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THE IMPACT OF STATE AID ON THE FUNDING OF PUBLIC EDUCATION IN OKLAHOMA: INCENTIVE AND EQUALIZATION

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CHAPTER I

INTRODUCTION

In recent years there has been a growing concern with the funding of education in the United States. Questions have been raised about the way it is financed, the level of financing, and the impact of government aid on local funding. Since the turn of the twentieth century, expenditures for education have assumed a growing budgetary importance. At all levels of government, educational expenditures have increased both absolutely and as a percentage of total spending since 1902. From 1902 to 1975, federal educational spending has increased from 0.7% to 4.8% of total spending, while state and local spending for education increased from 23.3% to 33.0% of total spending by those governmental units. For all three governments, educational expenditures rose from 15.4% to 17.1% over the period.[1]

Some educational spending is indirect and is in the

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[1] U.S. Census Bureau, Historical Statistics of the U.S., Colonial Times to 1970 and U.S. Census Bureau, Governmental Finance, 1974-75, cited by Thomas F. Pogue and L. G. Sgontz, Government and Economic Choice: An Introduction to Public Finance (Boston: Houghton Mifflin Company, 1978), pp. 36-38.

form of a transfer from a higher to a lower governmental unit. Such outlays have increased. For example, in Oklahoma, state aid to education increased from $500,000 for fiscal 1925 to $224,748,186 in fiscal 1976.[2] The impact of such intergovernmental transfers is not clear, and a body of theoretical and empirical work has centered on definition and measurement of this impact. The determination of whether state aid to education in Oklahoma encourages or discourages local funding is a major objective of this study.

The issue of state aid stimulating or discouraging local spending for education in Oklahoma is an important issue on two counts. First, an examination of item six of the Oklahoma School Code addressed the importance of encouragement.[3] Section 18-101 of the Oklahoma School Code reads as follows in regard to legislative intent.

> The Legislature hereby declares that this act is passed for the general improvement of the public schools in the State of Oklahoma; to provide the best possible educational opportunities for every child in Oklahoma; and to have a more beneficial use of public funds expended for education; and this act shall be liberally construed to attain these goals within the purview of the following principles and policies:
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> . . .
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> 6. The system of public school support should encourage local school districts to provide and support improved educational programs.[4]

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[2] 1975-76 Annual Report, Oklahoma State Department of Education by Leslie Fisher, State Superintendent of Public Instruction (Oklahoma City: Allied Printers and Publishers, Inc., 1976), pp. 29-31.

[3] Oklahoma, Statutes, Annotated (West Publishing Company, 1972).

[4] Ibid.

Second, the encouragement of local districts to support improved educational programs is justified by the efficient allocation of resource argument expressed above. Since positive externalities result from education purchased by the local school district, state aid should encourage an increased purchase to move the school district toward a socially efficient equilibrium.

Another question to be addressed deals with which components of state funding produce stimulation, if any? State revenues passed down to local levels are in the form of foundation aid, incentive aid, and dedicated revenues. Which of these stimulates local educational funding and which acts as a substitute for local effort?

Since stimulation of local educational spending is a desirable goal for state aid, an evaluation of the relative success of various components in accomplishing this goal is necessary. To this end of evaluation the effectiveness of state foundation aid, state incentive aid, and state dedicated revenue, each of their effects on local spending must be measured.

The Oklahoma Statutes establish another purpose of state aid to education as the equalization of educational opportunity.[5] Does state aid to education assist in equalizing educational opportunity in Oklahoma?

An examination of item nine of the Oklahoma School

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[5]Ibid.

Code indicates that equalization of educational opportunity is a goal of public school finance.

> 9. State support should be extended to all local districts regardless of wealth, for this not only develops a sense of broader responsibility, but also creates flexibility taxwise permitting the exercise of local initiative. State support should, to assure equal educational opportunity, provide for as large a measure of equalization as possible among districts. The taxing power of the state should be utilized to raise the level of educational opportunity in the financially weakest districts of the state.[6]

Besides the Oklahoma Statutes, several court cases have recently called attention to the equalization of educational spending within state boundaries, e.g., in California, Serrano v. Priest[7] and in Texas, Rodriguez v. San Antonio Independent School District.[8]

The Serrano v. Priest case centered on the argument that fourteenth amendment rights of the U.S. Constitution had been violated. Public schools in California were financed in such a manner as to discriminate against those who lived in poorer districts, i.e., property taxes were heavily relied upon. Further, higher tax rates had to be

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[6]Ibid.

[7]Serrano v. Priest, 5 Cal. 3d 584, 487 P. 2d 1241, 96 Cal. Rptr. 601 (1971), cited by Betsy Levin, Alternatives to the Present System of School Finance: Their Problems and Prospects (Washington, D.C.: Urban Institute, 1973), p. 895.

[8]Rodriguez v. San Antonio Independent School District, 337 F. Supp. 280 (W. D. Texas 1971), prob. juris noted, 406 U.S. 966 (1972) (No. 71-1332), cited by Betsy Levin, Alternatives to the Present System of School Finance: Their Problems and Prospects (Washington, D.C.: Urban Institute, 1973), pp. 896-897.

paid in the poorer districts to maintain a comparable level of education to other areas of the state. The case was appealed to the California Supreme Court and their ruling follows. There is a constitutional right to an education the quality of which is not "a function of the wealth of . . ." the pupil's neighborhood. This principle of "fiscal neutrality" requires that "the level of spending for a child's education . . . not be a function of wealth other than the wealth of the state as a whole."[9]

Although what is trying to be equalized with respect to the quality of education is an important issue, it will not be part of this study. The assumption will be made that quality of education is measured by total educational revenue per student in average daily attendance in a particular district.[10]

With the Rodriguez v. San Antonio Independent School District case fourteenth amendment rights were claimed. A lower court ruling was in favor of Rodriguez, based on the fiscal neutrality doctrine. The Supreme Court overturned the lower court ruling and said that the "constitutional

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[9]Serrano v. Priest, 5 Cal. 3d 584, 487 P. 2d 1241, 96 Cal. Rptr. 601 (1971), cited by Betsy Levin, Alternatives to the Present System of School Finance: Their Problems and Prospects (Washington, D.C.: Urban Institute), 1973), pp. 895-896.

[10]James S. Coleman, "Equal Schools or Equal Students," Public Interest 4 (Summer 1966): 70-75.

authority precluded" the lower court ruling.[11]

Following Serrano v. Priest and Rodriguez v. San Antonio Independent School District there have been fifty-two such actions in thirty-one states.[12] Even following the Supreme Court decision against Rodriguez the pressure remains strong to correct the discrimination in educational funding which ties quality of education and wealth together. Not only is the concern still strong in favor of the fiscal neutrality doctrine, but widespread concern exists with regard to funding education through the property tax. During the last five years, issues such as full-state funding of education, reducing dependence of educational funds on property wealth, and shifting of the property tax base through a redistribution of public service property tax revenues have been of concern in Oklahoma. The Oklahoma Legislature has shown concern by recently proposing a law which would redistribute the public service part of the property tax. (See Appendix 1 for a draft of this proposed legislation.)

The purposes of this study are to, first, determine the impact of state grants on local resource allocation to

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[11] Rodriguez v. San Antonio Independent School District, 337 F. Supp. 280 (W. D. Texas 1971), prob. juris noted, 406 U.S. 966 (1972) (No. 71-1332), cited by Betsy Levin, Alternatives to the Present System of School Finance: Their Problems and Prospects (Washington, D.C.: Urban Institute, 1973), pp. 396-897.

[12] Serrano v. Priest, 5 Cal. 3d 584, 487 P. 2d 1241, 96 Cal. Rptr. 601 (1971), cited by Betsy Levin, Alternatives to the Present System of School Finance: Their Problems and Prospects (Washington, D.C.: Urban Institute, 1973), p. 896.

education and, second, to determine how educational opportunity is affected by state grants to education in Oklahoma. Relevant to the first purpose is the question, do state grants stimulate or discourage local funding of education in Oklahoma? Purpose one will be dealt with by employing multiple regression analysis to a demand equation for education. The impact of total state educational revenue on local funding of education will be estimated. Next, the impact of block and matching grants will be isolated. Purpose two will be dealt with by testing a simple regression model, first, to see if educational opportunity is related to district wealth and, second, to determine the impact of state educational funding on the equality of educational opportunity. (A more complete explanation of purpose and method is present in Chapter IV.)

This study will proceed along the following lines. Chapter II will summarize the literature on the impact of grants on state and local funding of education. Chapter III will outline the collection and expenditure system for state educational monies in Oklahoma. Chapter IV will outline the models to be tested and the formal hypotheses which will be tested to address the relevant questions raised. Chapter V will present a discussion of issues concerning the testing of hypotheses established in Chapter IV. The final chapter will summarize the empirical work and set forth conclusions derived. It also will touch on the need and the desired

direction for further work in this particular area of the grants economy.

CHAPTER II

SURVEY OF LITERATURE ON ECONOMICS OF GRANTS IN AID

The purpose of this chapter is to describe and assess the major studies that measure the impact of intergovernmental grants for education. Attention will focus principally on the objectives, methods employed, conclusions, and gaps left for further work. Thirteen studies were chosen for explanation because their demand equations for education utilized a wide range of independent variables, including state and/or federal aid.

Several studies have explored the impact of state and federal grants on local and state spending for education. Some of the demand models have used state and federal aid as independent variables to help explain local funding of education. Others of these educational demand models have employed state or federal aid as independent variables. Objectives of most of the studies involved measuring the stimulative versus substitution effects of intergovernmental grants for education. Methods of the researchers varied in regard to the independent variables list and the way the

dependent variable was specified. The number of independent variables employed ranged from three in Bishop's work[1] to ten in Ladd's model.[2] The dependent variable was often specified to be local or state spending for education,[3] but in some cases total educational spending was regressed on a list of independent variables.[4]

Few of these models examined measured the relative impact of block versus matching grants. Block grants require no direct effort on the part of the recipient government, while matching grants do require direct financing effort on the part of the government unit receiving the grant. Block and matching grants have differing impacts on the budget constraint of the government unit receiving these awards. (This issue of block versus matching grants will be discussed more fully in Chapter IV.) While the relative impact of block and matching grants is a question of importance, it has not been dealt with adequately.

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[1]George Bishop, "Stimulative Versus Substitution Effects of State School Aid in New England," National Tax Journal 17 (June 1964): 137.

[2]Helen F. Ladd, "Local Education Expenditures, Fiscal Capacity, and the Composition of the Property Tax Base," National Tax Journal 28 (June 1975): 148.

[3]Robert Anthony Gough, Jr., "Intergovernmental Grants-in-Aid: A General Model for Assessing the Local Fiscal Effects of the Massachusetts Variable-Matching Public School Aid Program." (Ph.D. dissertation, Duke University, 1974), p. 21.

[4]Ladd, p. 148.

None of the models broke federal aid down into its component parts of matching and block grants. Only two studies in 1975 broke state aid down into its matching and block components.[5,6]

Most of the studies of state and federal aid impact on local educational spending have involved regression analysis. Multiple linear regression by ordinary least-squares has been the most popular, using linear or log-linear forms. Some have used two-stage least-squares or principal components analysis.

A variety of results emerged from these aid studies. State aid was usually found to stimulate local spending for education, although two models have found it insignificant and one found that it discouraged local spending for education. Federal aid was found to stimulate local spending in five studies, while three found it not significant.

Five of the studies examined utilized both state and federal aid to help explain local educational spending. Two of this group of five studies used only total state and federal aid.

David W. Holland's study employed a time series of

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[5]Ladd, p. 148.

[6]Martin S. Feldstein, "Wealth Neutrality and Local Choice in Public Education," American Economic Review 65 (March 1975): 80-81.

Oklahoma data for the years of 1951 to 1970.[7] It aggregated school districts into counties and proceeded with data for seventy-seven Oklahoma counties. State revenue per student was found to have a negative impact on local spending for education; federal aid per student was not significant. Other significant variables in the Holland study and their impacts are as follows: income per student (positive), dummy variable designating western Oklahoma with a one and eastern Oklahoma with a zero (positive), public school enrollment per the population (positive), and non-white enrollment per the total enrollment (positive). Net migration was the main concern to Holland, and this variable was found to have no effect on local educational revenue.

A second study which used both state and federal aid to education without a breakdown was done by George B. Pidot, Jr.[8] The data base for this work was eighty large standard metropolitan statistical areas (SMSA's) throughout the United States for 1962. Principal components analysis was used by Pidot, mainly to by-pass the potential problem of multicollinearity. Six principal components were derived

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[7]David William Holland, "The Geographic and Income Class Distribution of the Benefits and Costs of Public Education--Implications for Common School Finance." (Ph.D. dissertation, Oklahoma State University, 1972), p. 56.

[8]George B. Pidot, Jr. "A Principal Components Analysis of the Determinants of Local Government Fiscal Patterns," Review of Economics and Statistics 51 (May 1969): 187.

and then combined with state and federal aid per capita as independent variables on which current educational spending per capita was regressed. Two principal components were not significant in explaining current educational spending. Four components were found to affect the dependent variable negatively: metropolitanism, inverse measure of wealth, absence of older and lower income people and the presence of manufacturing rather than retailing, and representative of areas of high residential rather than commercial property. Areas with those four characteristics tended to spend less on current education per capita. The metropolitanism component captured areas such as New York City, Washington, D.C., and Boston as compared to areas such as Phoenix, Fresno, and San Jose. Areas producing high principal component scores for metropolitanism had a high population density, slow or negative growth rates, large suburban agglomerations, and a commuting labor force using public transport. Inverse measure of wealth as a component showed negative impact on the dependent variable when regression was employed. The inverse measure of wealth was highly negatively correlated with income measures and with the indices of good housing quality. Also characteristic in this category were low amounts of value added in manufacturing and a high positive correlation with size of governmental units. By this inverse measure of wealth Rochester and San Francisco were labeled wealthy and at the other

extreme were Mobile and Memphis. The last two of the four components with negative influence defy such exacting identification as did metropolitanism and inverse measure of wealth. Areas with tendencies toward absence of older and lower income people and the presence of manufacturing rather than retailing produced lower per capita revenues for current education. Also, areas characterized with high residential development as opposed to commercial development had relatively lower property values and tended to spend less per capita on current education. State aid per capita produced a regression coefficient of + 0.323 and, thus, had a stimulative influence on local spending. Federal aid per capita and the principal component described as a general inverse index of size produced insignificant regression coefficients.

A third study to involve state and not federal aid in the explanation of educational spending was produced by Seymour Sacks and Robert Harris.[9] The purpose of this work was to compare results of Fabricant and Fisher with a similar result in 1960.[10,11] Sacks and Harris used data for

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[9]Seymour Sacks and Robert Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Funds," National Tax Journal 17 (March 1964): 83-84.

