems experienced by smaller jurisdictions. Thus, the use of disaggregated data, if available, would allow a more accurate picture of the condition of Oklahoma's local jurisdictions to be presented. Such data might show that the local government sector in Oklahoma was much more vulnerable to stress than indicated by the aggregate data.

In order to address this issue it is necessary to have detailed information on each jurisdiction's fiscal condition. Unfortunately, such detailed data are not published by any governmental agency. It is, however, available in the form of raw data. These data are found in the individual financial statements submitted annually to the Oklahoma State Auditor and Inspector by local governments. There may be a question of data accuracy due to the insufficient training of some individuals who report this data; however, the use of this data is unique because it not only allows the local government sector to be disaggregated into the county and municipal sectors, but also allows for analysis of individual jurisdictions. Hence, despite any shortcomings, this study employs these financial statements in its analysis of the fiscal condition of Oklahoma's local government sector.

This disaggregated data is used to develop tables II and

III at the end of the chapter which list from high to low the growth rates of the principal revenue sources[5] for counties and the largest municipality in each county during the 1977 - 1982 period and the 1982 - 1987 period. Unlike the aggregate data, examination of these tables indicates that many local governments experienced significant changes in their principal revenues.

Not only were there significant changes in the principal revenues of these local jurisdictions, tables II and III also illustrate the fact that governments which experienced above-average growth rates in revenues during the 1977 - 1982 time period tended to experience below-average growth rates during the 1982 - 1987 time period. This pattern is supported both by careful examination of the tables and by the high negative correlation coefficient that exists (-0.97 for counties and -0.96 for cities) between the high- and low-growth governments during these time periods.

Thus, the statistics derived from more detailed data indicate that the changes occurring in the energy and agricultural sectors and the changes occurring in the level of federal intergovernmental revenues throughout this period had a significant impact on the fiscal condition of local

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[5]The principal revenue sources for counties are: property taxes, sales taxes, fines, licenses, fees, interest income, and intergovernmental revenues. The principal revenue sources for cities are: property taxes, sales taxes, utility revenues, fines, licenses, fees, interest income,and intergovernmental revenues.

jurisdictions in Oklahoma. Instead of being insulated from these shocks, these data suggest that many of Oklahoma's local jurisdictions were on a fiscal roller coaster throughout this time period.

The purpose of this study is to analyze the impact of these disruptions on local governments in Oklahoma during the period of 1977 - 1987. Specifically, detailed financial records of individual jurisdictions are used to examine the importance of a hypothesized set of relevant variables. These records are also used to identify the response of local jurisdictions to changes in fiscal pressure.

Policy makers may be able to use the information gleaned from this study to identify those jurisdictions most vulnerable to stress and to design policies to help alleviate stress in a jurisdiction. The information provided will also allow policy makers to gain insight as to how counties and municipalities adjust to changes in their level of stress. Such information is useful in examining the need for restructuring local revenue bases so as to decrease a jurisdiction's vulnerability to stress.

Within the context of this study, the term fiscal stress is used to refer to a potential imbalance between governmental revenues and expenditures, complicated by the difficulties of maintaining a legally required balanced budget. This imbalance is assumed to be caused by an excess demand for the goods and services provided by a local jurisdiction.

In order to measure the level of fiscal stress experienced by a jurisdiction, an index of fiscal stress is developed in Chapter II. This index is the ratio of the jurisdiction's actual revenues to its potential revenues. Increases in this index indicate the possibility of over-utilization of revenue bases within the jurisdiction.

In addition to measuring a jurisdiction's level of stress, policy makers may wish to know which jurisdictions are most susceptible to fiscal stress. In order to answer this question, it is necessary to identify those variables having the greatest impact on stress. The identification of these variables is the focus of Chapter III. The model used to estimate the level of stress within a jurisdiction is also discussed in this chapter.

Chapter IV presents the results of regressing the index of stress against the variables which literature suggests are likely to influence a jurisdiction's level of stress. The results of this regression indicate those variables which are significant in explaining stress at the local government level in Oklahoma.

In addition to the information presented in Chapters III and IV, policy makers may also wish to gain insight as to how jurisdictions might adjust to changes in their level of stress. Chapter V uses both correlation analysis and simple regression analysis to examine this problem. In addition, Chapter V also uses correlation analysis and simple regression

analysis to examine the question of whether a jurisdiction's index of stress is particularly sensitive to changes in a specific revenue source. Such information could be useful in examining the need for restructuring local revenue bases so as to decrease a jurisdiction's vulnerability to stress.

Finally, Chapter VI summarizes what has been learned about fiscal stress in Oklahoma as a result of this study. This chapter also makes suggestions for areas of future research.

TABLE I

COUNTY AND MUNICIPAL TOTAL REVENUES
1977 - 1987

Year	County Revenue (millions of dollars)	Municipal Revenue (millions of dollars)
1977	$251.4	$743.7
1978	273.3	854.7
1979	296.7	910.9
1980	334.3	1033.3
1981	351.9	1186.4
1982	419.8	1241.3
1983	429.1	1280.5
1984	540.9	1636.7
1985	594.7	1788.1
1986	647.2	1833.2
1987	608.5	1855.0

Source: Governmental Finances, selected years. U.S. Department of Commerce. U.S. Government Printing Office.

TABLE II

GROWTH RATES IN PRINCIPAL COUNTY REVENUES

Percentage Change in Revenues			
County	1977-82	County	1982-87
Adair	128.28	Okfuskee	-27.67
Noble	93.47	Love	-18.07
Roger Mills	90.13	Adair	-17.34
Washita	81.80	Pittsburg	-9.41
Pawnee	80.90	Pawnee	-8.46
Custer	80.43	Noble	-8.34
Cleveland	78.77	Rogers	-7.64
Muskogee	76.86	Canadian	-7.05
Love	75.91	Roger Mills	-6.57
Major	73.75	Bryan	-6.52
Pittsburg	72.54	McClain	-6.31
Kingfisher	72.07	Stephens	-5.21
Rogers	69.92	Kingfisher	-4.25
Stephens	65.88	Seminole	-0.14
Canadian	65.05	Jackson	0.63
McClain	64.46	Major	1.21
Carter	61.51	Leflore	1.68
Caddo	59.33	Caddo	2.55
Blaine	54.34	Texas	2.86
Haskell	53.18	Logan	4.11
Texas	51.05	Pontotoc	4.28
Garvin	50.34	Beaver	4.87
Delaware	50.27	Cimarron	5.02
Pottawatomie	49.79	Latimer	6.82
Johnston	49.44	Sequoyah	7.36
Jackson	48.43	Wagoner	8.11
Kay	48.40	Creek	8.48
Logan	47.95	Osage	8.58
Leflore	47.94	Delaware	8.67
Choctaw	47.54	Cleveland	9.13
Ellis	45.67	Garvin	9.74
Creek	45.21	Dewey	9.77
Alfalfa	44.66	Johnston	9.85
Coal	44.59	Grady	10.07
Beaver	42.61	Blaine	10.11
Payne	41.68	Carter	10.23
Harper	41.22	Alfalfa	10.45
Bryan	41.15	McIntosh	11.26
Wagoner	40.63	Marshall	13.45
Mayes	40.58	Hughes	13.46
Woodward	40.50	Pottawatomie	13.78
Grant	39.25	Lincoln	13.89
Washington	39.21	Woods	14.33
Seminole	39.10	Ottawa	15.31

TABLE II (Continued)

Harmon	38.96	Muskogee	15.88
Dewey	38.75	Kay	16.57
Grady	38.47	Woodward	16.68
Hughes	38.45	Jefferson	16.85
Jefferson	38.32	Payne	17.06
Woods	38.15	Tillman	17.83
Marshall	36.65	Tulsa	19.02
Tillman	35.74	Coal	20.10
Atoka	32.58	Grant	20.19
Oklahoma	32.42	Kiowa	20.52
Ottawa	31.62	Ellis	21.80
Cotton	30.83	Cotton	24.11
Okfuskee	29.29	Comanche	24.29
Comanche	29.03	Washita	24.67
Osage	28.16	Harper	26.95
Tulsa	26.61	Haskell	27.14
Garfield	26.57	Custer	28.34
McCurtain	25.08	Choctaw	31.19
Craig	24.74	Pushmataha	31.20
Pushmataha	23.50	Harmon	33.90
Kiowa	22.04	McCurtain	35.58
Greer	21.62	Greer	37.19
Sequoyah	20.50	Oklahoma	39.81
McIntosh	19.92	Washington	39.90
Lincoln	19.06	Mayes	41.02
Latimer	18.90	Atoka	44.86
Cimarron	15.93	Craig	45.00
Okmulgee	8.69	Garfield	45.43
Cherokee	4.95	Murray	48.52
Beckham	-23.98	Cherokee	59.03
Pontotoc	-14.83	Beckham	59.24
Murray	-49.09	Okmulgee	63.37
Nowata	-57.71	Nowata	87.05
AVERAGE	44.77	AVERAGE	13.05

Correlation Coefficient -0.97
(0.0001)

Source: Financial Statements submitted to the Oklahoma State Auditor and Inspector (1977, 1982, and 1987).

TABLE III

GROWTH RATES IN PRINCIPAL MUNICIPAL REVENUES

Percentage Change in Revenue			
Municipality	1977-82	Municipality	1982-87
Checotah	106.93	Duncan	-49.62
Coalgate	106.38	Elk City	-38.13
Antlers	104.90	Woodward	-30.17
Guthrie	102.32	Hobart	-25.14
Hobart	96.17	Stroud	-24.71
Grove	94.94	Antlers	-18.74
Vinita	93.90	Frederick	-18.10
Shawnee	92.10	Pauls Valley	-12.12
Holdenville	90.16	Guthrie	-9.16
Woodward	90.16	Durant	-8.53
Anadarko	89.66	Weatherford	-5.95
Elk City	89.16	Shawnee	-5.21
Watonga	86.37	Waurika	-3.84
Durant	85.36	Coalgate	-3.79
Frederick	84.77	Yukon	-3.69
Purcell	84.10	Guymon	-2.37
Boise City	81.05	Tishomingo	-1.89
Cleveland	80.68	Vinita	-0.94
Stroud	80.18	Tahlequah	0.23
Weatherford	77.83	Seiling	1.61
Pryor	77.34	Hollis	2.76
Duncan	75.42	Tulsa	3.01
Kingfisher	73.86	Medford	5.22
Waurika	73.64	Beaver	6.04
Enid	73.40	Wilburton	7.66
Sallisaw	72.09	Kingfisher	8.70
Claremore	71.12	Purcell	10.01
Beaver	70.38	Muskogee	10.80
Marietta	67.93	Cleveland	11.33
Norman	67.32	Bartlesville	12.06
Alva	65.40	Walters	12.23
Wagoner	64.90	Pryor	12.68
Tishomingo	62.61	Ponca City	13.80
Stillwater	61.19	Seminole	13.96
Cherokee	60.53	Cheyenne	15.29
Chickasha	59.42	Oklahoma City	15.59
Stigler	55.89	Checotah	15.83
Sulphur	55.88	Ardmore	16.07
Seminole	54.54	Enid	17.14
Muskogee	54.13	Marietta	17.87
Ardmore	53.72	Claremore	19.20
Pauls Valley	52.46	Madill	20.28
Yukon	52.31	Wagoner	21.56
Guymon	51.60	Stigler	21.66

TABLE III (Continued)

Fairview	51.26	Fairview	23.17
Medford	49.57	Sallisaw	24.67
Ada	49.33	Laverne	25.10
Tahlequah	48.82	Norman	27.20
Walters	46.52	Shattuck	27.23
Sapulpa	46.33	Holdenville	27.91
Shattuck	45.81	Cherokee	27.93
Madill	45.39	Stillwell	29.16
Okemah	45.38	Chickasha	31.65
Altus	45.36	McAlester	32.33
Cordell	41.84	Watonga	33.75
Stillwell	40.68	Anadarko	34.01
Perry	40.01	Cordell	34.30
Seiling	40.01	Sapulpa	35.45
Wilburton	39.71	Mangum	37.43
Hollis	34.51	Alva	38.81
Lawton	33.13	Pawhuska	40.40
Laverne	31.78	Ada	40.83
Poteau	31.09	Lawton	40.99
Idabel	23.82	Altus	41.40
Mangum	23.51	Perry	42.31
Nowata	23.50	Idabel	43.86
Cheyenne	21.38	Grove	44.02
Atoka	19.01	Miami	54.72
Oklahoma City	12.29	Hugo	55.00
Tulsa	12.20	Nowata	56.87
Miami	5.16	Boise City	57.72
Bartlesville	0.94	Poteau	58.36
Ponca City	-10.34	Sulphur	59.23
Pawhuska	-10.66	Stillwater	59.49
McAlester	-12.29	Atoka	65.27
Okmulgee	-37.69	Okmulgee	66.03
Hugo	-52.63	Okemah	68.58
AVERAGE	54.33	AVERAGE	19.80

Correlation Coefficient -0.96
(0.0001)

Source: Financial Statements submitted to the Oklahoma State Auditor and Inspector (1977, 1982, and 1987).

