THE RESPONSE OF STATE AND LOCAL GOVERNMENTS TO FEDERAL GRANT-IN-AID PAYMENTS

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THE RESPONSE OF STATE AND LOCAL GOVERNMENTS TO FEDERAL GRANT-IN-AID PAYMENTS

by

David Lionel Smith

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I hereby recommend that this dissertation prepared under my direction by David Lionel Smith

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be accepted as fulfilling the dissertation requirement of the degree of Doctor of Philosophy

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ABSTRACT

The dissertation analyzes the response of state and local governments to federal grants via cross-section studies of 1960 and 1965, and a time-series study, 1957-1965. Of special interest is the empirical validity of the "distortion thesis," which holds that the matching requirements of the present conditional grants tend to induce the lower-level governments to redistribute their budgets, transferring funds from activities which receive no federal support to those which do.

The ultimate objective of the study is to attempt to explain the observed response to grants in terms of the demand for public goods by state and local governments. A theory of the demand for public goods is developed which emphasizes the political nature of the provision of public goods at the state and local level. The response to grants is then analyzed in terms of the elasticity of demand for these goods. A proxy measure of the income elasticity of demand for public goods is devised to provide a priori estimates of the response to grants.

In general, the proxy income elasticity measure was found to provide a fairly accurate indication of the response to grants in the cross-section analysis. With respect to the response to specific functional grants, per capita state and local expenditures from their own sources were found to be positively related to per capita grants for public welfare and highways. However, federal aid to education and health and hospitals was not associated with increased state and local expenditures for these functions.

Perhaps the most significant finding of the study was that state and local expenditures for the non-aided functions had a very significant positive relationship to federal grants in 1965. This finding indicates that the "distortion thesis" is invalid, as federal grants appear to produce a strong income effect which acts to release funds for expenditure on the non-aided functions, rather than drawing funds away from them. In short, this indicates that even though the grants are tightly conditioned, they tend to subsidize a wide range of state and local services.

In contrast to the finding of a significant positive relationship between federal grants and state and local expenditures from their own sources, there appears to be no association between federal aid and lower-level government fiscal effort. Quite significantly, the lack of association between grants and fiscal effort indicates that the expenditures "stimulated" by federal aid are not financed via increased fiscal effort. In other words, the allocation of a state's income between the public and private sectors is apparently not affected by federal aid considerations.

The conclusion, drawn from the cross-section analysis, that a major effect of federal grants has been the stimulation of expenditures on the non-aided functions, is also strongly supported when the responses of individual states are analyzed over time. Over the period 1957-1965, there was no evidence of any state "distorting" its budgets, that is, reducing expenditures on the non-aided functions. Furthermore, all but five states expressed a significant positive relationship between grants and non-aided expenditures.

Finally, a measure of the elasticity between expenditures and income, over time, was developed for the individual states to provide tentative estimates of what the response might be expected to be to a system of unconditional grants. It was concluded that the great majority of states could be expected to increase expenditures with the unconditional grants, rather than cut taxes and fiscal effort. Furthermore, the evidence suggests that a majority of the states would tend to allocate any unconditional grants to education.

CHAPTER I

INTRODUCTION: THE PROBLEM AND THE METHOD OF INVESTIGATION

The Problem

A fairly widespread concensus has been reached concerning the importance of federal aid as a factor accounting for some of the interstate variation in the per capita expenditure levels of state and local governments in the United States.[1] Although the estimates of the size of the impact of federal aid upon expenditure levels differ slightly, all agree that per capita federal grants exhibit a significant positive relationship with the level of total per capita state and local government expenditures. Federal aid has also been found to be an especially important factor in accounting for part of the interstate variations in per capita state and local expenditures for highways and public welfare.[2]

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1. Seymour Sacks and Robert Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Funds," National Tax Journal, Vol. XVII, No. 1, March 1964, pp. 75-85; Roy W. Bahl and Robert J. Saunders, "Determinants of Changes in State and Local Government Expenditures," National Tax Journal, Vol. XVIII, No. 1, March 1965, pp. 50-57; Roy W. Bahl and Robert J. Saunders, "Fabricant's Determination After Twenty Years: A Critical Reappraisal," The American Economist, Vol. X, No. 1, Spring 1966, pp. 27-44; Roy W. Bahl and Robert J. Saunders, "Factors Associated with Variations in State and Local Government Spending," Journal of Finance, Vol. XXI, No. 3, September 1966, pp. 523-534; and Jack W. Osman, "The Dual Impact of Federal Aid on State and Local Government Expenditures," National Tax Journal, Vol. XIX, No. 4, December 1966, pp. 362-372.

2. See below, Chapter IV.

The question of the effect of federal aid upon the budget structures of state and local governments, however, is somewhat more unsettled. The disagreement centers largely over whether or not federal aid induces the lower-level governments to neglect those activities which receive no federal funds in favor of those which are federally supported.[3]

Given the fact that a major concern of virtually all of the studies cited above was the determination of those factors which account for the interstate variations in the expenditure levels of state and local governments, federal aid was treated merely as another explanatory variable. Primarily because of this past emphasis on federal aid as an expenditure "determinant," very little has been done in way of attempting to explain how and why the lower-level governments respond to federal grants. While it is important to know the impact of federal aid on state and local spending, it is also important to try to understand why the observed effects occur and to determine the impact of federal grants on the budgets of the lower-level governments. The present study is directed toward filling this gap.

Purpose of the Study

Primary Objective

The primary objective of this study is to determine how the lower-level governments respond to federal grant-in-aid payments. More specifically, the objective is to determine the nature of the expenditure

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3. See below, Chapter II. The reduction in state-local expenditures on the non-aided functions in favor of increased expenditures on the aided functions is commonly referred to as "budget distortion."

response, if any, associated with federal aid for selected functional categories. Toward this end, answers to the following questions are sought: (1) To what extent, if any, does federal aid induce state and local governments to increase expenditures from their own sources on a function receiving federal support? (2) What is the effect of federal aid on those functions not directly aided? That is, do the lower-level governments tend to reduce expenditures from internal sources on the non-aided functions so that they might increase expenditures on the aided ones, thereby "distorting" their budgets, or does federal aid to specific functions tend to release funds for expenditures on the non-aided activities? (3) Are federal funds viewed as substitutes for state-local funds in some areas, so that federal aid is associated with a reduction in expenditures from state and local sources? Finally, (4) does federal aid tend to have any effect upon the fiscal effort exerted by lower-level governments? That is, do state and local governments tend to alter the proportion of their resources devoted to the public and private sectors of their economies as a consequence of federal aid?[4]

Empirical answers to the above questions will be sought in terms of the cross-section response as between states at a given point in time. In addition, the response of individual states to federal grants over time shall be analyzed. This represents a departure from all previous studies in the field, but it is necessary if the impact of federal aid on the lower-level governments is to be more fully understood.

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4. For the purpose of this study, a change in state-local fiscal effort associated with federal aid is referred to as the "fiscal response" to grants. A change in expenditures is referred to as the "expenditure response" to grants.

Ultimate Objective

The ultimate objective of this study is to consider the response of state and local governments to federal grants in light of their demand for public goods. The goal is to provide an understanding of why the observed expenditure and fiscal responses occur in terms of the demand for the particular function in question, and the demand for public goods in general.

A central feature of the analysis of the demand for public goods by the lower-level governments and their response to federal grants is the concept of the "elasticity of demand for public goods."[5] By considering the elasticity of demand for various public goods, it is hoped that a more complete understanding of the response to federal aid by state and local governments may be obtained.

The Basic Hypothesis

This study is based upon the hypothesis that the response of the lower-level governments to federal grants is a function of their demand for public goods. Therefore, it is hypothesized that the response to

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5. For the purposes of this study, the elasticity of demand for public goods is defined in terms of the percapita personal income of a state and the per capita expenditures of its governmental units. Therefore, if the per capita expenditures on public goods increases more than proportionately with increase in per capita income, as between states at a given point in time, the demand for public goods is said to be elastic. If per capita expenditures increase less than proportionately with increases in per capita income, the demand for public goods is said to be inelastic. If per capita expenditures increase in the same proportion as per capita income, the elasticity coefficient for public goods is unitary. The elasticity coefficients may also be used to demonstrate trends in intersectoral resource allocation by relating changes in per capita expenditures to changes in per capita income over time. See Bernard P. Herber, Modern Public Finance, Homewood, Illinois: Richard D. Irwin, Inc., 1967, pp. 9-10.

grants can be explained in terms of the "elasticity of demand for public goods." For example, federal aid to a function with an elastic demand should be associated with an increase in state-local expenditures from their own sources on the function. In contrast, aid to a function with an inelastic demand should be associated with a decline in state-local expenditures on the function from internal sources. Similarly, federal grants may tend to "distort" state and local government budgets because the elasticity of demand for the aided function is greater than that for the non-aided activities.[6]

The Method of Investigation

Regression Analysis

The empirical analysis of this study is based almost entirely upon regression analysis, both simple and multiple. The objective is to find the extent of association, if any, between federal aid and state and local government expenditures from their own sources for selected functional categories. However, it must be emphasized that one cannot infer a causal relationship from a regression analysis per se. In general, "A statistical determination of the nature of any relation, no matter how complicated the methods used, tells nothing of the reason for the relation observed."[7] For example, the finding of a positive

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6. As will be shown in Chapter III, the traditional definition of budget "distortion" implicitly assumes that the lower-level governments' elasticity of demand is greater than unity in the aided areas. However, should the demand for the aided function be inelastic, or less elastic than the non-aided activities, budget "distortion" would not be expected to occur.

7. Mordecai Ezekiel and Karl A. Fox, Methods of Correlation and Regression Analysis, third edition, New York: John Wiley and Sons, 1959, p. 475.

association between per capita federal aid and per capita state and local expenditures tells nothing whatever concerning the direction of causation between the two variables. "The analysis itself can never provide the interpretation of cause and effect. It can only establish the facts of the relation--for the meaning of those facts, the investigator must look elsewhere."[8] Therefore, the task of establishing a causal relationship between the variables rests primarily with the theoretical considerations regarding the demand for public goods by state and local governments.

By means of regression analysis, the line of best fit is obtained that relates the dependent variable (state and local government expenditures) to the independent variable(s). The criterion for the line of best fit is known as the method of least squares, which "demands that the line we fit to our data be such that the sum of the squares of the vertical deviations (distances) from the points to the line be a minimum."[9] The equation thus obtained is of the form:

$$Y = a + b_1X_1 + b_2X_2 + \ldots b_nX_n$$

where; Y = the dependent variable

$X_1 \ldots X_n$ = the independent variables

a = the constant term

$b_1 \ldots b_n$ = the regression coefficients

The regression coefficients measure the slope of the regression line, so that they are estimates of the average number of units increase or

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8. Ibid.

9. John E. Fruend and Frank J. Williams, Modern Business Statistics, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1958, p. 290.

decrease in the dependent variable associated with each increase of a specified unit in the independent variable(s).[10]

Definitions and Restrictions

Federal grants-in-aid are defined as payments made by the federal government to state and/or local governments for cooperative federal-state or federal-local programs administered at the state and/or local level, and for those programs in which the bulk of the funds are channeled through the agencies of state and local governments. Specifically excluded are: reimbursements to states and localities for expenditures incurred by them as agents of the federal government in administering programs primarily national in character; shared revenues; payments in lieu of taxes; loans to states; and federal aid granted directly to individuals and to public and private institutions.

Conditional grants-in-aid are defined as payments to the lower-level governments for use on specified programs or projects. The conditional grant may be a closed end--constant matching grant, where Congress specifies the maximum annual amount to be provided for each state and requires the recipient to match the federal funds at some pre-defined ratio. Another type is the open end--variable matching grant. Here, there is no limit to the maximum amount provided to each state, but the recipient is required to match the federal funds at varying ratios depending upon the recipient's level of expenditures for the function.

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10. For a more detailed discussion of the exact form and meaning of the regression models used in this study, see Chapter IV, pp. 106-109.

In a few cases, the conditional grant contains no matching requirements, specifying only the use of the funds.

Unconditional grants-in-aid are defined as block payments to the lower-level governments with no limitations as to their use.

State and local governments include all governmental units in the United States below the federal government. The fifty state governments and all of the political subdivisions within the states, counties, municipalities, school districts and all special districts are included.[11]

All expenditure variables used in this study are per capita direct general expenditures less federal aid. Direct general expenditures are defined as expenditures by state and local governments for general government purposes. It includes both expenditures for current operation and capital outlay, but excludes all utility and trust fund expenditures.

The functional categories of expenditures considered are:[12]

(1) Education
(2) Highways
(3) Public Welfare
(4) Health and Hospitals
(5) "Non-aided"--the sum of all functions other than Education, Highways, Public Welfare, and Health and Hospitals

The time period of the analysis for the time-series study of

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11. As of 1962, there were 91,236 governmental units below the federal government, including 50 state governments, 3,043 counties, 18,000 municipalities, 17,142 townships, 34,678 school districts, and 18,323 special districts. U.S. Bureau of the Census, Census of Governments: 1962, Vol. IV, No. 4, Compendium of Government Finances, Washington: U.S. Government Printing Office, 1964, Table 45.

12. For a more detailed definition of these expenditure variables, see Chapter IV, pp.105-106,and Appendix B, "Definitions of Expenditure Variables."

Chapter VI consists of the fiscal years 1957 - 1965 inclusive. The analysis must be restricted to these years due to the fact that the Census Bureau did not publish state-by-state expenditure data for state and local governments combined for any years between 1942 and 1957.

Limitations of the Data

The most serious limitations of the data used in this study stem from the aggregated form in which the expenditures of state and local governments are reported by the Bureau of the Census. First, the expenditure figures represent the sum of all governmental units within a particular state. Although such aggregation is necessary to obtain any degree of comparability in the provision of public goods between states with wide variations in constitutional delegations of power and authority, it greatly oversimplifies the decision-making process of the lower-level governments.

A second major limitation of the data is the aggregated form in which the functional expenditure categories are reported and their lack of strict conformity with the functional reporting of federal grants by the Treasury Department. As a result, the functional areas treated in this study are not as precise as may be desired.

Finally, some measurement error must be expected in the expenditure data. The Bureau of the Census compiles state finance statistics from official records and reports of the various states, but makes estimates on local government statistics based on information obtained from

a sample of local governments.[13] However, it is not felt that these limitations are so serious as to prohibit qualified use of the data.

Organization of the Study

The growth of federal grants since the mid 1930's and their current importance in the financing of state and local functions are briefly discussed in Chapter II, along with the controversy surrounding the contention that federal grants induce the lower-level governments to "distort" their budgets.

The nature of public goods is discussed in Chapter III, and the theoretical considerations pertaining to the elasticity of demand for public goods and the response to grants are explicitly introduced. The basic theoretical assumptions of the study are also developed, especially the political aspects of state and local government expenditure decisions.

In Chapter IV, the empirical studies on the determinants of state and local expenditures are reviewed and the relevant factors for this study are isolated. The specific working models of state and local behavior are introduced and explained.

The results of the empirical analysis using cross-section data for the years 1960 and 1965 are presented in Chapter V. These results are then explained in terms of the elasticity of demand for public goods.

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13. For fiscal 1965, the sample consisted for more than 10,000 local governments classified by type and size. For a description of the sample, see U.S. Bureau of the Census, Governmental Finances in 1964-65, Series GF-No. 6, Washington: U.S. Government Printing Office, 1966, p. 14.

The response of individual states to federal grants over time is analyzed in Chapter VI, along with some estimates of the response to a system of unconditional grants.

In Chapter VII, the conclusions of the analysis are summarized and implications for public policy are drawn.

CHAPTER II

THE "DISTORTION THESIS"

Background: The Growth of Federal Grants

Federal grants-in-aid to state and local governments date back to the beginning of our history as a nation. The earliest grants, to townships, were of federal land to be used primarily for popular education or internal improvements.[1] Money grants began in 1879 with aid for the printing and distribution of education materials for the blind, and were followed shortly by a whole series of grants to states under permanent legislation. The modern allocation-formula grants with state and/or local matching requirements were first introduced during the World War I period with the Federal Aid Road Act of 1916 and the Smith-Hughes Act of 1917 for vocational education.[2]

Despite the long history of federal grants, their emergence as an important factor in the revenue systems of the lower-level governments has been largely a post-World War II phenomena. As shown in Table 1, federal grants have risen from 7.3 per cent of state and local revenues from internal sources in 1946, to 16.8 per cent of state-local

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1. Northwest Ordinances of 1785 and 1787. See Bryon L. Johnson, The Principle of Equalization Applied to the Allocation of Grants-in-Aid, Washington: Social Security Administration, Bureau of Research and Statistics, Memorandum No. 66, September 1947, Chapter 4 and Appendix B.

2. Ibid.

TABLE 1

FEDERAL GRANTS RELATIVE TO FEDERAL EXPENDITURES AND STATE AND LOCAL REVENUES FROM OWN SOURCES: SELECTED YEARS, 1932-1965

Year	Total[1] Federal Grants (Thousands)	Federal[1] Grants per Capita	Grants as[6] per cent of Federal Expenditures	Grants as[6] per cent of Federal Non-Defense Expenditures	Grants as[8] per cent of State and Local own general Revenues
1932	$ 213,879	$ 1.70	5.0	10.5	3.0
1934	1,802,703	14.12	30.3	43.5	27.1
1936	1,014,656	7.84	11.1	17.4	13.6
1938	790,392	6.03	9.4	13.2	9.4
1940	967,005	7.26	9.6	13.7	11.2
1942	926,221	6.83	2.6	12.4	9.7
1944	982,700	7.16	1.0	8.0	9.9
1946	843,721	6.22	1.3	8.7	7.3
1948	1,575,394	10.77	4.4	13.2	10.2
1950	2,208,019	14.57	4.9	11.5	12.0
1952	2,326,998	14.89	3.3	13.9	10.3
1954	2,957,566	18.34	3.8	14.2	11.4
1956	3,438,225	20.54	4.5	13.8	11.0
1957	3,933,005	23.09	4.8	14.4	11.5
1958	4,791,832	27.60	5.6	15.8	13.2
1959	6,313,134	35.75	6.7	17.6	16.2
1960	6,836,590	38.72	7.0	17.8	15.7
1961	6,920,005	38.54	6.6	15.7	14.8
1962	7,701,987[2]	41.48[2]	6.8	15.7	15.3
1963	8,319,562[3]	44.13[3]	7.0[7]	16.4[7]	15.5[9]
1964	9,758,280[4]	50.99[4]	7.7[7]	17.4[7]	16.7[9]
1965	10,630,073[5]	54.73[5]	8.2[7]	17.4[7]	16.8[9]

Sources:

1. U. S. Department of Health, Education, and Welfare, Social Security Bulletin, Annual Statistical Supplement, 1959, Table 5; 1960, Table 13; 1961, Table 17.

2. Sophie R. Dales, "Federal Grants, 1961-62," Social Security Bulletin, Vol. XXVI, No. 6, June 1963, Tables 2 and 3.

3. Sophie R. Dales, "Federal Grants, 1962-63," Social Security Bulletin, Vol. XXVII, No. 6, June 1964, Tables 2 and 3.

4. Sophie R. Dales, "Federal Grants, 1963-64," Social Security Bulletin, Vol. XXVIII, No. 6, June 1965, Tables 2 and 3.

5. Sophie R. Dales, "Federal Grants, 1964-65," Social Security Bulletin, Vol. XXXIX, No. 6, June 1966, Tables 2 and 3.

6. U.S. Bureau of the Census, Census of Governments: 1962, Vol. VI, No. 4, Historical Statistics on Governmental Finances and Employment, Washington: U.S. Government Printing Office, 1964, Table 3.

7. U.S. Bureau of the Census, Government Finances in 1964-65, Series GF-No. 6, Washington: U.S. Government Printing Office, 1966, Table 2.

6 and 7. Non-Defense expenditures exclude National Defense and International Relations, Veterans' Services, and Interest on General Debt.

8. Historical Statistics, op. cit., Table 4.

9. Governmental Finances, op. cit., Table 3.

own general revenues in 1965. In absolute terms, federal grants have grown from $843.7 million in 1946 to $10.6 billion in 1965.