[10]Solomon Fabricant, The Trend of Government Activity in the United States Since 1900 (New York: National Bureau of Economic Research, 1952), pp. 112-139.

[11]Glenn W. Fisher, "Determinants of State and Local Government Expenditures: A Preliminary Analysis," National Tax Journal 14 (December 1961): 349-355.

the forty-eight states of the United States for 1942, 1957, and 1960. The dependent variable involved in this multiple linear regression was per capita state and local spending for local schools. Independent variables were few, namely: population density per square mile for 1960, per capita income in 1960, and per capita state aid in 1960 dollars. State aid was found to be a major determinant of state and local spending for education. A major flaw in the Sacks and Harris work was the use of state aid to education as an independent variable since it is also part of the dependent variable, state and local spending for education. A degree of circularity is introduced into the regression when this procedure is followed.

Another work which involved the use of both state and federal aid to explain local spending for education was done by Helen F. Ladd.[12] Ladd not only employed state and federal grants to education, but these were separately viewed in three variables. A local tax share variable was used to measure the effect of state matching aid. Non-matching state aid was accounted for in a unique variable. Categoric grants from both state and federal governments were estimated in another independent variable.

Ladd's data base was the Boston SMSA for 1970. Ladd used a log form for her regressions and, thus, directly estimated relevant elasticities. Results of this study can

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[12]Ladd, p. 148.

be summarized as follows. Elasticity with regard to state block grants was found to be significant and positive (0.030 to 0.0386). State matching grants stimulate educational spending. Categoric grants, federal and state combined, stimulate educational spending. It should be noted that Ladd's dependent variable is total educational spending per student, i.e., local, state, and federal. Other findings of Ladd which do not involve state and federal aid's impact on educational spending include income and wealth elasticities; both were positive and significant (0.42 to 0.459) and (0.239 to 0.30), respectively. Thus, income and wealth were both found to stimulate total educational spending per pupil. The price elasticity for the residential portion of the tax base was estimated to be - 0.31; thus, the higher the fraction of residential property in the tax base the lower was the spending for education. The price elasticity for the local share component of the tax base was negative and significant, (- 0.49). This implies that the greater the burden is for localities to finance education, the less energetic they are to spend for education.

Perhaps, the most outstanding work of the studies examined was that of Martin S. Feldstein which involved cross-sectional data for 1970 in Massachusetts.[13] The Feldstein study was used by the writer of this dissertation as a guide for testing the wealth neutrality hypothesis--

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[13]Feldstein, pp. 75-89.

established by court cases like Serrano v. Priest--that the spending per student for education was not to be related to the wealth of the school district in which the student resides.[14]

Feldstein regressed current educational expenditures per pupil (local, state, and federal) on nine independent variables. Of particular interest in the Feldstein model were variables for price = (1 - local matching rate). This variable refers to the price of an educational expenditure to the local district, i.e., one minus the portion paid by the state. If the matching rate was twenty-five percent, then a 0.75 price to the local district would result. State block grants was another component of state aid to education. Federal grants were viewed in lump sum form, i.e., no separation was made as to block, categoric, or matching funds. Representative results of the Feldstein work allow several comments in summary. Elasticity with respect to wealth is low, (0.28). Price elasticity is high, (- 1.0). Income elasticity is low, (0.48). Elasticity with respect to state block grants is low and less than federal grants, (0.066 and 0.136), respectively. Thus, state block grants stimulate total educational spending, but less than federal grants. The residential portion of the tax base produced a negative coefficient, which suggests that non-residential taxes are considered to be less costly than

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[14]Serrano v. Priest, L. A. 29820, Superior Court No. 938254 (1971), cited by Feldstein, p. 77.

residential taxes. A large number of private school students tends to depress public school spending; an elasticity of (- 1.112) was produced. A growth in the number of pupils causes the level of per pupil spending to go down; the elasticity coefficient was (- 0.336). The contribution of the Feldstein work lies in his use of the price variable which works in the effect of state matching grants. Most studies have worked with dollar amounts and have ignored the price effect of state matching grants.

Four studies observed used state aid as an independent variable in trying to explain educational spending. One such study was done by George Bishop, who worked with six New England states for the period 1961-1962.[15] Bishop's model was one of the simplest examined; he employed only three independent variables with which to explain educational spending for the six New England states. These three independent variables were: state aid per pupil, equalized property value per student, and number of pupils in average daily attendance (ADA). Bishop's contribution was that he used data for towns and cities which were weighted by size (number of pupils or expenditures). His results indicated that the relationship between state aid and expenditures per student was negative or insignificant. A summary of findings of the Bishop study goes as follows. Much variation exists between regression coefficients

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[15]Bishop, pp. 133-143.

between states, e.g., + 0.44 in Maine to - 0.98 in Massachusetts. State aid was the least significant of the three variables. Property value was significant except in Rhode Island. The size of school membership was significant, except in unweighted cases. The substitution effect of state aid was found to be greater than the stimulative effect. The substitution effect of state aid involves the extent to which aid from the state tends to replace local dollars, i.e., discourage local effort. The stimulation effect of state aid refers to the tendency for aid payments to encourage local spending for education.

A second study to use state aid and not federal was done by Raymond J. Struyk.[16] The Struyk study covered data for 140 school districts in New Jersey for 1960. Population in the chosen districts was 10,000 or over. Two-stage least-squares regression was done due to the interrelationship between state grants to local districts, total educational spending per school district, and tax collections of the jurisdiction. Struyk's conclusion was that state aid was not significant as a determinant of educational spending at the local level.

Gough, in a dissertation, provided a third case in which state aid was used in the absence of federal aid to

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[16]Raymond J. Struyk, "Effects of State Grants-in-Aid on Local Provision of Education and Welfare Services in New Jersey," Journal of Regional Science 10 (August 1970): 226.

explain local spending per student on education.[17] The data base for the Gough work was 300 school districts in Massachusetts for fiscal 1971. State aid was found to have a positive effect on local spending for education. From each dollar of state aid local districts increased their spending by $0.59, according to Gough.

A fourth study by Edward J. Renshaw was a cross-sectional analysis using 1950 data for forty-eight states.[18] Annual current expense per student in ADA was regressed by OLSQ on three independent variables: percentage of revenue coming from state, per capita income, and percentage of state population non-white. A summary of results indicates that about 16% of state aid serves to stimulate local spending, while about 84% was substituted for local spending for education. Thus, the substitution effect of state aid was found to be greater than the stimulation effect.

Five studies will be cited for using federal and not state aid as a determinant of state and local spending for education. A study published in the mid-1960's by Jack Osman investigated the dual impact of federal aid, i.e., possible stimulative effect on the aided function and the impact of aid on the non-aided function.[19] When a

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[17] Gough, pp. 27-28.

[18] Edward F. Renshaw, "A Note on the Expenditure Effect of State Aid to Education," Journal of Political Economy 67 (April 1960): 171.

[19] Jack W. Osman, "The Dual Impact of Federal Aid on State and Local Government Expenditures," National Tax Journal 19 (December 1966): 362-372.

regression was run using spending on local schools as a dependent variable, federal aid was found to have a high degree of stimulation. (The regression coefficient for federal aid was 2.7.) About $0.33 out of each aided dollar goes for items other than the aided function. Other significant independent variables according to Osman's study were per capita income in the state, federal aid to functions other than education, and the number of students per 1,000 population.

Pogue and Sgontz, using a data base of the forty-eight states of the United States, found that federal aid was not significant in explaining local and state spending for education.[20] To reach this conclusion, first per capita local spending for local education was regressed on several independent variables. Then federal aid per capita for education was regressed on the same list of explanatory variables. Estimates of the model were such that the conclusion is made that, "aid payments appear to be determined, in part, by expenditures and/or the same variables which determine expenditures."[21] The contribution of this project was to conclude that models in which federal aid was used as an explanatory variable for annual per capita state and local spending for education would produce biased estimates

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[20]Thomas F. Pogue and L. G. Sgontz, "The Effects of Grants-In-Aid on State-Local Spending," National Tax Journal 21 (June 1968): 196-197.

[21]Ibid., p. 199.

of the impact of federal aid.

A third study by David L. Smith used federal but not state aid for fifty states of the United States for fiscal 1965.[22] Federal aid was found not to be statistically significant in explaining state and local per capita spending for education. A negative and significant coefficient for the population density variable suggests economies of scale. Other significant independent variables were per capita personal income and public school enrollment per 1,000 population.

D. A. L. Auld examined the impact of outside grants on local spending.[23] Auld used data for fifteen cities in Ontario as a basis for his study. Both linear and log-linear regressions were run, but the linear produced best results. From pooled, cross-sectional data it was concluded that conditional grants had a positive impact on per capita spending for education. Of interest, average taxpayer income was not found to be significant in explaining per capita spending for education at the local level.

Bahl and Saunders indicated that federal aid had a significant impact on changes in state per capita spending

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[22]David L. Smith, "The Response of State and Local Governments to Federal Grants," National Tax Journal 21 (September 1968): 352.

[23]D. A. L. Auld, "Provisional Grants and Local Government Expenditures," Public Finance Quarterly 4 (July 1976): 295-306.

for education, 1957-1960.[24] Five independent variables were used in this study, but changes in per capita federal grants were most significant. Other independent variables included the following: changes in per capita personal income, population density, urban population, and public school enrollment.

Much disagreement exists between the various works that were discussed in this chapter. These differing conclusions on the impact of state and federal aid to education can be justified with reasonable ease. Purposes of the studies reviewed varied. Holland's main concern in Oklahoma was with the impact of a net migration variable on local revenue for education.[25] Pidot was concerned with explaining local fiscal patterns in general and not just for educational spending.[26] Methods of the researchers often varied due to this variation in purpose. Inter-state variations in educational spending were significant to some,[27] while to others intra-state differences were important.[28] Variation in purpose had influence on method and contributed to the different conclusions reached.

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[24]Roy W. Bahl and Robert J. Saunders, "Determinants of Changes in State and Local Government Expenditures," National Tax Journal 18 (March 1965): 51.

[25]Holland, pp. 55-66.

[26]Pidot, p. 176.

[27]Fisher, pp. 349-355.

[28]Gough, pp. 27-28.

With few exceptions, writers used multiple linear regression by ordinary least-squares, but little consistency existed in variables lists used to explain educational expenditures. The wide range of explanatory variables used to explain state or local spending for education contributed negatively to consistency of results.

Some gaps still remain for further work on the impact of intergovernmental grants. More needs to be done in measuring impacts of particular components of state and federal aid to school districts. Little work has been done with the Oklahoma system of financing local education and the impact of intergovernmental grants, and more is called for. The Holland work was the only citation of meaningful economic analysis with the system of educational funding in Oklahoma.[29]

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[29]Holland, pp. 1-142.

CHAPTER III

INSTITUTIONAL DESCRIPTION OF OKLAHOMA'S COLLECTION AND EXPENDITURE PROCESS FOR EDUCATIONAL AID

State aid to education in Oklahoma is apportioned by the Senate from dollars collected in the general fund. For the fiscal year of 1976 general fund collections amounted to $412,038,327.60, of which $224,748,186.00 was returned to school districts in the form of state educational aid. Thus, about 54.5% of general fund money went to educational aid in fiscal 1976. The purposes of this chapter are to, first, explain the collection of general fund money and, second, to engage a discussion of the state aid formula with a numerical example. A better understanding of the Oklahoma system of funding education is useful in formulating the model applied to the analysis of that system. General fund collections and state aid payments change in formulation and absolute dollar amounts from one year to the next. This discussion will center around the rules and appropriate numbers applying to the fiscal year of 1975-76. Fiscal 1976 is used in this illustration, for that is the year in which data were collected for the empirical work of Chapter V.

Sources of general fund revenues ranked in importance for fiscal 1976 appear in Table 1. Nearly half of the general fund revenues came from the income tax, almost a fourth from the gross production tax, and another fourth from vehicle excise, estate, beverage, alcoholic beverage, use, cigarette, and franchise taxes. Only two other classes of taxes yielded as much as a percent of general fund dollars: sales tax and drivers license revenue. Some eighteen remaining categories of revenues ranging from tobacco tax and license to rural electric coop tax and license contributed a mere 2.709% of monies to the general fund.

State aid to education for school districts in Oklahoma centers around a few basic items. Aid is highly dependent on average daily attendance (ADA), net assessed value, special programs, and local support level.

The Oklahoma Senate appropriates dollars to be used for aid to education. These dollars come from general revenue sources and are passed down to school districts in the form of foundation and incentive aid in the following manner.

A minimum program is based on the minimum dollars necessary to support a student in the public schools. It is reasoned that a secondary pupil is more costly to educate and, thus, the figure for elementary ADA is multiplied by a factor of 1.2 to get secondary ADA. For fiscal 1976 the minimum program amounts for elementary and secondary

TABLE 1

REVENUES COLLECTED FOR THE OKLAHOMA GENERAL FUND FOR THE FISCAL YEAR 1976

	Revenue Source	Amount Collected	Percentage of General Fund Collection
1.	Income Tax	$190,317,421.36	46.19
2.	Gross Production Tax	98,472,782.09	23.90
3.	Vehicle Excise Tax	24,953,082.68	6.06
4.	Estate Tax	20,575,963.16	5.00
5.	Beverage Tax and License	13,776,077.55	3.34
6.	Alcoholic Beverage Tax	12,262,538.26	2.98
7.	Use Tax	11,001,151.15	2.67
8.	Cigarette Tax and License	10,038,857.29	2.44
9.	Franchise Tax	9,463,597.26	2.30
10.	Sales Tax	5,400,000.00	1.31
11.	Drivers License	4,618,613.03	1.12
12.	Tobacco Tax and License	3,250,936.78	0.788
13.	Gift Tax	2,421,020.05	0.588
14.	Gasoline Excise Tax (8/100¢)	1,340,523.84	0.325
15.	Title Fees	977,279.75	0.237
16.	Auto and Farm Truck License	676,353.00	0.164
17.	Coin Device License	657,948.27	0.160
18.	Oversize Truck Permits	547,870.00	0.133
19.	Freight Car Tax	309,906.73	0.075
20.	Registered Agent Fees	296,655.00	0.072
21.	Commercial Vehicle License	279,303.00	0.068
22.	Unclaimed Property Fund	155,685.20	0.038
23.	Special Fuel Decal	73,212.00	0.018
24.	Personalized License Plates	68,147.90	0.017
25.	Boat and Motor License	52,190.08	0.013
26.	Miscellaneous Receipts	22,690.48	0.006
27.	House Trailer License	22,454.00	0.005
28.	Fireworks License	3,733.20	0.001
29.	Rural Electric Coop Tax and License	2,334.59	0.001
	TOTAL	$412,038,327.60	100.019

Source: These figures came from apportionment sheets furnished by the Oklahoma Tax Commission for the period of July 1, 1975 to June 30, 1976.

were $275 and $330 per ADA, respectively.