CHAPTER II

MEASURING FISCAL STRESS

Introduction

This chapter focuses upon measuring fiscal stress. Because the next chapter discusses the issue of modeling fiscal stress, the reader should take note of the distinction between the two. Measuring and modeling fiscal stress entail two distinct activities. Measuring stress involves using theory in order to develop a system that estimates the amount of fiscal stress a jurisdiction is experiencing. For the purposes of this study, measuring fiscal stress means giving a numerical estimate to the level of stress experienced by a jurisdiction. Modeling fiscal stress, on the other hand, involves using theory to explain why a specific measure of stress is being experienced by a jurisdiction or to explain why the jurisdiction's measure of stress is changing.

Section B of this chapter discusses various methods of measuring fiscal stress. The particular method of measuring stress developed by this study relies on the concept of potential revenues put forth by the U.S. Advisory Commission on Intergovernmental Relations (ACIR). In order to understand this concept, the reader must first understand the meaning of

fiscal capacity. Section C of this chapter acquaints the reader with this concept. Acquiring the fundamentals of fiscal capacity makes it possible to discuss the measurement of potential revenues. This task is undertaken in Section D. These various sections furnish the reader with the essentials of measuring fiscal stress. This knowledge, in turn, enables us to turn our attention to the model of fiscal stress that is developed in Chapter III.

Measuring Fiscal Stress

For the purpose of this study, the term fiscal stress is defined as a potential imbalance between governmental revenues and expenditures, complicated by the difficulties of maintaining a legally required balanced budget. This imbalance is assumed to be caused by an excess demand for the goods and services provided by a local government. There have been several approaches used to identify and measure fiscal stress. These can be grouped into two broad categories: the comparative quantitative analysis approach and the case study approach.

Comparative Quantitative Approach

This approach attempts to find a statistical relationship between the fiscal outcomes of a community and its social, economic, and demographic characteristics. Examples of such studies are: ACIR (1968, 1977), Bunce (1976), Clark (1976),

Nathan and Adams (1976), Smith (1977), Aronson and King (1978), Dearborn (1978), U.S. Department of Treasury (1978), Brown and Syron (1979), Howell and Stamm (1979), Clark, et al. (1980), Bradbury, Downs, and Small (1982), and Srinivason (1989). In each of these studies a number of variables including the deficiency of revenues compared to expenditures, deficit cash position, bond ratings, short- and long-term borrowing, taxes per capita, and tax effort are used to indicate fiscal stress. Generally, an index of stress is computed by comparing the measure of stress in each jurisdiction to some national average measure of stress. Often, in order to analyze stress either trend analysis or Z-tests (where Z indicates the number of standard deviations by which a given measure of stress deviates from the national average) are employed.

Bahl (1984) enumerates some problems associated with this method of measuring fiscal stress. First, in theory, indicators of stress should be derived from the analysis of both the past and the current situation of the jurisdiction. Further, such measures should indicate the jurisdiction's possible future fiscal situation. These indicators should also reflect the economic and social structure of the area as well as the financial position of the government. None of the above studies include indicators that incorporate the full range of these considerations. A second problem with this analysis is its sensitivity to the sample of cities chosen, to

the variables included in the analysis, and to the cutoff index selected for the measure of stress.

Case Study Approach

Unlike, comparative quantitative analysis, the case study method allows for a high level of detail. Further, using this method it is possible to take into account certain factors that may be important to the specific city under consideration. Examples of such studies include ACIR (1968, 1973), Committee for Economic Development (1968), Dearborn (1973, 1978, 1979), and Stanley (1976). The basic problem of this approach is the difficulty of applying the results to more general situations. Second, a lack of uniform financial reports makes comparability between jurisdictions a problem. A final problem is that of the prohibitive cost of comparative case study work (Bahl 1984).

Using a Supply-Demand Framework to Measure Fiscal Stress

In order to determine the response of localities to fiscal stress it is first necessary to derive an operational definition of stress. This study uses a supply-demand framework to structure stress. Within this framework a government is said to be suffering from stress if there is an excess demand for the goods and services supplied by the jurisdiction. Excess demand may be caused by either an increase in the demand for or a decrease in the supply of

these goods and services.

Given this definition, the next step is to choose an operational measure of stress. The quantitative comparative approach is used to derive an index of stress. Because stress is assumed to be caused by an excess demand for the jurisdiction's goods and services, a tax effort index measuring the jurisdiction's actual revenues to its potential revenues is used to reflect this excess demand.

Within the context of the supply-demand model, excess demand results in an increase in price as a system moves from one equilibrium point to another. In the case of a local government, the tax rate is representative of the price of the goods and services provided by the jurisdiction. Hence, increases in the tax effort index indicate increases in fiscal stress.

The idea of increases in the tax effort index being associated with increasing levels of stress in a jurisdiction is intuitively appealing as well. The behavior of the private sector implies a desire on the part of individuals to minimize their tax burden. In general, it is likely that tax increases will be approved by voters only when it becomes apparent that the current level of financing will leave a jurisdiction unable to maintain (or expand) desired services. Thus, increases tax rates, and hence the index, are likely to occur during periods of stress when a jurisdiction is finding it difficult to maintain services to voters.

With regard to the index, two comments should be made. First is the fact that changes in tastes and preferences could result in changes in the index that do not reflect fiscal stress. For example, a change in tastes and preferences may cause citizens to increase their demand for the goods and services supplied by a local jurisdiction. This would result in a increase in tax rates, and hence, an increase in the index. Obviously, this does not imply increased stress levels for the jurisdiction. It simply means that individuals want more of a jurisdiction's goods and services and are willing to pay for these commodities through increased taxes. While such changes in tastes and preferences are possible, they are unlikely to have been a significant force during the relatively short period covered by the analysis.

Second, it should be noted that the index of fiscal stress in no way represents the well-being of citizens within a jurisdiction. It is possible that a jurisdiction would match a decline in revenue bases with a proportionate decrease in expenditures. Within the supply-demand framework, no change in the index would occur. The jurisdiction would not be facing increased levels of fiscal stress because there would be no excess demand. It is clear, however, that the well-being of citizens within the jurisdiction may have fallen because they would have fewer goods and services available to them.

Keeping these general comments in mind, we now turn to

the specific measure of stress. The index chosen to measure fiscal stress is based on the ACIR's representative revenue system measure of fiscal capacity and is derived as:

$$FS_{jt} = (\sum_{i=1}^{I} AR_{ijt} / \sum_{i=1}^{I} PR_{ijt}) * 100 \quad (2.1)$$

$$i = 1,...,I \quad j = 1,...,J \quad t = 1,...,T.$$

FS_{jt} is the fiscal stress in jurisdiction j during time period t. AR_{ijt} is the revenue collected from base i in jurisdiction j during time period t. PR_{ijt} is the potential revenue that could be collected from base i in jurisdiction j during time period t. 1,...,I represent the I revenue bases, I,...,J represent the J jurisdictions, and 1,...,T represent the T time periods.

As previously stated, tax rates are representative of the price voters are willing to pay for the goods and services provided by a jurisdiction. Hence, within the context of the supply-demand model, increases in the tax effort index indicate increases in fiscal stress.

Because the index of stress employs the use of potential revenues, it will be helpful to explore in more detail how these revenues are measured. As a prerequisite to this discussion, the concept of fiscal capacity must be examined. This is necessary because of the fact that potential revenues are based upon the concept of fiscal capacity.

Fiscal Capacity

Recall that the definition of fiscal stress used by this

study suggests that measures of stress should reflect the local government's inherent ability to generate revenue. It is this ability that lies at the heart of the problems (or lack of problems) associated with stress.

In order to measure revenue generating ability, it is necessary to turn to measures of fiscal capacity where fiscal capacity refers to the potential revenue a jurisdiction is capable of raising given its revenue base. Barro (1986) enumerates some basic propositions associated with fiscal capacity measurements. The most important in terms of analyzing local governments are as follows. First, fiscal capacity refers only to own-source revenue. Thus, intergovernmental aid is generally excluded from any measure of fiscal capacity. Second, fiscal capacity refers to nominal rather than real values. While the need to adjust for cost differentials between governments is recognized, it has generally been treated as a matter separate from the measurement of capacity. Hence, fiscal capacity refers to the government's ability to generate nominal dollars. Finally, capacity, ideally, should be independent of the actual fiscal and economic choices made by the government. In other words, capacity is an inherent characteristic of a government's economy. As such it should reflect the government's underlying resources instead of the public (and private) decisions about how to use these resources. Several approaches have been used in deriving a measure of fiscal

capacity. These include the income approach, the representative tax system approach, and the behavioral model approach. A brief discussion of each of these methods follows.

The Income Approach

Some analysts argue that a jurisdiction's ability to raise revenue is directly related to the income of the citizens within the jurisdiction. It is this income that is the source of taxes, fines, fees, and any other revenues raised by the jurisdiction. These analysts suggest, then, that the level of income within a jurisdiction provides a measure of the jurisdiction's level of fiscal capacity.

There are several different income measures available: per capita personal income (PCPI), gross product (GP), total taxable resources (TTR), and export adjusted income (EAI). Of these, only TTR and EAI need any definition. TTR includes any income within a jurisdiction that may be taxed. Thus, it attempts to provide the analyst with a relatively broad measure of income. EAI attempts to adjust income in order to account for the possibility of tax exportation by a jurisdiction. Basically, this measure makes an upward adjustment in the income of a jurisdiction.