The importance of federal financing of state and local functions during the most recent decade (1956-1965) is shown in Table 2. Although federal aid provided about 13 per cent of the total general revenues of the lower-level governments during the period, the heavy concentration in the functions of public welfare and highways is evident. Federal grants financed nearly one-half (47.9 per cent) of the total welfare expenditures and about one-fourth (25.5 per cent) of all expenditures on highways.

Although federal grants are undoubtedly an important revenue source for state and local governments, the use of such aid is not without problems. Virtually all grant-in-aid programs currently in force in the United States are conditional, that is, the funds must be applied to specific projects which meet federal standards and regulations, and nearly all require that the recipient match the federal

TABLE 2

FEDERAL FINANCING OF STATE AND LOCAL FUNCTIONS:
TOTAL FOR PERIOD 1956-1965
(millions of dollars)

	Total[1]	From Federal Government[2]	From State and Local Sources[3]	Federal As Per Cent of Total
Total General Revenue	$526,862	$68,643	$458,219	13.0
Total Direct General Expenditures	546,932	68,643	478,289	12.3
Education	200,643	4,217	196,426	2.1
Highways	97,592	24,861	72,731	25.5
Public Welfare	46,287	22,163	24,124	47.9
Health and Hospitals	40,208	2,821	37,387	7.0
All Other	162,202	14,581	147,621	9.0

Sources:

1. U.S. Bureau of the Census, Census of Governments: 1962, Vol. VI, No. 4, Historical Statistics on Governmental Finances and Employment, Washington: U.S. Government Printing Office, 1964, Table 4, and U.S. Bureau of the Census, Governmental Finances in 1964-65, Series GF-No. 6, Washington: U.S. Government Printing Office, 1966, Table 3.

2. Sophie R. Dales, "Federal Grants, 1964-65," Social Security Bulletin, Vol. XXIX, No. 6, June 1966, Table 2.

3. By subtraction.

funds according to some pre-defined formula. As shown in Table 3, there are only four major programs which do not require matching funds. Most of the programs contain uniform matching ratios, while some, mainly in the area of public assistance, contain variable matching requirements.[3]

The "Distortion Thesis"

A major criticism of the matching requirements contained in the present system of conditional grants concerns their effect upon the budget policies of state and local governments. By their very nature, the conditional grants put a premium upon state performance of certain activities, since a dollar of local money spent in some ways draws in another dollar (more or less) from the outside. Federally aided activities are thus placed in a preferred position to those activities which may be equally meritorious, but which receive no federal support. Consequently, James A. Maxwell contends, "If a state government had reached a rational revenue-expenditure distribution before the federal aid became effective, this is now completely distorted because of the greater utility given to a dollar spent in a particular direction."[4]

Maxwell's position is typical of those who feel that conditional

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3. For a description of the grant-in-aid programs currently available to state and local governments, see Library of Congress, Legislative Reference Service, Catalog of Federal Aids to State and Local Governments, prepared for the Subcommittee on Intergovernmental Relations, Senate Committee on Government Operations, 88th Congress, 1st Session, Washington: U.S. Government Printing Office, 1964, and the Supplements of January 4, 1965, and January 10, 1966.

4. James A. Maxwell, The Fiscal Impact of Federalism in the United States, Cambridge: Harvard University Press, 1946, pp. 389-390.

TABLE 3

MATCHING RATIOS ON THE LARGEST FEDERAL GRANTS TO STATE AND LOCAL GOVERNMENTS: 1966

Unmatched Grants	
Assistance to schools in federally affected areas	
Elementary and secondary education (Title I)	
Administration of employment security programs	
Vocational rehabilitation	
Research and demonstration	
Expansion	
Uniform Matching	Federal Share
Highways	
Grants for construction	
Interstate system	90%
Primary system	50
Secondary system	50
Urban highways	50
Emergency relief	50
Grants for planning and research	78 (average)
Economic Opportunity programs	
Work-study	90
Adult education	90
Head Start	90
Neighborhood Youth Corps	90
Work-experience	90
Higher education facilities construction	
Title I	
Public junior colleges and technical institutes	40
Four year colleges and other	33-1/3
Title II	
Graduate education centers	33-1/3
Vocational education	
Work-study (vocational)	90
Other	50
Vocational rehabilitation	
Training and innovation	90
Basic grants	75
Low Rent Public Housing program	66-2/3
Urban renewal programs	66-2/3

TABLE 3 (continued)

Variable Matching	Federal Share Minimum	Maximum
Vocational rehabilitation (facilities)	50%	70 %
School lunch	25	83.8
Public assistance		
Old Age Assistance	50	83.8
Aid to Families of Dependent Children	50	83.8
Aid to Blind	50	83.8
Aid to Permanently and Totally Disabled	50	83.8
Medical Assistance	50	80
Appalachian Development Highway Program	(up to)	70

Source: Selma J. Mushkin and Robert F. Adams, "Emerging Patterns of Federalism," National Tax Journal, Vol. XIX, No. 3, September 1966, p. 234.

grants "distort"[5] the budgets of the lower-level governments by inducing a transfer of funds from activities which receive no federal aid to those which are federally supported. The "distortion effect" is held to be especially strong in the lower-income states which cannot increase their tax effort enough to meet the matching requirements. If this is the case, the conditional grant system is thought to impose restrictions upon consumer sovereignty in some areas of the nation and not in others, merely because of variations in income or wealth among the political subdivisions.

Distortion: Common Positions

A classic example of the "distortion thesis" was presented in 1949 by the Commission on the Organization of the Executive Branch of the Government:

> The force with which these national grants have distorted state budgets can be demonstrated simply. The low-income states have channeled their limited funds into programs where national dollars are available to match state and local expenditures . . .

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5. It must be emphasized that the term "distortion," as used in this study, to refer to reduced expenditures on those functions not receiving federal aid in favor of increased expenditures on the aided functions, is a highly specialized use of the concept. The more general use of the term distortion, or nonneutrality, refers to the situation where public sector budgetary action alters consumer want-satisfaction and/or business profit-seeking behavior in the private sector of the economy. As such, intersector nonneutral effects, or distortions, can be negative or positive. "Negative nonneutral effects" are those which introduce economic inefficiencies and therefore interfere with the market process of allocation. "Positive nonneutral effects" are those which provide economies to the private sector. Therefore, it must not be concluded that nonneutrality, or distortion, is bad per se. On the concept of distortion and nonneutrality, see Herber, op. cit., pp. 75-80, Richard A. Musgrave, The Theory of Public Finance, New York: McGraw-Hill, 1959, pp. 140-159, and James M. Buchanan, The Public Finances, rev. ed., Homewood, Illinois: Richard D. Irwin, Inc., 1965, pp. 139-153.

> In the fiscal year 1946-47, New York spent for aid to the old, to dependent children and to the blind about three times its expenditure for general relief. Mississippi, by contrast, spent 189 times more in the national grant relief field than it did for general assistance . . . . The imbalances can be explained in large part by the fact that states with relatively few tax resources distort their budgets to take advantage of national grants. By doing so, they are forced to neglect state programs for which no national matching exists.[6]

The Council on State Governments explains, "Budgetary distortion is caused principally by the privileged position that federal-aid programs enjoy. When federal grants are small the problem is usually not serious, but when large federal-aid apportionments must be matched by state funds, there may be an inclination to neglect other functions."[7] Similarly, Joseph P. Harris notes, "A major problem in Federal aid is its effect upon unaided government services . . . it is having serious effects in inducing state and local legislative bodies to favor aided activities at the expense of others equally meritorious."[8] Alvin Hansen and Harvey Perloff also support the distortion thesis:

> The effect of singling out a few governmental functions or parts of functions for federal aid is to place them in a preferred position in securing state and local appropriations. In fact, the success of a matching grant for a specific service is

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6. U.S. Senate, Federal-State Relations, Report of the Commission on the Organization of the Executive Branch of the Government, Senate Document No. 81, 81st Congress, 1st Session, Washington: U.S. Government Printing Office, 1949, pp. 53-54.

7. Council on State Governments, Federal Grants-in-Aid, Report of the Committee on Federal Grants-in-Aid, Chicago: Council on State Governments, 1949, p. 45.

8. Joseph P. Harris, "The Future of Federal Grants-in-Aid," Annals of the American Academy of Political and Social Science, Vol. 207, January 1940, pp. 18-19.

> generally measured by the degree to which it stimulated the recipient units to expand their outlays on the aided service. Because a few nationally supported services (such as highways, old-age assistance, and vocational education) have been placed in a highly favored position, other governmental functions equally important and meritorious (such as general education and relief) have suffered in many areas of the country because of the diversion of available state and local funds into the aided activities. Within the poorer sections of the country, especially, the extension of federal aid for a limited number of functions tends to bias state and local budgets in the direction of the aided services; and from the standpoint of the relative need for the various social services, to distort the budgets.[9]

Walter Heller contends that "In drawing on a limited supply of resources to finance and staff particular functions, the matching grant tends to siphon them away from the nonaided programs. And the poorer the state, the greater the tax effort that must be made to achieve any given amount of matching, and hence the less is left over for the nonaided functions. To some extent, then, the state-local government trades fiscal freedom for fiscal strength."[10]

James Maxwell explains that Congress did not realize that the

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9. Alvin H. Hansen and Harvey S. Perloff, State and Local Finance in the National Economy, New York: W. W. Norton & Co., 1944, p. 127. For others who take similar positions regarding the distortion thesis, see James A. Maxwell, Federal Grants and the Business Cycle, New York: National Bureau of Economic Research, 1952, pp. 38-39; James M. Buchanan, "Federal Expenditure and State Functions," in Federal Expenditure Policy for Economic Growth and Stability, Joint Economic Committee, 85th Congress, 1st Session, Washington: U.S. Government Printing Office, 1957, pp. 173-179; Paul Studenski and E. J. Baikie, "Federal Grants-in-Aid," National Tax Journal, Vol. II, No. 3, September 1949, p. 206; and the testimony of John E. Burton, in Hearings on a Bill to Establish a National Commission on Intergovernmental Relations, House and Senate Committee on Expenditures in the Executive Departments, Senate Document No. 810, 81st Congress, 1st Session, Washington: U.S. Government Printing Office, 1949, p. 84.

10. Walter W. Heller, New Dimensions of Political Economy, Cambridge: Harvard University Press, 1966, p. 142.

matching requirements of federal grants would absorb larger portions of state-local tax revenues in the poor states than in the rich ones. "And Congress did not appreciate that state legislatures, in order to finance the services eligible for federal aid, would sometimes divert state money from services not eligible for federal aid."[11]

Most of those cited above, who believe that federal grants do have a "distorting effect" on state and local budgets, usually refer to the case of public assistance, where four categories receive substantial amounts of federal aid (old-age assistance, aid to dependent children, aid to the blind, and aid to the totally disabled), while expenditures for general assistance (a catch-all group covering needy persons not in the four groups above) receives no federal support. The ratio of old-age assistance payments to those for general assistance by high versus low-income states is used to illustrate that the high-income states tend to have a much lower ratio than the low-income states, indicating that the low-income states channel most of their public assistance funds into those functions that receive federal aid, thereby implying budget "distortion."[12]

Distortion Questioned

Not all students of the subject, however, adhere to the thesis

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11. James A. Maxwell, Financing State and Local Governments, Washington: The Brookings Institution, 1965, p. 58.

12. This technique is used by Maxwell, Ibid, pp. 58-59; Maxwell, Federal Grants and the Business Cycle, op. cit., pp. 48-50; The Council on State Governments, op. cit., pp. 159-160; and Hansen and Perloff, op. cit., pp. 127-128.

that grants "distort" lower-level government budgets. In its Report to the President, the Kestenbaum Commission noted with concern that a number of state budget officers believe that grants have distorted state budgets. It held that "neither the nature nor the extent of the distortion is entirely clear."[13] The Commission took the position that the very purpose of the grant-in-aid system was to induce state and local governments to adopt an expenditure pattern somewhat different from that which would prevail in the absence of grants. "Such an effect is indeed one of the major objectives of grants-in-aid, for the grant is intended to stimulate States and their localities to exert greater effort in aided programs than they presumably would exert without financial assistance from the National Government."[14]

Selma J. Mushkin is another who questions the validity of the distortion thesis, but she does so on the grounds that differences in public support of various functions may reflect differences in public interest and preferences for varying governmental functions rather than the effects of grant provisions.[15] For example, in the following statement, she questions the entire basis of the distortion thesis:

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13. The Commission on Intergovernmental Relations, A Report to the President for Transmittal to Congress, Washington: U.S. Government Printing Office, 1955, p. 129.

14. Ibid. James Maxwell has dissented quite strongly with this aspect of the Commission's Report, see his "The Report of the Commission on Intergovernmental Relations," National Tax Journal, Vol. IX, No. 1, March, 1956, pp. 55-68.

15. See Selma J. Mushkin, "Report of the Commission on Intergovernmental Relations," Review of Economics and Statistics, Vol. XXXIX, No. 3, August 1957, pp. 334-341.

> We have taken almost for granted that differential federal reimbursement ratios are a factor in state budget decisions. A priori, if a state can get 90 cents on each $1 of expenditure on interstate highways and only 33-1/3 cents on each $1 spent to build hospitals, the state will exhaust its federal highway fund allotment before spending anything on hospitals. Governments, however, do not act like individuals, they do not take maximum advantage of federal grant offerings. Some allotments of federal funds, even at fairly favorable matching ratios, are not taken up.
>
> Even in those instances in which there is some federal aid for one program and none for a related program, it is not clear that federal aid is the cause of differential state action. States may be spending more for old-age assistance payments than for general assistance, not because state funds are matched in the first instance and not in the other, but because the aged are a strong political force. Political alignments responsible for federal grants for old-age assistance may be reflected in higher state appropriations for the aged.[16]

Finally, Phillip Monypenny, who holds that the present system of grants is a result of political pressures in a federal system, contends, "despite the availability of grants under uniform conditions states are making quite different decisions as to how to spend their money, and how much money to raise and spend."[17] Regarding the contrast between old-age and general assistance payments, Monypenny replies, "the exceptions only show that the presumably controlling conditions do not prevent individual choice."[18]

It would thus appear that the extent of budget "distortion," or

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16. Selma J. Mushkin, "Barriers to a System of Federal Grants-in-Aid," National Tax Journal, Vol. XIII, No. 3, September 1960, pp. 212-213.

17. Phillip Monypenny, "Federal Grants-in-Aid to State Governments: A Political Analysis," National Tax Journal, Vol. XIII, No. 1, March 1960, p. 11.

18. Ibid.

the lack of it, may well depend upon the preference pattern of the communities in question regarding public goods in general, and specific public goods in particular. To date, this aspect of the problem has not received adequate attention.

Empirical Considerations

In addition to the lack of attention paid to the varying preference patterns of different communities, the common positions regarding the distortion thesis, both pro and con, have been almost devoid of empirical content. In fact, in a 1958 paper, I. M. Labovitz offers the conclusion that there is no way to empirically verify the distortion hypothesis. He cites the following barriers to measuring accurately the distortion effects, if any, of conditional grants-in-aid: (a) a lack of comparable state and local government expenditure data, (b) the changing provisions of federal grant programs, and (c) the problem of isolating the effects of federal grants from those of other factors which influence state and local expenditure decisions.[19] More recently, Mark Haskell has examined the possible distortion effects of federal grants on both a theoretical[20] and an empirical level.[21] His admittedly rough test for distortion involves comparing, over a number of years,

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19. I. M. Labovitz, "Stimulative Effect of Federal Grants-in-Aid: Some Illustrative Data," unpublished paper, Washington: Library of Congress, Legislative Reference Service, 1958, pp. 1-2.

20. Mark A. Haskell, "Federal Grants-in-Aid: Their Influence on State and Local Expenditures," Canadian Journal of Economics and Political Science, Vol. XXX, No. 4, November 1964, pp. 585-591.

21. Mark A. Haskell, "Federal Grants and Budgetary Distortion," Quarterly Review of Economics and Business, Vol. II, No. 2, May 1962, pp. 79-87.

the percentages of total state and local expenditures accounted for by functions which have received substantial federal aid against those which have received no federal support. He concludes that the data do not support the view that the matching provisions of federal grants have caused a transfer of state and local resources to subsidized activities.[22] It is important to note, however, that neither Labovitz nor Haskell state that distortion does not occur, but rather that their analysis of the available data will not support the contention that it does.[23]

The most complete empirical analysis of the distortion thesis to date has been conducted by Roy Bahl and Robert Saunders.[24] On the basis of a priori considerations, they believed that federal aid to a high-income state would result in a higher level of expenditures than would an equal injection of federal aid into a low-income state.

> Consequently, matching requirements of federal grants would absorb larger proportions of state-local tax revenues in poor than in rich states. Total expenditures in the poor states would not increase by as large an amount since in order to finance services eligible for federal aid, state legislatures

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22. He notes, however, that the area of public assistance (old-age versus general assistance) may be an exception. Ibid., p. 87.

23. Although Haskell is of the opinion that if federal grants cause a stimulation of state and local expenditures, he feels "state and local contributions are probably most often financed by increasing the public budget, i.e., by increasing tax effort. If distortion is to take place, it will most likely occur in the case of low-income states." Ibid.

24. Roy W. Bahl and Robert J. Saunders, "The Effects of Intergovernmental Flows of Funds on State and Local Government Budget Structures," unpublished paper, presented at the Thirty-Sixth Annual Conference of the Southern Economic Association, November 1966.

may tend to divert state money from services not eligible for federal aid.[25]

In contrast to their a priori expectations, Bahl and Saunders found little evidence of budgetary distortion resulting from federal grants. Their analysis was based upon a cross-section study of the proportion of state and local expenditures from their own sources for various functions in the forty-eight coterminous states for fiscal 1964. Federal aid was used as an independent variable in two forms--per capita, and the ratio of federal aid to total general revenue from the lower-level governments' own sources. In the case of the education and health and hospitals regressions, neither form of the federal aid variable produced a significant increase in the amount of interstate variation explained. Therefore, they felt, "no empirical evidence of distortion may be observed for these functions."[26] For highways, they found that the addition of the federal aid variables increased the explained variation by only a small amount.

While the federal aid variables were not found to be significant in explaining the interstate variations in the proportions spent on education, health and hospitals, and highways, this was not true for public welfare expenditures. "The regression analysis of welfare proportions

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25. Roy W. Bahl and Robert J. Saunders, "Fabricant's Determination After Twenty Years: A Critical Reappraisal," The American Economist, Vol. X, No. 1, Spring 1966, pp. 36-37.

26. Bahl and Saunders, "The Effects of Intergovernmental Flows of Funds on State and Local Government Budget Structures," op. cit., p. 15. However, they noted that while the federal aid variables were not significant in the four variable models (per capita income, urbanization, density, and federal aid), that they are significant when per capita income is omitted from the model. Hence they conclude, "a distortion effect may be present but undetected in the four variable model as a result of intercorrelations among the independent variables." (p. 15).

shows pronounced evidence of a stimulative effect. Both aid variables are positively related to the proportions of local welfare expenditures and result in a substantial increase in the amount of variation explained."[27] Based upon these results from their multiple regression analysis, Bahl and Saunders reach the conclusion, "given the effect of differences in interstate needs factors (per capita income, urbanization, and density), those states which receive larger relative magnitudes of federal welfare funds tend to devote a greater proportion of revenues raised from internal sources to the welfare function."[28]

In addition to examining the relationships between the two forms of the federal aid variable and the proportion of state and local expenditures from their own sources for selected functions, they also sought to determine the nature of the relationship, if any, between variations in fiscal effort and the proportion of funds devoted to the various functions. They found state-local fiscal effort to be "positively and significantly related to the proportion of funds spent for education, highway, and welfare functions . . . . This finding suggests that interstate differences in the distribution of funds from own sources are more closely related to differences in fiscal effort than to differences in the level of intergovernmental flows."[29] However, Bahl and Saunders interpret the intercorrelations between the effort and the aid variables to imply that those states "making relatively

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27. Ibid., pp. 15-16.