Minimum program is determined by multiplying elementary ADA and secondary ADA by appropriate factors. From the minimum is deducted chargeable income for the school district; this includes the following items:

1. Net assessed value of the school district during the next preceding year multiplied by fifteen mills,
2. Seventy-five percent of the amount received by the school district from the proceeds of the county four mill levy during the second preceding fiscal year,
3. Actual collections of the auto license and farm truck tax for the second preceding year computed on a per capita ADA basis,
4. School land earnings (state apportionment),
5. Gross production tax of the county, shared by school districts on an ADA basis,
6. Taxes collected from rural electric installations in the county and apportioned to the school districts on an ADA basis.

Thus, state foundation aid to education represents a minimum amount per student in average daily attendance, minus certain chargeable incomes of the school district, plus special programs money. Aid for special programs includes transportation, special education, and vocational programs. Each public school district in Oklahoma is awarded one-hundred percent of the average approved expenditure for pupil transport during the next preceding three years. Funds for special education are assigned by multiplying the number of programs per district by the appropriate factor for that year. The number of vocational

agriculture and other vocational programs are funded at a fixed level determined on a yearly basis, dependent on the level of legislative appropriations.

An example of how foundation aid was computed for Weatherford School District for fiscal year 1975-1976 appears in Table 2, at the end of this chapter.

In summary, foundation aid consists of minimum program monies, minus minimum program chargeable incomes, plus special areas monies. In general, state foundation educational aid will be larger, the more students there are in ADA, the lower the level of chargeable revenues, and the greater the number of special programs of the particular school district.

Incentive aid to education in Oklahoma is currently determined by an eight step formula. First, district valuation per ADA (students in average daily attendance) is determined by dividing net assessed value of real property, personal property, and value of public services (net assessed valuation) in the district by ADA. Second, the district wealth ratio is determined by dividing district valuation per ADA by the state average wealth per ADA (8,007 in fiscal year 1976). Next, the district wealth ratio is multiplied by the local support factor to determine the local support ratio. (The local support factor is determined by the legislature; this figure was 0.553 for fiscal year 1976.) The state support ratio is then determined by

deducting the local support factor from one-hundred percent or one. (The legislature determines the maximum and minimum levels for the state support ratio. For fiscal year 1976 this range was from 0.4150, minimum to 0.8350, maximum. If the state support ratio had been calculated for a district to be below 0.4150, then 0.4150 would have been used. Had the state support ratio been above 0.8350, then 0.8350 would have been employed.) A fifth step involves computing the state average support per mill. This is accomplished by dividing the state average wealth per ADA by the local support factor. (For fiscal year 1976 this looked as follows: 8.007 / 0.553 = 14.48 = state support level.) A sixth step requires that the state support level (determined in step five) be multiplied by the state support ratio (determined in step four) to yield state support per mill. The state support per mill is multiplied by mills levied above fifteen by the local district to produce the matching grant. An eighth and final step produces incentive aid by multiplying the matching grant times the ADA of the district.

In Table 2, which follows, computations for incentive aid for the Weatherford School District for fiscal year 1975-1976 are presented and added to foundation aid to derive total state aid.

In summary, there are three basics which control the size of the incentive aid to education passed from the

state to an individual school district. Aside from the factors determined by legislative edict, these three items are: net assessed valuation of the district, mills levied above fifteen, and ADA. Incentive aid will be greater, the smaller the net assessed valuation of the district, the more mills levied above fifteen, and the more students there are in average daily attendance. Total state aid to a school district in Oklahoma results from the addition of incentive aid and foundation aid.

Certain observations can be made. School districts are encouraged to assess property at low rates and tax at a thirty-five mill rate to compete for state dollars. The incentive for low assessments comes from both foundation and incentive aid formulas. Higher net assessed values result in larger totals for locally-raised revenues charged against foundation aid. (See line 4 of the foundation aid formula.) In computing a district's incentive aid, higher district wealth ratios (line 2) bring about higher local support ratios (line 3) and, thus, lower state support ratios (line 4). In other words, the more wealth the district shows in re net assessed value the less the state will grant in incentive aid. An examination of line 7 of the incentive aid formula indicates that a school district that votes over fifteen mills of property tax will receive incentive aid. School districts are encouraged by state aid formulas to adjust local property tax revenues collected

not by the mills levied, but by the assessment ratio for real property. For fiscal 1976 only eleven Oklahoma school districts out of 623 voted less than thirty-five mills on property.[1]

Distortions have been entered into the system as a result of this game which encourages school districts to compete against each other for state aid. These distortions will be dealt with later by testing a statistical model in an attempt to untangle the puzzle by addressing the issue of the true impact of state aid to education on local revenue raising. Does incentive aid produce encouragement for local districts to finance education, or does it produce negative stimulation?

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[1] 1975-76 Annual Report, Oklahoma State Department of Education by Leslie Fisher, State Superintendent of Public Instruction (Oklahoma City: Allied Printers and Publishers, Inc., 1976), pp. 34-187.

TABLE 2

WEATHERFORD PUBLIC SCHOOLS STATE AID CALCULATIONS
FOR SCHOOL YEAR 1975-1976 USING FORMULA

1.	Elementary ADA 644	x $275	=	$ 177,100.00
2.	Secondary ADA 564	x $330	=	$ 186,120.00
3.	Minimum Program	Total	=	$ 363,220.00
	Subtract Chargeable Income			
4.	1974-1975 Net Assessed Val. x 15 Mills $ 10,419,471.00 x 0.15		=	$ 156,292.07
5.	1973-1974 Collections of: 75% of County 4 Mill Levy		=	$ 32,440.50
6.	Auto License and Farm Truck Tax		=	$ 101,399.00
7.	School Land Earnings		=	$ 11,280.00
8.	Gross Production Tax		=	$ 6,093.00
9.	Rural Electric Coop. Tax		=	$ 2,083.00
10.	Minimum Program Chargeable Income Total		=	$ 309,587.57
11.	Line 11 (Line 3 total Minus Line 10) Total		=	$ 53,632.43
	Add the Following			
12.	Transportation: (Average Daily Haul x Per Capita) (409 x $77.00)		=	$ 31,493.00
13.	Special Education: 4.0 programs	x $5,000	=	$ 20,000.00
14.	Vocational Programs: 1.0 vo. ag.	x $3,980	=	$ 3,980.00

TABLE 2 (Cont'd.)

15. Line 15: Total Special Areas	=	$ 60,473.00
FOUNDATION AID (Line 11 plus Line 15)	=	$ 114,105.43

INCENTIVE AID

1. District Valuation divided by District ADA = District Val. per ADA		
($10,419,471 ÷ 1208	=	$ 8,625.39)
2. District Valuation per ADA divided by $8,007.00 = District Wealth Ratio		
($8,625.39 ÷ $8,007.00	=	1.0772)
3. District Wealth Ratio x 0.553 = Local Support Ratio		
(1.0772 x 0.553	=	0.5957)
4. 1.0000 - Local Support Ratio = State Support Ratio (Min. 0.4150; Max. 0.8350)		
(1.0000 - 0.5957	=	0.4043)
5. State Average Support per Mill ($8.007) divided by 0.553 = Support Level ($14.48)		
6. $14.48 x State Support Ratio = State Support per Mill		
($14.48 x 0.4150	=	$ 6.0092
7. State Support per Mill x Mills levied above 15 = Matching Grant		
($6.0092 x 20 Mills	=	$ 120.184)
8. Matching Grant x Dist. ADA = INCENTIVE AID		
($120.184 x 1208	=	$ 145,182.27)
(Foundation Aid plus Incentive Aid) TOTAL STATE AID	=	$ 259,287.70

Source: These figures came from tentative state allocations furnished by the Oklahoma State Department of Education for the period of July 1, 1975 to June 30, 1976.

CHAPTER IV

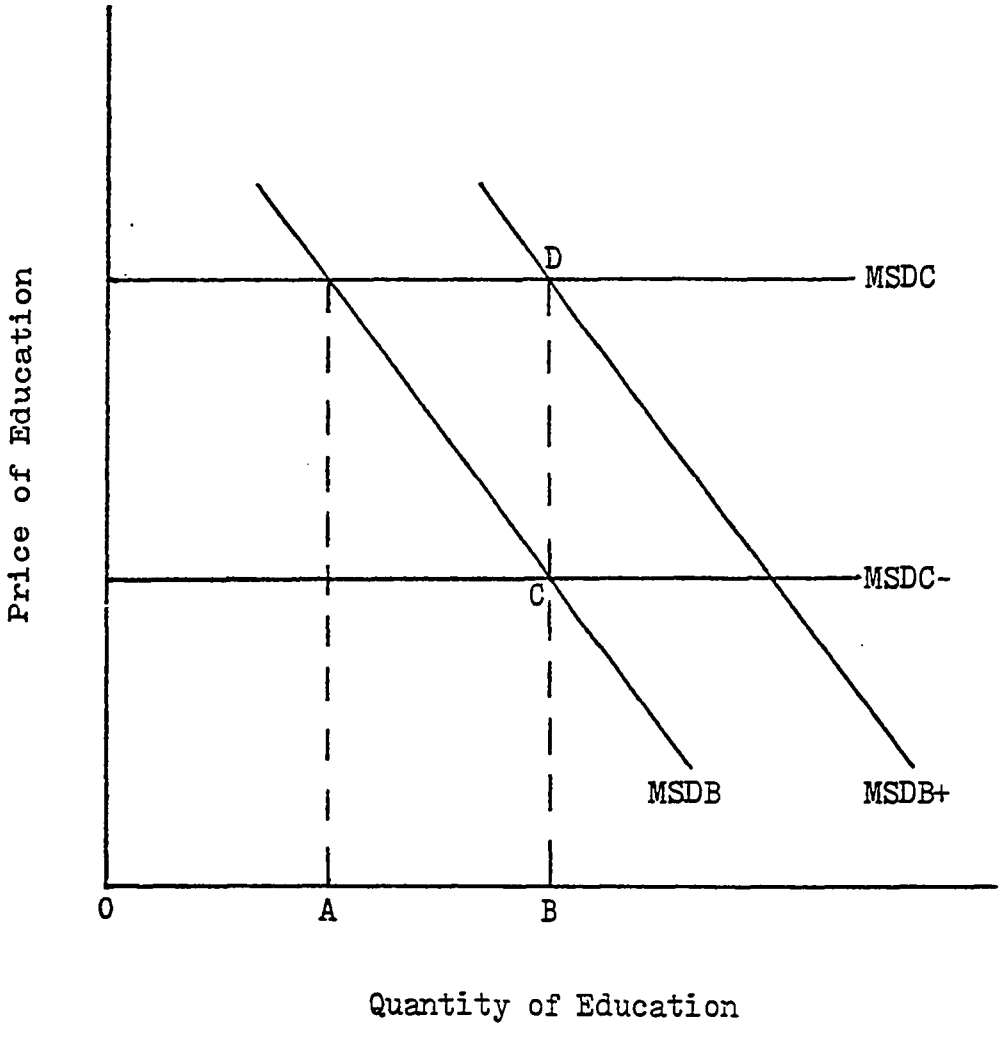
TESTING FOR THE INCENTIVE AND EQUALIZATION EFFECT OF STATE AID TO EDUCATION: HYPOTHESES AND MODELS

The impact of intergovernmental transfers has motivated a body of theoretical and empirical work. A primary question of much concern to many of these studies is the effect on the efficiency of resource allocation. Certain public goods generate benefits not limited to the jurisdiction in which they are purchased. In the case of education, benefits are not limited to the local school district, but spill over to the state and nation. These additional benefits will not be considered by a local school district, which will tend to spend too little on education. That this is so may be explained by reference to Figure 1.

When all the costs of education are borne by the local district, the amount purchased will be OA. Without state or federal aid, the local district will allocate funds so as to equate marginal school district cost (MSDC) and marginal school district benefits (MSDB). If the

FIGURE 1

AN EFFICIENT ALLOCATION
OF RESOURCES TO EDUCATION



Source: Wallace E. Oates, Fiscal Federalism (New York: Harcourt Brace Jovanovich, Inc., 1972), p. 67.

benefits of education that spill over the school district boundaries are considered, marginal benefits are represented by MSDB+. With MSDB+ and MSDC intersecting at D, the socially optimum quantity of education is OB because at that level total benefits equal total costs. This socially optimum amount of education will not be purchased by the school district on its own initiative. However, if a grant is awarded to the local district in the amount of CD, then it will purchase OB. Equivalently, the impact of a grant CD can be viewed as reducing marginal school district costs (MSDC) to the level of MSCD-. In this case the school district purchases education of OB, where MSDC- intersects MSDB.[1]

In this example it was assumed that the grant would represent a net addition to spending by the school district, but that may not be the case. The local unit may use it in lieu of some of its spending. If so, the amount of education purchased would be less than the social optimum. This type of unwanted impact may actually be the result of state aid rather than the desired result of stimulating total spending.

A body of theory exists relating state and federal government grants to spending at lower levels of government. For an example of the theory of intergovernmental transfers

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[1]Wallace E. Oates, Fiscal Federalism (New York: Harcourt Brace Jovanovich, Inc., 1972), pp. 66-71.

see a work by Wallace E. Oates, Fiscal Federalism.[2] Oates casts the intergovernmental transfers impacts in a model where state and local governments maximize utility subject to a budget constraint.

The following analysis assumes that school districts are indifferent between the combinations of quantities of education and quantitites of all other goods that would yield the same level of welfare to the school district. A budget constraint is placed on the school district, which limits its purchases of education and other goods. To maximize school district utility, education is purchased so that the school district reaches its highest indifference curve allowed by its budget constraint.

Government grants can be classified as block grants or matching grants. Block grants are awarded to the local jurisdiction without requiring reciprocal payments by that local district. In Oklahoma, foundation aid and state dedicated revenues are block grants. Matching grants are given on the basis of the recipient's willingness to match the transfers from the higher level government. Incentive aid in Oklahoma fits the requirements for a matching grant.

Block grants have the impact of moving the budget constraint a parallel amount to the right. Block grants do not affect the tax price of education, but they do make more available without increased local effort.

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[2]Ibid., pp. 71-78.