As can be seen there are several different income measures available; however, there are problems associated with the use of each measure. For example, both PCPI and GP

exclude certain types of income and thus tend to be biased downward. Neither PCPI, GP, nor TTR deal with the problem of tax exportation. Exportation through the deductibility of state and local taxes from the federal income tax and exportation because of the government's ability to tax activities in which nonresidents participate increase government's purchasing power and hence its fiscal capacity. To the extent that government is able to engage in exporting, PCPI, GP, and TTR will all be biased downward. EAI, based on the concept of a state-local budget constraint, makes an attempt to overcome the problem of exporting; however, technical problems arise due to the necessity of determining tax incidence and of calculating weights for each type of tax. Finally, as ACIR (1986) notes, the income approach indicates the capacity of taxpayers to pay taxes; however this capacity does not necessarily reflect the government's ability or capacity to collect taxes (exploit the revenue base). "In this instance the whole (government's capacity) need not equal the sum of its parts (individuals' ability to pay taxes)," (ACIR, 1986; p. 44). In order to gauge this capacity it is necessary to understand the representative tax system.

The Representative Tax System Approach

The representative tax system (RTS) focuses on the statutory bases that are commonly taxed by state and local governments; hence, the RTS views capacity as the dollar

amount of revenue that could be raised if each jurisdiction applied a nationally uniform set of tax rates to a common set of tax bases. Since the same rates are used for each jurisdiction, estimated yields vary only because of differences in the relative components and absolute sizes of the underlying bases. The RTS has several advantages that recommend its use. First, the RTS is able to implicitly account for the ability of jurisdictions to export their taxes. According to the ACIR (1986) the level of exportation is reflected in the estimated level of each tax base.

> For example, sales to tourists effectively export taxes by collecting some of the income of nonresidents. In the RTS the tourist trade is included in a jurisdiction's total retail sales, which is used to calculate the base for general sales taxation, (ACIR, 1986; p. 20).

Because of the problems associated with accurately estimating exportation rates (as required by EAI), this advantage is an important one. Second, because the RTS relies on tax bases rather than income it provides a more accurate picture of a jurisdiction's economic and fiscal changes. Thus, the RTS will reflect changes in capacity more completely than a capacity measure based on income alone.

There are several criticisms aimed at the RTS. The omission of revenue sources such as user fees, rents, and royalties affects capacity; further, these omissions have an ambiguous effect upon capacity. For jurisdictions that rely heavily upon such sources fiscal capacity is understated, while fiscal capacity in jurisdictions that place little

reliance upon such revenue sources is overstated. A second problem involves feedback effects arising from such sources as changes in tax rates. A change in rates may result in changes in tax bases due to spatial shifting or due to the capitalization of taxes into asset prices. While these feedback effects are legitimate concerns, no capacity measure makes any type of adjustment for these effects. Further, since the magnitude of these effects has never been estimated, the size of their impact on the bases is unknown. Another problem associated with the use of the RTS is the fact that federal deductibility is not taken into account. Finally, the RTS applies the national average severance tax rate to mineral production. If one hypothesizes that each jurisdiction is already maximizing its effective rate this will result in an underestimate of capacity in some states and an overestimate in others (Gold, 1986).

Fortunately the RTS is fairly adaptable and several attempts have been made to overcome these shortcomings. First, in an attempt to broaden the measure, a representative revenue system (RRS) has been constructed. This system augments the RTS with non-tax revenue bases such as user fees, rents, and royalties. A second adaption has been to use severance tax collections rather than the value of resources as the base for the tax. Finally, in an attempt to deal with the issue of deductibility, an estimate of the effect of deductibility on collections in each jurisdiction has been

used instead of using actual federal income tax liability.

The Behavioral Model Approach

A final method of estimating capacity is the use of behavioral models. A problem common to both the income and RTS approaches to measuring capacity is the lack of any link to an explicit theory of state and local governmental behavior. As Barro (1985, p. 184) points out,

> each depends on ad hoc revenue comparison rules: equal tax burden in the case of income-based indices; hypothetical national rates in the case of the RTS. The theoretical interpretations and rationales, if any, must be supplied after the fact.

The behavioral models, on the other hand begin by formulating a theoretical model of the determinants of the jurisdiction's own-source revenue. These determinants include both fiscal capacity factors as well as other factors such as cost, taste, etc. that influence revenue decisions. This model is then estimated and the hypothetical revenue that each state would raise is computed. Ideally, an analyst using this method would specify some preference function for public services and maximize the function subject to the governmental budget constraint.

Various behavioral models have been put forth by Akin (1973, 1979), Reischauer (1974), Morgan (1974), Ladd (1975), Gurwitz (1978, 1979), and Fastrup (1984); however, there are some general problems with each of these models. For example, most are incompletely specified because some influences on

state and local fiscal decisions are omitted. The omission of these influences causes the estimates computed by these studies to be biased. Further, none of the studies draw upon the more advanced fiscal behavioral models that differentiate between the behavior of state and local governments. Barro (1985) argues that developing behavioral models requires a high degree of technical expertise. Due to this high degree of technicality, he questions whether such models will ever enjoy widespread acceptance among non-economists.

Measuring Potential Revenue

After gaining insight into the measurement of fiscal capacity, attention can now be turned to the calculation of potential revenue. Potential revenue is derived as follows:

$$PR_{jt} = \sum_{i=1}^{I} B_{ijt} * A_{it} \qquad (2.2)$$

$$i=1,\ldots,I \quad j=1,\ldots,J \quad t=1,\ldots,T.$$

B_{ijt} is revenue base i in jurisdiction j during time period t and A_{it} is the average rate applied to base i during time period t. This average is derived by calculating for each base the ratio of the sum of revenue collected in each jurisdiction to the sum of the revenue base in each jurisdiction. A_{it} is given as:

$$A_{it} = \sum_{j=1}^{J} R_{ijt} / \sum_{j=1}^{J} B_{ijt} \qquad (2.3)$$

$$i=1,\ldots,I \quad j=1,\ldots,J \quad t=1,\ldots,T.$$

R_{ijt} is the revenue collected from base i in jurisdiction j during time period t and B_{ijt} is base i in jurisdiction j

during time period t.

Two basic adjustments have been made in order to derive potential revenue. First, instead of applying an average national tax rate, an average rate of all Oklahoma localities has been applied. This is the more desirable approach because the main focus of the study is the stress of the locality relative to other Oklahoma localities, not relative to other U.S. localities. Second, because the interest is in the locality's ability to raise revenues from all sources, not just own sources, intergovernmental revenues have been included in the analysis. As is customarily done in deriving capacity measures, figures have generally been stated in per capita terms.

Conclusion

This chapter has focused on developing a measure of fiscal stress for local governments in Oklahoma. This measure has been derived by using a supply-demand framework and is represented as the index of a jurisdiction's actual revenues to its potential revenues. Understanding of this index was furthered by discussing the concept of fiscal capacity and the method of calculating potential revenues.

Attention may now be turned to developing a model of stress. This model, put forth in the following chapter, will be used to explain why a jurisdiction's level of stress might change. Emphasis will be upon the factors hypothesized to

affect the level of stress experienced by an Oklahoma local government and upon the statistical model that will be used to evaluate the significance of these factors.

CHAPTER III

MODEL OF STRESS

Introduction

Chapter two focused attention on the measurement of fiscal stress, giving a numerical estimate to the level of stress experienced by a jurisdiction. This chapter focuses upon modeling fiscal stress, using theory to explain why a specific measure of stress is being experienced by a jurisdiction or to explain why the jurisdiction's measure of stress is changing.

Theory suggests several independent variables that might have an impact on stress. Section B of this chapter discusses the general variables suggested by theory while section C centers upon those variables that are hypothesized to be specifically related to fiscal stress at the local government level in Oklahoma. It is imperative to know which variables have an impact on the level of stress experienced by local governments in Oklahoma in order to predict the level of stress that might occur in these jurisdictions or to predict how the level of stress in these jurisdictions might change over time. Determining the variables that impact a local jurisdiction's level of stress will also be useful in

assisting officials to design policies that might be used to alleviate stress.

Section D of this chapter explains why a pooled data set is used to model stress while section E examines the specific technique applied to the pooled data set in order to estimate stress. The results of this estimation will be the focus of chapter four.

A General Discussion of the Sources of Fiscal Stress

In general, the literature suggests numerous factors contributing to fiscal stress. Among these are changes in birth and death rates, structural shifts in economic activity, financial mismanagement, business cycles, the level of debt, and a slowing of intergovernmental aid (Peterson, 1976; ACIR, 1979; Hamilton, 1980; Levine, 1980; Stanley, 1980; Walker, 1980; Friedland, 1983; and Bahl, 1984).

Changes in Birth and Death Rates

The slowing of the birth rate since 1964 and a decline in the death rate has led to an increase in the average age of the U.S. population. This increase in the proportion of the population that is elderly implies an increase in the demand for special health, housing, and transportation services that is unaccompanied by total ability to pay for such services by the aging population. Hence, changes in birth and death rates have resulted in increased stress on governments who are

expected to provide more services but find themselves faced with a population that possesses less ability to pay for the services demanded.

Structural Shifts in Economic Activity

Changes in factors such as technology and consumer tastes and preferences can lead to structural shifts in economic activity which result in fiscal stress. For example, the decline in demand for domestic automobiles and steel has resulted in a deterioration of the economic bases of the "rust belt" in the same manner that the decline in oil and gas prices and production have affected the energy producing states. Such shifts tend to result in unemployment which in turn erodes a government's revenue base. Further, these economic shifts are often accompanied by changes in population which further aggravate pressures on the government.

For instance, regions whose economic base is declining will normally experience net out-migration. The increased fiscal stress associated with such out-migration arises from two sources. First, a decrease in population is generally associated with increasing short run per capita service costs. Second, out-migration is often accompanied by an erosion of a jurisdiction's tax bases.

There are various factors that account for the increase in per capita service costs. One factor working to increase per capita costs is the fact that once an area's

infrastructure has been constructed to serve a given population, the total cost of maintenance and debt service does not decline significantly as population falls. Fixed costs are spread across a smaller number of individuals resulting in an increase in cost per capita. A second factor is the fact that fire and police costs are likely to rise as population falls because abandoned property becomes the target of vandalism and crime. Finally, the changes in demographic mix caused by out-migration can increase per capita costs. Generally the poor and the aged are less mobile. As net out-migration occurs per capita income falls and the age of the population rises. Both the poor and the aged require special services from their government, but lack the funds to pay for such services. As a result, government expenditures may increase, but there are fewer taxpayers with the ability to shoulder the increase. All of this indicates that to run most efficiently the city should be operated at or near its design capacity. Studies show that when it becomes necessary to operate a city at two-thirds capacity or less, the cost per taxpayer rises steeply (Peterson, 1976; p. 45).

The tendency for out-migration to be accompanied by a fall in both property values and retail sales can also lead to higher levels of stress. The decrease in property values and sales leads to an erosion of the property and sales tax bases. Hence important sources of governmental revenues may be falling at the very time that the population is putting

pressure on government to increase expenditures. Each of these factors combine to aggravate the stress experienced by a government during periods of net out-migration.

Stress can also be experienced by regions whose economic base is growing. Economic growth is generally accompanied by net in-migration. Population growth may be accompanied by an increase in the demand for governmental services that outstrips government's ability to provide such services. For example, in-migration may be accompanied by an increase in the demand for health services, education, and expanded infrastructure systems. While the larger population may provide government with a greater revenue base, this base may not be large enough to cover the substantial expenditures required to meet the new, higher levels of demand.

Financial Mismanagement

In some cases financial mismanagement has led to fiscal stress. This factor figures prominently in explaining the New York City financial disaster (Stanley, 1980; p. 107). Such mismanagement involved unsound budgeting and accounting practices and the undertaking of massive short-term borrowing in order to cover current operating expenses. Generally, city officials engage in such practices because their short-term goal of surviving the current fiscal year overrides the long-term goal of fiscal stability. As a result, actions may be undertaken that detract from the government's long-term fiscal

integrity. In smaller jurisdictions it is likely that such mismanagement will occur simply because of inexperience and poor training on the part of government officials.