28. Ibid., p. 16.

29. Ibid.

greater fiscal effort for a given function also receive a greater level of aid for that function. Therefore, both the simple relationships and the increases in the coefficients of determination reinforce the contention that (both) a distortion of budget structure and a stimulative effect is clearly evidenced for the welfare function."[30]

The general results of the study by Bahl and Saunders seem to indicate that the over-all effect of the federal grant system is stimulative, with clear-cut evidence of distortion only in the case of public welfare. By contrast, Edward Gramlich's time-series analysis of state and local government expenditures using quarterly observations, 1954-1964, yields a different conclusion regarding the effects of federal welfare grants:

> Even though about forty per cent of Federal grants-in-aid have been for transfer-oriented programs, and even though all grants are conditional on matching state funds, the equation says that states have not increased their transfer payments at all as a result of the increase in Federal grants. They have simply taken Federal public assistance money, added about one-third more to satisfy the matching requirement, and then reduced other transfer payments by four-thirds of the Federal grant. The only effect that these grants have had on states is that they have increased other types of purchases . . . . The states seem to be spending this money as they will almost regardless of how the Federal Government says it should be spent.[31]

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30. Ibid. "The simple correlation coefficients between the effort variable and per capita federal aid for the ith function, are .47 for education, .49 for highways, and .59 for welfare." (p. 16).

31. Edward M. Gramlich, "A Model of the Behavior of State and Local Governments in the United States," unpublished paper, part of an econometric model-building project sponsored by the Board of Governors of the Federal Reserve System, November 1966, p. 16.

Summary

The question of whether or not the matching requirements of conditional federal grants cause state and local governments to "distort" their budgets is clearly not settled. Nevertheless, the empirical evidence presented by Haskell and Bahl and Saunders seems to indicate that the welfare function is most subject to such a budget reallocation. Almost all are in agreement that federal aid tends to stimulate expenditure levels, but the empirical measurements and conclusions differ somewhat.

In spite of all the contentions, both pro and con, regarding the "distortion thesis" very little has been done to explain why the phenomenon may or may not occur. In particular, the preference patterns of the various lower-level governments have been completely overlooked.

CHAPTER III

THE DEMAND FOR PUBLIC GOODS AND THE RESPONSE TO GRANTS: SOME THEORETICAL CONSIDERATIONS

The present chapter seeks to introduce explicitly the preference patterns of state and local governments for public goods into an analysis of the response of the lower-level governments to federal grants. More specifically, community preference patterns are introduced via the political process in which individuals express their demand for public goods through their elected representatives. In addition, the nature of "collective" goods and services are discussed and contrasted with "private" goods and services. Briefly, "pure private" goods have divisible benefits and are provided by the private sector of the economy via the market mechanism. In contrast, some collective goods yield benefits which are indivisible among consumers, and are termed "pure public" goods. Others, called "quasi-public" goods, take on collective characteristics in that part of the benefits are indivisible, but they also assume characteristics of private goods in that a portion of the benefits are divisible.

"Pure Private" Goods

The distinguishing characteristics of a "pure private" good is that its benefits are entirely divisible among individual consumers. Therefore, it is possible for the market mechanism to provide such goods through the application of the "exclusion principle." If a consumer wishes to satisfy his desire for any particular commodity, he must meet

the terms of exchange set by those who happen to possess the good or service. If he does not (for whatever reasons), he is excluded from its benefits. Thus, when the benefits of a good are divisible, the consumer must bid for the commodities he wants and thereby reveal the value he assigns to them.

Public Wants and Public Goods

Social Wants and "Pure Public" Goods

In the case of those collective goods whose benefits are indivisible, the exclusion principle cannot operate. The consumer is not forced to bid for the commodities, nor can he be excluded from any benefits that arise from their provision. In short, the satisfaction derived by any individual consumer is independent of his own contribution. This inapplicability of the exclusion principle occurs in those cases where the wants are "social," which Richard Musgrave defines as wants "satisfied by services that must be consumed in equal amounts by all. People who do not pay for the services cannot be excluded from the benefits that result; and since they cannot be excluded from the benefits, they will not engage in voluntary payments."[1] In such a case, the market mechanism is inoperative and the wants must be satisfied via a public budget if they are to be satisfied at all.

Musgrave notes that the nature of "social" wants presents serious difficulties in the actual determination of the public budget. First,

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1. Richard A. Musgrave, The Theory of Public Finance, New York: McGraw-Hill, 1959, p. 8. For a good discussion of the concept of public goods and collective consumption, see Herber, op. cit., pp. 17-37.

because the exclusion principle does not apply, true preferences will not be revealed. "Yet the government must determine these preferences before it can decide how to satisfy them efficiently. A way must be found by which to induce people to reveal their preferences."[2] Second, he points out that even if the true preferences are known, "there is no single most efficient solution to the satisfaction of social wants or to the problem of supplying services that are consumed in equal amounts by all . . . . Therefore, a more specific welfare function is needed to secure an optimal solution."[3]

The collective consumption feature of Musgrave's "social wants" has been employed by Paul Samuelson as the major criterion in a definition of the polar case of a "pure public" good. In Samuelson's terminology, "Collective consumption goods (X_{n+1}. . . . X_{n+m}) are those which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good, so that $X_{n+j} = X^i_{n+j}$ simultaneously for each good and

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2. Musgrave, op. cit., p. 8. However, he notes: "In the case of local finance, some registration of preferences may occur by moving from less to more congenial fiscal communities . . . " (p. 10).

3. Ibid., p. 8. It should be pointed out that not all agree with Musgrave's contention that the market mechanism is not applicable to the provision of public goods. For example, Ansel Sharp and Donald Escarraz contend, "As a normative model, it does not appear there is anything logically inconsistent with the price theory of public finance." They base this view upon a rejection of Musgrave's analysis of the two basic difficulties involved with the satisfaction of social wants mentioned above. See Ansel M. Sharp and Donald R. Escarraz, "A Reconsideration of the Price or Exchange Theory of Public Finance," Southern Economic Journal, Vol. XXXI, No. 2, October 1964, pp. 132-139. For a more detailed analysis, see Donald R. Escarraz, The Price Theory of Value in Public Finance, Gainesville, Florida: University of Florida Press, 1966.

every ith individual and each collective good."[4]

In a later clarification of his "Pure Theory," Samuelson expanded his definition of a pure public good:

> A public consumption good (is) like an outdoor circus or national defense, which is provided for each person to enjoy or not, according to his tastes. I assume the public good can be varied in total quantity, and write X_2 for its magnitude. It differs from a private consumption good in that each man's consumption of it, X^1_2 and X^2_2 respectively, is related to the total X_2 by a condition of equality rather than of summation. Thus, by definition, $X^1_2 = X_2$, and $X^2_2 = X_2$.[5]

Although many have criticized Samuelson's admittedly polar case as being too restrictive and unrealistic,[6] the ramifications of the controversy are not crucial here, as the main interest of this study is

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4. Paul A. Samuelson, "The Pure Theory of Public Expenditures," Review of Economics and Statistics, Vol. XXXVI, No. 4, November 1954, p. 387.

5. Paul A. Samuelson, "Diagrammatic Exposition of a Theory of Public Expenditure," Review of Economics and Statistics, Vol. XXXVII, No. 4, November 1955, p. 350. In contrast is the private good: "A private consumption good (is) like bread, whose total can be parcelled out among two or more persons with one man having a loaf less if another gets a loaf more. Thus if X_1 is total bread, and X^1_1 and X^2_1 are the respective private consumption of Man 1 and Man 2, we can say that the total equals the sum of the separate consumptions--or $X_1 = X^1_1 + X^2_1$." (p. 350).

For an argument that even national defense is not a pure public good, see Fred S. Hoffman, "The Economic Analysis of Defense: Choice Without Markets," American Economic Review, Vol. XLIX, No. 2, May 1959, pp. 368-376.

6. See Julius Margolis, "A Comment on the Pure Theory of Public Expenditures," Review of Economics and Statistics, Vol. XXXVII, No. 4, November 1955, pp. 347-359; Gerald Colm, "Comments on Samuelson's Theory of Public Finance," Review of Economics and Statistics, Vol. XXXVIII, No. 4, November 1956, pp. 408-412; Charles M. Tiebout, "A Pure Theory of Local Expenditures," Journal of Political Economy, Vol. LXIV, No. 5, October 1956, pp. 416-424; and Robert H. Strotz, "Two Propositions Related to Public Goods," Review of Economics and Statistics, Vol. XL, No. 4, November 1958, pp. 329-331.

with public goods supplied at the state and local levels, which fall largely into the category of "quasi-public" goods.

Merit Wants and "Quasi-Public" Goods

A second category of public wants, called "merit wants," are defined by Musgrave as wants met by goods and services subject to the exclusion principle but which become public wants "if considered so meritorious that their satisfaction is provided for through the public budget, over and above what is provided for through the market and paid for by private buyers."[7] He cites examples as publicly furnished school lunches, subsidized low-cost housing, and free education.

The "quasi-public" goods devoted to the satisfaction of these "merit" wants contain characteristics of both "pure private" and "pure public" goods in that some of the benefits are divisible while part of the benefits are indivisible. Public expenditure for education is an example of the "quasi-public" good. Private families benefit directly when their children's education is publicly financed and so part of the benefit is divisible. But the whole community also benefits from the advantages of a well-educated citizenry. To this extent, the benefits of education are indivisible.[8]

It should be noted that most services provided by state and local governments are of the "quasi-public" type. In fact, only the areas of

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7. Musgrave, op. cit., p. 13.

8. For an excellent analysis of the benefits of education, see Burton A. Weisbrod, External Benefits of Public Education: An Economic Analysis, Princeton: Industrial Relations Section, Princeton University, 1964.

protection (police and fire) and general control could be viewed as "pure public" goods. The larger and more important state and local government services such as education, highways, public welfare, and health and hospitals, are not consumed collectively by all with indivisible benefits, but in most cases, are rationed among consumers, with a portion of the benefits being directly divisible.[9]

Local Public Goods

In addition to the fact that most of the services provided by state and local governments are "quasi-public," the individual citizen is generally able to exert more influence over the provision of "local public" goods than he is over the goods and services provided by the national government. This is essentially due to the alternatives open to the citizen at the local level. To the extent that he is mobile, the citizen can move from one fiscal community to another that better meets his demand for public goods. For example, Charles Tiebout argues that people tend to join homogeneous communities which will legislate what each wants in the way of collective goods:

> The consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods. This is a major difference between central and local provision of public goods. At the central level the preferences of the consumer-voter are given, and the government tries to adjust to the pattern of these preferences, whereas at the local level various governments have their revenue and expenditure patterns more or less set. Given these revenue and expenditure patterns, the consumer-voter moves to that community whose local governments best satisfy his set of preferences.

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9. See Margolis, "A Comment on the Pure Theory of Public Expenditures," op. cit.

> The greater the number of communities and the greater the variance among them, the closer the consumer will come to fully realizing his preference position.[10]

Another aspect of the difference between public goods provided at the central level and those provided at the local level has been pointed out by Alan Williams.[11] He feels that in the central public good case, agreement has to be reached by the nation as a whole concerning some particular amount of public goods which is then the amount for the entire nation. On the other hand, at the local level, the same decision is made within each separate local community. "We are thus able to introduce a spatial reference point into the provision of public goods, which affects their availability as between communities. In other words, the site of production is explicitly introduced as a relevant influence upon the pattern of consumption.[12]

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10. Tiebout, "A Pure Theory of Local Expenditures," op. cit., p. 418. See also, Charles M. Tiebout, "A Regional Framework for Government Expenditures," in Federal Expenditure Policy for Economic Growth and Stability, Joint Economic Committee, 85th Congress, 1st Session, Washington: U.S. Government Printing Office, 1957, pp. 818-824.

However, Samuelson contends that Tiebout's homogeneous local communities is not a proper solution: "The old don't want to live in homogeneous gettos with their own kind, and the same goes for many other groups." Paul A. Samuelson, "Aspects of Public Expenditure Theories," Review of Economics and Statistics, Vol. XL, No. 4, November 1958, p.337.

11. Alan Williams, "The Optimal Provision of Public Goods in a System of Local Government," Journal of Political Economy, Vol. LXXIV, No. 1, February 1966, pp. 18-33.

12. Ibid., p. 32. For other examples of this approach, see Seymour Sacks, "Spatial and Locational Aspects of Local Government Expenditures," in Howard G. Schaller, ed., Public Expenditure Decisions in the Urban Community, Washington: Resources for the Future, Inc., 1963, pp. 180-198; and Charles M. Tiebout, "An Economic Theory of Fiscal Decentralization," in National Bureau of Economic Research, Public Finances: Needs, Sources, and Utilization, Princeton: Princeton University Press, 1961, pp. 79-96.

A Political Approach

A third approach to the problem of local public goods, and the one followed in this study, is to emphasize the political nature of the provision of public goods by state and local governments. It is based upon the assumption that elected government officials are not primarily interested in maximizing a social welfare function, the common good, or the public interest--whatever these may be--but that instead they seek to maximize their own interests. Following the lead of Anthony Downs,[13]

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13. Anthony Downs, An Economic Theory of Democracy, New York: Harper & Brothers, 1957. In this work, Downs constructs a theory of government analogous to the theory of markets by concentrating his attention on the behavior of political parties. The attempt of parties to maximize voter support replaces the attempt of individuals to maximize their utilities in the market process. Specifically, his basic hypothesis is that political parties seek to maximize their gains from office; but that they win office by catering to the preferences of the voters, and can only continue in office by satisfying the voters' preferences for various types and quantities of government activity. In other words, power is exchanged for desired policies in a political transaction between party and electorate. A strategic element in Downs' theory of the workings of democracy is the cost of acquiring information. He uses this cost to explain the reliance on persuasion in arriving at political decisions; the inequality of political influence; the role of ideology; electoral apathy; and the bias of democratic government toward serving producer rather than consumer interests.

Downs describes the logic of government decision-making in the following manner: "According to our hypothesis, governments continue spending until the marginal vote gain from expenditure equals the marginal vote loss from financing. The determinants of vote loss and vote gain are the utility incomes of all voters and the strategies of opposition parties. Thus governments are engaged in political warfare as well as maximization problems.

"Under conditions of certainty, a government's best strategy is to adopt policies which are favored by a majority of voters . . . . However, conforming to the will of the majority does not guarantee reelection for the incumbents. Sometimes the opposition can form a coalition of dissenters and win by upholding the minority view on key issues, and at other times no clear majority position exists. In both cases, the incumbent's downfall is caused by lack of strong concensus in the electorate combined with the opposition's ability to refrain from committing

it is assumed that elected officials attempt to maximize the probability of their reelection, a probability which is assumed to be dependent upon the policies that are implemented as well as on the degree to which they are implemented. This relationship rests on the view that political parties and the electorate are engaged in a sort of exchange in which the votes are traded for policies.[14] Therefore, in order to maximize the probability of reelection, it is assumed that political parties endeavor to "produce" those policies which can be exchanged for the largest possible quid pro quo, that is, the largest number of votes. This is analogous to the profit-seeking entrepreneurs of the private economy. So as to attain their ends (reelection), political parties formulate whatever policies they believe will gain the most votes, just as the

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itself until after the government acts.

"Thus majority rule does not always prevail on specific issues, but it usually does in a two-party system whenever the majority strongly favors a certain policy." (pp. 73-74).

14. See James Q. Wilson, "The Economy of Patronage," Journal of Political Economy, Vol. LXIX, No. 4, August 1961, pp. 369-380, for the thesis that political machines specifically, and political parties generally, allocate patronage so as to maintain their organization, and that this goal may, or may not, be compatible with the desire to maximize votes, depending upon the position of the leader and the character of the situation. Wilson notes that the operating principle of his model is the same as Downs', i.e., reward to the members, the difference being that vote maximization is only one goal. "The variety of goals arises from the fact that the boss needs to reward not only voters, but ward leaders, precinct workers, and elective officials as well. The demands of each group are not always compatible with the demands of the other groups, and thus resources (patronage) must be allocated among competing ends." (p. 380).

entrepreneurs produce whatever products they believe will yield them the most profits.[15]

The essence of this political approach to a theory of local government expenditures has been summarized in the following manner by Otto Davis and George Haines:

> The basic idea here is that in a democratic society individual voters are the basic determinants of political decisions. Politicians, who actually make both expenditure and taxation decisions, are viewed as being motivated by a desire to attain and remain in power (office). Hence, politicians, or at least the successful ones, must both promise and actually make decisions which result in a 'mix' of expenditures and taxes which will appeal to a dominant coalition of voters. Politicians, then are viewed as being followers of a perceived 'will of a majority' rather than as molders of public opinion.
>
> Individual voters, on the other hand, are assumed to be motivated by self-interest. They favor and vote for those politicians who offer mixes of expenditures and taxes which are the closest of the available alternatives to the particular policies which self-interested voters might view as the ideal ones.
>
> . . . Hence, politicians are conceived of as being participants in a sort of 'guessing game' where the winner is the one who makes the best approximation to the expenditure-tax mix which can cause the formation of a dominant coalition of voters.[16]

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15. For variations of this political approach to government expenditures, see James M. Buchanan and Gordon Tullock, The Calculus of Consent, Ann Arbor: University of Michigan Press, 1962; James L. Barr and Otto A. Davis, "An Elementary Political and Economic Theory of the Expenditures of Local Governments," Southern Economic Journal, Vol. XXXIII, No. 2, October 1966, pp. 149-165; Otto A. Davis and George H. Haines, Jr., "A Political Approach to a Theory of Public Expenditure: The Case of Municipalities," National Tax Journal, Vol. XIX, No. 3, September 1966, pp. 259-275; and Albert Breton, "A Theory of the Demand for Public Goods," Canadian Journal of Economics and Political Science, Vol. XXXIII, No. 4, November 1966, pp. 455-467.

16. Davis and Haines, op. cit., pp. 260-261. The authors note that this approach is based upon what James Buchanan calls the "individualistic theory of the state." In this view the state is conceived of as the representation of the sum of the individual members acting in a collective capacity. The opposing view is the "organismic theory" in which the state is conceived as being some type of organic entity. See

Similarily, Albert Breton emphasizes the political reaction to the wishes of the more powerful group of voters:

> . . . an individual's participation in political activity, including voting, will reveal his true preferences for public goods. Indeed, it is at the level of political activity and not at that of market activity that the preferences for public goods are made known.
>
> . . . . The supply of public goods will be determined . . . by the preferences of individuals for public goods relative to the amount available, by the 'prices' that they must have to pay for these goods, by the relative costs of joining political activities, and by the political structure in society as seen by politicians. The presumption is that the supply of public goods and the system of taxation will tend to reflect the preferences of the more powerful group. This follows from the fact that these groups can 'deliver' the largest number of votes and that politicians will cater to these groups to get the votes they 'control.'[17]

Otto Davis and George Haines subjected the political approach to an empirical test, using data for municipalities in the Pittsburgh Metropolitan Region for the year 1959.[18] They hypothesized that the larger the value which an "interest group" or "taste determining" variable assumes, the greater effect it is likely to have on the politicians' decisions concerning the mix of expenditures and taxes.[19] Therefore,

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James M. Buchanan, "The Pure Theory of Government Finance: A Suggested Approach," Journal of Political Economy, Vol. LVII, No. 6, December 1949, pp. 496-505.

17. Breton, "A Theory of the Demand for Public Goods," op. cit., pp. 465-66.

18. Davis and Haines, op. cit.

19. Their independent variables were: population density, the per cent of the electorate which own property, the market value of personal property, the market value of industrial property, and the median family income. The dependent variables were per capita expenditures for selected functions. Ibid.

they assumed that successful politicians must react at least implicitly to the values of these variables in their efforts to make those decisions which would result in their being supported by a majority of the voters.

Although they only claimed that the study uncovered some of the underlying political influences behind expenditure decisions, they felt, "in general, granted the crude approximations that had to be used for some variables, the results were favorable."[20]

In another study, Davis examined the political influences upon school expenditures for six counties in western Pennsylvania.[21] Again, he found that the interest group variables[22] were of the correct sign and significantly different from zero, so that the results "tended to support the Down-Buchanan-Tullock notions that 'political' forces are the determinants of public expenditures."[23]

An implicit feature of this political approach to governmental expenditures is that individuals have differing demands for public goods and that they are able to make these demands known via the election of

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20. Ibid., p. 274.

21. Otto A. Davis, "Empirical Evidence of Political Influences Upon the Expenditure Policies of Public Schools," in Julius Margolis, ed., The Public Economy of Urban Communities, Washington: Resources for the Future, Inc., 1965, pp. 92-111.