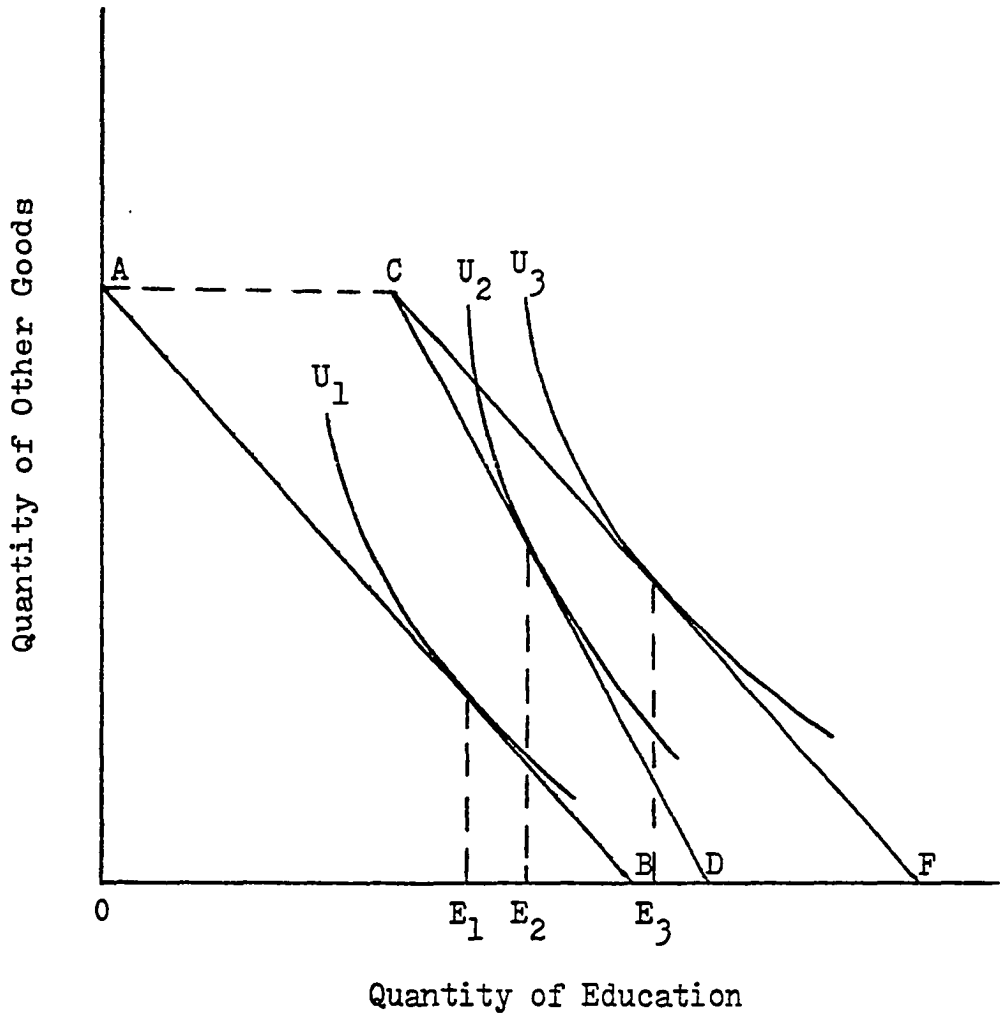
A matching grant changes the slope of the school district budget constraint. Matching grants with positive matching properties reduce the tax price, while those with reverse matching tendencies increase tax price.

By combining the effects of a block and matching grant, the net impact of state aid to education in Oklahoma on local spending for education can be analyzed. To illustrate this impact Figure 2 is used.

A careful examination of the educational aid system in Oklahoma led to the tentative hypothesis implicit in Figure 2. Without state educational revenues (state foundation aid, state incentive aid, and state dedicated revenue), the local district buys OE_1 quantity of education. The OE_1 equilibrium results where indifference curve U_1 is tangent to budget constraint AB. State grants move the budget constraint to CD, which is tangent to U_2. Budget line CD has greater slope than AB, for incentive aid has reverse matching tendencies. The new equilibrium brought about by the state grants puts the school district on a higher indifference curve and increases quantity of education purchased to OE_2. Thus, total state aid has caused purchases of education to increase by the amount E_1E_2. Budget line CF is added to allow the effects of the block and matching grants to be separated. A block grant of AC would have given the local district a budget constraint of CF. With CF and U_3 tangent, the district would have spent

FIGURE 2

SCHOOL DISTRICT EQUILIBRIUM
WITH BLOCK AND MATCHING GRANTS



Source: Wallace E. Oates, Fiscal Federalism (New York: Harcourt Brace Jovanovich, Inc., 1972), pp. 75-78.

OE_3 on education. Thus, the impact of the block grant alone would have been to increase local spending from OE_1 to OE_3 (a positive effect). The impact of the matching grant with reverse matching tendencies produced a negative effect on local spending measured by $(OE_2 - OE_3)$.

In conclusion, Figure 2 is an attempt at summarizing the anticipated effect of state aid on local spending for education in Oklahoma. The net effect on local spending for education was to increase it from OE_1 to OE_2. The matching grant, state incentive aid, had a negative effect on local purchases of education, i.e., a decrease from OE_3 to OE_2. The stimulation effect on local spending for education was produced by the block grants, state foundation aid and state dedicated revenues.

With the theory of intergovernmental grants reviewed and with applications to the Oklahoma system of aid to local districts completed, several empirical questions remain. The purpose of the analysis that follows is to measure the impact of state aid to public education on the financing of elementary and secondary education in Oklahoma. Four hypotheses will be tested. Hypothesis 1: State aid to education encourages local spending on education in Oklahoma. Hypothesis 2: Foundation aid encourages local spending for education; and incentive aid discourages local spending for education. Hypothesis 3: Fiscal neutrality does not exist in Oklahoma with regard to educational spending per child. Hypothesis 4: Equality of educational

spending is enhanced by state aid to education.

Tests of the hypotheses employed multiple linear regression analysis (by ordinary least-squares) for three models, applied to cross-sectional data on 623 public school districts in Oklahoma for the fiscal year of 1976. This study predominantly involved an analysis of county units, i.e., school districts aggregated into county units and analyzed on that basis. School district numbers were used when data were available.

The use of a linear demand equation and the use of cross-sectional data require justification. The literature reviewed in Chapter II showed that linear demand functions are often used unless evidence suggests their inappropriateness. This work followed the lead of others and employed a demand function for local educational spending which had first power variables that related in additive fashion. Also, an examination of the Oklahoma system of purchasing education did not suggest any relationships that would make a linear demand function inappropriate.

Two basic ways to structure economic data for a regression model are by means of time series and by cross-section. A cross-section regression is fit to observations on individual units at a point in time, while a time series study is fit to observations over time and usually involves an aggregation of economic units. Cross-section regression requires the assumption that the structure of the

relationship is constant across units; time series regression necessitates the assumption of constant structure across dates. The structure is the same for school districts for fiscal 1976 in terms of state aid formulas, property assessment ratios, general economic conditions, distribution of population, and number of school districts. Although these factors would be less stable over time, this study observes school districts and counties in Oklahoma in fiscal 1976 so that the assumption of constant structural relationships is appropriate. Thus, a cross-sectional regression is suggested.

As a rule, cross-section data offer a richer base for sampling than time series. For example, time series data drawn from yearly observations of total educational spending in Oklahoma would be more limited than samples drawn from the 623 school districts Oklahoma had in 1975-76.

Time series and cross-section regressions do not answer the same questions. Time series regression estimates the response of one unit or an aggregation of micro units to changes in independent variables. For example, time series studies might measure the impact on state spending for education over a period of time as certain independent variables change. Cross-section regressions relate the response of micro units within the aggregation to changes in the independent variables. For example, cross-section regressions show responses of school districts or county

units to changes in independent variables. The latter type of response fits the purpose of this study, therefore cross-section analysis is preferred.

In summary, there are three strong justifications for a cross-sectional study. First, structural relations affecting educational spending are more stable for fiscal 1976 than over several years. Second, a cross-sectional regression offers the rich data base of the 623 Oklahoma school districts. Third, the purpose of the current work calls for cross-section regression.[3]

The model used to test the hypotheses dealing with state aid encouraging or discouraging local spending for education is as discussed below.

$$Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_{10}X_{10} + u$$

where

b_0 = constant term

b_i = regression coefficient for X_i, i = 1, 2, ...,10

u = residual term

X_1 = Personal Income/Population

X_2 = Average Daily Attendance/Number of School Districts per County

X_3 = Average Daily Attendance/1,000 Population

$$X_4 = \frac{\text{(1975-76 Enrollment - 1970-71 Enrollment)}}{\text{1970-71 Enrollment}}$$

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[3]Edward M. Gramlich, "Effects of Federal Grants on State-Local Expenditures: A Review of the Econometric Literature," National Tax Association, Proceedings of the Sixty-second Annual Conference on Taxation, 1969, pp. 578-581.

X_5 = Federal Aid to Education/ADA

X_6 = State Foundation Aid/ADA

X_7 = State Incentive Aid/ADA

X_8 = State Dedicated Revenue/ADA

X_9 = Total State Aid to Education/ADA

X_{10} = Market Value of Property/Population

Y_1 = Local Educational Revenue/ADA

Y_1' = Local Assessment Ratio.

The above model was used in two basically different ways. By leaving out X_6, X_7, X_8 the model was fitted to test the hypothesis that state aid discourages local spending for education. By examining the coefficient for X_9 the question was dealt with as to whether or not state aid stimulates local spending. Alternatively, the model was used without X_9 to see where the encouragement of local spending originates in regard to aid from the state. An examination of the regression coefficients for X_6, X_7, X_8 allowed an explanation of what part of the state aid package stimulates local educational spending and which portion did not.

A significant amount of concern in testing this model was placed on the possibility of multicollinearity. In several of the articles examined, problems have been created due to one or more of the independent variables being correlated with each other. For an example of this problem in a model similar to the one stated here, see a

paper by Bahl and Saunders.[4] For this study multicollinearity was detected by the use of the Farrar-Glauber Test aided by factor analysis.[5]

Another problem of concern was heteroscedasticity. One of the negative features of cross-sectional data is that it often produced heteroscedastic error terms. When reasons existed to expect heteroscedasticity (failure of regression coefficients to be significant) square residuals were plotted against the suspect independent variable to test for heteroscedasticity.[6]

Some discussion needs to be given to the independent variables and their expected signs.

X_1: Personal Income/Population. The personal income per capita variable was intended as a measure of the capacity to support education and was expected to be positively correlated with local spending for education per capita. Thus, the expected sign of b_1 was positive, where $b_1 = \partial Y/\partial X_1$.

X_2: ADA/Number of School Districts per County. This variable represents the mean size school district for

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[4]Roy W. Bahl and Robert J. Saunders, "Factors Associated with Variations in State and Local Government Spending," Journal of Finance 21 (September 1966): 525-526.

[5]Donald E. Farrar and Robert R. Glauber, "Multicolinearity in Regression Analysis: The Problem Revisited," Review of Economics and Statistics 49 (February 1967): 102-105.

[6]Damodar Gujarati, Basic Econometrics (New York: McGraw-Hill Book Company, Inc., 1978), pp. 201-202.

each county in terms of students in average daily attendance (ADA). It was often used in the regression equation as one variable and, at times, as three with break-downs made in terms of three sizes of school districts. The Oklahoma data were such that the following designations were appropriate in terms of small, moderate, and large districts. Small districts included those from 0-600 ADA. Moderate spanned 601-1200 ADA. Large districts were declared when ADA was in excess of 1200 per district per county. By using a single variable in the regression equation for mean ADA per district per county (X_2) the impact on local spending could be determined. Where smaller school districts are present, more busing is required which requires more spending.[7] An examination of the sign of b_2 allowed a measure of this size effect. Negative values for b_2 suggest that larger districts collect less local revenue for education and positive values imply more collected by larger districts. By employing the mean ADA variable in three parts (X_{2A}, X_{2B}, X_{2C}) internal economies of scale could be examined. Negative regression coefficients for the school district size variables suggested internal economies of scale. That is, to be a larger school district was to collect less revenue for education locally (spend less). When regression coefficients for (X_{2A}, X_{2B}, X_{2C}) resulted in positive values,

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[7]Werner Z. Hirsch, "Determinants of Public Education Expenditures," National Tax Journal 13 (March 1960): 33.

disadvantages to size were suggested.

X_3: ADA/1,000 Population. This variable, relating public school enrollments to total population, was included because it was thought to help explain demand for education. The greater the number of public school students per 1,000 population the greater will be the desire to spend for education locally. Thus, b_3 should be positive.

X_4: Percentage Change in Enrollments. Percentage change in enrollments during the last five years is used to classify high growth areas versus low or average growth counties. If it is true that high growth areas spend more dollars per student than low growth areas, then the sign of b_4 will be positive.

X_5: Federal Aid to Education/ADA. Whether federal aid stimulates local spending for education or represents substitution for local spending depends on marginal propensity of the county to spend on the aided good, education. Matching aid is more apt to stimulate local effort than is non-matching aid.[8] The analysis is made more difficult by the fact that both matching and non-matching aid is involved and no attempt is made to separate their effects. In fiscal 1976, 4.7% of the federal funds which came to Oklahoma for education were matched, with 95.3% not matched. To the extent federal aid is substituted for local educational

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[8]James A. Wilde, "The Expenditure Effects of Grants-In-Aid Programs," National Tax Journal 21 (September 1968): 343.

spending the sign of b_5 will be negative. The stimulative effect of federal funds for local spending will be evidenced by a positive tendency for b_5. It is being argued that the substitution effects of federal aid to education will overweigh the stimulative effects in re local educational effort. Thus, the sign of b_5 was predicted to be negative.

X_6: State Foundation Aid/ADA. An examination of the foundation component of state aid suggests that it is largely paid to districts in an inverse fashion to their ability to pay. Districts are paid flat amounts per student in average daily attendance at the elementary and secondary level, twenty percent more per secondary student than per elementary one. Several designations of locally collected revenues are, next, deducted from the foundation grants. Then, flat grants for special programs, such as special education and vocational agriculture are accumulated to complete the foundation aid computation. These flat grants, such as the $6,000 one for each special education program per district, can be expected to stimulate local spending. This should be stimulative, for $6,000 would not even pay an average teacher salary;[9] thus, the existence of a special education program suggests additional revenues which will likely come from local sources. State foundation aid has

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[9] 1975-76 Annual Report, Oklahoma State Department of Education by Leslie Fisher, State Superintendent of Public Instruction (Oklahoma City: Allied Printers and Publishers, Inc., 1976), p. 28.

components which should both stimulate and be substituted for local spending. The sign of b_6 depends on which of the two forces of stimulation or substitution is greater.

The causation, instead of being straightforward between foundation aid and local spending may be of the third factor type. Low levels of local wealth may contribute to both low local spending on education and a high level of foundation aid. This third factor effect has prompted the inclusion of X_{10}, market value of property per capita.

X_7: State Incentive Aid/ADA. State incentive aid depends on two main variables: local ability to pay, measured by the net assessed value of property and the willingness to support education locally, as mirrored by the property tax millage voted over fifteen. Districts are penalized in incentive aid receipts who have high property valuations per student. Thus, there is a disincentive to assess property at relatively high rates of value. However, districts are encouraged to vote high rates of property tax on themselves. In fact, if the school district does not vote millage in excess of fifteen no incentive aid will be forthcoming. Since both an incentive to local spending as well as disincentive exist, an a priori projection as to the sign of b_7 was complicated. A careful examination of Oklahoma's incentive aid formulation for fiscal 1976 reveals what might be called reverse matching tendencies, i.e., more

state aid was the reward for less local effort. Thus, the sign of b_7 was likely to be negative, indicating disincentive to local spending for education.