Business Cycles

National business cycles are another factor which tend to increase the fiscal stress experienced by governments. Although inflation is generally associated with the expansionary phase of the business cycle, this does not imply that governments are experiencing low levels of stress. During inflationary periods the amount government must pay for labor, materials, and supplies rises. Offsetting this increase in costs is an increase in governmental revenues. Such increases in revenues occur because the nominal value of tax bases generally increases with inflation; however, some studies indicate that governmental costs may be more responsive to inflation than are governmental revenues. In this case, during inflationary periods the increase in revenues may be outstripped by rising expenditures and the purchasing power of government may fall (Bahl, 1984; p. 110).

During periods of recession there is a tendency for governmental expenditures to increase automatically due to the payment of unemployment benefits and other entitlements. At the same time governmental revenues are falling due to a decrease in both income and property values. Hence both inflation and recession can lead to an imbalance between

revenues and expenditures and increase the level of stress upon the government.

Debt

The level of debt incurred by a jurisdiction can also make it vulnerable to fiscal stress. As a jurisdiction expands its level of debt, a greater proportion of its expenditures will be devoted to servicing this debt. If the financial conditions of the jurisdiction change, it cannot, in the short run, adjust these expenditures. Thus, a locality with a high level of indebtedness may find itself in a position in which its revenues are falling, but be unable to effect the necessary decreases in expenditures. As a result, the jurisdiction will experience increasing levels of fiscal stress.

Intergovernmental Aid

A final factor leading to stress is the contraction of intergovernmental aid. Since 1954 there has been a tremendous growth in intergovernmental aid to both state and local governments. For example, by 1978 intergovernmental aid had become a more important financing source for state and local governments than property, sales, or income taxes (Bahl, 1984; p. 15). However, after Reagan took office in 1980 there was a change of attitude with respect to federal aid. Instead of a growth in aid there was a focus on retrenching federal

programs. As a result of retrenchment, the amount of federal intergovernmental revenue to local governments declined from 13.3 percent of total revenues in 1979-80 to 3.7 percent of total revenues in 1986-87 (Government Finances, 1979-80 and 1986-87). This retrenchment occurred at a time when the U.S. was experiencing one of the worst recessions since the Great Depression. Hence governments not only had to deal with the decline in revenues caused by the economic slowdown, but also had to deal with the decline caused by a drop in federal aid. This combination of factors resulted in an upward trend in the fiscal stress experienced by governments.

Sources of Fiscal Stress for Loacl Government in Oklahoma

While each of the above factors can lead to fiscal stress, not all are relevant for a study of Oklahoma local governments. Those variables most pertinent for a study of Oklahoma local government are structural shifts in economic activity, the effects of national business cycles, and the slowing of intergovernmental aid. Table IV at the end of the chapter shows the independent variables designed to reflect these factors.

Structural Changes

In order to understand the importance of structural shifts to government in Oklahoma, one must recognize that the Oklahoma economy (and especially some local jurisdictions) is

relatively dependent at the margin on the energy and agricultural sectors. The energy boom resulted in net migration into many local jurisdictions. As a result of this in-migration, jurisdictions began to experience increasing levels of stress. The end of the energy boom in 1982 brought about a dramatic decrease in energy production in the state. Workers became unemployed and began to search for employment in other regions of the country. Many local jurisdictions began to experience net out-migration, and were again subject to increasing levels of fiscal stress.

In addition to the changes in the energy sector, the economic policies of the federal government in the early 1980s resulted in structural changes in the agricultural sector. These policies caused a strengthening of the dollar which impeded the export of agricultural products. As a result, the economic bases of some local jurisdictions began to erode and stress levels began to increase.

The variables designed to reflect these structural changes include population, population density, per capita income, unemployment, and the value of energy and agricultural production. As previously discussed, both in- and out-migration can increase the level of fiscal stress. Hence, it is not possible to predict the sign on the population variable. This is also true of population density. As density increases, stress may fall as government takes advantage of economies of scale in the production of some

public goods. On the other hand, increases in density could be associated with increased expenditures for fire and police protection and increased expenditures for infrastructure. Theoretically income, unemployment, and the value of agricultural and energy production are all ambiguously related to stress; however the experience of some governments would lead one to expect income to be negatively related to stress and unemployment and the value of agricultural and energy production to be positively related to stress.

Intergovernmental Aid

The stress caused by structural changes in the economy was reinforced by the slow-down in federal intergovernmental aid. The decrease in aid directly affected stress by reducing an important revenue source of many local governments. Since intergovernmental aid is itself a component of the measure of stress, it is not included as an independent variable.

Business Cycles

Finally, the slower growth of the U.S. economy also exacerbated the level of stress experienced by local governments. Local governments in Oklahoma are little involved in providing entitlements; hence, the increased stress resulting from the payment of escalating entitlement benefits during recessionary times is not applicable to these governments. Instead, periods of recession result in

increased stress because there is a decrease in the demand for energy and other products produced by the private sector. This decrease in demand causes a short term reduction in a jurisdiction's tax base which leads to increased levels of stress.

Income, the unemployment rate, and the rate of inflation are intended to reflect these cyclical changes. As previously stated, income would be expected to be negatively related to stress, and the unemployment rate to be positively related to stress. Because inflation results in increases in both nominal revenues and expenditures, its relationship to stress cannot be predicted.

Conclusion

The reader should note that changes in birth rates, financial mismanagement, and the level of debt are of little importance for the study of fiscal stress at the local government level during the time period under consideration. This is true because first, local governments in Oklahoma are not the major suppliers of the special health, housing, and transportation services needed by an aging population. Second, while financial mismanagement may have put some jurisdictions into stressful situations, it was by no means the major cause of the stress experienced by localities during the period of interest to this study. Finally, because of constitutional and statutory restrictions, local debt levels

in Oklahoma are low relative to other states. Thus, like financial mismanagement, debt was not a major culprit in causing the problems faced by Oklahoma local governments.

Type of Data Set

After examining those independent variables most likely to affect the level of stress at the local government level in Oklahoma, attention can be turned to the type of data set (cross-sectional, time series, or pooled) that will be used in modeling fiscal stress. The problem addressed by a study will generally dictate the type of data set to be used. This study is concerned with differences in levels of stress across jurisdictions. Such a concern would imply the use of cross-sectional data. This study is also concerned with changes in a jurisdiction's level of stress over time which would imply the use of time series data.

The data available for both types of jurisdictions consists of 77 observations over three time periods. Obviously, there is sufficient data to undertake cross-sectional analysis; however, three time periods is hardly sufficient to undertake time series analysis. Further, the prohibitive cost of obtaining more data (it took this researcher and an assistant an entire summer to collect just three years of data) rules out undertaking time series analysis at some future date. Given this problem and given the fact that this study is concerned with both differences in

the level of stress across jurisdictions and changes in fiscal stress over time, a pooled data set was used to estimate fiscal stress.

This data set consists of J cross-sectional observations over T time periods. Such data combines the characteristics of cross-sectional and time series data. Like cross-sectional data, it describes each of a number of individuals. Like time-series data, it describes a single cross-sectional unit through time. Such data are important because "they allow the analyst to deal with both the intertemporal dynamics and the individuality of the entities being investigated," (Dielman, 1983; p. 111).

The general model used to estimate stress from this pooled data set is given by:

$$\ln FS_{jt} = \alpha_0 + \sum_{k=1}^{K} \ln\beta_k X_{kjt} + \epsilon_{jt}. \quad (3.1)$$

$$k=1,\ldots,K \quad j=1,\ldots,J \quad t=1,\ldots,T$$

α_0 is the intercept, X_{kjt} represents the independent variables in jurisdiction j during time period t, and ϵ_{jt} is the random error term. K represents the number of explanatory variables. Because the equation is estimated in logarithmic form, the coefficients (β) are interpreted as elasticities which show the percentage change in stress that will occur as a result of a one percent change in an independent variable.

Techniques for Using Pooled Data Sets

While the use of pooled data to estimate (3.1) is

obviously important, problems in estimation can arise because the analyst must find a method that allows for differences in behavior over the cross-sectional units as well as differences in behavior over time for a given cross-sectional unit (Judge et al., 1982; p. 477). Two basic methods of estimating such data are the covariance or dummy variable (DV) model and the error components (EC) model.

The question of which model to use depends on the independence of the cross-sectional units. If the cross-sectional units cannot be assumed to be mutually independent then the DV model should be used. If it is appropriate to assume the mutual independence of these units, then the EC model may be used. A priori grounds may be employed to determine the appropriate model. For example, if the cross-sectional units are randomly selected, then cross-sectional independence is a valid assumption. On the other hand, if the cross-sectional units are not a random sample of a population (e.g. the states in the United States) cross-sectional independence is less likely (Kmenta, 1986; p. 625). If the analyst is in doubt, a statistical test developed by Hausman (1978) to determine independence may be employed. The Hausman test performed on both the county and city pooled data sets indicated that the appropriate technique to estimate stress was the error components model.

Conclusion

This chapter has addressed the question of what

independent variables to include in the model of fiscal stress and what signs will appear on these variables when the model is estimated. The logic for using a pooled data set was also discussed. Finally, the specific technique used to estimate the model given in equation (3.1) was examined. The following chapter focuses attention on the results of estimating this model by employing the error components technique.

TABLE IV

INDEPENDENT VARIABLES INCLUDED IN STUDY

Independent Variable	Effect on Stress
Population	Ambiguous
Population density	Ambiguous
Per capita income	Negative
Rate of unemployment	Positive
Value of agricultural product	Positive
Value of energy product	Positive
Rate of inflation	Ambiguous

CHAPTER IV

ESTIMATION RESULTS

Introduction

The previous chapter discussed the model used to estimate fiscal stress and the expected signs of the independent variables. This chapter focuses on the results of estimating the model of stress. Section B argues that the index of fiscal stress behaves in a logical manner. This section demonstrates that growth in variables such as potential revenue and personal income tend to be accompanied by a decline in the index of stress. On the other hand, as potential revenues and personal income grow at slower rates, the index of stress tends to increase. Section C briefly examines the problem of multicollinearity while sections D and E focus on the results of estimating the model for the county and city data, respectively. Section F compares and contrasts the results of estimating the model with the county and city data. Section G concludes the chapter and turns attention to the topics of chapter 5, what revenues have the greatest impact on the index of stress and how jurisdictions react to changes in this index.

The Behavior of the Index

Before focusing on the results of estimating the model, it is necessary to ascertain that the index chosen to measure fiscal stress behaves in a predictable manner. Analysis of the data indicates that those jurisdictions experiencing above average increases in potential revenue tend to have declining indexes of stress while increasing indexes are found in those jurisdictions experiencing below average increases in potential revenue. For example, during the 1977 - 1982 time period, Beckham county was experiencing a 4 percent increase in its index of fiscal stress. The increase in Beckham county's index of stress was accompanied by changes in potential revenue and personal income that were below average as well as by above average increases in the county's unemployment rate.

During this same time period, Grady county (a relatively large oil producer) experienced an 8 percent decline in its index of stress. This decline was accompanied by increases in potential revenue and personal income that were well above average. The county also experienced below average increases in its unemployment rate.