22. The percentage of voters owning property, the percentage of the population presently attending public schools, the percentage of the population presently attending non-public schools, and the percentage of the adult population with college training. Ibid.

23. Ibid., p. 111.

public officials.[24] Therefore, assuming a similarity of political access and alternatives in different communities, it may be postulated that the varying provision of public goods and services by state and

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24. For an exploration of the ways and means to get a more valid and clear-cut expression of voter preferences for government services, see Howard R. Bowen, Toward Social Economy, New York: Rinehart & Company, Inc., 1948. In Chapter 18 (pp. 172-198), Bowen explores both voting and polling techniques for ascertaining those individual tastes and preferences which cannot find expression in, or be measured by, the market mechanism. See also, Howard R. Bowen, "The Interpretation of Voting in the Allocation of Economic Resources," Quarterly Journal of Economics, Vol. LVIII, No. 1, November 1943, pp. 27-43. For an empirical study of voting behavior, see James Q. Wilson and Edward C. Banfield, "Voting Behavior on Municipal Public Expenditures: A Study in Rationality and Self-Interest," in Julius Margolis, ed., The Public Economy of Urban Communities, Washington: Resources for the Future, Inc., 1965, pp. 74-91. The authors conducted a study of thirty-five expenditure proposals from twenty separate elections in Cleveland, Chicago, Detroit, Kansas City, Los Angeles, Miami, and St. Louis. Regarding the low-income wards (median family income below $3,000), they found: "in the heavily non-homeowning districts the voters almost invariably support all expenditure proposals . . . . The strength of voter support is about the same regardless of the character of the proposed expenditure." (p. 75). Furthermore, they found "non-homeowners show more taste for public expenditures that are to be financed from property taxes than do homeowners." (p. 76). Finally, they found "the higher the income of a ward or town, the more taste it has for public expenditures of various kinds. That the ratio of benefits to costs declines as income goes up seems to make no difference." (p. 78). See also, William C. Birdsall, "A Study of the Demand for Public Goods," in Richard A. Musgrave, ed., Essays in Fiscal Federalism, Washington: The Brookings Institution, 1954, pp. 235-294. Birdsall conducted a study of the per cent yes vote on public finance referenda in New York State, for fifty-five cities, 1955-1961. He concluded: "The characteristics of cities (fifty-two independent variables) explain between 50 and 85 per cent of the variance of per cent Yes Vote for most of the referenda. Several general, consistent determinants have been found. Per cent Yes Vote on all referenda is negatively related to the per cent of the labor force which works in industry, an effect which may be related to the sociological concept of political alienation. Per cent Yes Vote on state referenda is negatively related to local expenditures on education, which can be explained as a substitution effect. It is positively related to a wealth variable, namely, equalized full valuation of taxable property per person, and to the per cent of occupied dwelling units with 1.01 or more persons per room." (pp. 292-293). For the complete study, see William C. Birdsall, "Public Finance Allocation Decisions and the Preferences of Citizens: Some Theoretical and Empirical Considerations," unpublished Ph.D. dissertation, Johns Hopkins University, 1963.

local governments tends to reflect the community preference patterns for public goods in general, and specific public goods in particular.

As a final point, it should be noted that the assumption that social preferences are revealed through the process of majority voting involves some oversimplification. As Kenneth Arrow has shown,[25] it is often impossible to make community or social decisions consistent with individual preferences when a majority voting technique is used to select between three or more alternatives. Arrow's "Impossibility Theorem" results from the inability of majority voting among several alternatives to meet the conditions required if collective decisions are to be rational in revealing the true individual preferences which constitute the effective social welfare function. These conditions have been summarized by Bernard P. Herber as:

1) Social choices must be transitive (consistent), that is, if Choice X is preferred to Choice Y, and if Choice Y is preferred to Choice Z, then Choice Z cannot be preferred to Choice X in the social welfare function. A unique social ordering must exist regardless of the manner in which individuals in the community order their alternative choices.

2) The Social welfare function must be nonperverse in the sense that an alternative which would have been chosen otherwise by the community must not be rejected because some individuals have changed the relative rankings of the other alternatives.

3) The rankings of the choices in the social welfare function between two alternatives must not be dependent on the ranking by individuals of other alternatives which are irrelevant to the choice between the two alternatives.

4) Social choices must not be dictatorial, that is, they must not be based solely on the preferences of one individual imposed either from within or without the community.

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25. Kenneth Arrow, Social Choice and Individual Values, New York: John Wiley & Sons, Inc., 1951.

> The individuals of the community must be able to vote freely among all alternatives.[26]

Although there are serious theoretical reservations involved in the use of majority voting to reflect the true preferences of voters, Richard A. Musgrave concludes:

> Decision making by majority vote somehow leads to reasonably satisfactory results. While it is difficult in many cases to arrange matters of budget choice in a single dimension, the problem of choice is facilitated where a fair degree of similarity exists between the preference patterns of voters. . . . If majority rule does not provide a wholly efficient solution, it remains to be seen what sort of an approximation it provides. The result of majority voting is optimal in the sense that it is the solution agreed to by more people than any other.[27]

An Economic Analysis of the Demand for Local Public Goods

To develop an economic analysis of the demand for local public goods, the political approach to expenditure decision-making is combined with traditional indifference curve analysis (with some modifications). The advantage of such an approach is two-fold: it permits an explicit introduction of the political influences into the analysis, and it avoids the question of interpersonal utility comparisons. It is assumed that the elected representatives have the authority to make judgments regarding the social welfare of different individuals.

The major modification of the indifference curve analysis itself,

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26. Herber, op. cit., pp. 66-67. For a detailed discussion of Arrow's conditions, see Jerome Rothenberg, The Measurement of Social Welfare, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961, pp. 17-58. See also, William S. Vickrey, Microstatics, New York: Harcourt, Brace & World, Inc., 1964, pp. 268-282.

27. Musgrave, op. cit., pp. 125-127.

is that the indifference curves are regarded as belonging to the legislative bodies of the respective governmental units. This is done in order to recognize the fact that it is the legislative body which must make the ultimate decisions regarding the provision of public goods, and that some decision must be made.

Another feature of the analysis is that while the diagrams show only the legislative indifference between two alternatives (public goods versus private goods), there is a third factor which must be considered, namely, the taxation necessary to provide the public goods. Therefore, the indifference curves represent not only the utility of having the different goods, but also the disutility of levying the taxes necessary to pay for the public goods.[28]

Finally, the analysis expands the traditional concept of the "budget line"[29] somewhat. For the purposes of the initial analysis, the budget line refers to the total income of the community,[30] which may be used to purchase private and/or public goods.[31] This technique is

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28. A similar approach is used by A. D. Scott, "The Evaluation of Federal Grants," Economica, n.s., Vol. XIX, No. 76, November 1952, pp. 377-394.

29. In consumer demand theory, the "budget line" or the "line of attainable combinations" refers to the consumer's known and fixed money income for the period under consideration, which may be allocated between two different commodities in accordance with their respective prices. See Charles E. Ferguson, Microeconomic Theory, Homewood, Illinois, Richard D. Irwin, Inc., 1966, pp. 26-31.

30. In the analysis that follows, "community" is used to refer to any lower-level governmental unit. It could be either a state or a local government.

31. At a later stage of the analysis, when the allocation decisions made by the legislature between different public goods are considered, the budget line shall refer to the actual governmental budget available for expenditure on public goods.

adopted so as to permit a consideration of the allocation of resources between the public and the private sectors of the economy and to emphasize the fact that it is a community's income that must ultimately provide the revenues for its governmental units.

Assumptions

The assumptions upon which the following analysis is based are:

1) Individuals are able to evaluate the benefits they receive from public goods along with the benefits they receive from private goods.

2) Politicians are motivated by the desire to attain and remain in office. Therefore, they must both promise and actually make decisions which result in a "mix" of expenditures and taxation which will appeal to a dominant coalition of voters.

3) Individuals act in their own self-interest in voting for the available candidates. More specifically, they desire those expenditures and taxes which will maximize their utility, and they favor that candidate whom they anticipate will make those decisions most resembling the ones they consider to be optimal.

4) Only one private and one public good exist. They are produced at constant returns to scale, require the same ratios of factor inputs, and are purchased under conditions of pure competition.

5) Both the private and public goods are supplied at "prices" which reflect their real resource costs to society.

Analysis

Given these assumptions, it is possible to examine the equilibrium properties of the economic system they describe. Consider Figure

1, where the vertical axis measures the amount of private good, P, available to the community, and the horizontal axis measures the amount of public good, S, available. The indifference curve of the legislature is represented by I_1I_1.[32] The total income of the community available for consumption of private and public goods is given by YY.

At the point of tangency, W_1, between the indifference curve, I_1I_1, and the budget line, YY, the legislature expresses its preferences (and presumably the preferences of its citizens) between public good S and private good P. Amount OA of good S is available to the citizens of the community and amount OB of good P is available.

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32. It should be emphasized that the assumption of transitivity of choice is required to obtain a convex indifference curve. The transitivity assumption merely requires that if an individual consumer prefers Choice A to Choice B, and prefers Choice B to Choice C, then he also prefers Choice A to Choice C. However, when the indifference curve is attributed to a group of people, such as a legislature, the transitivity assumption cannot be met. The use of a convex "legislative indifference curve" is therefore somewhat questionable. However, with regard to the use of such indifference curves, A. D. Scott maintains: "(the idea of legislative indifference curves) is acceptable if we believe the legislature does satisfactorily reflect community opinions." (Scott, op. cit., p. 382).

A possible solution to the problem may be to regard the legislative indifference curve as a "social indifference curve." Consequently, "the true ordering of social preferences becomes a reality only when the state of ex ante distribution is established, causing one social indifference curve to become the effective demand of the society for private and public goods. Importantly, it is the voting power of income and wealth distribution which determines effective demand in the market sector, and political voting power which determines the effective demand for public goods. The actual resource allocation which follows from this effective demand for public and private goods leads to the ultimate state of real income and consumption distribution, in a welfare or living standard sense, among the consumers of the society . . . . Thus, ex ante distribution determines the relevant social indifference curve which becomes tangent to the utility frontier with the resulting actual allocation of economic output between public and private goods and ex post distribution of these goods among the consumers of the society." (Herber, op. cit., p. 63).

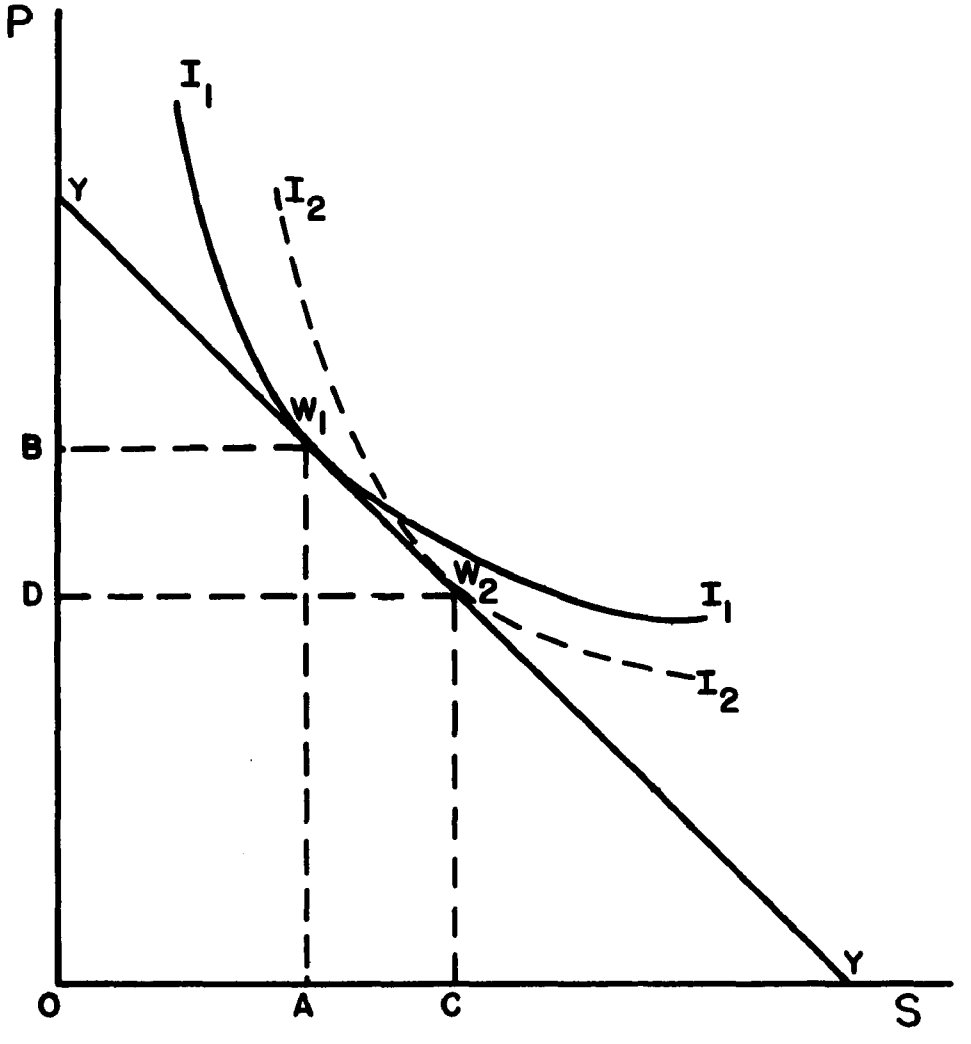

FIGURE 1

LEGISLATIVE INDIFFERENCE CURVE BETWEEN
PUBLIC AND PRIVATE GOODS

Figure 1 may also be used to illustrate how a different community, with the same per capita income, but different demands for public goods, would allocate its resources between the public and private sectors. Let I_2I_2 represent the legislative indifference curve between public and private goods in Community 2. Given the same income, YY, the point of tangency would be W_2, so that amount OC of public good S and the amount OD of private good P were provided. The consumer-voters of Community 2 would thereby express a greater demand for public good S, relative to private good P, than would the citizens of Community 1. In addition, because the two communities have the same income level, the legislature of Community 2 would have to levy a heavier tax burden upon its citizens than would the legislature of Community 1. It should be noted that this difference between the two communities is due basically to the fact that their preference patterns between public and private goods are different.

A more detailed understanding of a community's preference pattern for public goods may be obtained via an analysis of the legislative reaction to a change in the community's income and a change in the price of S.

Consider first an increase in the community's income as shown in Figure 2a. The budget line, YY, is shifted up to Y'Y', thereby permitting the community to consumer more of both private good P and public good S. The point of tangency, W', indicates that amount OC of good S will now be available and amount OD of good P will be consumed. In this case, the legislature views both the private and public goods as "normal," that is, the consumption of each rises with the increase in income so

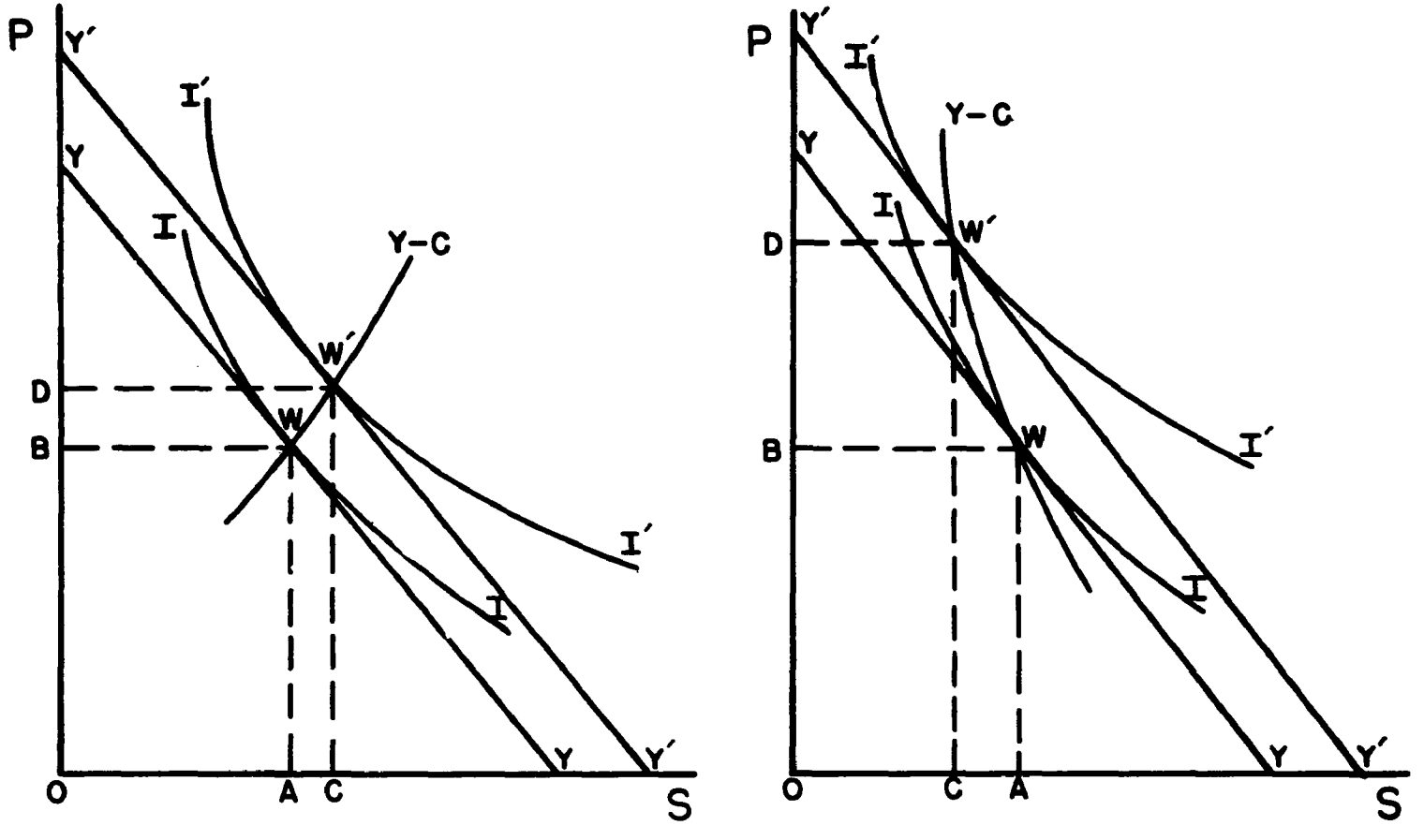

FIGURE 2

THE EFFECT OF A CHANGE IN INCOME UPON THE CONSUMPTION OF PUBLIC AND PRIVATE GOODS

that the income effect is positive.[33]

If, on the other hand, the increase in income should lead to a decrease in the consumption of public good S, it would be viewed as an "inferior" good by the community. For an example of such a case, see Figure 2b. Again, the increase in income shifts the budget line, YY, to Y'Y', but the new point of tangency, W', is such that the amount of S consumed declines from OA to OC.

Should the price of public good S change, it would be possible to determine whether the community's price elasticity of demand was unitary, elastic, or inelastic. Consider Figure 3, which illustrates the three possible cases of a decline in the price of S. In Figure 3a, the decline in price brings about an increase in the amount of S consumed by the community from OA to OC. In this case, the proportionate decrease in price is exactly offset by the proportionate increase in the quantity consumed. Consequently, demand has unitary price elasticity over this range, and the price-consumption line (P-C) is horizontal.

In Figure 3b, a decrease in the price of S is accompanied by an increase in the amount consumed from OA to OC. The proportionate decrease in the price of S is more than offset by the proportionate increase in the amount consumed. Demand is therefore price elastic, and the price-consumption line is negatively sloped.

In Figure 3c, a decrease in the price of S is again accompanied

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33. See Ferguson, op. cit., pp. 46-48.