X_8: State Dedicated Revenue/ADA. State dedicated revenue is collected by the state, but given back to the districts in which it was collected, independent of the state incentive and foundation formulas. These dedicated revenues depend directly on the wealth of the district. Since districts may view these revenues similarly to local spending for education, it was expected that these would not stimulate local spending but be a substitute for it; thus, a negative sign for b_8.

X_9: Total State Aid/ADA. This variable for total state aid includes foundation, incentive, and miscellaneous aid. While foundation and incentive aids are inclusive of the majority of state aid to education, other categories include the following: recent teacher salary increases, spending for special education, elementary counseling, and support personnel. An examination of b_9 allowed an answer to the question of whether or not state aid stimulates local spending for education. Since there are forces of encouragement and discouragement to local spending inherent in the aid formulations, the expected sign of b_9 was not presupposed. If the sign associated with the b_9 coefficient was positive, then state aid was to be viewed as an encouraging factor for local effort. If the sign of b_9 was negative, then local spending was reduced as a result of state aid.

X_{10}: Market Value of Property/Population. Property value is a measure of ability to finance education as is income per capita. Demand relationships commonly involve wealth as an independent variable.[10] If wealth is defined to include all items of realizable market value, then the forms it can take on are many and varied. Items included in wealth range from durable personal possessions, such as clothing, house, and automobile to intangible items, such as equities in life insurance, annuities or retirement funds.[11] Having more or less of these items should influence one's desire to purchase education. Due to the difficulty associated with measuring wealth, real property will serve as its proxy. It was expected that wealth, for which real property is being used as a proxy, should be positively related to local spending for education. Thus the sign of b_{10} should have been positive, suggesting that a higher value of wealth would imply a larger expenditure for education and vice versa. In order to separate the effects of personal and real versus public service property wealth the X_{10} variable was split-up. An X_{10A} variable designated market value of real and personal property, while X_{10B} measured market value of public service property. If taxpayers

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[10]James E. Hibdon, Price and Welfare Theory (New York: McGraw-Hill Book Company, Inc., 1969), p. 14.

[11]Daphne Greenwood, "An Estimation of the Distribution of Wealth in the U.S., 1972." (Ph.D. disseration (proposed), University of Oklahoma, 1978), p. 6.

were more intent on high assessment ratios and local revenue raised when more of the tax would not be paid directly by them, then the coefficients of X_{10A} and X_{10B} should have reflected this.

Y_1: Local Educational Revenue/ADA. This dependent variable measures the revenue which is locally raised per student in average daily attendance. Typically, demand functions measure changes in quantity purchased in response to changes in certain relevant variables.[12] Education presents a tough problem in defining quantity. Common to the literature of demand for public education is the use of spending or revenue as a measure of quantity purchased.[13] This study employed revenue raised as a proxy for quantity of education. It is the local revenue variable that is of concern in measuring the impact of state aid to education. However, the local district (county) has little control over the amount of revenue collected except via the assessment ratio. Thus, a second dependent variable was used in the model as an alternative to Y_1.

Y_1': Local Assessment Ratio. This variable indicates the percentage of market value at which the county assesses its property. A 10% assessment ratio suggests that property is assessed at 10% of its fair market value. Higher assessment ratios per county would indicate greater

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[12] Hibdon, pp. 14-16.

[13] Hirsch, p. 33.

local effort and vice versa. Through election of the county assessor, persons living in the county have some control over rates at which property will be valued in terms of its market value.

The model for testing for fiscal neutrality is discussed below. The Serrano v. Priest case established a mandate that educational spending was not to be tied to the wealth of the district. Educational revenues per student was used as a proxy for quality of education. Fair market value of property was used for district wealth per student. Thus, fiscal neutrality makes it unlawful to make the quality of education of a child dependent on their place of residence within a given state.[14]

Define the following variables:

Y_2 = Total Educational Revenue/ADA

X'_{10} = Market Value of Property/ADA

Model:

$$Y_2 = b'_0 + b_{10}X'_{10} + u'$$

Hypothesis Test:

H_o: $b_{10} = 0$

H_A: $b_{10} \neq 0$

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[14]Serrano v. Priest, 5 Cal. 3d 584, 487 P. 2d 1241, 96 Cal. Rptr. 601 (1971), cited by Martin S. Feldstein, "Wealth Neutrality and Local Choice in Public Education," American Economic Review 65 (March 1975): 77.

If the data indicate that the null hypothesis must be rejected, then it could be concluded that fiscal neutrality does not exist in Oklahoma.

A model for testing the impact of state aid on the equalization of educational spending, the fourth hypothesis, was supplied as follows:

$$Y_3 = b_0'' + b_{11}X'_{10} + u''$$

where

$Y_3 = X_9$ = Total State Aid to Education/ADA

X'_{10} = Market Value of Property/ADA.

Hypothesis Test:

$$H_0: \ b_{11} \geq 0$$

$$H_A: \ b_{11} < 0$$

Since $\partial Y_3/\partial X'_{10} = b_{11}$, b_{11} can be examined in terms of sign to accept or reject the hypothesis that equality of educational spending is reduced by state aid to education. If the null hypothesis is rejected it can be concluded that equality of educational spending is not reduced as a result of state aid to education.

CHAPTER V

TESTING FOR THE INCENTIVE AND EQUALIZATION EFFECT OF STATE AID TO EDUCATION: EMPIRICAL RESULTS

The purpose of this chapter is to present the results of empirical testing of the models outlined in the preceding chapter.

Test of Hypothesis One

The first hypothesis is: state aid to education encourages local spending for education. The complete model used to test this first hypothesis is provided below.

$$(5\text{-}1) \quad Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_9X_9 + b_{10}X_{10} + u$$

where

b_0 = constant term

b_i = regression coefficient for X_i, i = 1, 2, ...,10

u = residual term

X_1 = Personal Income/Population

X_2 = Average Daily Attendance/Number of School Districts per County

X_3 = Average Daily Attendance/1,000 Population

$X_4 = \frac{\text{(1975-76 Enrollment - 1970-71 Enrollment)}}{\text{1970-71 Enrollment}}$

X_5 = Federal Aid to Education/ADA

X_9 = Total State Aid to Education/ADA

X_{10} = Market Value of Property/Population

Y_1 = Local Educational Revenue/ADA

Y_1' = Local Assessment Ratio.

The regression results of the above model are presented below.[1]

$$(5\text{-}2) \quad Y_1 = -113.356 + \underset{(3.43)}{0.057}\, X_1 + \underset{(0.49)}{0.007}\, X_2 - \underset{(-2.41)}{1.273}\, X_3 - \underset{(-2.21)}{4.056}\, X_4 - \underset{(-2.64)}{0.757}\, X_5 + \underset{(2.83)}{0.543}\, X_9 + \underset{(7.63)}{0.013}\, X_{10}$$

$$R^2 = 0.92005$$

The t-scores are in parentheses, and to be significant their absolute values must be greater than or equal to

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[1]The income and population figures came from preliminary data for the Statistical Abstract of Oklahoma 1978 by Neil J. Dikeman, Jr., and Marjorie E. Earley (Norman: University of Oklahoma, 1978), pp. 15, 16, 277, 278. The local assessment ratios were supplied in a telephone interview with J. L. Merrill, Oklahoma Tax Commission, Oklahoma City, Oklahoma 13 March 1978 and Oklahoma Tax Commission, Average Assessment Rates for Locally Assessed Property, By County Based on Mean Assessment Rates Estimated by Professional Appraisers: Oklahoma 1976. All other data for this study came from 1971-72 Annual Report, Oklahoma State Department of Education by Leslie Fisher, State Superintendent of Public Instruction (Oklahoma City: Oklahoma State Board of Affairs' Print Shop, 1972), p. 17, and 1975-76 Annual Report, Oklahoma State Department of Education by Leslie Fisher, State Superintendent of Public Instruction (Oklahoma City: Allied Printers and Publishers, Inc., 1976), pp. 21-187.

1.97. The sample had seventy-seven observations and was tested at the 0.05 significance level. Notice that only the coefficient of the X_2 variable was not significant. Heteroscedasticity was questioned in equation (5-2), due to the insignificance of b_2. Cross-sectional data are often plagued with heteroscedasticity. A test for the detection of heteroscedasticity is suggested by Gujarati.[2] The test uses the residuals as proxies for the error terms. Squared residuals are graphed with corresponding values of the suspect independent variables (ones which produce insignificant regression coefficients). In equation (5-2), the X_2 variable was not significant and was tested for heteroscedasticity by the method discussed above. No pattern was present in the plotting of squared residuals versus the X_2 values. A density variable, similar to X_2, was not significant when used by Holland in a comparable model for education in Oklahoma. Transportation in Oklahoma is funded largely through the state, as part of foundation aid (special programs). This may keep the average school district size from being significant.[3]

Elasticities of local educational revenue per ADA

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[2]Damodar Gujarati, Basic Econometrics (New York: McGraw-Hill Book Company, Inc., 1978), pp. 201-202.

[3]David William Holland, "The Geographic and Income Class Distribution of the Benefits and Costs of Public Education--Implications for Common School Finance." (Ph.D. dissertation, Oklahoma State University, 1972), p. 63.

with respect to the significant independent variables are helpful in analyzing equation (5-2). The formula used to compute the income elasticity coefficient was: $(\partial Y/\partial X_1)(\bar{X}_1/\bar{Y})$, where $\bar{X}_1$ is mean income and $\bar{Y}$ is mean local educational revenue.[4] Elasticities for the other independent variables were computed in similar fashion. The following elasticities resulted for equation (5-2): income, 0.667; ADA/1,000 population, - 0.649; past five year enrollment growth, 0.0053; federal aid to education/ADA, - 0.190; total state educational revenue/ADA, 0.818; and wealth, 0.61. Notice that income elasticity is positive, thus education is a superior good in Oklahoma, i.e., as incomes rise the percentage change in educational revenues is greater than the percentage change in income. A similar statement to the one regarding income can be made for property wealth, for it also has positive elasticity. The elasticity coefficient for state educational revenue suggests that a one percent increase in state revenue results in a 0.8% increase in local educational revenue.

Some of the signs of the regression coefficients were as predicted and some were not. The sign for the per capita income variable (X_1) was positive as expected. The X_3 variable (ADA/1,000 Population) had a negative sign rather than the predicted positive.

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[4]Werner Z. Hirsch, "Determinants of Public Education Expenditures," National Tax Journal 13 (March 1960): 37.

The negative sign yielded by b_4 (the regression coefficient for the enrollment growth variable) suggests that time lag problems keep high growth areas behind on their spending and low growth areas ahead in terms of per capita spending. When enrollments in an area increase, it is reasonable for a time lag to exist between the increased spending needs and the revised spending. Thus, the new funds may be months or years in catching up with the new growth of increased enrollments. When enrollments are lost, a time period may separate the recognition of lessened need and decreased spending. Thus, time lags could explain the negative sign of b_4.

Federal aid to education/ADA (X_5) produced a negative regression coefficient as predicted. This result would support the argument that federal aid has more of a substitution effect on local spending than a stimulation. Increased federal aid corresponds to decreased levels of local educational revenue, thus federal funds substitute for local effort.

Per capita property wealth was represented by X_{10} (Market Value of Property/Population) which produced a positive coefficient of regression as projected. This result allows one to conclude that greater levels of real property wealth implies higher levels of local spending for education.

The total state aid variable (X_9) had a positive sign, allowing an acceptance of the first hypothesis: State

aid to education encourages local spending on education in Oklahoma. For the X_9 variable, data for allocated state monies were used alternative to those actually paid, and produced virtually the same results. Signs and significance of all regression coefficients were the same; actual values of coefficients varied little. See equation (5-2') for the regression results produced by allocated state revenues (X_9').

$$(5\text{-}2') \quad Y_1 = -48.426 + \underset{(3.36)}{0.058}\, X_1 + \underset{(0.50)}{0.008}\, X_2 - \underset{(-2.46)}{1.323}\, X_3 - \underset{(-2.03)}{3.720}\, X_4 - \underset{(-2.68)}{0.777}\, X_5 + \underset{(2.51)}{0.550}\, X_9' + \underset{(7.85)}{0.013}\, X_{10}$$

$$R^2 = 0.91815,$$

where X_9' = Total State Aid to Education/ADA (Allocated).

Also, the model was run with the local assessment ratio (Y_1') used as the dependent variable. The results are shown in the equation below.

$$(5\text{-}3) \quad Y_1' = 1.158 + \underset{(4.98)}{0.001}\, X_1 + \underset{(4.92)}{0.001}\, X_2 + \underset{(0.34)}{0.003}\, X_3 - \underset{(-1.56)}{0.043}\, X_4 - \underset{(-1.47)}{0.006}\, X_5 + \underset{(1.40)}{0.004}\, X_9 - \underset{(-4.28)}{0.0001}\, X_{10}$$

$$R^2 = 0.81338$$

Variables having significant regression coefficients for equation (5-3) are three: per capita income (X_1), average size of school district per county (X_2), and per capita property value (X_{10}). The state aid variable was not helpful

in explaining the local assessment ratio.

The model was, also, fit with the X_2 (ADA/Number of School Districts per County) variable separated into three components, X_{2A}, X_{2B}, X_{2C}. Data used for these were the mean ADA per school district per county. If this mean was above 1,200 it was used in the X_{2A} variable, with zeroes in the X_{2B} and X_{2C} variables. If the mean ADA per school district per county was between 601 and 1,200, it was used in the X_{2B} variable with zeroes in X_{2A} and X_{2C}. When the mean ADA was below 601, it was used in the X_{2C} variable with zeroes in the X_{2A} and X_{2B} variables. Essentially, what was done here was to use a weighted dummy variable for average school district size per county.

As regressed with the mean ADA broken down as discussed above the following results were produced.

$$(5\text{-}4)\quad Y_1 = -127.76 + \underset{(3.34)}{0.057}\, X_1 + \underset{(0.56)}{0.010}\, X_{2A} + \underset{(0.30)}{0.021}\, X_{2B} + \underset{(0.21)}{0.025}\, X_{2C} - \underset{(-2.36)}{1.279}\, X_3 - \underset{(-2.05)}{4.067}\, X_4 - \underset{(-2.5)}{0.745}\, X_5 + \underset{(2.78)}{0.551}\, X_9 + \underset{(7.19)}{0.0128}\, X_{10}$$

$$R^2 = 0.92019$$

These results were similar to the prior results achieved when X_2 (ADA/Number of School Districts per County) was run as one variable. None of the coefficients for the separated X_2 variable was significant at the 0.05 level; thus, no explanatory value was added to the model as a result of dividing the X_2 variable into three components.