Similar patterns can be observed during the 1982 - 1987 time period. For example, Carter county (a top oil producer) experienced an 11 percent increase in its index of stress. This increase was accompanied by below average increases in potential revenue and personal income as well as by above

average increases in the county's unemployment rate.

During this same time period, Atoka county (not heavily involved in either oil or agriculture) experienced a 4 percent decline in its index of stress. This decline was accompanied by above average increases in its potential revenue and personal income as well as by below average increases in the county's unemployment rate.

These same relationships are also observed when examining city data. During the 1977 - 1982 time period, the index of stress in Yukon increased by 45 percent. This city (relatively reliant on both oil and agriculture production) experienced below average increases in potential revenue and personal income and above average increases in its unemployment rate.

During this same period, Stillwell's index of stress fell by 18 percent. This decline was accompanied by above average increases in Stillwell's potential revenue and personal income and by below average increases in the city's unemployment rate.

During the 1982 - 1987 period, Elk City (relatively dependent on oil activity) experienced an increase in its stress index of 24 percent. This was accompanied by below average growth rates in potential revenue and personal income and by above average increases in unemployment.

On the other hand, Stillwell (with practically no reliance on oil) experienced a 29 decline in its index of

stress. This decline was accompanied by above average increases in potential revenue and personal income and by below average increases in unemployment.

These examples indicate that the index chosen to measure fiscal stress appears to behave in a logical manner. Variables such as declining revenue and personal income which would be expected to cause a jurisdiction's level of stress to increase tend to be accompanied by increases in the index of stress. Increases in these same variables are associated with declines in the value of the index. Given this behavior, attention may now be turned to the econometric analysis of the model.

Multicollinearity Problems

The model of stress is first estimated using county data and then estimated using city data. This model is given by:

$$\begin{aligned} LnFS_{jt} = {} & \alpha_1 + \beta_1 LnPOP_{jt} + \beta_2 LnDEN_{jt} + \beta_3 LnINC_{jt} + \beta_4 LnINF_{jt} \\ & + \beta_5 LnOIL_{jt} + \beta_6 LnAG_{jt} + \beta_7 LnU_t + u_j + \epsilon_{jt}. \quad (4.1) \\ & j = 1,\ldots,77 \quad t = 1,\ldots,3 \end{aligned}$$

FS_{jt} is the index of stress in jurisdiction j during time period t; a_1 represents the overall intercept; POP_{jt} is the population in jurisdiction j during time period t; DEN_{jt} is the population density of jurisdiction j during time period t; INC_{jt} is the income in jurisdiction j during time period t; INF_{jt} is the inflation rate in jurisdiction j during time period t; OIL_{jt} is the value of oil production in jurisdiction

j during time period t; AG_{jt} is the value of agricultural production in jurisdiction j during time period t; U_{jt} is the national unemployment rate; u_j represents the extent to which jth cross-sectional unit's intercept differs from the overall intercept; ϵ_{jt} represents the random error term.

Given the independent variables included in the model, there is reason to suspect a problem of multicollinearity. If multicollinearity exists, the coefficients estimated are still the best linear unbiased estimates, however, the sampling variances of the coefficients of the collinear variables will be large. The greater the collinearity, the larger will be the variances. This problem arises because the estimating procedure is not given enough independent variation in a variable to calculate with confidence its effect on the dependent variable. This is similar to what occurs when there is inadequate variability of the regressors in a data set (Kennedy, 1985; p. 147).

There are several different methods that may be used to detect multicollinearity. These range from the use of simple a priori knowledge to more sophisticated tests relying on condition indexes and regression coefficient variance decomposition.

In order to determine the necessity of correcting the model in equation 4.1 for multicollinearity, a two step technique advocated by Belsley, Kuh, and Welsch (1980) was employed. Using this method, the analyst must first identify

any condition indexes whose values are greater than 30. For each of these indexes, the analyst then examines the variance-decomposition proportions of each coefficient. Coefficients with proportions greater than 0.5 are likely to have been adversely affected by multicollinearity.

Using this technique on the county data set, it was found that multicollinearity among the various independent variables did exist. The most serious linear relations were between unemployment and income and between population and population density. However, given the above criteria, this relationship did not present a serious multicollinear problem; hence no correction was made for its presence.

This technique was also applied to the city data set. In this instance the most serious linear relations were between unemployment, income, and inflation and between the value of oil production and population density. According to the criteria set forth by Belsley, et al. (1980), the linear relations between unemployment, income, and inflation did represent some concern. Thus, the model for cities was estimated both with and without the unemployment variable. It was found that omission of the variable did not significantly alter the estimation results, thus the final model includes the unemployment variable.

County Results

After determining the extent of the multicollinearity

problem, the model in equation 4.1 was estimated. Table V at the end of the chapter presents the estimation results of the model for the county data. As can be seen, the signs on the population and population density coefficients are positive and negative, respectively. However, the "t" statistics indicate that neither is significantly different from zero. Income, unemployment, the value of oil production, and the value of agriculture production all have the predicted signs. Of these variables income and the value of oil production are the only significant variables. The coefficient on income indicates that a 1 percent increase in personal income in a county is associated with a 0.39 percent decline in the level of stress. The coefficient on the value of oil production indicates that a 1 percent increase in the value of oil production is associated with a 0.0017 percent decline in a county's index of stress. This decrease is probably due to the fact that some of the intergovernmental revenue received by counties is based on the value of their oil production. Finally, the table shows that inflation is both significant and negatively related to stress. Thus, for counties, the increase in revenue associated with inflation must outweigh any increase in expenditures. According to the model, a 1 percent increase in the rate of inflation is associated with a 0.48 percent decrease in a county's index of stress.

The adjusted R^2 for the model is relatively low. This is of some concern because it indicates that although certain

variables may be significant in explaining variations in the index of stress, the overall model does not perform very well. Other models were also estimated in order to see if the overall performance could be improved. Cross-sectional models of each time period were estimated. These models tended to have a somewhat higher R^2, however some variables lost their significance.

A dummy-variable model using regional dummies was also estimated. This particular model tended to give a somewhat higher R^2 than the error components model. Further, the same variables tended to be significant in both the dummy-variable and error components models. Although the overall results of the dummy-variable model appear to be somewhat better than the results of the error components model, the dummy-variable model was not used. This is because econometric tests indicated that use of the error components model was preferred.

City Results

The next step was to employ the city data to estimate equation 4.1. Table VI presents the results of this estimation. As previously stated, due to the possibility of multicollinearity problems this model was run both with and without unemployment. The omission of the variable did not significantly affect the model, hence the results in table VI include this variable. Population and population density both

carry a positive sign; however, only population is significant in explaining changes in the level of stress. The coefficient on this variable indicates that a 1 percent change in population is associated with a 0.078 percent increase in the city index of stress. Thus it appears that for cities, that costs of providing for a growing population outweigh the benefits that may be associated with population growth. Income, unemployment, and the value of agriculture production all carry the predicted signs; however, of these variables, only income is significant in explaining changes in a city's index of stress. The value of this coefficient indicates that a 1 percent increase in income is associated with a 0.298 percent decrease in a city's index of stress. As with the county estimation, the inflation rate is significant and is found to be negatively related to the index of stress. Its coefficient indicates that a 1 percent increase in the rate of inflation is associated with a 0.28 percent decline in a city's index of stress. Finally, contrary to predictions, the value of oil production has a negative sign. However, this variable is not significant in explaining changes in a city's index of stress.

As with the county results, the adjusted R^2 is relatively low indicating that the overall explanatory power of the model is poor. Hence cross-sectional and dummy-variable models were also estimated with the city data. The adjusted R^2s of the cross-sectional model were somewhat higher, however some

independent variables lost their significance. The dummy-variable model gave a higher R^2 than the error components model and retained the significance of the independent variables; however, econometric tests indicated that despite its lower overall explanatory power, the error-components model was preferable.

County versus City

For the reader's convenience, table VII compares the county and city estimates. Note that neither population nor population density are important in explaining changes in the stress index for counties. However, at the city level population is important in explaining changes in the stress index. The positive sign on population indicates that for cities, the costs of in-migration tend to outweigh the favorable benefits associated with in-migration discussed in chapter 2.

Income is important in explaining changes in both county and city stress indexes. In both cases it carries the predicted negative sign.

The oil variable is important in explaining changes in the stress index for counties. Any increase in the value of oil production in a county will cause its stress index to fall. However, this variable is unimportant for cities. This difference is most likely a result of the intergovernmental transfer counties receive from their oil production. No such

transfer is available to cities.

The national inflation rate is important in explaining changes in the stress index for both counties and cities. In both instances, an increase in the inflation rate leads to a decline in the stress index. Thus, it appears that for both counties and cities, the increase in nominal revenue associated with inflation outweighs the increase in expenditures associated with inflation.

Unemployment is not significant in explaining changes in the stress index at either the county or city level. This may be due to the fact that neither of these governments incurs additional expenditures such as unemployment or welfare benefits due to increased unemployment.

Finally, the value of agricultural output is not important in explaining changes in the fiscal stress index at either the county or city level.

Conclusion

This chapter has presented the results of estimating the model of fiscal stress using both county and city data. The variables which were significant in explaining changes in the county and city indexes of stress were discussed. Further, it was found that some differences do exist in explaining changes in stress at the county and city levels. Income and the inflation rate are important in explaining changes in both the county and city indexes of stress. However, the value of oil

production is significant in explaining stress only at the county level while population is important in explaining changes only at the city level.

The next step is to examine how counties and cities adjusted to changes in stress. Specifically, focus in the following chapter will turn to how counties and cities adjusted expenditures in response to their changing levels of stress. It will also examine which revenue bases had the greatest impact on a jurisdiction's index of stress.

TABLE V

COUNTY REGRESSION RESULTS

Parameter	Estimate	t Stat	Pr > t	Std Error
Intercept	0.151693	0.912	0.3628	0.1663
Population	0.005688	0.529	0.5977	0.0109
Density	-0.004708	-0.416	0.6781	0.0113
Income	-0.039875	-3.204	0.0016	0.0124
Oil	-0.001726	-2.225	0.0271	0.0008
Inflation	-0.048137	-2.083	0.0385	0.0231
Unemployment	0.013608	1.403	0.1622	0.0097
Agriculture	0.001032	0.109	0.9163	0.0095
Adjusted R^2	0.0805			

TABLE VI

CITY REGRESSION RESULTS

Parameter	Estimate	t Stat	Pr > t	Std Error
Intercept	0.487302	0.689	0.4917	0.7074
Population	0.078240	2.849	0.0048	0.0275
Density	0.024016	0.600	0.5491	0.0400
Income	-0.298453	-4.567	0.0001	0.0653
Oil	-0.003798	-1.058	0.2913	0.0971
Inflation	-0.280875	-2.891	0.0042	0.0971
Unemployment	0.003526	0.080	0.9365	0.0442
Agriculture	0.014738	0.387	0.6993	0.0381
Adjusted R^2	0.0924			

TABLE VII

COUNTY AND CITY REGRESSION RESULTS COMPARED

	County		City	
Parameter	Estimate	Pr > t	Estimate	Pr > t
Intercept	0.151693	0.3628	0.487302	0.4917
Population	0.005688	0.5977	0.078240	0.0048
Density	-0.004708	0.6781	0.024016	0.5491
Income	-0.039875	0.0016	-0.298453	0.0001
Oil	-0.001726	0.0271	-0.003798	0.2913
Inflation	-0.048137	0.0385	-0.280875	0.0042
Unemployment	0.013608	0.1622	0.003526	0.9365
Agriculture	0.001032	0.9163	0.014738	0.6693
Adjusted R^2	0.0805		0.0924	

CHAPTER V

EXPENDITURES AND REVENUES

Introduction

The previous chapter discussed the results of estimating the model of fiscal stress. Those variables important in explaining changes in the index of stress at both the county and city level were identified. The purpose of this chapter is two-fold. The following section of the chapter will examine how counties and cities adjusted expenditures in response to changes in their index of stress. The final section of the chapter will discuss how changes in the various components of potential revenue affected the city and county indexes of stress.