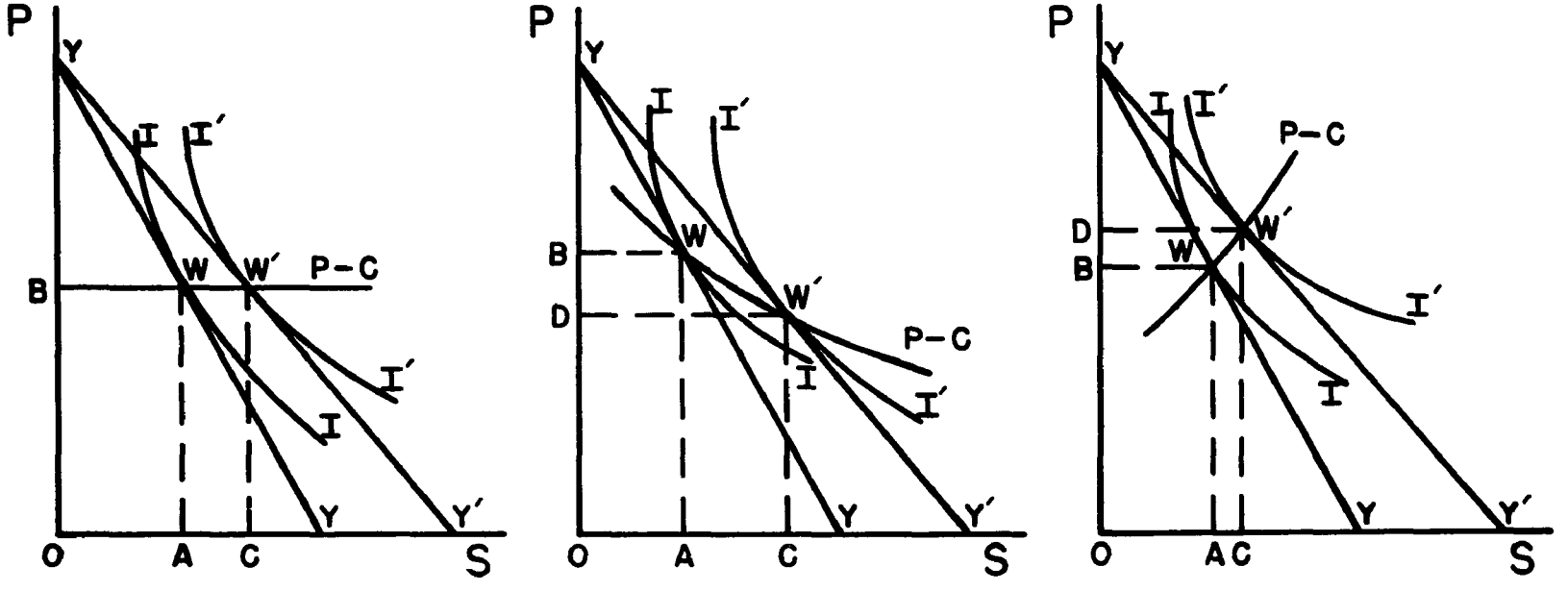

FIGURE 3

THE EFFECT OF A CHANGE IN THE PRICE OF S UPON THE CONSUMPTION OF PUBLIC AND PRIVATE GOODS IN RELATION TO THE ELASTICITY OF DEMAND FOR S

by an increase in the quantity consumed, from OA to OC. However, in this case, the proportionate decrease in price is associated with a less than proportionate increase in the amount consumed. Demand is therefore price inelastic, and the price-consumption line has a positive slope.[34]

While it is possible to discuss the theoretical implications of the elasticity of demand for public and private goods, it may be useful to consider some of the factors which might influence the intensity of a community's demand for public goods.

First, the availability of relatively good substitutes should tend to make the demand for a particular public good elastic. This would hold especially for those services which could be provided by private enterprise, such as municipal power, refuse collection, and some forms of police protection (for example, merchant security patrols).

Second, the philosophical viewpoints of the individual communities regarding the "proper" functions of government would tend to affect their marginal rates of substitution between private and public goods. For example, Mark Haskell contends, "A state with individualistic notions of the role of government would have a system of indifference curves similar to those of a low-income state. Another state with 'welfare state' orientation would show a high marginal rate of substitution of private for governmental services."[35]

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34. In summary, "demand has unitary price elasticity, is price elastic, or is price inelastic according as the price-consumption curve is horizontal, negatively sloped, or positively sloped." Ibid., p. 41.

35. Haskell, "Federal Grants-in-Aid: Their Influence on State and Local Expenditures," op. cit., p. 587.

Summary

In the analysis above, it has been assumed that the consumer-voter is able to express his preferences for governmental expenditures and taxation via the political process, especially voting. Consequently, the public finance decisions made by the legislative bodies of the lower-level governments are assumed to be a fairly accurate reflection of the preference patterns of the respective communities. Given these assumptions, it is possible to estimate how the lower-level governments could be expected to react to changes in their income and changes in the prices of various public goods in terms of their elasticity of demand for public goods in general, and the relative elasticities of particular functions.

With this analysis of the demand for public goods by state and local governments as a background, a theory of their response to federal grants-in-aid may now be developed.

The Response to Grants: Theoretical Aspects

The basic feature of a federal grant-in-aid payment to a state or local government is that it is a subsidy. Depending upon its type, the grant may be used to augment the budget of the recipient, or to reduce the prices of certain services to it. Therefore, the response of a lower-level government should tend to be a function of both its demand for public goods and the type of grant program offered.

The concern of the present section is with the theoretical aspects of the response to federal grants so as to provide hypotheses for empirical testing. In the analysis that follows, indifference curve

analysis is employed, but with two modifications from the form used in the preceeding section. First, the "budget line" or "line of attainable combinations" refers to the actual budget of the lower-level government which is provided by revenues raised from internal sources. Second, two different public goods, S_1 and S_2, are considered.

Unconditional Grants as Income Subsidies

The simplest type of federal grant program is where the national government provides an unconditional grant to a lower-level government.[36] Since the unconditional grant leaves the recipient free to spend the funds as it sees fit, it amounts to an income subsidy by automatically increasing the size of the recipient's budget.

The income effect of an unconditional grant is illustrated in Figure 4. The grant serves to increase the community's public budget, BB, to B'B', thereby permitting it to purchase more of both public good S_1 and public good S_2 with the same outlay from its own sources, assuming that both S_1 and S_2 are viewed as "normal" goods. The amount of S_1 consumed by the community increases from OE to OG, and that of S_2 increases from OF to OH. The community under consideration is therefore able to reach a higher indifference curve, I'I', due to the increased consumption of S_1 and S_2.

The effect of the unconditional grant upon the community's consumption of private goods and services will largely depend on whether

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36. This type of grant is not currently used in the United States by the federal government. However, there are currently several bills before Congress proposing unconditional grants to state and/or local governments. See below, Chapter VI, for a discussion of one of these proposals.

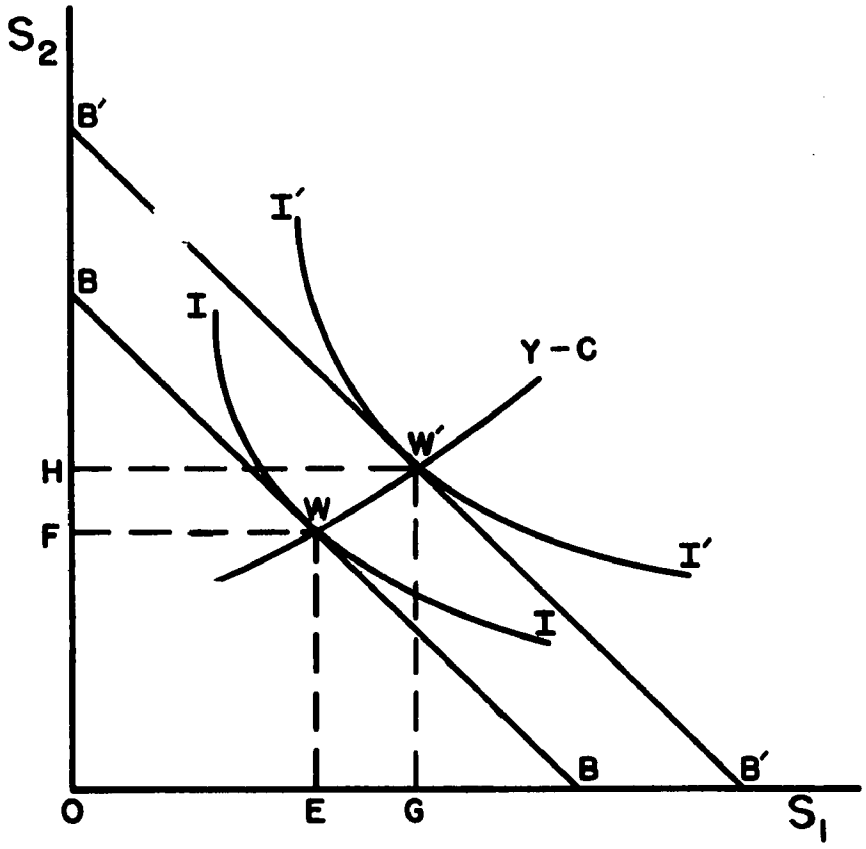

FIGURE 4

THE INCOME EFFECT OF AN UNCONDITIONAL GRANT

the grant is financed via existing federal taxes or new ones. If existing taxes are used to finance the grant, the community's federal tax bill would not be increased, and consequently there would be no decrease in the consumption of private goods and services. However, if new federal taxes are levied to finance the unconditional grant, the community's consumption of private goods would be decreased. The unconditional grant would therefore force a substitution of public for private goods in the community.

Assuming that present federal taxes are used to finance the grant, the community's increased consumption of public goods would not be at the expense of private goods and services. The community's allocation of the unconditional grant between S_1 and S_2 would tend to be a function of the respective income elasticities of demand for the two goods. The service with the highest relative income elasticity would be expected to receive most of the federal funds. In addition, the community would not be expected to increase the size of its own public budget after receiving an unconditional grant. As shown in Figure 4, the community would already be able to consume more of both S_1 and S_2. Any further increase in the budget would require a transfer of resources from the private to the public sector, assuming full employment.

Should the demand for all public goods be income inelastic, the legislature would be expected to view the grant monies as a substitute for its own funds, so that it would respond by reducing the size of its budget from internal sources, thereby keeping the service level about the same. This action would permit the citizens of the community to consume more private goods which would, in effect, be subsidized by

federal taxpayers. The decrease in the community's budget would be even greater if the community considered all public goods to be "inferior."[37]

In summary, a priori considerations indicate that a community will react to an unconditional grant by spending the federal funds on that service with the highest relative degree of income elasticity. Should the demand for all public goods be income inelastic, the community would be expected to react by reducing the size of its own public budget, thus transferring resources from the public to the private sector of its economy. In this case, federal funds are viewed as substitutes for the community's own funds.

Conditional Grants as Price Reductions

The United States presently employs a system of conditional grants-in-aid to state and local governments, which have the effect of reducing the prices of specific governmental services to the lower-level governments. The conditional grants are treated as price reductions rather than income subsidies because they are for pre-defined projects, most of which require that the recipient provide some matching funds.[38] The matching requirements of the conditional grants therefore enable the lower-level governments to purchase more of a federally aided program, with the same outlay from internal sources, than could have been

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37. In a case where public goods are viewed as "inferior," the income effect is negative, so that the unconditional grant would produce an actual decline in the total amount of public goods consumed.

38. See Table 3 for the matching requirements of the larger federal aid programs.

purchased before introduction of the grant.

The most common form of conditional grant-in-aid is known as a closed end--constant matching grant. Here Congress appropriates a fixed sum of money which is apportioned among the states according to some specific formula. For any individual state, the federal government will match expenditures on approved projects at a pre-determined ratio up to the state's maximum allocation. Such a grant is illustrated in Figure 5, with the total expenditures for the function depicted on the horizontal axis and the state and federal shares on the vertical axis. In this case, the federal government matches the state's funds on a 50-50 basis up to the maximum allotment, OA. Beyond OA, all expenditures for the function must be assumed by the state.[39]

The second type of grant currently used in the United States is the open end--variable matching grant applied under the public assistance provisions of the Social Security Act.[40] For example, as shown in

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39. For a description of the types of grants used in other federal countries, see Scott, "The Evaluation of Federal Grants," op. cit., and Mark A. Haskell, "The Influence of Federal Grants on State and Local Expenditures," unpublished Ph. D. dissertation, Rutgers--The State University, 1962, pp. 90-94.

40. Under the present (1965) provisions of the Social Security Act for old-age assistance, federal funds equal twenty-nine thirty-fifths of the first $35 of a maximum average monthly payment of $70 per recipient plus a proportion (the federal percentage) of the next $35 of such average payment, which varies according to the average per capita income in the state for the most recent three years, except that the federal percentage in any state shall not be less than 50 per cent nor more than 65 per cent of the total payment. For a fuller description of these provisions, see U.S. Department of Health, Education, and Welfare, Grant-in-Aid and Other Financial Assistance Programs Administered by the U.S. Department of Health, Education, and Welfare, Washington: U.S. Government Printing Office, 1965, pp. 313-317.

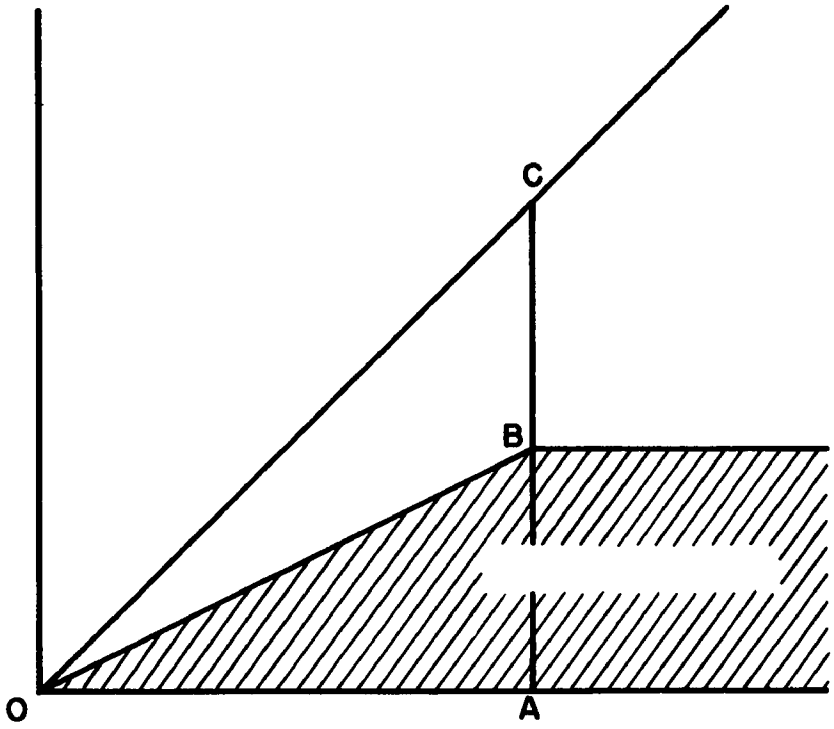

FIGURE 5

CLOSED END--CONSTANT MATCHING GRANT

Figure 6, the federal government pays about four-fifths of the total expenditures per month to any individual qualifying under the plan up to OA. Between OA and OD per recipient, the federal government matches state expenditures on a 50-50 basis. Beyond OD, the federal share ceases, any additional expenditures being made entirely from state funds. This type of grant is called "open-ended" because there is no maximum federal commitment on expenditures to any particular states. But from the point of view of the states, it is a "closed-end" grant since at a certain level of expenditure (OD per recipient), the federal contribution ceases, with the state assuming full responsibility for any additional expenditures.

The Response to a Closed End--Constant Matching Grant

The response of a lower-level government to a closed end--constant matching grant is illustrated in Figures 7 and 8. Indifference curve analysis is again employed, with the grant being made to support public good S_1, while public good S_2 receives no federal aid and must be financed entirely by the community.

Assume first that the community's demand for S_1 is price elastic (Figure 7). BB is the budget line of the community before the introduction of the conditional grant. The point of tangency is W, so that amount OE of S_1 and amount OF of S_2 is consumed by the community. With the introduction of a 50-50 matching grant for S_1, the budget line is shifted to BbB'.[41] The shift in the budget line enables the community

41. The kink at b reflects the closed end nature of the grant where the community's expenditure for S_1 will be matched only up to amount OL. Beyond OL of S_1, the community must bear the entire cost of the good so that the budget line reverts back to slope of the original budget line, BB.

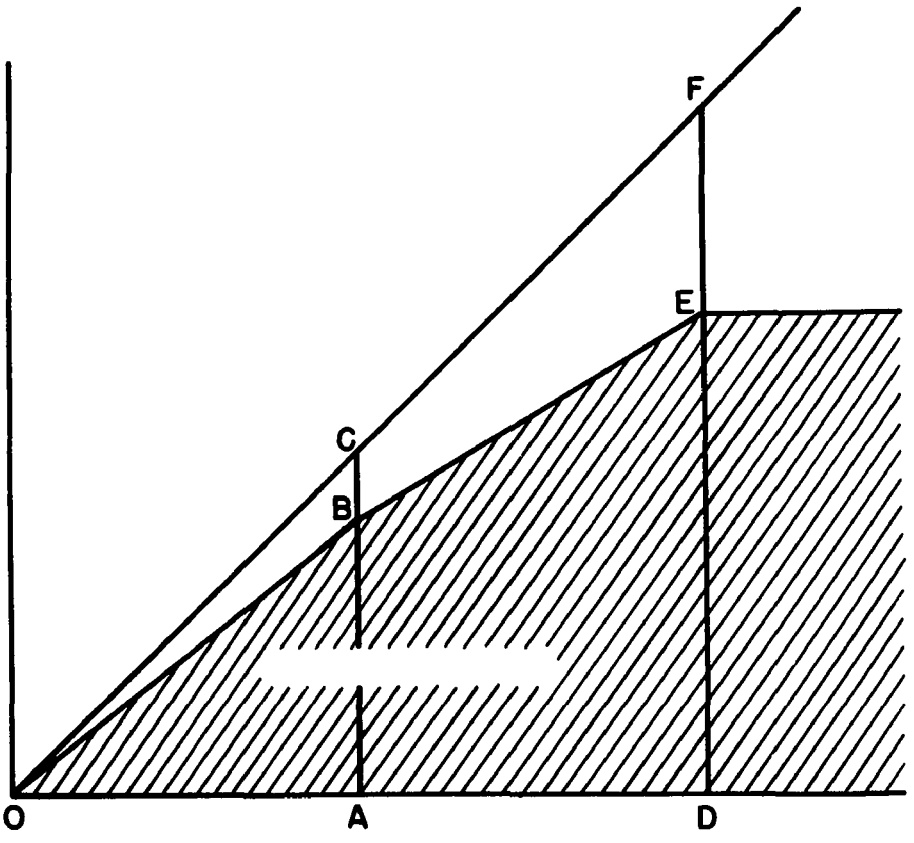

FIGURE 6

OPEN END--VARIABLE MATCHING GRANT

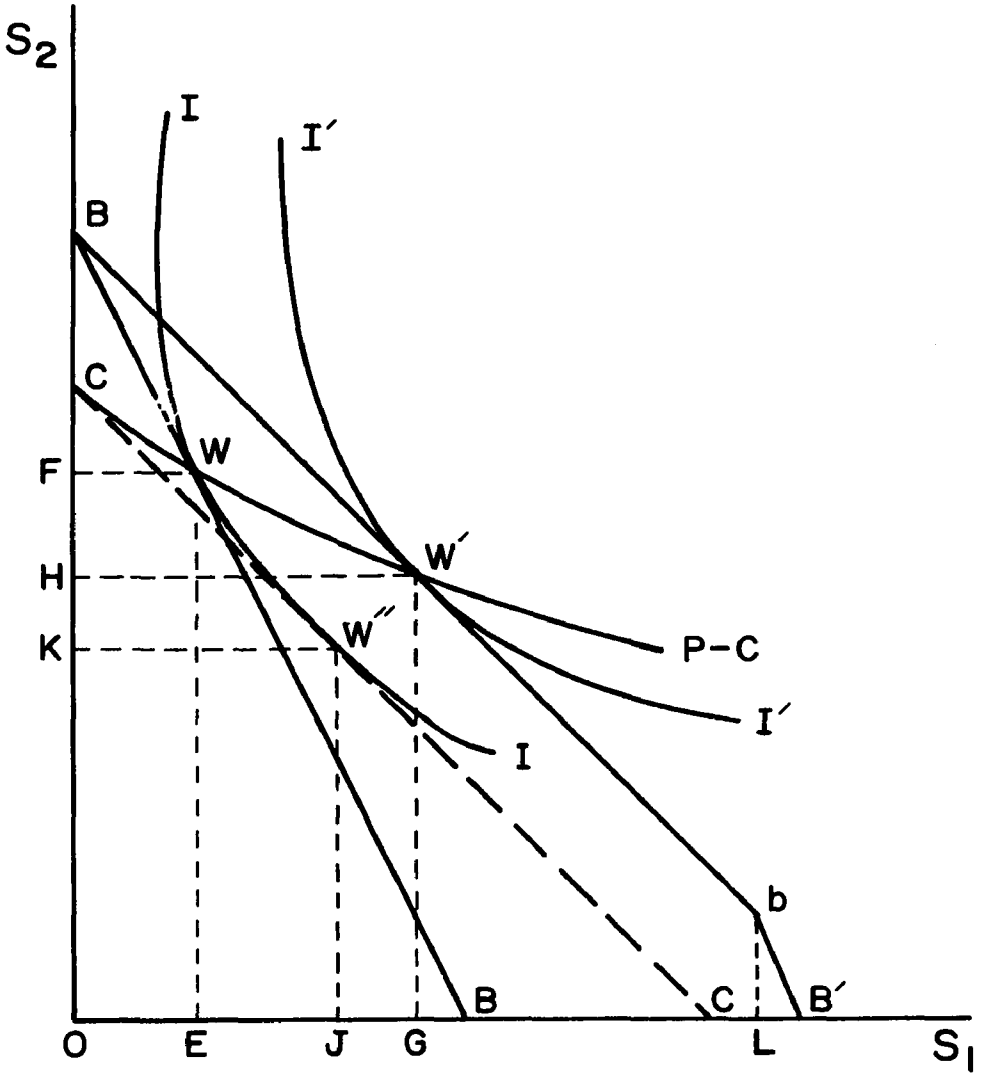

FIGURE 7

THE INCOME AND SUBSTITUTION EFFECTS OF A CLOSED END--CONSTANT MATCHING GRANT: PRICE ELASTIC DEMAND FOR S_1

to reach a higher indifference curve, I'I', a new point of tangency, W'. As a result of the grant, the amount of S_1 consumed increases to OG, and the amount of S_2 consumed decreases to OH. In this case, the conditional grant has the overall effect of inducing the legislature to "distort" its budget in the traditional sense of the term (that is, to decrease its consumption of the unaided service, S_2, and to increase its consumption of the aided service, S_1). It is essential to point out, however, that this so-called "distortion" is a reflection of the price elastic demand for the subsidized service, S_1.