Regressing the above model with local assessment ratio as the dependent variable produced diverse results.

$$(5\text{-}5)\quad Y_1' = 2.667 + \underset{(5.09)}{0.001}\, X_1 + \underset{(3.98)}{0.001}\, X_{2A} + \underset{(1.06)}{0.001}\, X_{2B} + \underset{(0.32)}{0.001}\, X_{2C} - \underset{(-1.06)}{0.001}\, X_3 - \underset{(-1.77)}{0.052}\, X_4 - \underset{(-1.41)}{0.006}\, X_5 + \underset{(1.92)}{0.006}\, X_9 - \underset{(-4.33)}{0.0002}\, X_{10}$$

$$R^2 = 0.82014$$

Few variables were significant in this case. Significant were X_1, X_{2A}, and X_{10}, i.e., income, large school districts, and wealth. More income and larger school districts resulted in higher assessment ratios, i.e., greater effort in financing education. Greater amounts of property tax wealth resulted in less desire to tax property at high rates and thus to fund education locally.

When the model was fit with the market value of property variable (X_{10}) broken down into X_{10A} (Market Value of Personal and Real Property/Population) and X_{10B} (Market Value of Public Service Property/Population), the results were as follows.

$$(5\text{-}6)\quad Y_1 = 226.72 + \underset{(6.18)}{0.056}\, X_1 + \underset{(1.38)}{0.011}\, X_2 - \underset{(-6.62)}{1.924}\, X_3 + \underset{(0.12)}{0.126}\, X_4 + \underset{(0.53)}{0.089}\, X_5 + \underset{(0.15)}{0.017}\, X_9 + \underset{(8.51)}{0.008}\, X_{10A} + \underset{(15.82)}{0.06}\, X_{10B}$$

$$R^2 = 0.97745$$

In this configuration the model only yielded three significant coefficients: per capita income (X_1), ADA/ 1,000 population (X_3), and per capita wealth (X_{10A} and X_{10B}). The conclusion here is that the most important determinants of what a school district spends for education are its per capita income and wealth. State aid as well as the items other than ADA per 1,000 population were not helpful in explaining local spending for education. The signs of both the wealth variables were positive indicating that more wealth means more dollars for education locally raised, regardless of the origin of the wealth, i.e., personal or public service.

When the prior model was fit using the county average assessment ratio as the dependent variable results were as listed. Note that X_{10A} represents personal and real property value per capita and X_{10B} represents public service property value per capita. Both are in market value terms.

$$(5\text{-}7) \quad Y_1' = 4.015 + \underset{(5.55)}{0.001}\, X_1 + \underset{(5.69)}{0.001}\, X_2 - \underset{(-0.38)}{0.003}\, X_3 - \underset{(-0.31)}{0.008}\, X_4 + \underset{(0.18)}{0.001}\, X_5 - \underset{(-0.13)}{0.0004}\, X_9 - \underset{(6.07)}{0.0001}\, X_{10A} + \underset{(3.14)}{0.0003}\, X_{10B}$$

$$R^2 = 0.85807$$

A regression of the local assessment ratio on the same variables as above produced similar results. Significant variables in explaining local assessment rates were per capita income, per capita wealth, and mean school

district size per county. The sign of b_1 (the regression coefficient for the per capita income variable) was expected to be positive, and was. Greater levels of per capita income meant higher assessment ratios. The division of the wealth variable made a contribution; the sign of X_{10A} (Market Value of Personal and Real Property/Population) was negative, while the sign of X_{10B} (Market Value of Public Service Property/Population) was positive. An interpretation can be made that personal property wealth and assessment ratios were negatively related, while public service property wealth and assessment ratios were positively related. Thus, local districts were more interested in funding education out of public service wealth than out of personal wealth.

When the model was regressed breaking down the variables X_2 (ADA/Number of School Districts per County) and the X_{10} (Market Value of Property/Population), few regression coefficients were significant, whether using Y_1 (Local Educational Revenue/ADA) or Y_1' (Local Assessment Ratio) as the dependent variable. Those results are presented in the two following equations.

$$(5\text{-}8) \quad Y_1 = 209.875 + \underset{(6.12)}{0.057}\, X_1 + \underset{(1.50)}{0.015}\, X_{2A} + \underset{(0.72)}{0.028}\, X_{2B} + \underset{(0.89)}{0.060}\, X_{2C} - \underset{(-6.59)}{1.959}\, X_3 + \underset{(0.32)}{0.357}\, X_4 + \underset{(0.58)}{0.101}\, X_5 + \underset{(0.13)}{0.015}\, X_9 + \underset{(8.09)}{0.008}\, X_{10A} + \underset{(15.66)}{0.061}\, X_{10B}$$

$$R^2 = 0.97766$$

$$(5\text{-}9)\quad Y_1' = \underset{}{4.001} + \underset{(5.28)}{0.001}\,X_1 + \underset{(4.63)}{0.001}\,X_{2A} + \underset{(1.20)}{0.001}\,X_{2B}$$

$$+ \underset{(0.46)}{0.001}\,X_{2C} - \underset{(-0.31)}{0.002}\,X_3 - \underset{(-0.43)}{0.012}\,X_4 + \underset{(0.19)}{0.0001}\,X_5$$

$$- \underset{(-0.07)}{0.0002}\,X_9 - \underset{(-5.65)}{0.0001}\,X_{10A} + \underset{(3.08)}{0.0003}\,X_{10B}$$

$$R^2 = 0.85850$$

In both instances of the above two models per capita income (X_1) and wealth (X_{10A} and X_{10B}) variables were significant. When Y_1 (Local Educational Revenue /ADA) was used, both the X_{10A} and X_{10B} variables were positively related to Y_1. When Y_1' (Local Assessment Ratio) was involved, X_{10A} had negative impact and X_{10B} had positive impact. One additional variable was significant in each case. With Y_1 (local revenue per ADA), the X_3 (ADA per 1,000 population) variable was significant. In explaining Y_1' (local assessment ratio) the large school district variable (X_{2A}) was helpful. In neither case was the regression coefficient for state aid to education (b_9) significant.

Using the Farrar-Glauber test for severe multicollinearity, it was determined that per capita income (X_1) and wealth (X_{10}) were highly interrelated.[5] Thus, the model was fit using the income or wealth variable, but not both. See Appendix 2 for a reporting of the results of the Farrar-

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[5]Donald E. Farrar and Robert R. Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," Review of Economics and Statistics 49 (February 1967): 102-105.

Glauber test. The Farrar-Glauber test for multicollinearity was used rather than the Durbin-Watson test, due to the data. Farrar-Glauber is applicable to cross-section regressions, while Durbin-Watson statistics only apply to time series studies.[6] Also, a factor analysis was done to further substantiate the severe multicollinearity results; see Appendix 3. After regressing the model with per capita income or wealth deleted, the most promising result is reported below.

$$(5\text{-}10)\quad Y_1 = -465.81 + \underset{(7.46)}{0.141}\,X_1 - \underset{(-1.97)}{0.038}\,X_2 - \underset{(-2.15)}{1.581}\,X_3 - \underset{(-2.87)}{7.015}\,X_4 - \underset{(-2.86)}{1.119}\,X_5 + \underset{(5.38)}{1.403}\,X_9'$$

$$R^2 = 0.8383,$$

where X_9' = Total State Aid to Education/ADA (Allocated).

These results are similar to the model initially discussed with respect to the testing of the first hypothesis; see equation (5-2). All the regression coefficients were significant. The signs were the same as for equation (5-2), except X_2 (the mean school district size variable) had a negative sign and was significant in equation (5-10). Elasticity of local spending with respect for state educational aid was greater in this later case: 1.666 for equation (5-2) compared to 0.818 in equation (5-10).

The analysis with respect to the testing of the first hypothesis was lengthy enough to require a summary.

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[6] Ibid., p. 92.

The first hypothesis was accepted: State aid to education encourages local spending for education in Oklahoma. Per capita income showed a positive impact in terms of local spending for education. The mean school district size variable (X_2) was ambiguous and contributed little to the explanatory value of the model. The ADA/1,000 population variable, X_3, consistently showed a negative influence on local spending for education, which was in opposition to what was anticipated. The population growth over the last five years was dealt with in X_5; its influence on local spending was negative. Time lags best explain why this influence would be negative. For a time after enrollments go down spending per student remains high, and vice versa. Per capita wealth and local revenue for education were positively related; this was as expected. Localities are more interested in raising assessment ratios due to public service wealth increases than personal wealth increases. For justification of this last statement see equation (5-9).

Test of Hypothesis Two

Hypothesis two was divided into two parts. Foundation aid encourages local spending for education; and incentive aid discourages local spending for education.

The model used in testing this two-part hypothesis is specified as follows.

$$(5\text{-}11)\quad Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_{10}X_{10} + u$$

where

b_0 = constant term

b_i = regression coefficient for X_i, i = 1, 2, ..., 10

u = residual term

X_1 = Personal Income/Population

X_2 = Average Daily Attendance/Number of School Districts per County

X_3 = Average Daily Attendance/1,000 Population

$X_4 = \frac{\text{(1975-76 Enrollment - 1970-71 Enrollment)}}{\text{1970-71 Enrollment}}$

X_5 = Federal Aid to Education/ADA

X_6 = State Foundation Aid/ADA

X_7 = State Incentive Aid/ADA

X_8 = State Dedicated Revenue/ADA

X_{10} = Market Value of Property/Population

Y_1 = Local Educational Revenue/ADA

Y_1' = Local Assessment Ratio.

In estimating this model problems of severe multicollinearity were experienced which plagued the entire analysis of measuring the stimulative and substitutive influences of state aid. By employing the Farrar-Glauber test for severe multicollinearity the following results developed.[7] Variables causing problems in the analysis were X_1, X_6, X_7, X_8, and X_{10}. The per capita income and wealth variables (X_1 and X_{10}) were highly interrelated. Also, the X_6, X_7,

[7] Ibid., pp. 102-105.

and X_8 variables were severely multicollinear. (See Appendix 4).

As a further test of multicollinearity a factor analysis was performed. (See Appendix 3.) Conclusions derived from the factor analysis were that either X_6 (State Foundation Aid/ADA) or X_7 (State Incentive Aid/ADA) should be used, but not both. Also, X_8 (State Dedicated Revenue/ADA) or X_{10} (Market Value of Property/Population) or X_{10A} (Market Value of Real and Personal Property/Population) and X_{10B} (Market Value of Public Service Property/Population) should be used alternatively in equation (5-11). Representative results of the model fit with these prescribed deletions follow.

To test the part of the second hypothesis dealing with foundation aid, X_6 was used in the model without X_7; X_{10A} and X_{10B} were used instead of X_8 or X_{10}:

$$(5\text{-}12)\quad Y_1 = 460.60 + \underset{(2.55)}{0.023}\,X_2 - \underset{(-3.72)}{1.356}\,X_3 - \underset{(-0.69)}{0.784}\,X_4 + \underset{(0.01)}{0.002}\,X_5 - \underset{(-3.60)}{0.772}\,X_6 + \underset{(9.81)}{0.0098}\,X_{10A} + \underset{(15.20)}{0.060}\,X_{10B} \qquad R^2 = 0.96881$$

With assessment ratio as the dependent variable the results were similar.

$$(5\text{-}13)\quad Y_1' = 8.856 - \underset{(6.64)}{0.001}\,X_2 + \underset{(1.74)}{0.014}\,X_3 - \underset{(-0.89)}{0.023}\,X_4 + \underset{(0.34)}{0.002}\,X_5 - \underset{(-5.02)}{0.024}\,X_6 - \underset{(-5.42)}{0.00012}\,X_{10A} + \underset{(3.06)}{0.003}\,X_{10B} \qquad R^2 = 0.83906$$

A discussion of the results of equations (5-12) and (5-13) is needed. Neither of the equations produced significant coefficients for X_4 (Enrollment Growth over prior five years) and X_5 (Federal Aid to Education/ADA). In equation (5-13) the X_3 (ADA/1,000 Population) variable was not significant. The X_2 (ADA/Number of School Districts per County) variable produced significant and positive coefficients. Larger school districts spend more for education and have higher assessment ratios. The personal and public service property variables, X_{10A} and X_{10B}, respectively, were significant in both cases. Property wealth affects local educational revenues positively. High personal property values impact negatively on assessment ratios, but public service property values impact positively on assessment rates. Citizens are more interested in higher property assessment rates when the higher taxes are paid out of public service wealth.

The foundation aid variable, X_6, produced significant and negative coefficients in equations (5-12) and (5-13). Foundation aid acts as a substitute for local spending, i.e., discourages local spending for education.

Alternatively, the model was fit with X_7 (State Incentive Aid/ADA), X_{10A} (Market Value of Real and Personal Property/Population), and X_{10B} (Market Value of Public Service Property/Population) to test the hypothesis dealing with the impact on local spending for education by state

incentive aid. These results can be observed in equations (5-14) and (5-15).

$$(5\text{-}14)\quad Y_1 = 549.890 + \underset{(2.96)}{0.027}\,X_2 - \underset{(-3.02)}{1.244}\,X_3 - \underset{(-0.80)}{0.946}\,X_4 - \underset{(-0.55)}{0.111}\,X_5 - \underset{(-2.79)}{1.208}\,X_7 + \underset{(8.06)}{0.009}\,X_{10A} + \underset{(14.00)}{0.058}\,X_{10B} \qquad R^2 = 0.96667$$

$$(5\text{-}15)\quad Y_1' = 11.751 + \underset{(6.99)}{0.001}\,X_2 + \underset{(1.98)}{0.018}\,X_3 - \underset{(-0.99)}{0.027}\,X_4 - \underset{(-0.36)}{0.002}\,X_5 - \underset{(-3.98)}{0.039}\,X_7 - \underset{(-5.23)}{0.0001}\,X_{10A} + \underset{(+2.20)}{0.0002}\,X_{10B} \qquad R^2 = 0.81942$$

The similarity of results between equations (5-12), (5-13), (5-14), and (5-15) was to be expected, for the correlation coefficient between X_6 (State Foundation Aid/ADA) and X_7 (State Incentive Aid/ADA) is 0.91352. The foundation and incentive aid variables contain similar information, thus the regression results were similar with incentive and foundation aid used alternatively.

In equation (5-14) and (5-15) the sign of the regression coefficient for the incentive aid variable (X_7) was significant and negative. Incentive aid discourages local funding for education via the property tax. Lower assessments are encouraged by the incentive aid formula, which reduces local revenue raised for education. Again, the regression coefficient of the personal property variable

(X_{10A}) had a negative sign when the assessment ratio was regressed, while the coefficient of the public service property variable (X_{10B}) had a positive sign. Thus, taxpayers are more intent on raising assessment ratios when it is done to tax public service property and not personal property. The X_2 variable, relating mean ADA per school district per county, was significant and positive. Large school districts pay more locally for education and have higher assessment rates. Inconsistent results were yielded by the coefficient for the X_3 variable, which measured ADA per 1,000 population.