Government Response to Stress

In general, government is expected to adjust expenditures in response to changing levels of stress. For example, it is predicted that government will decrease expenditures in response to increasing levels of stress. On the other hand, if fiscal stress were to fall, government might increase expenditures.

Not only would government be expected to respond to

changing levels of stress in this manner, it is also likely that if expenditures must be cut, government will (in the short run) attempt to decrease those expenditures which will least affect the services it provides to voters. This implies that capital expenditures bear the brunt of cuts during periods of increasing fiscal stress.

During periods of increasing fiscal stress, government may attempt to maintain personnel expenditures because cuts in these expenditures would affect the level of services provided to voters. For example, if government laid off police personnel there would be fewer patrols or there would be increased response times to calls. In addition, cuts in personnel expenditures would be obvious to voters because these lay offs would result in increases in unemployment. Thus in the short run, government may attempt to maintain personnel expenditures, even during periods of increasing fiscal stress.

Likewise, government may also attempt to maintain maintenance and operating expenditures during periods of increasing fiscal stress. A decline in maintenance and operating expenditures would entail cuts in items such as supplies and materials. Hence, just like declines in personnel expenditures, decreases in maintenance and operating expenditures could entail a decline in the services provided to voters.

Unlike decreases in personnel expenditures and

maintenance and operating expenditures, a short run decrease in capital expenditures will have little impact on the level of goods and services provided to voters. A cut in capital expenditures will translate into less construction, fewer improvements on land and buildings, and fewer equipment purchases. Since such cuts will be the least likely to affect the level of governmental services provided to voters, it is reasonable to predict that capital expenditures would bear the brunt of cuts during periods of increasing fiscal stress.

In order to test this hypothesis, it would be desirable to examine the changes that occur in fiscal stress during one year, t, and then observe how government adjusts expenditures during the following year, t + 1. Unfortunately, the data set does not contain enough time periods to make this type of observation. Instead, the hypothesis is tested by first examining the Pearson correlation coefficients of the index of stress and the various categories of expenditures and by then regressing the various categories of expenditures against the index of stress.

Table VIII at the end of the chapter presents the correlation analysis for the county level of government. Expenditures are classified as either personnel, maintenance and operating, or capital. This simple analysis indicates that at the county level each category of expenditures carries the predicted sign. Thus, at the county level, correlation analysis tends to lend support to the general hypothesis that

government may attempt to decrease expenditures when levels of stress are increasing and increase expenditures when levels of stress are falling.

Further, note that the coefficient on the log of capital has the greatest absolute value. This coefficient is also the only one that is significantly correlated with the index of stress. Thus, at the county level, the evidence also lends support to the hypothesis that capital expenditures tend to be more sensitive to changes in the level of stress than other types of expenditures.

An OLS model using expenditures as the dependent variable and the index of stress as the independent variable was employed to further test the hypothesis. Table IX at the end of the chapter presents the regressions for the county level of government. Because the coefficients are in log form, they may be interpreted as elasticities. As the adjusted R_2 of each regression indicates, the various regressions do little in terms of explaining variations in expenditures. However, the regressions do lend further support to the aforementioned hypothesis. For example, in each of the regressions the log of stress carries the predicted negative sign. Further, these regressions indicate that at the county level adjustment of expenditures was carried out through changes in capital expenditures.

As these equations demonstrate, when capital expenditures are regressed against the index of fiscal stress, the

coefficient of stress is significant at the .0001 level. When regressing personnel or maintenance and operating expenditures against the index of stress, the coefficients are not significantly different from zero. Further, the value of the coefficient on capital expenditures implies that these expenditures are highly elastic; a 1 percent change in the stress index is associated with a 6 percent change in capital expenditures. Hence, the data implies that capital expenditures at the county level are fairly sensitive to changes in the government's level of stress.

While the county data tends to lend support to the hypothesis that government adjusts expenditures, especially capital expenditures, in response to changes in the level of fiscal stress, the city data offers less support for this hypothesis. Table X at the end of the chapter shows the correlation between the index of stress and the various components of expenditures at the city level of government.

For cities, the only the coefficient between fiscal stress and maintenance and operating expenditures and between fiscal stress and capital expenditures carries the predicted negative sign. According to correlation analysis, the coefficient between the index of stress and personnel expenditures carries a positive sign. Further, the analysis indicates that the only significant relation is that between the index of stress and personnel expenditures.

The regression equations shown in table XI at the end of

the chapter present a similar picture. This analysis shows a positive relation between the log of stress and personnel expenditures. The coefficient on the index indicates that a one percent change in the index of stress is associated with a 0.26 percent change in personnel expenditures. Like the correlation analysis, the regression models do show a negative sign on the log of stress when maintenance and operating expenditures and capital expenditures are regressed against the index; however, the coefficient of stress is not significantly different from zero in either of these models.

There is an important reason as to why the hypothesized relations may be violated at the city level. As stated earlier, it would be ideal to examine the index of stress during year t and the change in expenditures in year t + 1. This is because there actually exists a two-way relationship between expenditures and fiscal stress. On the one hand, changes in fiscal stress may cause government to adjust expenditures. On the other hand, changes in expenditures may also cause changes in levels of fiscal stress. For example, if government were to increase its expenditures without a corresponding increase in revenues, there may be an increase in the level of fiscal stress.

This means that the index of stress used in the correlation and OLS regression analysis is actually an endogenous variable. Because increases in expenditures may result in increases in fiscal stress, use of the OLS technique

causes the coefficient on the index to be biased upward. Unfortunately, as previously stated, there is inadequate data to overcome this problem.

Changing Revenues and the Index of Stress

The final analysis deals with the effect of changes in the various categories of potential revenue on the index of stress. Policy makers should find such knowledge quite valuable. For example, suppose a jurisdiction is relatively reliant on a particular source of revenue. In this instance, a small change in the revenue source may be associated with a relatively large change in the jurisdiction's index of stress. Such a response would be indicative of the fact that the jurisdiction is fairly vulnerable to changes in specific types of revenue. If this is the case, policy makers may wish to undertake actions that will result in the diversification of the jurisdiction's revenue bases.

The ideal way to examine the response of stress to changes in various revenue sources would be to observe the changes in revenues during one year, t, and then examine how such changes affect stress during the next year, t + 1. As with the expenditure analysis, the data set does not contain observations that allow this type of analysis. Instead, the study relies on the use of correlation and regression analysis.

Table XII at the end of the chapter shows the correlation

between the index of stress and the various principle sources of potential county revenue. These sources include potential property taxes, potential fees, potential sales taxes, interest, and intergovernmental revenues. Because intergovernmental revenues and potential property taxes account for the largest share of principle potential revenues (60 and 25 percent, respectively), it is reasonable to predict that changes in these sources of revenue would have the greatest impact on the index of stress.

The analysis indicates that the coefficients between each principal potential revenue source and the index of stress carry the predicted negative sign. It also demonstrates that the only significant relations are between potential property taxes and the index of stress and between potential fees and the index of stress. Contrary to predictions, intergovernmental revenues are not significantly related to the index.

In order to gain further information about these relationships, the index of stress was regressed against the various revenue bases. Table XIII at the end of the chapter presents the results of this regression. All coefficients are in log form and may be interpreted as elasticities. According to this analysis, potential property taxes, potential fees, and interest income are all significant in explaining changes in the index of stress at the county level. Both potential property taxes and potential fees are negatively related to

the index while interest income exhibits a positive relation to the index. This latter relation violates the type of relation one would hypothesize between the stress index and a revenue source. The coefficients on potential property tax revenues and fees are quite similar. Both indicate that a 1 percent change in property tax revenue or fees is associated with a 0.026 percent change in the index of stress. The inelasticity of these coefficients is somewhat surprising as property taxes and fees account for the major source of general fund revenue for county governments. The small coefficient may reflect the fact when revenue from all sources is considered, county governments are found to be heavily reliant on intergovernmental revenues. Thus, even a relatively large percentage change in either potential property taxes or potential fees may not significantly affect a county's total revenue, and hence its index of fiscal stress.

Given that county governments derive such a large percentage of their principal potential revenue from intergovernmental transfers, it is surprising that the coefficient on this variable is not significant. A factor that may be important in explaining this is the fact that the study is forced to use an endogenous variable as an independent variable.

While it is true that changes in revenues affect the level of fiscal stress, it also equally true that government

may attempt to adjust revenues in response to changing levels of stress. Thus, as stress levels within a jurisdiction increase, government may attempt to increase revenues in order to alleviate the stress. As with the expenditure analysis, the use of the endogenous variable causes the independent variable to be biased. If the index of fiscal stress were calculated for period t + 1, it would be possible to overcome the problem; unfortunately, this study does not have the data necessary to carry out these calculations.

Table XIV at the end of the chapter presents the correlation analysis between the index of stress and the principal sources of potential revenues at the city government level. The principal sources of potential revenues for city governments are potential utility revenues, potential revenues from fines, licenses, and fees, interest income, potential sales taxes, potential property taxes, potential franchise taxes, and intergovernmental revenues. Potential sales taxes and potential utility revenues are the most important sources of principle potential revenues for cities. They account for 45 percent and 28 percent of these potential revenue sources, respectively. Given this, one would expect the index of stress to be particularly sensitive to changes in these potential revenues.

As the analysis in table XIV indicates, there is a significant negative relation between the index and potential utility revenues, the index and potential revenues from fines,

licenses, and fees, and the index and potential franchise tax revenues. Contrary to predictions, the coefficients between potential sales tax revenues and the index of stress, potential property tax revenues and the index of stress, interest income and the index of stress, and intergovernmental revenues and the index of stress all carry a positive sign.

Regression analysis was performed in order to further examine these relationships. Table XV at the end of the chapter presents the results of regressing the index of fiscal stress on the various potential city revenues. As in the correlation analysis, the coefficients on the log of potential utility revenues, the log of potential revenues from fines, licenses, and fees, and the log of potential franchise taxes all carry the predicted negative sign. Of these, only potential utility revenues and potential franchise taxes are significantly related to the index. However, changes in these revenues do not have a large effect on the index of stress. The coefficient on potential utility revenues indicates that a 1 percent change in this variable is associated with only a 0.02 percent change in the index of stress while the coefficient on potential franchise taxes indicates that a 1 percent change in this variable is associated with only a .14 percent change in the index of stress.

The analysis indicates that the log of potential sales tax revenue, the log of potential property taxes, the log of interest income, and the log of intergovernmental transfers

all have a positive sign. Of these coefficients, only potential sales tax revenue and interest income are significant. Obviously, this type of relation violates the prediction that increases in potential revenues would be associated with decreases in the index of stress. As with the county analysis, the violation of the hypotheses is probably a result of being forced to use endogenous variables as independent variables.

Conclusion

This chapter has examined how counties and cities adjusted expenditures in response to changes in their index of stress. It has also discussed how changes in the various components of potential revenue affected the city and county stress indexes. Because of the problem of endogeneity in the independent variables, care must be used in interpreting the results.