It should also be emphasized that the movement from W to W' is the sum total of the "substitution effect" and the "income effect" of the change in the price of S_1 to the community as a result of the 50-50 matching grant. The substitution effect is represented by the movement from W to W" on indifference curve II and describes the reallocation that takes place between consumption of S_1 and S_2 if the price change is compensated by a simultaneous income change forcing the community to remain on the same indifference curve. As a result of the substitution effect, the amount of S_1 consumed increases from OE to OJ, while the amount of S_2 consumed decreases from OF to OK.

The income effect is represented by the movement from W" to W' and reflects the fact that the lower price of S_1 enables the community to reach a higher indifference curve, I'I', by consuming more of both S_1 and S_2 with the same outlay from its own sources. Therefore, the income effect permits the community to increase its consumption of S_1 from OJ to OG and to increase its consumption of S_2 from OK to OH.

In the final analysis, when the demand for the subsidized

service, S_1, is price elastic, the substitution effect is dominant, and results in budget "distortion" as the community's consumption of S_2 decreases and that of S_1 increases following the introduction of a conditional grant for S_1.

It would be impossible for the alleged budget "distortion" to take place if the demand for S_1 is price inelastic. In Figure 8, the budget line, BB, again represents the pre-grant situation. BbB' is the budget line after the introduction of a 50-50 matching grant. The new point of tangency is W', so that amount OG of public good S_1 is consumed, and amount OH of S_2 is consumed. Due to the fact that the demand for S_1 is price inelastic (the price-consumption line is positively sloped), the amount consumed of the unsubsidized service, S_2, increases from OF to OH even though there is a simultaneous increase in the amount of S_1 consumed (from OE to OG). Therefore, when the demand for the subsidized service is price inelastic, there is no substitution of one service for another within the community's budget, that is, "distortion." In fact, the conditional grant for S_1 releases funds for additional consumption of the unsubsidized service via the dominance of the income effect.

The substitution effect in this case is represented by the movement along indifference curve II from W to W" where the amount of S_2 consumed drops from OF to OK while the amount of S_1 consumed increases from OE to OJ. The income effect is represented by the movement from W" to W' as consumption of S_2 rises from OK to OH and consumption of S_1 increases from OJ to OG.

The effect of a conditional grant-in-aid upon the budget of a

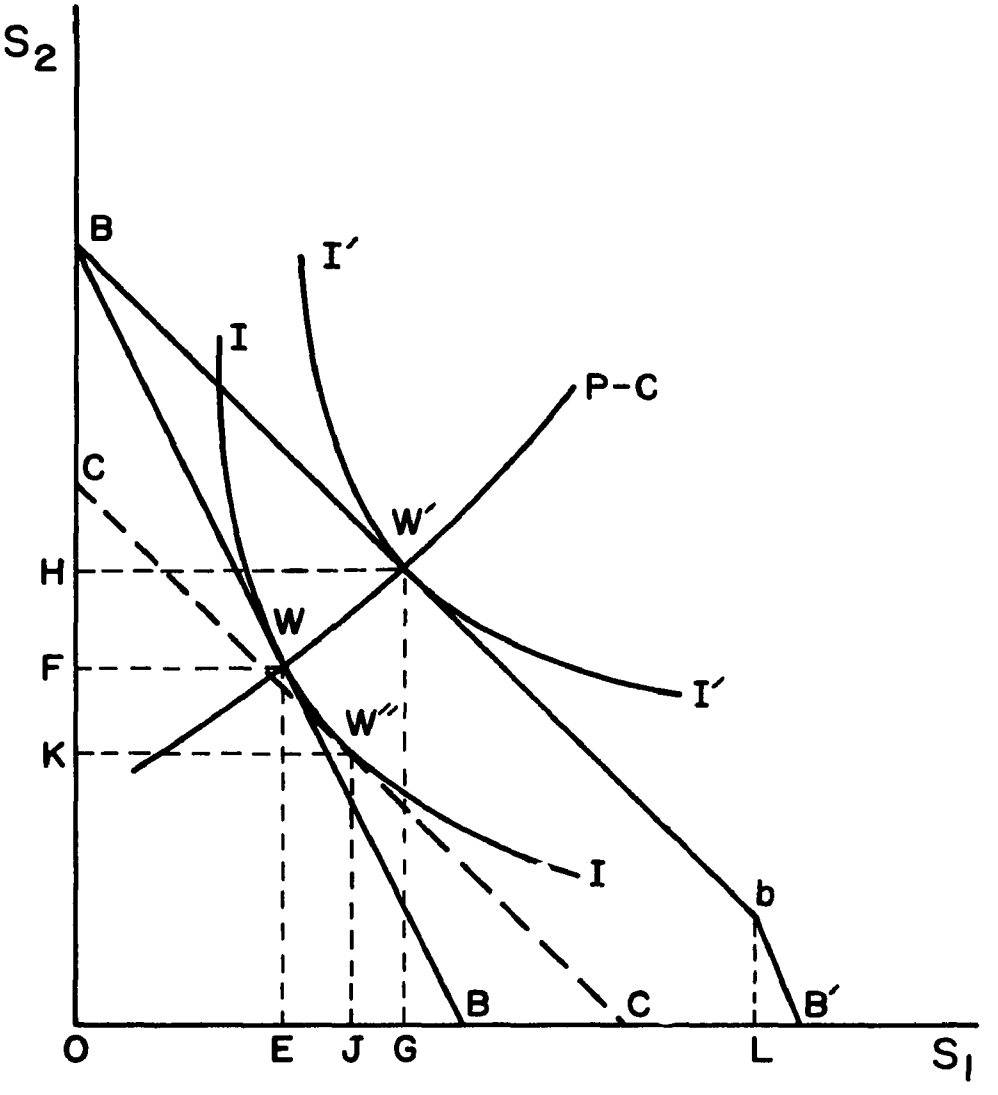

FIGURE 8

THE INCOME AND SUBSTITUTION EFFECTS OF A CLOSED END--CONSTANT MATCHING GRANT: PRICE INELASTIC DEMAND FOR S_1

lower-level government is therefore a function of the price elasticity of demand for the subsidized service. When the demand for the aided activity is price elastic, the substitution effect is relatively strong and the result is a substitution of the subsidized activity for the unsubsidized activity in the community's budget, or "distortion." However, when the demand for the aided activity is price inelastic, the income effect is dominant, so that the community increases its consumption of both S_1 and S_2.

At this point it should be noted that the preceeding analysis was based upon the assumption that the budget of the lower-level government in question was fixed. That is, the community did not alter its allocation of resources between public and private goods as a result of the introduction of the conditional grant. If this assumption is relaxed to allow for a variable budget, the elasticity of demand for all public goods, relative to private goods, must be considered in addition to the elasticity of demand for the subsidized service. Should the demand for S (all public goods) be price elastic, the conditional grant might induce the legislature to increase its fiscal effort and the size of its budget. The increase in the community's public budget would involve a substitution of public for private goods and services. In such a case, the extent of budget "distortion" would not be clear, as it would be a function of the budget increase and the relative price elasticities of demand between the aided and non-aided services.

On the other hand, should the demand for all public goods be price inelastic, the grant would tend to have the effect of inducing the legislature to decrease its budget, thereby substituting federal funds

for local funds. Again, some budget "distortion" may take place, depending upon the relative price elasticities of demand. However, the budget decrease would mean that federal taxpayers were subsidizing the consumption of private goods and services in the community under consideration.

As noted in the preceeding chapter,[42] many have contended that the low-income states are most likely to "distort" their budgets, since they have limited tax capacities, while the high-income states may be expected to increase their tax effort as a means of providing the necessary matching funds so that no "distortion" or budget transfers take place. For example, Mark Haskell contends, "Where stimulation does take place, state and local contributions are probably most often financed by increasing the public budget, i.e., by increasing tax effort. If distortion is to take place, it will most likely occur in the case of low income states."[43]

In contrast to Haskell's position, the analysis presented above indicates that the differential response to grants is due more to the relative price elasticities of demand for the subsidized and unsubsidized services in a community's budget, and the relative price elasticity of demand between public and private goods, than the community's income level alone. First, no "distortion" would take place if the demand for the aided activity is price inelastic. Second, the budget of either a high- or a low-income community would be increased if the

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42. See pp. 16-22.

43. Haskell, "The Influence of Federal Grants on State and Local Expenditures," op. cit., p. 198.

demand for public goods was price elastic relative to private goods and services. Therefore, a low-income community may not increase its public budget because private goods are preferred over public goods. On the other hand, another low-income community which values the goods differently, may respond by increasing its tax effort. In the end, budget "distortion" would not occur because a community has low income, but because it values private goods more than public goods and its demand for the aided activity is price elastic.

To summarize, a conditional grant-in-aid would be expected to "distort" the budget of a lower-level government only when the budget is fixed and when the demand for the aided services is price elastic. If the demand is price inelastic, and the budget still fixed, the grant would have the effect of releasing funds for expenditure on the non-aided activities. Assuming a variable budget, the expected response would be an increase in the public budget if the demand for all public goods is price elastic relative to private goods, but a reduction in the budget if the demand for public goods is price inelastic relative to private goods and services.

The Response to an Open End--Variable Matching Grant

The response to an open end--variable matching grant would be essentially the same as that to the closed end--constant matching grant, with the major consideration being the relative price elasticities of demand for the aided and non-aided services. The most noticeable difference would be on the budget lines themselves, as shown in Figure 9. The pre-grant situation would produce an equilibrium at W, with OE of S_1

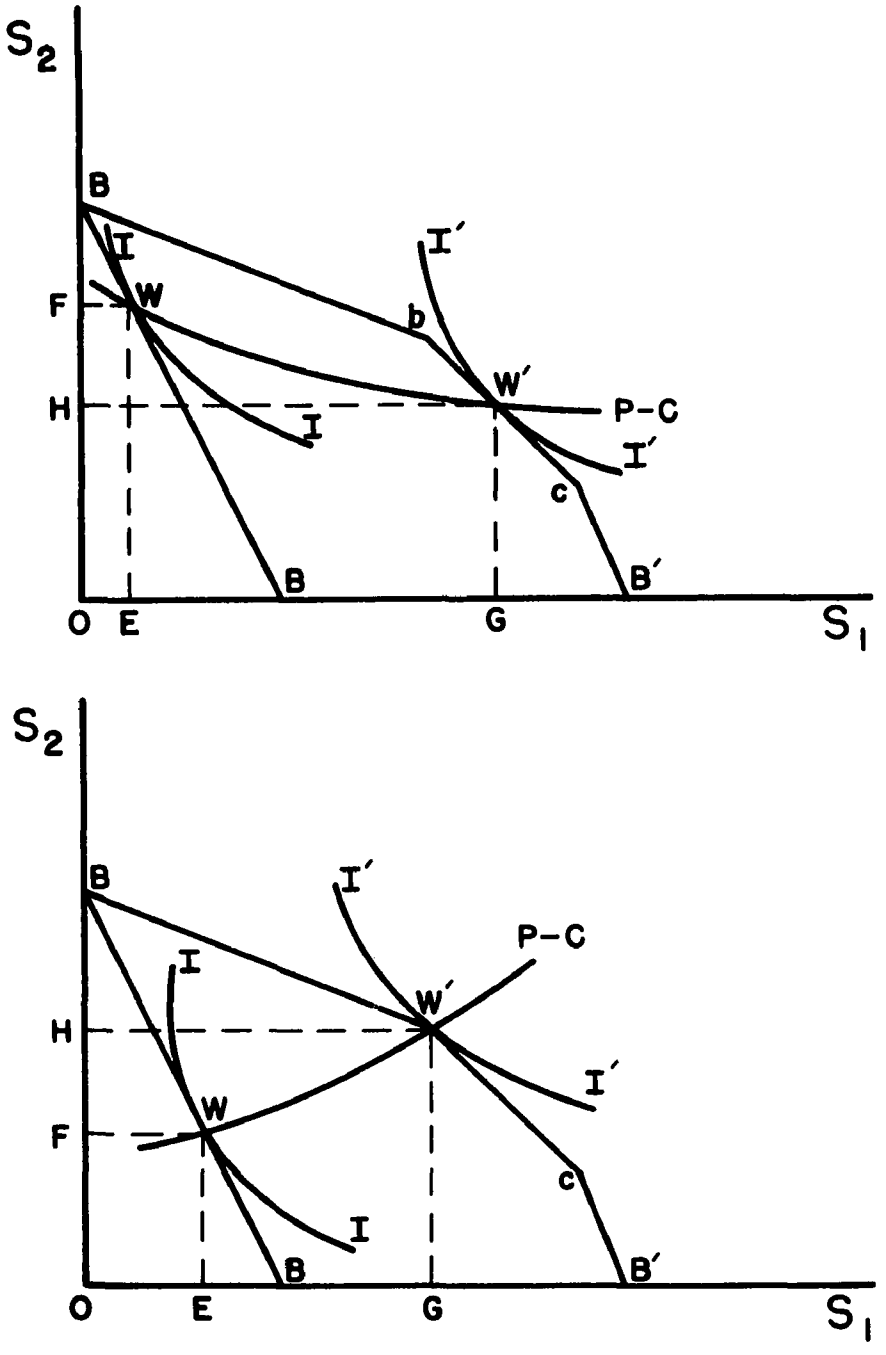

FIGURE 9

THE TOTAL EFFECT OF AN OPEN END--VARIABLE MATCHING GRANT

consumed and OF of S_2 consumed. The variable matching requirements of the grant would serve to change the slope of the budget line to BbcB'. The first segment, Bb, represents the 4:1 matching provisions. The matching requirements are 1:1, in segment bc of the budget line, with no federal matching in segment cB'.

As shown in Figure 9a, a price elastic demand for the subsidized service, S_1, with a fixed budget, would lead to budget "distortion" in the same manner as the closed end--constant matching grant. The community would respond to the variable matching grant by increasing its consumption of S_1 from OE to OG, while decreasing its consumption of the unaided service, S_2, from OF to OH.

Should the demand for S_1 be price inelastic (Figure 9b), the community would respond to the grant by increasing its consumption of S_1 somewhat (from OE to OG), but it would also increase its consumption of the unaided service, S_2, (from OF to OH). The grant would therefore, release local funds for expenditure in the non-aided areas.

The Case of Unequal Matching Grants

Another area which has received a good deal of attention in the "distortion thesis" argument regards the effect of two grant programs with unequal matching provisions. As Selma Mushkin has pointed out,[44] a priori considerations have led many to believe that if a community has the option of two grant programs, one with matching ratios of 9:1 and another with 3:1, the community would be expected to use up its allotment

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44. Mushkin, "Barriers to a System of Federal Grants-in-Aid," op. cit., pp. 212-213.

in the first program before spending anything on the second. However, she contends that governments do not act like individuals and try to take maximum advantage of federal grant offerings, but rather, a community's response to grant offerings will be a function of the preferences of the citizens and its political power structure--in short, the community's preferences for the two services in question.

Miss Mushkin's contention may be supported with reference to Figure 10, where BB represents the budget line before the introduction of any grant programs. Assume for the moment that a 50-50 matching grant is offered for both services S_3 and S_4. The new budget line, B'B', would produce a tangency at W_1, so that amount OI of S_3 is consumed and amount OJ of S_4 is consumed. Now assume that the grant provisions for S_3 are changed to a 2:1 basis, with those for S_4 remaining at 1:1. The result would be a new budget line, CC, reflecting the new relative prices of the services to the community. W_2 is the new point of tangency so that OK of S_3 is consumed and OL of S_4 is purchased by the community. The net effect of these differential matching ratios would be to cause a change in the relative quantities of S_3 and S_4 purchased. The extent of this change would be a direct function of the relative valuation of the two services, that is, the convexity of the indifference curves.[45]

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45. A final point concerns the case where a conditional grant is offered for a service not previously provided by the lower-level governments. Since the program is new, the community would have no previous chance to express the extent of its preference for it and therefore the response to the grant would be somewhat unpredictable, especially if no program was currently offered that might be considered a close substitute for the new activity. In such a case, the acceptance of the grant would probably tend to be a function of its political appeal to the community. However, due to the aggregate nature of the expenditure data used in this study, it is impossible to empirically determine the response of state and local governments where the service is entirely new.