As a conclusion to the discussion of testing the second hypothesis the following findings can be summarized. Both foundation and incentive aid were found to have a negative impact on local funding of education. The first part of the second hypothesis is rejected: foundation aid does not encourage local spending for education. The second part of the hypothesis is accepted: incentive aid discourages local funding for education.

Recall that total state educational revenue was found to stimulate local spending for education. Both foundation and incentive aid were found to discourage local spending for education. Consistency with the above findings required the effect of state dedicated revenue on local funding of education to be positive. Estimates of the model which included X_8 (State Dedicated Revenue/ADA) produced

regression coefficients that were significant and between 1.46 and 1.78. (See Appendix 5 for these results.) Consistency was achieved regarding impact of state aid on local funding of education. Total state revenues per ADA stimulate local funding. The stimulative effect of state dedicated revenues is greater than the substitution effect of foundation and incentive aid. The net result is that total state revenues per ADA encourage local effort, thus improving resource allocation to education. Local school districts spend more for education with aid than without, and the external benefits of education are partially internalized. As suggested by the indifference curve analysis proposed earlier, state matching grants caused decreased local spending for education, while the block grants increased local effort.

Test of Hypothesis Three

The testing of the third and fourth hypotheses was more straightforward than that of the first and second. The third hypothesis is: fiscal neutrality does not exist in Oklahoma with regard to educational spending per child. Fiscal neutrality means that the wealth of the school district of residence and the educational spending per student are not related. The model for testing hypothesis three is as follows.

$$(5\text{-}16) \quad Y_2 = b'_0 + b'_{10}X'_{10} + u$$

where

b_0 = constant term

b'_{10} = regression coefficient of X'_{10}

X'_{10} = Market Value of Property/ADA

Y_2 = Total Educational Revenue/ADA

The hypothesis test was set up as follows.

H_0: $b'_{10} = 0$

H_A: $b'_{10} \neq 0$.

The above model was estimated with data for the 623 public school districts of Oklahoma in fiscal 1976. The results of the regression are shown in equation (5-17).

$$(5\text{-}17) \quad Y_2 = 821.649 + \underset{(36.79)}{0.0031}\ X'_{10} \qquad R^2 = 0.82792$$

The hypothesis test was done at the 0.05 significance level for the 623 observations. The significance of b'_{10} required a t score with absolute value greater than or equal to 1.96. The null hypothesis was refuted with the empirical evidence of equation (5-17). Fiscal neutrality does not exist in Oklahoma with regard to educational spending per child. There is a relationship, a positive one, between spending per student and the wealth of the district in which the student resides. Thus, the educational funding system in Oklahoma is suspect in regard to fiscal neutrality.

Test of Hypothesis Four

The fourth hypothesis dealt with the impact of state funding of education on the equality of education opportunity. Using total educational aid per ADA as the dependent variable and market value of property per ADA as the independent variable a test is available. If equality of educational funding per student is enhanced by state aid, then property value per ADA and total state revenue per ADA must be negatively related. The model used to test the fourth hypothesis was equation (5-18).

$$(5\text{-}18) \quad Y_3 = b_0'' + b_{10}''X_{10}' + u$$

where

b_0'' = constant term

b_{10}'' = regression coefficient for X_{10}'

X_{10}' = Market Value of Property/ADA

$Y_3 = X_9$ = Total State Aid to Education/ADA

The hypothesis test was as follows:

H_0: $b_{11} \geq 0$

H_A: $b_{11} < 0$.

Regression results of model (5-18) are summarized below.

$$(5\text{-}19) \quad Y_3 = 498.66 - \underset{(-4.87)}{0.0031}\, X_{10}'$$

$$R^2 = 0.31409$$

Hypothesis testing done for the 623 observations and a significance level of 0.05 required a t score $\geq \pm 1.96$ for significance. The regression coefficient for the X'_{10} variable was negative and significant. The null hypothesis was rejected: equality of education spending is enhanced by state aid to education.

Testing of hypotheses three and four produced the following results. Quality of education per student, defined as total revenue per student in ADA, is dependent on district wealth. However, state aid makes educational revenue per student more equal. There is a relationship between quality of education and district wealth, but state aid payments go more heavily in the direction of less wealthy areas of the state.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In recent years, there has been a growing concern for the funding of public education, especially the impact of intergovernmental transfers. This work focused on two important facets of intergovernmental grants. The first involved the impact of state aid on resource allocation to education. A second issue focused on equality of educational opportunity.

The initial thrust of this study centered on the notion that education is a good purchased at the school district level, but with benefits that spill over school district boundaries. Without internalization of these external benefits, resources get under-allocated to education. To remedy this malady, federal and state governments offer aid to local school districts. The purpose of this intergovernmental aid is to encourage local districts to increase purchases of education.

The efficient resource allocation to education question led to the testing of two hypotheses. First, state aid to education encourages local spending on education in

Oklahoma. The purpose of this hypothesis was to formalize an empirical test for the overall effect of state revenues on local funding. Had stimulation been the conclusion of hypothesis test one, then resource allocation to education was improved by state grants. A substitution conclusion for the test of hypothesis one was interpreted as unimproved allocation of resources to education resulting from state monies. A second, two-part, hypothesis was designed to determine the component(s) that produced the stimulation of or substitution for local effort. The first part of hypothesis two was: foundation aid encourages local spending for education. The final part of hypothesis two was: incentive aid discourages local spending for education. A test of the second hypothesis was to allow an evaluation of state educational funding on the basis of the resource allocation criterion. Stimulative characteristics got high marks for improved allocation. Substitution tendencies produced low marks for allocation improvement.

Statistical testing of the first and second hypotheses proceeded with multiple linear regression by ordinary least-squares. Multicollinearity was severe between some of the independent variables involved in testing the second hypothesis. Corrections for the multicollinearity were handled by estimating the model with a partial variables list. Regression results allowed an acceptance of hypothesis one: total state aid to education stimulates local funding

of education in Oklahoma. The first part of hypothesis two was rejected: foundation aid does not encourage local funding of education in Oklahoma. Part two of the second hypothesis was accepted: incentive aid discourages local funding of education in Oklahoma.

Total state educational revenues stimulate local funding for education. Thus, a more desirable allocation of resources to education is accomplished via state funding in Oklahoma. Goal number six of the Oklahoma School Code is met by local funding being encouraged by state revenues. Both foundation and incentive aid substitute for local spending, and thus discourage educational funding from local sources. The stimulation of local spending is done via state dedicated revenue.

Foundation aid was substituted for local spending for education. Foundation aid depends directly on ADA and indirectly on local ability to collect revenue, i.e., net assessed value of property. More foundation aid is awarded to a school district as a result of more students in ADA, ceteris paribus. As the ability to finance education locally increases, the dollars charged against a district's foundation aid increase, and the foundation grant is reduced. This close inverse relationship between a district's ability to collect local funds and its propensity to receive foundation aid encourages local districts to substitute state spending for local effort.

Incentive aid was substituted for local spending and, thus, discouraged local educational funding. Reverse matching tendencies were viewed for incentive aid, prior to statistical testing, i.e., districts received incentive aid penalties for high levels of net assessed property valuation. It was not surprising that incentive aid discouraged local effort. This tendency for incentive aid to discourage local funding of education in Oklahoma should force a re-examination of the incentive aid formula or a renaming. As now written, the incentive aid formula should be referred to as disincentive aid. The only incentive in fiscal 1976 was for school districts to vote over fifteen mills of property tax. No incentive aid is received, unless property tax millage is greater than fifteen. The greater the mills levied over fifteen, the more incentive aid is paid to the district. (See state aid formula in Appendix 6.) Virtually all school districts voted the maximum in fiscal 1976, thirty-five mills. The mechanism used to adjust local property tax effort was the assessment ratio. To get the most state aid from a given amount of local effort, the locality voted thirty-five mills of property tax, but kept its tax payments at the desired level by adjusting assessment ratios. Under the system prevailing in 1975-76, incentive aid did not reward local effort. All the incentive aid formula encouraged was a thirty-five mill tax levy and unequal assessment ratios. Property tax equalization has been, recently,

strengthened by the Oklahoma Supreme Court and could make the incentive aid formula work better. (See Appendix 7 for a brief explanation of this recent ruling involving equalized assessments.) With more equal assessment rates, an incentive to vote millage over fifteen would encourage larger local support of public education.

The second major issue addressed by this work was equalization of educational opportunity. Spending per child was employed to measure quality of education, thus bypassing the issue of what is being equalized. The conflict of the right of a United States citizen to equal educational opportunity centers on fiscal neutrality. The fiscal neutrality doctrine states that dollars spent on education per child should not be a function of the wealth of the district in which the child resides. Fiscal neutrality has been limited to state boundaries by the courts.

The equalization of educational opportunity controversy motivated the testing of a third and fourth hypothesis. The third hypothesis was: fiscal neutrality does not exist in Oklahoma with regard to educational spending per child. The purpose of this hypothesis was to determine whether or not educational funding in Oklahoma discriminates against students living in poorer districts. A regression of total education revenue per ADA on real value of property per ADA was performed. These results precipitated the conclusion that district wealth and spending per student were

positively related in Oklahoma. Thus, the third hypothesis was accepted. Fiscal neutrality does not exist in Oklahoma with regard to educational spending per child.

Even though revenue per student in ADA is positively related to property wealth, the question of the intergovernmental impact of state funds remained. To test impact of state funds on equality of revenue per student, a fourth hypothesis was employed: equality of educational spending is enhanced by state aid in Oklahoma. Regressions of total state education revenue per ADA on real value of property per ADA were performed. State educational revenue per student was negatively related to wealth. Larger amounts of state revenues go to less wealthy districts, thus the fourth hypothesis was accepted. Equality of educational spending is enhanced by state aid in Oklahoma.

The last two hypotheses and their tests suggested recommendations for Oklahoma. Expenditures for education per student are positively related to district wealth. Discrimination exists in Oklahoma with regard to educational opportunity. Children living in less wealthy areas are penalized by receiving an inferior education. State aid does not lessen educational equality, but it does not entirely correct it. Concern has been shown in the last few years by the Oklahoma Legislature and the Governor in this regard. Attention has been focused on these problems through Serrano v. Priest-type litigation. To avoid problems in the future,

the Oklahoma system of funding education should be thoroughly reviewed. Specific recommendations should be made and implemented which would correct the discriminate funding of education in Oklahoma. In particular, state dedicated revenue could be dealt with differently. Currently, dedicated revenue is returned to the district in which it is collected, although not dollar for dollar. Since wealth and state dedicated revenue for a district are related positively, this component of state payments to local districts enforces the tying of expenditures per student to district wealth.

A straightforward solution to the discrimination problem may not lie in revising state dedicated revenue grants. State dedicated revenue was the only component of state educational funding that improved resource allocation to education. Reducing wealth discrimination in funding education via state dedicated revenues may adversely affect resource allocation.

Recommendations for future research in the area of the grants economy, especially in Oklahoma include the need for better school district data. The school district in Oklahoma is a political subdivision for which little relevant data are available, except for numbers used specifically by the Oklahoma State Department of Education. County data were used for lack of school district personal income and population numbers. To facilitate

empirical work on intergovernmental grants, Oklahoma needs more complete data for school districts.

This study attempted to discern internal economies and diseconomies of scale. This effort was not useful; the way economies were put into the regression model the coefficients of regression for relevant variables were not significant. Other studies are called for before anything definitive can be said about economies of scale in public education for Oklahoma.

Some attention was focused on the possible relationship between a mean school district size variable and foundation aid. The mean school district size per county variable was not significant in the model used to test the second hypothesis. Severe multicollinearity and heteroscadasticity were ruled out, but further investigation was suggested.

Fertile ground for further study lies in the impact of intergovernmental grants on non-aided public goods. This problem has not been addressed in Oklahoma, and few have attempted it with other systems.

A better understanding of the Oklahoma system of financing education could be aided by better data at the school district level. In terms of statutory objectives the current system of state aid is reasonably appropriate, but could be improved considerably. It was empirically shown that state revenues stimulate local spending for

education and help equalize expenditures per student. State dedicated revenues exacerbated the equalization objective and should be revised, unless this revision would adversely affect resource allocation to education. Incentive aid had a substitution effect on local spending for education, thus it should be renamed or its formula rewritten.

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Appendix 1

ENGROSSED HOUSE JOINT RESOLUTION NO. 1041

BY: POULOS, THOMPSON (Don), BENNETT, HOLT, McCALEB, DUKE, LANCASTER, DRAPER, CRAID and HOLADAY

A JOINT RESOLUTION DIRECTING THE SECRETARY OF STATE TO REFER TO THE PEOPLE FOR THEIR APPROVAL OR REJECTION A PROPOSED AMENDMENT TO SECTION 12a OF ARTICLE X OF THE OKLAHOMA CONSTITUTION MODIFYING MANNER OF DISTRIBUTION OF CERTAIN TAXES COLLECTED FOR THE MAINTENANCE OF THE COMMON SCHOOLS; CREATING THE STATE PUBLIC SCHOOL EQUALIZATION FUND; PROVIDING ADDITIONAL TAX SOURCES FOR THE PUBLIC SCHOOL EQUALIZATION FUND; PROVIDING A BALLOT TITLE; AND DIRECTING FILING.

BE IT RESOLVED BY THE HOUSE OF REPRESENTATIVE AND THE SENATE OF THE 2ND SESSION OF THE 36TH OKLAHOMA LEGISLATURE:

SECTION 1. The secretary of State shall refer to the people for their approval or rejection, as and in the manner provided by law, the following proposed amendment to Section 12a of Article X of the Constitution of the State of Oklahoma, to read as follows.

Section 12a. All taxes collected for the ~~maintenance~~ support of the common schools of this state, which shall not include sinking fund tax collections for debt issued pursuant to Article 10, Sections 9B and 26 of the Constitution of Oklahoma, and which are levied upon the property of any railroad company, ~~pipe-line~~ pipeline company,

telegraph company, or upon the property of any public service corporation or utility cooperative which operates in more than one county in this state, shall, after July 1, 1981, be paid into the ~~Common-School-Fund-and-distributed as-are-other-Common-School-Funds-of-this-state~~ State Public School Equalization Fund and shall be apportioned to school districts according to the average daily attendance of the students of the school district.