Bearing this in mind, it can be stated that the results show that at least at the county level there does tend to be a negative relation between expenditures and the index of fiscal stress. Further, analysis tends to support the hypothesis that in the short run, governments at the county level prefer to carry out adjustments through capital expenditures.

In general, the evidence tends to point towards a negative relation between the index of stress and the various

components of potential revenue. Further, the analysis demonstrates that the relationship tends to be inelastic. Changes in the various potential revenues sources do not lead to large changes in the index of stress. Thus, although limited, the analysis seems to suggest that there may be little need for either county or city governments to undertake major changes in order to diversify their revenue sources.

The following chapter will offer the reader a brief review of the results of this study. It will remind the reader of those variables that may be important in explaining changes in fiscal stress at the county and city levels of government in Oklahoma. It will also attempt to provide some explanation as to why the model of fiscal stress developed does not perform particularly well when attempting to explain overall variations in stress at these levels of government.

TABLE VIII

PEARSON CORRELATION COEFFICIENTS
OF COUNTY EXPENDITURES

	Log of Stress
Log of Personnel	-0.05569 (0.3995)
Log of Maint. & Op.	-0.01823 (0.7828)
Log of Capital	-0.20883 (0.0014)

TABLE IX

COUNTY REGRESSIONS OF EXPENDITURES ON STRESS

Log of Personnel Expenditures

Variable	Estimate	Standard Error	t for Ho: Parameter=0	Prob > |t|
Intercept	3.827819	0.0421807	90.749	0.0001
Log Stress	-0.591481	0.7008041	-0.844	0.3995

Adjusted R_2 -0.0013

Log of Main. & Op. Expenditures

Variable	Estimate	Standard Error	t for H0: Parameter=0	Prob > |t|
Intercept	3.640844	0.0514729	70.733	0.0001
Log Stress	-0.236025	0.8551988	-0.276	0.7828

Adjusted R_2 -0.0040

Log of Capital Expenditures

Variable	Estimate	Standard Error	t for Ho: Parameter=0	Prob > |t|
Intercept	-0.025382	0.1126844	-0.225	0.8220
Log Stress	-6.049749	1.8722010	-3.231	0.0014

Adjusted R_2 0.0394

TABLE X

PEARSON CORRELATION COEFFICIENTS
OF CITY EXPENDITURES

	Log of Stress
Log of Personnel	0.16387 (0.0128)
Log of Maint. & Op.	-0.05611 (0.3970)
Log of Capital	-0.05206 (0.4320)
Log of Total	0.08576 (0.1950)

TABLE XI

CITY REGRESSIONS OF EXPENDITURES ON STRESS

Log of Personnel Expenditures

Variable	Estimate	Standard Error	t for Ho: Parameter=0	Prob > |t|
Intercept	4.521181	0.0338366	133.618	0.0001
Log Stress	0.262373	0.1046052	2.508	0.0128

Adjusted R_2 0.0226

Log of Main. & Op. Expenditures

Variable	Estimate	Standard Error	t for Ho: Parameter=0	Prob > |t|
Intercept	3.819101	0.0393125	97.147	0.0001
Log Stress	-0.103139	0.1215339	-0.849	0.3970

Adjusted R_2 -0.0012

Log of Capital Expenditures

Variable	Estimate	Standard Error	t for Ho: Parameter=0	Prob > |t|
Intercept	1.378824	0.2946229	14.468	0.0001
Log Stress	-0.231916	0.2946229	-0.787	0.4320

Adjusted R_2 -0.0017

TABLE XII

PEARSON CORRELATION COEFFICIENTS
OF COUNTY REVENUES

	Log of Stress
Log of Property	-0.23507 (0.0003)
Log of Fee	-0.22604 (0.0005)
Log of Sales	-0.04834 (0.4647)
Log of Interest	-0.00436 (0.9474)
Log of Intergovernmental	-0.03663 (0.5796)

TABLE XIII

COUNTY REGRESSIONS OF STRESS ON REVENUES

Variable	Estimate	Standard Error	t for Ho: Parameter=0	Prob > |t|
Intercept	0.073626	0.0243713	3.021	0.0028
Log Prop	-0.026249	0.0110409	-2.377	0.0183
Log Fee	-0.026350	0.0119046	-2.213	0.0279
Log Sales	-0.001667	0.0046377	-0.359	0.7196
Log Int	0.010288	0.0042149	2.411	0.0154
Log Intgov	0.007248	0.0068579	1.057	0.2917
Adjusted R_2	-0.0013			

TABLE XIV

PEARSON CORRELATION COEFFICIENTS
OF CITY REVENUES

	Log of Stress
Log of Utility	-0.16695 (0.0112)
Log of Fines & Fees	-0.14319 (0.0299)
Log of Sales	0.04609 (0.4867)
Log of Property	0.00852 (0.8977)
Log of Franchise	-0.12177 (0.0653)
Log of Interest	0.06637 (0.3162)
Log of Intergovernmental	0.05670 (0.3920)

TABLE XV

CITY REGRESSIONS OF STRESS ON REVENUES

Variable	Estimate	Standard Error	t for Ho: Parameter=0	Prob > |t|
Intercept	-0.437372	-0.24412659	-1.792	0.0746
Log Utility	-0.021880	-0.01078067	-2.030	0.0436
Log Fines	-0.137223	-0.11185610	-1.227	0.2212
Log Sales	0.184977	0.06355764	2.910	0.0040
Log Property	0.020091	0.01791030	1.122	0.2632
Log Franch	-0.142573	0.01836995	-1.655	0.0994
Log Interest	0.032087	0.01836995	1.747	0.0821
Log Intgov	0.020810	0.02566573	0.811	0.4183
Adjusted R^2	0.0751			

CHAPTER VI

CONCLUSION

The purpose of this study has been to examine fiscal stress at the local government level in Oklahoma during the period 1977 to 1987. This sector was disaggregated into the county and municipal sectors. Chapter II introduced the concept of fiscal stress as a potential imbalance between government revenues and expenditures. This imbalance was said to be caused by an excess demand for the goods and services provided by a jurisdiction. It was postulated that this excess demand would result in an increase in the price of goods and services provided by the jurisdiction. Since taxes may represent the price paid for public goods and services, a tax effort index of actual to potential revenues was used as the measure of fiscal stress.

Potential revenues are based on the ACIR's concept of capacity and represent the revenue that a jurisdiction has the ability to raise. It was hypothesized that increases in fiscal stress would lead to tax increases. As a result, the jurisdiction's actual revenues would rise. This increase in actual revenues would result in an increase in the index of fiscal stress. As this index increases, there is the

possibility of over-utilization of revenue bases in the jurisdiction.

Chapter III discussed the factors most likely to have the greatest impact on the index of fiscal stress. Identifying those variables affecting a jurisdiction's level of fiscal stress is quite important. If policy makers are aware of these variables, they may be able to identify those jurisdictions which are most vulnerable to stress. It may also be possible to design policies that will alleviate the level of stress experienced by a jurisdiction.

Chapter III hypothesized that the level of fiscal stress experienced by a local government in Oklahoma was likely to be influenced by population, population density, per capita income, the state's rate of inflation, the jurisdiction's unemployment rate, and the values of energy and agricultural production in a jurisdiction. Changes in both population and population density were thought to be ambiguously related to a jurisdiction's level of stress as was the rate of inflation. Income was predicted to be negatively related to stress, while the unemployment rate and the values of energy and agriculture production were thought be positively related to a jurisdiction's level of stress.

Chapter III also put forth the general model to be estimated. This model was represented as:

$$\ln FS_{jt} = \alpha_0 + \sum_{k=1}^{K} \ln \beta_k X_{kjt} + \epsilon_{jt} \quad (3.1).$$

The data set used in this model was a pooled data set. Such a data set was used because this study was concerned not only with differences in fiscal stress across jurisdictions, but also with changes in fiscal stress across time. Econometric tests indicated that an error components model should be used to estimate the equation.

Chapter IV discussed the results of estimating equation (3.1) by the error components method. The regression results for the county level of government indicated that changes in per capita income, the value of oil production, and inflation were the most important variables in terms of explaining changes in the index of stress. All three of these variables were found to be negatively related to stress.

At the municipal level of government, changes in population, per capita income, and inflation were found to be the most influential variables. Both per capita income and the rate of inflation were negatively related to the index of stress. Population was found to be positively related to a municipality's level of stress.

As previously stated, identification of these variables should be helpful to policy makers. First, it provides policy makers with information as to what jurisdictions may be vulnerable to stress. For example, if a certain city is currently experiencing rapid increases in population, it may be reasonable to expect that city's level of fiscal stress to increase. Secondly, identification of these variables

provides a guide for directing the flow of intergovernmental transfers to jurisdictions. For example, if policy makers know that a certain county is experiencing major declines in the value of oil production, they may want to direct transfers to that county in order to mitigate the increase in fiscal stress that is likely to accompany this drop in production.

Although the results in Chapter IV allowed those variables most likely to affect stress to be identified, it was found that the adjusted R^2's of both the county and city equations were quite low (0.0805 and 0.0924, respectively). This indicates that overall, the model did not perform well when it came to explaining variations in fiscal stress. This poor performance may be a result of the fact that, in general, there is only a small variation in the index both across jurisdictions and across time. While there were obviously outliers, many of the indexes at both the county and city level were found to be very close to 100. In order for the model to explain variation in the indexes, there must first be some meaningful variation.

The relatively insignificant variation in the index is not a total surprise. The impetus for this study was the notion that significant variations in the level of stress existed both across jurisdictions and across time. However, as noted in the introduction, data at the aggregate level indicates that local jurisdictions in Oklahoma might be insulated from the shocks that were affecting the private

sector throughout this period.

It is possible that aggregate data does not indicate variations accurately. First, the behavior of larger jurisdiction's may mask changes that are occuring in smaller ones. Also, the uniformity associated with the institutional framework of a single state will tend to reduce variations that would appear if the framework were to be considered on a more micro level. However, in the case of this study, it appears that contrary to expectations, the aggregate data presented the more accurate picture.

Understanding of this statement can be obtained by examining the revenues of these local jurisdictions. Of specific interest are the intergovernmental funds flowing to these jurisdictions and the taxes and charges and miscellaneous revenues raised by these jurisdictions. Table XVI at the end of the chapter presents this information for counties while the information for cities is presented at the end of the chapter in Table XVII.

As can be seen, federal intergovernmental aid at the county level fell throughout the period from $21.2 million in 1976-1977 to it lowest level of $12.7 million in 1986-1987. Thus counties lost $8.5 million in revenues from federal government over the period. On the other hand, state intergovernmental aid to these jurisdictions rose from $85.5 million in 1976-1977 to $133.6 million in 1986-1987. This increase of $48.1 million more than made up for the lost deral

revenues.

At the same time that state intergovernmental transfers to counties were increasing, we find that both tax revenues and revenues from charges and miscellaneous sources were also increasing. Tax revenues at the county level increased from $87.6 million in 1976-1977 to $195.4 million in 1986-1987. Revenues from charges and miscellaneous sources increased from 54.0 million in 1976-1977 to 247.4 million in 1986-1987. Thus, although the private sector in Oklahoma was suffering throughout the period of the energy bust, it appears that in general counties were able to maintain their fiscal viability through both the generosity of state government and by employing their coercive power to raise revenue.