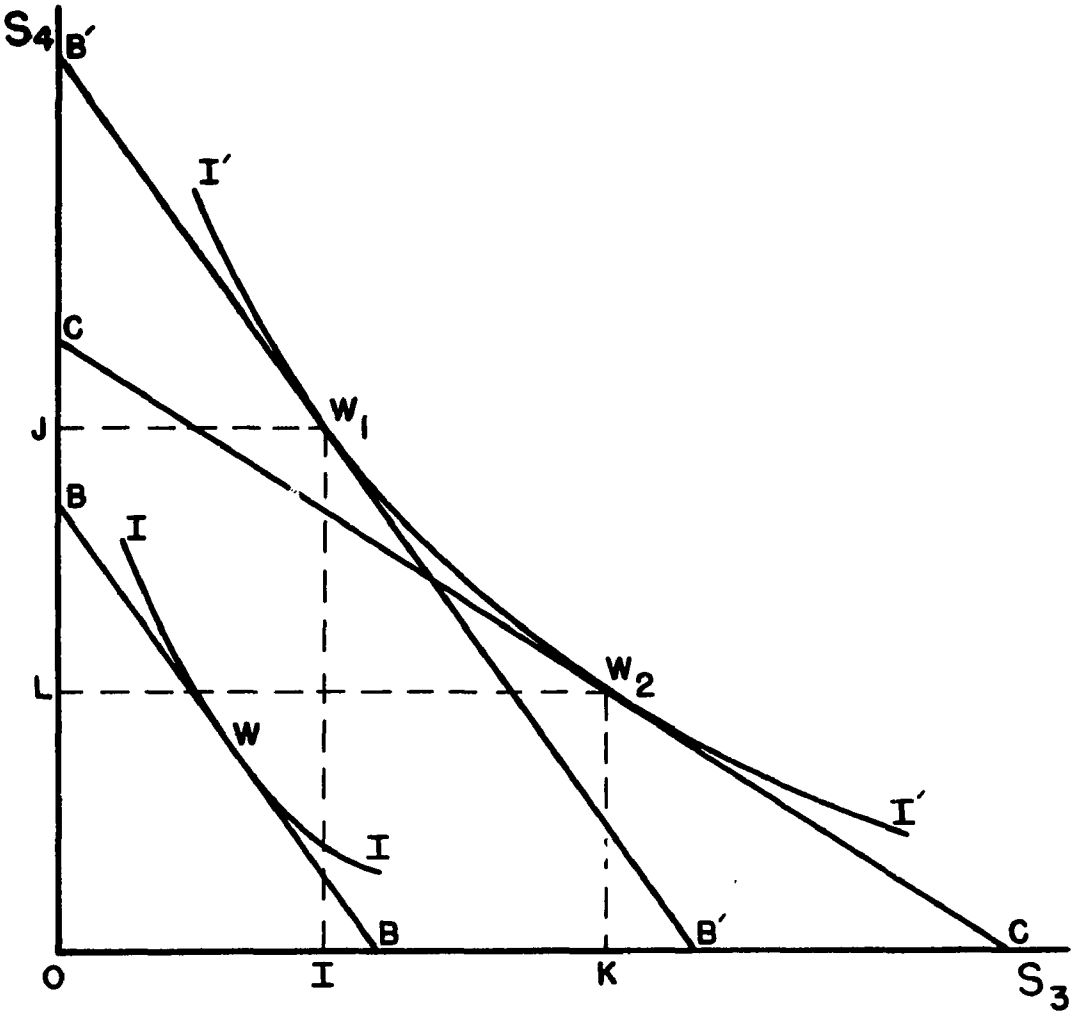

FIGURE 10

UNEQUAL MATCHING GRANTS

Conclusions of the Analysis

In summary, a federal grant-in-aid to a lower-level government acts as a subsidy. If the grant is unconditional, it subsidizes the entire budget of the recipient, enabling it to purchase more of all public goods. In contrast, a conditional grant with matching requirements reduces the price of a specific program to the lower-level government. In either case, it is possible to determine the response, *a priori*, to federal grants in terms of the income and price elasticities of demand for the particular public goods in question and for public goods in general.

With respect to the response to an unconditional grant, the analysis indicates that the allocation of the grant between different public goods would be a function of their respective income elasticities of demand. Therefore, expenditure of the grant monies would tend to be directed to those services with the highest relative income elasticities. The community would not be expected to increase the size of its own public budget after receiving an unconditional grant, as this would require a shift of the community indifference curve from private to public goods. On the other hand, if the community's demand for public goods is income inelastic, it may respond to the unconditional grant by decreasing its own budget. In such a case, the federal funds would be viewed as a substitute for local funds which would result in a transfer of resources from the public to the private sector within the community.

The response of a lower-level government to a conditional grant was shown to be a function of the price elasticity of demand for the subsidized service and whether or not the budget is assumed to be fixed. Under the assumption of a fixed budget, where the demand for the aided

activity is price elastic, the expected response would be a reduction in expenditures on the non-aided activity and an increase in expenditures on the subsidized activity due to the dominance of the substitution over the income effect. The reaction would therefore be budget "distortion." However, "distortion" would not be expected if the demand for the aided service is price inelastic. In fact, the conditional grant, via a strong income effect, would tend to stimulate expenditures on the non-aided activity as the community would realize increased consumption of both aided and non-aided services.

If the budget is assumed to be variable, the response will tend to be a function of the community's relative valuation of public versus private goods. A community with a high relative valuation of public goods could be expected to increase the size of its public budget after the introduction of a conditional grant program as a means of providing the necessary matching funds. In contrast, a community with a low relative valuation of public goods may tend to view the federal funds as a substitute for local funds and respond by reducing its budget. The extent of "distortion" would then depend upon the relative valuation of the various public goods.

Finally, the analysis indicates that the major effect of two conditional grant programs with different matching requirements is to shift the proportions of the two services in the community's budget. The extent of the shift, however, would be a function of the convexity of the indifference curves.

CHAPTER IV

DETERMINANTS OF THE DEMAND FOR PUBLIC GOODS: A REVIEW OF THE LITERATURE AND DEVELOPMENT OF TWO WORKING MODELS OF STATE AND LOCAL SPENDING

Before the response of state and local governments to federal grants can be empirically determined, it is necessary to isolate those factors which may be considered to be the "determinants' of the demand for public goods by state and local governments. The purpose of the present chapter, therefore, is to review the empirical literature concerning state and local expenditures so that the relevant factors for this study may be ascertained. Of special interest will be the role, if any, played by federal aid in determining the demand for public goods by the lower-level governments. In addition, the two working models of state and local spending used in this study will be developed and explained.

Empirical Studies of Government Expenditures

Solomon Fabricant

One of the early studies of state and local government expenditures was made by Solomon Fabricant,[1] in which he sought to identify those factors which would account for the interstate differences in

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1. Solomon Fabricant, The Trend of Government Activity in the United States Since 1900, New York: National Bureau of Economic Research, 1952, Chapter 6.

state and local government activity. In an analysis of the interstate variations in per capita expenditures for 1942, Fabricant found that the three variables of per capita income, the degree of urbanization, and population density accounted for 72 per cent of the variance in per capita total general expenditures for the forty-eight states. Quantitatively, the most important factor as measured by the elasticity coefficient,[2] was per capita income. With urbanization and density held constant, a one per cent increase in income was associated with a 0.90 per cent increase in per capita total general expenditures. On the other hand, assuming income and density constant, a one per cent increase in urbanization led to a 0.11 per cent increase in per capita expenditures, while a one per cent increase in population density was associated with a 0.07 per cent decline in expenditures.[3]

The regression coefficients of the independent variables are presented in Table 4 together with the coefficient of multiple determination (R^2) for the various functional expenditure categories. Fabricant found the explanatory power of the three independent variables to range from a high of 85 per cent of the variance in fire expenditures to a low of 29 per cent in the case of highway expenditures. He noted that the relationships expressed by the equations in the table of regression coefficients

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2. Fabricant described the elasticity coefficient as, "the percentage change in per capita expenditures associated with a one per cent change in the independent variable specified. The change in the independent variable is calculated with its arithmetic mean value as the point of departure, the two other independent variables being held constant at their mean value. Elasticities (are) calculated from (the) change between first and second quartile values of the independent variables, and between their second and third quartile values." Ibid., p. 125.

3. Ibid., p. 123.

TABLE 4

STATISTICAL RELATIONS BETWEEN GOVERNMENT EXPENDITURES PER CAPITA OF THE 48 STATES IN 1942 AND THEIR RESPECTIVE LEVELS OF INCOME PER CAPITA, URBANIZATION, AND DENSITY

Dependent Variable	Regression Coefficient of Independent Variable					
Expenditure per Capita (1942)	Constant Term	Per Capita Income (1938-42)	Urbanization (1940)	Density (1940)	Coefficient of Multiple Correlation	R^2
General Control	.31	.0119 (.0017)	-.0456 (.0216)	-.0010 (.0019)	.77	.59
Public safety						
Police	-1.02	.0042 (.0008)	.0173 (.0097)	.0015 (.0008)	.90	.81
Fire	-.80	.0012 (.0005)	.0284 (.0064)	.0015 (.0006)	.92	.85
Other	-.55	.0020 (.0005)	.0085 (.0068)	.0006 (.0006)	.75	.56
Highways	3.14	.0123 (.0031)	-.0554 (.0402)	-.0070 (.0035)	.54	.29
Schools	5.58	.0240 (.0040)	-.0155 (.0512)	-.0102 (.0045)	.77	.59
Sanitation	-.58	.0008 (.0006)	.0236 (.0078)	.0006 (.0007)	.79	.62

TABLE 4 (continued)

Dependent Variable	Regression Coefficient of Independent Variable					
Expenditure per Capita (1942)	Constant Term	Per Capita Income (1938-42)	Urbanization (1940)	Density (1940)	Coefficient of Multiple Correlation	R^2
Health, hospitals & public welfare						
Health & hospitals	-.89	.0078 (.0013)	-.0002 (.0167)	.0015 (.0015)	.85	.72
Public welfare	-1.99	.0072 (.0045)	.1835 (.0582)	-.0212 (.0051)	.67	.45
Other	.12	.0110 (.0022)	-.0176 (.0284)	-.0048 (.0025)	.68	.46
Total	3.32	.0822 (.0178)	.1271 (.1516)	-.0396 (.0132)	.85	.72

Expenditure is in dollars per capita; income is personal income in dollars per capita; urbanization is percentage of population in cities of 2,500 or more; density is population per square mile. Figures in parentheses are standard errors of the coefficients.

Source: Solomon Fabricant, The Trend of Government Activity in the United States Since 1900, New York: National Bureau of Economic Research, 1952, Table 23, p. 124.

may be read in absolute terms:

> An additional $10 of per capita income, at given levels of urbanization and density, was accompanied in 1942 by about $0.82 of additional state and local government expenditure per capita. Every shift of 1 per cent of the population from rural areas to cities of 2,500 or more was accompanied by additional per capita government expenditures of $0.13. And every addition to population of one person per square mile was accompanied by a fall in per capita government expenditure of $0.04.[4]

The "main conclusion" drawn by Fabricant from his statistical analysis is that, "urbanization is by itself a minor factor, much less important than income and not more important than density. The major factor accounting for interstate differences in government expenditures is income."[5] He feels that the importance attributed to urbanization in the past is due "only because it is itself highly associated with income. At a given level of income (and density), even fairly pronounced differences in degree of urbanization are associated with only slight differences in per capita expenditures."[6]

In conclusion, Fabricant feels that these relationships make sense on a priori grounds. Higher income is associated with higher expenditures, "because it will increase both the demand for public services and the tax capacity basic to their supply." In addition:

> At a given level of income and density, urbanization would have little, but positive, effect on expenditures: little, because community-size differentials in expenditures would largely be eliminated through the income factor; positive, because not all would be . . . . Finally, increased density, at given levels of

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4. Ibid., p. 126.

5. Ibid., p. 127.

6. Ibid., pp. 127-128.

> income and urbanization, acts to reduce expenditures--presumably because when public facilities can be used more intensively the cost of meeting specified levels of public service per head is lessened.[7]

Harvey E. Brazer

In contrast to Fabricant's study of the interstate variations in state and local government expenditures, Harvey Brazer focused attention upon those factors contributing to the variations in per capita city expenditures in 462 cities in 1951, and also the forty largest cities in 1953.[8] He used a series of six independent variables in the regression analysis for one or more functional categories:

(1) Population, 1950
(2) Population density, 1950
(3) Rate of population growth, 1940-1950
(4) Median family income, 1949
(5) Employment per 100 of population in manufacturing, 1947, and trade and services, 1948
(6) Intergovernmental revenue per capita, 1951.[9]

These variables yielded coefficients of multiple determination (R^2) ranging from a high of 0.57 for total general operating expenditures, to a low of 0.06 for recreation. In other words, at best, 57 per cent of the variance among cities was accounted for by these variables, and at worst, 6 per cent.[10]

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7. Ibid., pp. 128-129.

8. Harvey E. Brazer, City Expenditures in the United States, Occasional Paper 66, New York: National Bureau of Economic Research, 1959. See also, Harvey E. Brazer, "Factors Affecting City Expenditures," Proceedings of the Fiftieth Annual Conference of the National Tax Association, 1957, pp. 437-444, for a brief summary of the above study.

9. Brazer, City Expenditures in the United States, op. cit., p. 25.

10. Ibid., p. 28.

Population size was found to be statistically significant only with respect to police protection and was the least important variable used. However, population density was found to be clearly associated with all expenditure categories except recreation. The relationship was negative with respect to highways and positive for all other functions. The rate of population growth was of only minor importance.[11]

Median family income was found to be statistically significant for all functions except total general expenditures. In each case the relationship was positive.[12]

The relationship between manufacturing employment and per capita expenditures was positive, but statistically significant only in the case of the combined common functions and police protection.[13]

Per capita intergovernmental revenue was the only independent variable which was statistically significant for all expenditure

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11. Ibid., pp. 28-29. Brazer observed, "the fact that the association between per capita expenditures and population size is not closer may be due in considerable part to the discrepancy between the census count of the number of people whose 'usual place of abode' is a given city and the number for whom that city provides services," Ibid., p. 28.

Brazer's observation was given empirical content by Amos H. Hawley who found that the per capita expenditures of the central city are associated with the size of the population resident in the metropolitan area outside of the central city, rather than with the population size of the central city itself. See Amos H. Hawley, "Metropolitan Population and Municipal Government Expenditures in Central Cities," Journal of Social Issues, Vol. VII, No. 1, 1951, pp. 100-108.

12. Brazer, City Expenditures in the United States, op. cit., p. 29.

13. Ibid., p. 30. Brazer notes that the failure of the regression analysis to lend more support to his hypothesis regarding the association between the employment variable and municipal expenditures may be ascribable in part to deficiencies in the variable itself. Ibid.

categories, and the relationship was positive in each case. It was also the most important variable in explaining the variation in per capita expenditures for all functions except police protection and highways, where population density was more important.[14]

In summary, Brazer found that intergovernmental transfers, per capita income, and population density were the most important variables in accounting for intercity expenditure variations for most functions. However, he noted that the relatively low R^2 for total general expenditures of 0.57 meant there were many other important factors.[15]

Glenn W. Fisher

Glenn Fisher followed Fabricant's precedent of using the three variables of per capita income, degree of urbanization, and population density to explain interstate expenditure variations for the state and local governments in 1957.[16] However, he noted that other factors often mentioned are "Differences in the political or social characteristics of the states and in the 'taste' for government . . . ."[17]

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14. Ibid. Brazer feels that the importance of per capita intergovernmental revenue "seems to lie principally in the fact that it serves as a measure of the distribution of functional responsibilities between the cities, on the one hand, and the state and its other local subdivisions on the other." Ibid.

15. For other studies of city expenditures see: Woo Sik Kee, "Central City Expenditures and Metropolitan Areas," National Tax Journal, Vol. XVIII, No. 4, December 1965, pp. 337-353, and Seymour Sacks and William Hellmouth, Jr., Financing Government in a Metropolitan Area: The Cleveland Experience, New York: The Free Press of Glencoe, Inc., 1961.

16. Glenn W. Fisher, "Determinants of State and Local Government Expenditures: A Preliminary Analysis," National Tax Journal, Vol. XIV, No. 4, December 1961, pp. 349-355.

17. Ibid., p. 349.

In his preliminary analysis, Fisher found the regression equation for estimating the total general expenditure of state and local governments to be:

$$E_t = 56.25 + 100.9244Y + 0.1845U - 0.1084D$$ [18]

where: E_t = per capita total general expenditures for state and local governments (dollars)

Y = per capita personal income (thousands of dollars)

U = degree of urbanization

D = population density

In other words, for each one dollar increase in per capita income, state and local government expenditures would increase by about 10 cents; for each one per cent rise in urban population, expenditures would increase by about 18 cents; and for each additional person per square mile, expenditures would decline by about 10 cents. The coefficient of multiple determination of 0.53 indicates that approximately 53 per cent of the interstate variance is accounted for by the three independent variables.

For the various functional categories, coefficients of multiple determination ranged from a high of 0.74 for police expenditures to a low of 0.14 for public welfare expenditures, indicating that, at best, 74 per cent of the interstate variance is accounted for, and at worst, 14 per cent.

The detailed results of Fisher's regression analysis are presented in Table 5. In general, Fisher found that expenditures for most functions are reduced by dense populations, but that in contrast,

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18. Ibid., p. 350.

TABLE 5

STATISTICAL RELATIONSHIP BETWEEN 1957 GOVERNMENTAL EXPENDITURE PER CAPITA AND INCOME PER CAPITA, URBANIZATION AND POPULATION DENSITY, 48 STATES

Function	Constant Term	Regression Coefficient of Independent Variable: Population per Square Mile(1957) X^2	Per Cent Urban Population (1950) X^3	Per Capita Income (1956-57) X^4	Coefficient of Multiple Correlation	R^2
State Institutions of higher education	6.68	-.0235	-.0088	+ 5.6940	.61	.37
Local Schools	15.91	-.0440	+.2503	+ 23.5224	.79	.62
Highways	23.57	-.0098	-.8783	+ 43.4448	.58	.34
Public Welfare	16.59	-.0182	+.4103	- 9.1954	.38	.14
Health & Hospitals	-.13	-.0029	+.1199	+ 6.0008	.68	.46
Police	-2.41	+.0008	+.0859	+ 2.6524	.86	.74
Fire Protection	-2.19	+.0025	+.0655	+ 1.2908	.82	.67
Natural Resources	2.10	-.0170	-.0930	+ 7.1340	.54	.29
Sewerage & Sewerage Disposal	-2.63	-.0023	+.0527	+ 2.6726	.59	.35
Other Sanitation	-.20	.0000	+.0770	- .9386	.69	.48
General Control	.24	-.0045	-.0062	+ 5.8167	.67	.45
All General Expenditures	56.25	-.1084	+.1845	+100.9244	.73	.53

Source: Glenn W. Fisher, "Determinants of State and Local Government Expenditures: A Preliminary Analysis," National Tax Journal, Vol. XIV, No. 4, December 1961, Table II, p. 353.

"urbanization is more often associated with increased expenditures."[19] Like Fabricant, Fisher's findings pointed to per capita income as the most important factor contributing to the interstate variations in state and local government expenditures.

In a more detailed study,[20] Fisher sought to explain 1960 state and local government expenditure variations with the aid of more independent variables than employed in his 1957 study.

After considering a series of twelve independent variables, he used the following seven for his detailed analysis:

(1) Percent of families with less than $2000 income, 1959
(2) Yield of representative tax system, 1960, as per cent of U.S. average
(3) Population per square mile, 1960
(4) Per cent of population in urban places, 1960
(5) Per cent increase in population, 1950-1960
(6) Index of two-party competition
(7) Per cent of population over 25 with less than 5 years of schooling, 1960 [21]

Perhaps the most significant finding of Fisher's study was the importance of income distribution upon expenditure levels. He found that the per cent of families with income below $2000 was the most important variable in explaining total general expenditures for the state

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19. Ibid., p. 352.

20. Glenn W. Fisher, "Interstate Variation in State and Local Government Expenditures," National Tax Journal, Vol. XVIII, No. 1, March 1964, pp. 57-74.

21. Ibid., p. 64. The five variables initially considered, but excluded after they were found to be relatively insignificant were: (a) per capita personal income, (b) median family income, (c) per capita yield of representative property tax, as per cent of U.S. average, (d) per cent of population living in urban places outside Standard Metropolitan Statistical Areas (SMSA), and (e) per cent of population living in SMSA. Ibid., pp. 61-63.

and local governments. In addition, he found that the relation was inverse, that is, that a higher percentage of low income families is associated with low government expenditures.[22]

In view of the importance of the income distribution variable, Fisher tested alternative forms based upon the percentage of families with income below $3000, below $5000, and between $2000 and $5000. He concluded that it made little difference which measure was used, as the coefficient of multiple determination was changed very little by the alternative forms. Therefore, he preferred to think of the variable in more indefiniate terms, such as the "per cent of low income families."[23]

A second important finding of the study is that the demographic variables (nos. 3, 4, and 5), as a group, are more important than the

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22. Ibid., p. 65. This conclusion was based on the fact that the beta coefficient for the variable reflecting low income families was higher than for any other. Fisher also found that the per cent of families with income below $2000 had the highest beta coefficient for nine out of the 13 expenditure categories. Ibid., p. 68.