SECTION 2. The Ballot Title for the proposed Constitutional amendment as set forth in SECTION 1 of this Resolution shall be in the following form:

BALLOT TITLE

Legislative Referendum No. ____ State Question No. ____

THE GIST OF THE PROPOSITION IS AS FOLLOWS:

Shall a Constitutional amendment

amending Section 12a of Article X of the Oklahoma Constitution, which requires taxes collected for maintenance of common schools, which are assessed on the property of certain public service corporations or utility cooperatives operating in more than one county, and be paid into a Common School Fund and distributed as are other Common School Funds of this state, by abolishing the Common School Fund and creating the State Public School Equalization Fund and requiring that taxes which are collected for the support of common schools, excluding

sinking fund tax collections for debt issued pursuant to Article 10, Sections 9B and 26 of the Oklahoma Constitution, and assessed on such public service corporations be paid into a State Public School Equalization Fund and apportioned to school districts according to the average daily attendance of the students of such school districts

be approved by the People?

SHALL THE PROPOSED AMENDMENT BE APPROVED?

☐ YES, FOR THE AMENDMENT

☐ NO, AGAINST THE AMENDMENT

SECTION 3. The Speaker of the House of Representatives shall, immediately after the effect date of this Resolution, prepare and file one copy thereof, including the Ballot Title set forth in SECTION 2 hereof, with the Secretary of State and one copy with the Attorney General.

Passed the House of Representatives the 13th day of February, 1978.

_____

Speaker of the House of Representatives.

Passed the Senate the ____ day of _____, 1978.

_____

President of the Senate.

Appendix 2

The Farrar-Glauber test involves computing an F-statistic within the independent variables and evaluating the relative size of the F-statistic to judge severity of multicollinearity. The size of the F-statistic and severity of multicollinearity are positively related. The F-statistic within X (the independent variables) is computed by the following formula.

$$F_{X_i}\ (n-1,\ N-n) = (R^2_{x_i} / 1 - R^2_{x_i})\ (N-n/n-1)\ ,$$

where

$R^2_{x_i}$ = squared multiple correlation between X_i and the other members of X

N = sample size

n = number of independent variables.

A Farrar-Glauber test was done with the following model.

$$Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_9X_9 + b_{10}X_{10} + u$$

See equation (5-1), Chapter 5 for the designations of variables relevant above.

The resulting F values used to judge severity of multicollinearity for equation (5-1) appear below.

F_{X_i} (6,70) =	X_1 Income	X_2 Density	X_3 ADA/Pop.
	19.0	5.3	3.2

X_4 Enroll. Gr.	X_5 Federal Aid	X_9 State Rev.
6.7	6.2	8.9

X_{10} Property Value
17.6

Stable relationships were concluded for X_2, X_3, X_4, X_5, and X_9. Moderately severe multicollinearity was judged for X_1 and X_{10}.

Source: Donald E. Farrar and Robert R. Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," Review of Economics and Statistics 49 (February 1967): 102-105.

Appendix 3

A factor analysis was performed for seventy-seven cases (counties) for sixteen variables. The sixteen variables are those worked with throughout Chapter five:

X_1 = Personal Income/Population

X_2 = Average Daily Attendance/Number of School Districts per County

X_{2A} = Mean ADA/Number of School Districts per County, when above 1,200

X_{2B} = Mean ADA/Number of School Districts per County, when 601 to 1,200

X_{2C} = Mean ADA/Number of School Districts per County, when below 601

X_3 = Average Daily Attendance/1,000 Population

$$X_4 = \frac{\text{(1975-76 Enrollment - 1970-71 Enrollment)}}{\text{1970-71 Enrollment}}$$

X_5 = Federal Aid to Education/ADA

X_6 = State Foundation Aid/ADA

X_7 = State Incentive Aid/ADA

X_8 = State Dedicated Revenue/ADA

X_9 = Total State Aid to Education/ADA

X_9' = Total State Aid to Education/ADA (Allocated)

X_{10} = Market Value of Property/Population

X_{10A} = Market Value of Personal and Real Property/Pop.

X_{10B} = Market Value of Public Service Property/Pop.

Factor groupings were as follows with an interpretation of the factors.

Factor Interpretations

Factor 1: Ability to finance education locally. Positive were wealth, income, and dedicated revenue. Negative were federal aid, foundation aid, and incentive aid.

Factor 2: Student density.

Factor 3: State aid total.

Factor 4: ADA Growth (Moderate and Small ADA districts).

Factor 5: ADA/1,000 population (negative).

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
X_1				
	X_2			
	X_{2A}			
			X_{2B}	
			$-X_{2C}$	
				$-X_3$
			X_4	
$-X_5$				
$-X_6$				
$-X_7$				
X_8				
		X_9		
		X'_9		
X_{10}				
X_{10A}				
X_{10B}				

Notice that interrelationships were not great between variables except for those in factor one. Income, wealth, federal aid, and the individual components of state aid were highly multicollinear.

Appendix 4

A Farrar-Glauber test was done on the following model.

$$Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_{10}X_{10} + u$$

See Chapter 5, equation (5-11) for variable designations. See Appendix 2 for the relevant formula and its explanation.

The F-statistics within X (the independent variables) can be used to measure each explanatory variable's dependence on other members of the set. The resulting F values from which severity of multicollinearity was judged for equation (5-11) appear below. The higher value of the F-statistic the more severe the multicollinearity.

$F_{X_i}(8,68) =$	X_1 Income	X_2 Density	X_3 ADA/Pop.	X_4 Enroll. Gr.
	26.2	3.9	7.6	4.8

X_5 Fed. Aid	X_6 Found. Aid	X_7 Incentive Aid
6.3	106.2	105.1

X_8 Ded. Rev.	X_{10} Prop. Value
20.3	33.9

Relatively stable were variables X_2, X_3, X_4, X_5.

Moderately affected by multicollinearity were X_1, X_8, and X_{10}. Severely multicollinear were X_6 and X_7.

Appendix 5

Regression results which include the variable for state dedicated revenue are illustrated below.

$$Y_1 = -321.097 + \underset{(4.14)}{0.093}\, X_1 - \underset{(-1.05)}{0.018}\, X_2 - \underset{(-0.49)}{0.35}\, X_3 - \underset{(-2.79)}{5.92}\, X_4 - \underset{(-1.74)}{0.636}\, X_5 + \underset{(1.65)}{0.905}\, X_6 + \underset{(7.80)}{1.775}\, X_8$$

$$R^2 = 0.88231$$

where

X_1 = Personal Income/Population

X_2 = Average Daily Attendance/Number of School Districts per County

X_3 = Average Daily Attendance/1,000 Population

$X_4 = \dfrac{\text{(1975-76 Enrollment - 1970-71 Enrollment)}}{\text{1970-71 Enrollment}}$

X_5 = Federal Aid to Education/ADA

X_6 = State Foundation Aid/ADA

X_8 = State Dedicated Revenue/ADA

Y_1 = Local Educational Revenue/ADA.

$$Y_1' = 39.233 + \underset{(2.54)}{0.051}\, X_1 - \underset{(-1.11)}{0.019}\, X_2 + \underset{(1.13)}{0.821}\, X_3 - \underset{(-2.22)}{4.80}\, X_4 - \underset{(-0.85)}{0.306}\, X_5 - \underset{(-1.84)}{1.563}\, X_7 + \underset{(6.10)}{1.455}\, X_8$$

where Y_1' = Local Assessment Ratio, $R^2 = 0.88345$.

Appendix 6

STATE DEPARTMENT OF EDUCATION
FINANCE DIVISION
STATE AID
1975-1976
Murl Venard, Administrator

The following is the formula, as provided by law, used in the calculating of Foundation and Incentive Aid. It reflects the correct amounts and factors in use today. The two equalizing factors in the formula are:

(1) The chargeable income in the Foundation Aid section. This reflects the districts ability to support itself at home.

(2) The district wealth ratio in the Incentive Aid section. This reflects the school districts valuation per ADA in relation to the State valuation per ADA.

FORM FOR CALCULATING STATE AID
FOUNDATION AID

(1) Elem. ADA _____ X $275 = $ _____

(2) Sec. ADA _____ X $330 = $ _____

(3) Line 3 Total $ _____

SUBTRACT CHARGEABLE INCOME

(4) 1974 Net Assessed Val. X 15 Mills

(valuation) X .015 = $ _____

1973-1974 Collections of:

(5) 75% of County 4 mill $ _____

(6) Auto License $ _____

(7) School Land $ _____

(8) Gross Production $ _____

(9) Rural Electric Coop. Tax $ _____

(10) Line 10 Total $ _____

(11) Line 11 (Line 3 Total Minus Line 10) = $ _____

ADD THE FOLLOWING

(12) Transportation:
(Average Daily Haul X Per Capita)
_____ X _____ = $ _____

(13) Special Education:

_____ programs X $5000 = $ _____

(14) Vocational Programs

_____ Vo. Ag. X $3980 = $ _____

_____ Other X $2500 = $ _____

(15) TOTAL $ _____

Foundation Aid = Line 11 Plus Line 15 = $ _____

INCENTIVE AID

(1) District Valuation divided by District ADA = District Valuation per ADA.

(2) District Valuation per ADA divided by 8,007 = District Wealth Ratio.

(3) District Wealth Ratio X .553 = Local Support Ratio.

(4) 1.0000 - Local Support Ratio = State Support Ratio. (Min. .4150 Max. .8350)

(5) State Average Support per mill (8.007) divided by .553 = Support Level (14.48)

(6) 14.48 X State Ratio = State Support per mill.

(7) State Support per mill X mills levied above 15 = Matching Grant.

(8) Matching Grant X Dist. ADA = Incentive Aid $ _____

Total State Aid $ _____

Source: 1975-76 Annual Report, Oklahoma State Department of Education by Leslie Fisher, State Superintendent of Public Instruction (Oklahoma City: Allied Printers and Publishers, Inc., 1976), p. 4.

Appendix 7

1. Use 30% as an assessment rate for public service property in Oklahoma for fiscal 1976. (This assessing is done by the Oklahoma Tax Commission and is more consistently done than the locally assessed property.)

2. The Board of Equalization set 12% as an equalized assessment rate, and on March 30, 1976, the Oklahoma Supreme Court modified this 12% rate. (a) The Supreme Court allowed a variance of ± 3% from the 12%. (b) A three year period was given to get assessments set. (Copies of documents in this regard were mailed to the writer.)

3. The ratio study done by Professional Appraisal Company, 1975, was criticized by the Board of Equalization, due to the failure to employ use value in the study.

4. Mr. Merrill mailed a copy of the average assessment rates for Oklahoma counties, 1976. (See Appendix 8 for these figures.) (a) These averages were computed by Oklahoma Tax Commission staff, but based on the following: State of Oklahoma Ratio Study 1975, Oklahoma Tax Commission by Professional Appraisal Company (Valuation Consultants), November 5, 1975. (b) These figures were widely circulated at the State Capitol; the writer received a copy from Tom A. Campbell, Oklahoma State Department of Education, October 27, 1976.

Source: Interview with J. L. Merrill, Oklahoma Tax Commission, Oklahoma City, Oklahoma, 13 March 1978.

Appendix 8

AVERAGE ASSESSMENT RATES FOR LOCALLY ASSESSED PROPERTY, BY COUNTY BASED ON MEAN ASSESSMENT RATES ESTIMATED BY PROFESSIONAL APPRAISERS: OKLAHOMA, 1976

No.	County	Present Average Assessment Rate	No.	County	Present Average Assessment Rate
1.	Adair	4.48	21.	Delaware	6.23
2.	Alfalfa	8.42	22.	Dewey	4.86
3.	Atoka	3.91	23.	Ellis	10.37
4.	Beaver	11.08	24.	Garfield	10.79
5.	Beckham	8.72	25.	Garvin	7.46
6.	Blaine	7.22	26.	Grady	6.87
7.	Bryan	4.89	27.	Grant	7.17
8.	Caddo	8.00	28.	Greer	8.30
9.	Canadian	9.98	29.	Harmon	7.16
10.	Carter	10.29	30.	Harper	9.81
11.	Cherokee	5.30	31.	Haskell	7.07
12.	Choctaw	10.12	32.	Hughes	5.60
13.	Cimarron	9.15	33.	Jackson	9.19
14.	Cleveland	12.95	34.	Jefferson	6.71
15.	Coal	5.10	35.	Johnston	5.01
16.	Comanche	11.91	36.	Kay	9.66
17.	Cotton	8.16	37.	Kingfisher	8.96
18.	Craig	5.92	38.	Kiowa	7.49
19.	Creek	8.43	39.	Latimer	7.84
20.	Custer	8.71	40.	Leflore	9.45

AVERAGE ASSESSMENT RATES (Cont'd.)

No.	County	Present Average Assessment Rate	No.	County	Present Average Assessment Rate
41.	Lincoln	4.82	60.	Payne	9.39
42.	Logan	6.93	61.	Pittsburg	8.79
43.	Love	4.79	62.	Pontotoc	7.07
44.	McClain	6.24	63.	Pottawatomie	10.26
45.	McCurtain	8.02	64.	Pushmataha	8.55
46.	McIntosh	4.21	65.	Roger Mills	5.42
47.	Major	6.83	66.	Rogers	6.93
48.	Marshall	4.76	67.	Seminole	10.00
49.	Mayes	6.31	68.	Sequoyah	5.02
50.	Murray	6.64	69.	Stephens	8.64
51.	Muskogee	10.04	70.	Texas	10.36
52.	Noble	8.46	71.	Tillman	10.11
53.	Nowata	6.03	72.	Tulsa	17.91
54.	Okfuskee	5.36	73.	Wagoner	6.20
55.	Oklahoma	15.53	74.	Washington	11.37
56.	Okmulgee	9.10	75.	Washita	7.88
57.	Osage	8.14	76.	Woods	5.88
58.	Ottawa	10.49	77.	Woodward	12.74
59.	Pawnee	7.78			

Appendix 9

FEDERAL AID TO EDUCATION IN OKLAHOMA, 1975-76:
MATCHED v. NON MATCHED
(Rounded to Nearest $)

Federal Program of Educational Aid	Amount Of Funds Matched	Amount Of Funds Non Matched
Vocational Aid	$2,425,723	
Johnson O'Malley		$ 1,124,073
Maintenance & Operation		
PL 874, PL 815		13,437,993
School Lunch & Milk		24,204,975
Title I - ESEA		22,336,767
Title I - ESEA Migrant		872,577
Title II - ESEA		502,909
Title III - ESEA		
Guidance & Counseling		44,126
Title III - ESEA Innovation		1,076,280
Title IV - B - ESEA		622,031
Title VI - ESEA, B, C, & G		1,448,467
Title III - NDEA	166,722	
Title IV - IEA		3,809,108
Title VII - ESAA		1,845,125
Indochinese Refugee Assist.		
Act, LEA's		411,600
Indochinese Refugee Assist.		
Act, Adult Education		36,436
Adult Education	920,722	
TOTAL	$3,513,167	$71,772,467

Source: Interview with Charles W. Sandmann, Oklahoma State Department of Education, Oklahoma City, Oklahoma, 25 January 1978.