Table XVII provides information for city governments over the 1977-1987 period. Like county governments, city governments also experienced a decrease in federal intergovernmental transfers over the period. These transfers fell from $174.2 million in 1976-1977 to $77.7 million in 1987-1988. This entailed a drop in federal revenues for cities of $88.5 million. Unlike county governments, this drop was not matched by large increases in state intergovernmental transfers to cities. State intergovernmental transfers rose by only $7.6. million over this period.

As a result, it might be expected that cities began to rely more heavily on taxes and charges in order to maintain services to their populations. Examination of Table 6.2 shows

that municipality tax revenues rose by an astounding $350.3 million (or 91 percent) over the period in question. Revenue from charges and miscellaneous sources increased by an unbelievable 593.2 million (or 124 percent). Thus, like counties, it appears that cities were able to maintain their fiscal viability through the use of their coercive power to raise revenue.

These results raise an interesting question. It appears that the coercive power of government (at both the state and local level) enabled local governments to continue operations "as usual" while many businesses in the private sector were severely buffeted by the changes occurring throughout this period. The reader may ask himself or herself if these actions on the part of government have resulted in the present tax limitation movement in the State.

Chapter V focused on the question of how jurisdictions adjusted to any changes in fiscal stress that they did experience. Although somewhat tenuous, the evidence in this chapter indicated that jurisdictions, especially at the county level, tended to adjust to changes in fiscal stress by altering capital expenditures. This result has important implications for a jurisdiction's capital stock. If jurisdictions experiencing increasing levels of stress decrease capital expenditures in order to maintain services to voters, there may ultimately be a deterioration of this capital stock. Hence, such adjustments should be of concern

to policy makers if they are interested in the long-term well-being their jurisdiction.

Chapter V also used correlation analysis and elasticity coefficients to examine the sensitivity of the index of stress to changes in a jurisdiction's principal revenue sources. It was thought that there might be a need for diversification of revenue sources if changes in a particular source were associated with relatively large changes in the index. The results of the analysis seemed to indicate that the index of stress at both the county and city levels was not particularly sensitive to changes in any specific source of revenue and hence, there was little need for restructuring revenues.

While this study has expanded the knowledge of fiscal stress at the local government level in Oklahoma, there is room for future research. The results of this study were based on data from a very limited time period. The collection of more data to create a more complete data set and using this data set to examine some of these questions would be interesting. Even more basic is the problem of a lack of theory when dealing with fiscal stress. Thus, perhaps in the future, the major focus should be on the development of a theory of fiscal stress grounded in public choice literature. Finally, the fact that there was little variation in the index of stress, the reasons for this results, and any relation to the State's tax limitation movement could be examined in much more detail.

TABLE XVI

COUNTY GOVERNMENT REVENUES
1976-77 THROUGH 1986-87

Year	Federal Intergovernmental Revenues (millions of dollars)	State Revenues (millions of dollars)	Taxes (millions of dollars)	Charges & Misc. (millions of dollars)
1976-77	$21.2	$85.5	$87.6	$54.0
1977-78	28.6	91.0	95.1	53.6
1978-79	23.7	98.0	100.5	68.8
1989-80	20.4	111.8	109.1	84.1
1980-81	18.9	121.2	97.8	105.5
1981-82	18.5	144.7	105.6	140.6
1982-83	18.6	142.4	144.8	112.9
1983-84	16.6	150.3	155.3	206.3
1984-85	16.1	151.2	172.8	237.0
1985-86	15.7	149.6	188.1	276.0
1986-87	12.7	133.6	195.4	247.4

Source: Governmental Finances, selected years. U.S. Department of Commerce. U.S. Government Printing Office.

TABLE XVII

CITY GOVERNMENT REVENUES
1976-77 THROUGH 1986-87

Year	Federal Intergovernmental	State Revenues	Taxes	Charges & Misc.
	(millions of dollars)			
1976-77	$174.2	$33.8	$208.4	$180.7
1977-78	149.2	26.6	245.2	226.9
1978-79	148.2	27.0	276.4	225.0
1989-80	159.3	27.0	308.4	261.1
1980-81	157.5	28.6	374.2	368.3
1981-82	116.2	31.3	461.6	387.7
1982-83	105.5	28.0	499.6	383.5
1983-84	115.9	33.7	539.7	611.0
1984-85	114.2	43.0	575.1	686.2
1985-86	111.5	43.0	549.2	737.1
1986-87	77.7	41.4	558.7	773.9

Source: Governmental Finances, selected years. U.S. Department of Commerce. U.S. Government Printing Office.

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APPENDIX A

DATA SOURCES FOR THE INDEPENDENT VARIABLES

Population Information on population for counties and cities is found in the Statistical Abstract of Oklahoma, 1980, 1986, and 1989; Center for Economic Management and Research, College of Business Administration, University of Oklahoma.

Population Density Population density is derived by dividing the jurisdiction's population by its land area. Information on land area can be found in the County and City Data Book, 1988; U.S. Department of Commerce, Bureau of the Census.

Per Capita Income Information on per capita income was collected from the regional economic profile provided by the U.S. Department of Commerce Bureau of Economic Analysis.

Unemployment Rate Information on county unemployment rates is found in Handbook of Labor Force Data, Vols. VI, VII, and VIII; Oklahoma Employment Security Commission.

Inflation Rate Information on the national inflation rate is found in Business Conditions Digest, March 1989.

Value of Energy Production Information on the value of energy production is found in the Statistical Abstract of Oklahoma, 1980, 1984, and 1989; Center for Economic Management and Research, College of Business Administration, University of Oklahoma.

Value of Ag. Production Information on the value of agricultural production is found in the Census of Agriculture, Vol. I, 1977 and 1987; U.S. Department of Commerce, Bureau of the Census.

APPENDIX B

DATA SOURCES FOR THE DEPENDENT VARIABLE

The county index of fiscal stress is derived by multiplying the ratio of actual revenues to potential revenues by 100. The principal revenue sources used for counties are property taxes, sales taxes, revenues from fees, revenues from interest, and revenues from intergovernmental transfers.

The first four revenue sources are found in the financial statements (Estimate of Needs) that local governments submit annually to the Oklahoma State Auditor and Inspector. Appendix C provides an in-depth discussion of this financial statement.

Information on intergovernmental transfers to counties is derived from several sources. Information on federal intergovernmental transfers can be found in General Revenue Sharing published by the Department of Treasury and in the Government Finance series published by the U.S. Department of Commerce. Information on state intergovernmental transfers can be found in State Payments to Local Governments published by the Oklahoma Tax Commission.

Potential revenue is derived by multiplying a revenue

base by its average tax rate. Potential sales tax revenue for a county is derived by multiplying the sales tax base in the county times the statewide average sales tax rate. Sales tax rates were provided by the Oklahoma Tax Commission. These rates were then used to derive the average sales tax rate. A county's sales tax base was derived by dividing the county's sales tax collections by its sales tax rate.

Potential property tax revenue is derived by multiplying the property tax base in a county times the average property tax. The information on property tax rates is found in the Estimate of Needs submitted by the counties to the Oklahoma Auditor and Inspector. These rates were used to derived the statewide average property tax rate. A county's property tax base was derived by dividing the county's property tax collections by its property tax rate.

Information on revenue rates for revenue from fees is not available. In order to derive a rate for fees, income was assumed to be the base from which the county collected its fee revenue. Given this assumption, a rate was derived by dividing a county's per capita revenue from fees by its per capita income. These rates were then used to derive the potential revenue that could be raised from fees.

Each county was assumed to be receiving the maximum possible in terms of interest and intergovernmental transfers. Hence actual and potential revenues from these

sources are identical.

The index of fiscal stress for municipalities is derived in a manner identical to the derivation of the county index of fiscal stress. The revenue sources for the municipality index of stress are property taxes, sales taxes, franchise taxes, revenue from utilities, revenue from fines, licenses, and fees, revenue from interest, and revenue from intergovernmental transfers.

The first six revenue sources are found in the financial statements (Estimate of Needs) that local governments submit annually to the Oklahoma State Auditor and Inspector. Information on intergovernmental transfers to cities is derived from several sources. Information on federal intergovernmental transfers can be found in General Revenue Sharing published by the Department of Treasury and the Government Finance series published by the U.S. Department of Commerce. Information on state intergovernmental transfers can be found in State Payments to Local Governments published by the Oklahoma Tax Commission.

Potential sales tax revenue is derived by multiplying the sales tax base in a municipality times the statewide average sales tax rate. The sales tax rates were provided by the Oklahoma Tax Commission. These rates were then used to derive the average sales tax rate. A municipality's sales tax base was derived by dividing its sales tax

collections by its sales tax rate.

Potential property tax revenue is derived by multiplying the property tax base in a municipality times the statewide average property tax. The information on property tax rates are found in the Estimate of Needs submitted by each municipality to the Oklahoma Auditor and Inspector. These rates were used to derived the average property tax rate. A municipality's property tax base was derived by dividing its property tax collections by its property tax rate. It should be noted that property taxes at the municipal level constitute only a small portion of a municipality's total revenues. This revenue source is available only for a sinking fund.

Information on franchise tax rates or revenue rates for utility revenue or revenue from fines, licenses, and fees was not available. In order to derive these rates, it was assumed that income was the base from which these revenues were raised. Given this assumption, a rate for each source was derived by dividing the per capita revenue of a source by the per capita income of the municipality. These rates were then used to derive a statewide average rate and the potential revenue that could be raised.

It was assumed that each municipality was receiving the maximum in terms of interest and intergovernmental transfers. Hence actual and potential revenues from these sources are identical.

APPENDIX C

INFORMATION ON THE ESTIMATE OF NEEDS

Each fiscal year every local government in Oklahoma must submit a financial statement to the Oklahoma State Auditor and Inspector's Office. This financial statement is entitled "Estimate of Needs and Financial Statement." Past copies of these statements can be found in the Oklahoma Archives at the state capitol. These statements provide detailed financial information on each local jurisdiction.

For the purposes of this study, the most important information found in these statements can be grouped into two classes: revenues and expenditures. Exhibit "T" on the Estimate of Needs provides information on a jurisdiction's ad valorem tax accounts. Property tax information for both counties and municipalities was taken from this exhibit. Exhibit "F-1" on the statement provides information about revenues from sources other than the ad valorem tax. Figures for revenue other than the property tax were found in this exhibit. Finally, Exhibit "Y" on the statement provides information about the tax levy millage. This exhibit was used to collect information about each jurisdiction's property tax rate.

Information on general fund expenditures can be found on the statement in Exhibit "M-A." It shows the estimated need of each general fund account for the coming fiscal year and the expenditures made from each account for the prior fiscal year. This account shows personnel services expenditures, maintenance and operating expenditures, and capital expenditures. Exhibit "M-C" provides the same type of information for cash funds (highways). For counties, the principal expenditures included in the study were: public safety, social services, health and hospital, government administration, agriculture, and transportation. For municipalities, the principal expenditures included in the study were: general government, public safety, parks and recreation, utility, and transportation.

While these financial statements are generally made available to interested parties, they are inconvenient to use. First, these statements must be examined at the state capitol. They cannot be removed from the premises. Second, these statements are not on computer but are on their original forms. Instead of being found on a single page or two, the data is scattered throughout the form. Thus, the entire form (which is quite lengthy) must be examined in order to collect the desired information. Considering that these forms are not only lengthy, but quite bulky (approximately 1.5 feet by 2 feet) this is quite an undertaking. Using these forms to collect large amounts of

data requires a substantial time investment on the part of a researcher and would not be recommended unless other data sources are unavailable.

2

VITA

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