For a similar conclusion regarding the importance of income distribution, see Robert F. Adams, "On the Variation in the Consumption of Public Services," Review of Economics and Statistics, Vol. XLVIII, No. 4, November 1965, pp. 400-405. Adams conducted a study using 11 independent variables of 1957 per capita expenditures for all local governments within a county area having a population density over 100. He found his results to "substantiate the contention that consideration must be given to the distribution of income as well as its level. For example, given a low percentage of families earning $10,000 and over, an increase in the percentage of families earning under $3,000 is related to a decrease in the consumption of police services. On the other hand, expenditures remain level when a moderate percentage of families earning over $10,000 are living in the community, regardless of the percentage of families earning $3,000 and under." Ibid., p. 403.

23. Fisher, "Interstate Variation in State and Local Government Expenditures," op. cit., p. 68.

economic variables (nos. 1 and 2) for education (both local schools and higher education), public welfare, police, fire, and general control.[24]

Fisher found population density generally to be inversely correlated with expenditures, which he felt might be attributed "to the greater cost of providing services in thinly populated areas."[25]

The per cent of the population living in urban places was found to be significant in four expenditure categories, and was the second most important variable in the case of highways where the relationship was inverse. To Fisher, this reflected, "at least in part, the fact that urban streets and highways are cheaper, per unit of vehicle travel than are rural roads."[26]

Seymour Sacks and Robert Harris

In addition to the original three "basic variables" used by Fabricant and Fisher, Seymour Sacks and Robert Harris emphasize the importance of intergovernmental flows of funds, both state and federal, in affecting the interstate variation in governmental expenditures.[27]

Using the three variables of the earlier studies, Sacks and

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24. Ibid., p. 71. This conclusion is based upon an analysis of the coefficients of multiple-partial determination, which indicate the proportion of variation, unexplained when the specified group of variables is excluded, that is explained when the group of variables is added to the analysis.

25. Ibid., p. 69.

26. Ibid., pp. 69-70.

27. Seymour Sacks and Robert Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Funds," National Tax Journal, Vol. XVII, No. 1, March 1964, pp. 75-85.

Harris computed the coefficients of multiple determination for 1942, 1957, and 1960 data. Their principal finding was a substantial decline in the variance "explained" by the factors of per capita income, urbanization, and density--from 72 per cent in 1942 to 53 per cent in both 1957 and 1960. With respect to the functional categories, Sacks and Harris found substantial declines in the per cent of variance accounted for in the areas of public welfare (from 45 per cent to 11 per cent), and health and hospitals (from 72 per cent to 44 per cent). The authors assert that this shift is due to the increased activity of the federal government in these areas.[28] They feel that the increased role of federal and state grants-in-aid are among the most important factors accounting for the variance in interstate expenditures. In fact, they maintain, "No analysis of the determinants of state and local government expenditures can be considered complete without explicitly taking account of state aid to localities and federal aid to state and local governments."[29]

Federal aid to state and local governments would be expected to have the effect of increasing state and local expenditures since "while not true from the taxpayer's point of view, federal aid can be regarded as 'outside money' from the point of view of the state and local governments . . . ."[30]

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28. Ibid., p. 76.

29. Ibid., p. 78. They feel that "To try to explain expenditures for those functions in which the federal government has taken a major interest without allowing for federal aid, is to omit perhaps the major determinant of the expenditure levels." Ibid., p. 79.

30. Ibid.

Sacks and Harris feel that state aid must also be considered, but for different reasons. First, they argue that since the major source of local tax revenue is the property tax (87.4 per cent in 1960), attempted increases in the tax are usually met with strong resistance. The existence of state aid allows expenditures to be financed by alternative means such as state income, sales, or excise taxes. In addition, the authors contend that state aid may also act to increase expenditures by reducing competition among neighboring local governments to maintain low tax rates to avoid losing industry. Finally, they feel that state aid programs may be of the incentive type explicitly designed to increase local expenditures.[31]

To demonstrate their case for the important role played by intergovernmental flows of funds in determining state and local expenditure levels, the authors added federal and state aid to the three "basic variables" (per capita income, urbanization, and density), in an analysis of

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31. Ibid., pp. 79-80. For studies of the impact of state aid to education which conclude that the general effect is one of substitution rather than stimulation (i.e., the effect is to reduce tax burdens or cause a shift in the use of local resources from the aided functions to some non-aided functions), see Edward F. Renshaw, "A Note on the Expenditure Effect of State Aid to Education," Journal of Political Economy, Vol. LXVIII, No. 2, April 1960, pp. 170-174, and George A. Bishop, "Stimulative versus Substitutive Effects of State School Aid in New England," National Tax Journal, Vol. XVII, No. 2, June 1964, pp. 133-143. Jerry Miner also concludes that "the extent to which the state participates in the collection of revenues for local schools is, if anything, a negative factor" on total per capita education expenditures. Jerry Miner, Social and Economic Factors in Spending for Public Education, Syracuse: Syracuse University Press, 1963, p. 100. For other studies on the determinants of education expenditures, see: Werner Z. Hirsch, "Determinants of Public Education Expenditures," National Tax Journal, Vol. XIII, No. 1, March 1960, pp. 29-40, and Sherman Shapiro, "Some Socioeconomic Determinants of Expenditures for Education: Southern and Other States Compared," Comparative Education Review, Vol. VI, No. 3, October 1962, pp. 160-166.

1960 total general expenditures. They found the aid variables to increase the coefficient of multiple determination (R^2) from 0.532 to 0.869, as shown in Table 6. In other words, the three basic factors "explained" about 53 per cent of the interstate variance, while 87 per cent was accounted for after the addition of federal and state aid. The most dramatic increases took place in the public welfare function, where the R^2 rose from 0.114 to 0.858 with the addition of the aid variables, and in the highway function, where the R^2 increased from 0.370 to 0.856.[32]

The main contribution of Sacks and Harris' study is to emphasize the importance of intergovernmental flows of funds in accounting for the interstate variance in the per capita expenditure levels of the state and local governments. However, it should be noted that Sacks and Harris based their conclusions upon the increase in R^2 when the aid variables were added, while their dependent variable was <u>total</u> state and local government expenditures--a measure which includes both federal and state aid in addition to expenditures from their own sources. In short, the independent variables are also components of the dependent variable, a situation which would naturally result in a high R^2. Techniques such as this bring Elliott Morss, for one, to question the use of federal aid as an independent variable to explain interstate expenditure variations: "The federal aid variable is significant in explaining variations in state and local expenditures only because these lower level governments are required to spend all of the federal aid payments they

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32. Sacks and Harris, <u>op. cit.</u>, p. 81.

TABLE 6

COEFFICIENTS OF MULTIPLE DETERMINATIONS (R^2) FOR REGRESSIONS OF PER CAPITA GENERAL EXPENDITURES ON THREE BASIC FACTORS AND WITH STATE AID AND FEDERAL AID ADDED, 1960

Expenditure Category	Three Basic Factors (Equation A)	State Aid Added (Equation B)	Federal Aid Added (Equation C)	Federal and State Aid Added (Equation D)
Total Direct General	.532	.667	.813	.869
Highways	.370	.374	.834	.856
Public Welfare	.114	.181	.830	.858
Local Schools*	.604	.721	N.C.	N.C.
Health and Hospitals	.435	.547	.472	.557
Not Specifically Aided and All Ohthers#	.577	.602	.627	.645

N.C. = Not computed.

*All other education expenditures are included in the "Not Specifically Aided and All Other" category.

#The "Not Specifically Aided and All Other" category must be interpreted in relation to the functional grouping of this Table. Thus, this category includes Fire, Police, and General Control--all of which were treated separately in Table I.

Source: Seymour Sacks and Robert Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Funds," National Tax Journal, Vol. XVII, No. 1, March 1964, Table III, p. 81.

receive. This is hardly an interesting finding."[33]

Roy Bahl and Robert Saunders

In their preliminary study of the determinants of state and local expenditures, Roy Bahl and Robert Saunders focused attention upon the factors accounting for changes in expenditures (1957-1960), rather than on the levels, as had been done in the previous studies.[34] The independent variables used were the 1957-1960 change in per capita personal income, population density, per capita federal grants, public school enrollment, and urbanization (1950-1960 change). Quite significantly, they found "the change in per capita federal grants to the states is the only factor which significantly affects changes in state and local per capita spending . . . ."[35]

The authors found that their five variable model "explained" approximately 47 per cent of the variation among states, while a two variable model containing only income and federal aid accounted for 42 per cent of the variation, and federal aid alone accounted for 39 per

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33. Elliott Morss, "Some Thoughts on the Determinants of State and Local Expenditures," National Tax Journal, Vol. XIX, No. 1, March 1966, p. 98. Morss suggests that if understanding the effects of federal aid on state and local government expenditures is the objective, "it would be interesting to explore the reasons for the lags between program establishment and utilization. Here, a cross-section analysis might yield some interesting results. That is, one might attempt to determine why some states make use of a particular program immediately, while others take considerably more time." (p. 99).

34. Roy W. Bahl and Robert J. Saunders, "Determinants of Changes in State and Local Government Expenditures," National Tax Journal, Vol. XVIII, No. 1, March 1965, pp. 50-57.

35. Ibid., p. 52.

cent of the interstate variation in expenditure changes.[36]

Bahl and Saunders also found that the basic factors of per capita income, degree of urbanization, and population density accounted for only 18 per cent of the variation in changes in state and local general expenditures. Like Sacks and Harris, they feel the diminished ability of these factors to explain variations in state and local expenditures to be "due to the increasing importance of federal aid as a determinant of state and local spending. That is to say that incrementally it is changes in per capita federal aid to states which have the most pronounced effect on both the level of and changes in state and local expenditures."[37]

In another study, Bahl and Saunders re-examined Fabricant's analysis in the light of 1962 data.[38] In particular, they considered Fabricant's conclusion regarding the unimportance of urbanization as an explanatory variable.[39] They contend that Fabricant's finding was due to the fact that his three variables were highly correlated, thereby making comparisons of their relative importance impossible. However, Bahl and Saunders feel that it is possible to reduce the variability of

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36. Ibid., p. 52.

37. Ibid., p. 57.

38. Roy W. Bahl and Robert J. Saunders, "Fabricant's Determination After Twenty Years: A Critical Reappraisal," The American Economist, Vol. X, No. 1, Spring 1966, pp. 27-44.

39. Fabricant had concluded that income was the most important of the independent variables, while "urbanization is by itself a minor factor, much less important than income and not more important than density," Fabricant, op. cit., p. 127.

the income and density factors by analyzing the 15 high income - high density states separately. They found that when the three standard variables are regressed on the per capita expenditures of this group of states, "urbanization is found to be statistically significant while the regression coefficients of neither income nor density differ significantly from zero . . . . The conclusion that at given levels of income and density, the degree of urbanization exerts only a minor direct influence on expenditure levels is, therefore, not supported by the results."[40]

Finally, Bahl and Saunders examined in more detail the considerations surrounding the use of federal aid as an independent variable in explaining interstate spending variations.[41] They recognized that the direction of the causality between federal aid and expenditures may be questioned on a priori grounds. For example, many public assistance grants are open-ended as far as the number of recipients is concerned, meaning that some state welfare expenditure decisions may actually determine the amount of federal aid received. As a result, Bahl and Saunders note that because of "the questionable direction of causation between federal aid and expenditures, the inclusion of federal aid as a 'determinant" of expenditures is subject to reservation."[42] On the other hand, they feel there are at least two possibilities for justifying

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40. Bahl and Saunders, "Fabricant's Determination," op. cit., p. 31.

41. Roy W. Bahl and Robert J. Saunders, "Factors Associated with Variations in State and Local Government Spending," Journal of Finance, Vol. XXI, No. 3, September 1966, pp. 523-534.

42. Ibid., p. 527.

the use of federal aid as a determinant of expenditure levels. "First, one could point to certain specific functional expenditures and argue that the level of earmarked federal funds is highly associated with interstate variability in the total amount spent for that function, regardless of the source of funds."[43] Secondly, they feel that federal aid is an important "stimulant" of state and local expenditures.

To support their contention that federal aid "stimulates" state and local government expenditures, Bahl and Saunders retracted their earlier agreement with Sacks and Harris' hypothesis of the increasing importance of federal aid as a determinant of expenditures.[44] This retraction was based upon the finding that "the marginal contribution of federal aid to explained variation does not differ significantly between 1942 and 1962."[45] Therefore, Bahl and Saunders hypothesize that the importance of federal aid as an explanatory variable is due to its "stimulative" effect on state and local expenditures:

> If federal grants are considered to be a 'high-powered' source of funds, it may be hypothesized that an additional dollar of federal aid stimulates a greater amount of spending by state and local governments than does an additional dollar from another revenue source. One obvious reason for this is the matching requirements of some federal aid programs. In addition, if some states view a federal grant at least partially as a complement to internal funds rather than as a substitute, then federal

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43. Ibid.

44. Bahl and Saunders, "Determinants of Changes in State and Local Government Expenditures," op. cit., p. 57.

45. Bahl and Saunders, "Factors Associated with Variations in State and Local Government Spending," op. cit., p. 531. The addition of federal aid to the 1942 data increased the R^2 from 0.72 to 0.86; for the 1962 data, the R^2 rose from 0.46 to 0.56. Ibid., p. 528.

aid could conceivably have a multiple effect on state and local expenditures.[46]

The main conclusion drawn from the works of Bahl and Saunders is a reaffirmation of the importance of urbanization as an independent variable and a recognition of the problems of multicollinearity among the independent variables of income, urbanization, and density. In addition, they feel that federal grants are among the most important factors accounting for the interstate variations in expenditure levels, primarily because such aid "stimulates" state and local spending.[47]

Jack W. Osman

The most complete examination of the factors accounting for the interstate variations in state and local government expenditures was recently completed by Jack Osman.[48] Table 7 summarizes the results of his analysis of the 1960 variations in state and local expenditures.

Osman's work differs from the previous studies mainly in that he included not only the "general" variables (income, urbanization, federal and state aid, etc.), but he also considered a number of "specific" variables for the respective functional categories. In particular, he found an important variable affecting the interstate variation in education expenditures to be the number of students attending local public

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46. Ibid., p. 527.

47. However, it should be noted that Bahl and Saunders followed Sacks and Harris in using total expenditures (including federal aid) as the dependent variable.

48. Jack W. Osman, "The Determinants of Interstate Variations in State and Local Government Expenditures in the United States," unpublished Ph. D. dissertation, Rutgers - The State University, 1966.

TABLE 7

REGRESSION EQUATIONS FOR PER CAPITA GENERAL EXPENDITURES BY SELECT FUNCTIONS: 1960

Function	Equation
(1) Total General $R^2 = 0.789$	$T/N = -2.60268 + 0.09858(Y/N)$ (0.00955) $+ 1.93583(F_T/N)$ (0.20239)
(2) Education: Total $R^2 = 0.824$	$E_T/N = -66.24166 + 0.04106(Y/N)$ (0.00502) $+ 0.21875(N_{SL}) + 5.11370(F_E/N)$ $(0.09000) \quad (0.82952)$ $+ 0.51923(F_{T-E}/N)$ (0.09012)
(3) Local Schools $R^2 = 0.809$	$E_{LT}/N = -54.41263 + 0.03682(Y/N)$ (0.00389) $+ 2.70713(F_E/N) + 0.33439(F_{T-E}/N)$ $(0.64289) \quad (0.06985)$ $+ 0.17965(N_{SL})$ (0.06978)
(4) Higher Education $R^2 = 0.677$	$E_H/N = 3.81511 + 2.59093(F_E/N)$ (0.32709) $+ 0.14578(F_{T-E}/N)$ (0.03453)
(5) Highways $R^2 = 0.830$	$R_T/N = 47.09277 + 1.37379(F_E/N)$ (0.09660) $- 0.29879(S_{\%})$ (0.10877)
(6) Public Welfare $R^2 = 0.805$	$W/N = -18.00123 + 0.21422(U)$ (0.04198) $+ 1.29032(A_{65}) + 1.37649(F_W/N)$ $(0.37340) \quad (0.10882)$
(7) Health and Hospitals $R^2 = 0.474$	$HH_T/N = 7.64708 + 0.00432(Y/N)$ (0.00167) $- 0.24723(A_{21}) + 2.08672(F_{HH}/N)$ $(0.15858) \quad (1.28143)$
(8) General Control $R^2 = 0.682$	$GC/N = -2.99096 + 0.00503(Y/N)$ (0.00078) $+ 0.07307(F_T/N) + 0.04828(\Delta N/N)$ $(0.01478) \quad (0.01726)$
(9) Interest $R^2 = 0.625$	$I/N = -9.13834 + 0.00665(Y/N)$ (0.00091) $- 0.04577(F_T/N) + 0.09516(S_{\%})$ $(0.01609) \quad (0.03198)$

Where:
$N \equiv$ state population
$T, E_T, \ldots, I \equiv$ expenditure on the indicated function, so that T/N, for example, is per capita total general expenditure
$Y/N \equiv$ state personal income per capita
$F_T/N, F_E/N \ldots F_{HH}/N \equiv$ per capita federal aid to the indicated function
$F_{T-E}/N \equiv$ per capita federal aid to functions other than education
$N_{SL} \equiv$ number of students attending local public schools per 1000 of state population
$S_{\%} \equiv$ per cent of state and local tax revenue derived from state sources
$U \equiv$ per cent of population living in urban areas
$A_{65} \equiv$ per cent of population 65 years and over
$A_{21} \equiv$ per cent of population below 21 years
$\Delta N/N =$ per cent increase in state population: 1950–1960.

Source: Jack W. Osman, "The Dual Impact of Federal Aid on State and Local Government Expenditures," National Tax Journal, Vol. XIX, No. 4, December 1966, p. 366

schools per 1000 of state population.[49] For the highway function, he found an important negative factor to be the percentage of revenues collected by the state government.[50] In the case of public welfare, he found the percentage of population sixty-five years of age and over to be positively associated with per capita expenditures for the function, with each one per cent increase in the aged population associated with a $1.29 increase in expenditures.[51]

For the purposes of this study, perhaps the most interesting aspect of Osman's analysis is what he calls the "dual impact" of federal grants on state and local governments. He separates the influence of federal aid into the stimulation of expenditures for the function receiving the aid, and the impact which federal aid to all other functions may have on a given function.[52]

To test this "dual impact" of federal grants, Osman employed multiple regression analysis and held that an "operationally meaningful definition of stimulation" would be a case where the regression coefficient of federal aid exceed unity.[53]

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49. Ibid., p. 204. Assuming other factors constant, each additional student per 1,000 of population was associated with an 18 cent increase in per capita expenditures.

50. Ibid., p. 217.

51. Ibid., pp. 222-223.

52. Ibid., pp. 146-156. See also, Jack W. Osman, "The Dual Impact of Federal Aid on State and Local Government Expenditures," National Tax Journal, Vol. XIX, No. 4, December 1966, pp. 362-372.

53. Ibid., p. 363. Osman defines stimulation as "an increase in state and local expenditures from their own sources as a result of federal aid to that function." (p. 362).

The results of the analysis yielded a substantial "stimulative" effect of federal aid on state and local government expenditures. In the case of total general expenditures, an additional dollar of federal aid was associated with an increase in per capita expenditures by the state and local governments of $1.94. Osman found the greatest stimulative effect to be on total education expenditures, where an additional dollar in federal aid was associated with an increase in state and local expenditures of $5.11. Other indications of stimulation were: highways, an increase of $1.37 for each additional dollar of federal aid; public welfare, $1.38 for each added dollar of federal aid; and health and hospitals, where state and local expenditures rose $2.09 for each additional dollar of federal aid.[54]

Osman also found that each one dollar increase in federal aid to all functions other than education was associated with a 52 cent increase in local education expenditures. He felt this implied that federal aid to other functions "releases" funds for education. However, just as significantly, his analysis did not indicate that federal aid to other functions had the effect of releasing funds for highways or public welfare.[55]

In summary, Osman stressed the importance of "specific" variables for certain functional categories, thereby focusing attention upon those factors which affect only a specific function. With regard to the impact of federal aid on state and local government spending, he concludes,

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54. Ibid., p. 366.

55. Ibid., p. 371.

"federal aid has had the effect of stimulating those functions to which it has been directed, and that the result has not been merely to substitute federal aid for state and local funds."[56] He also feels that an important implication of the analysis is "that the federal government is able to increase expenditures on a given function in either of two ways. Direct aid to a function will, in general, increase expenditures for that function, and will, our results indicate, stimulate expenditures on that function. Second, expenditures on some functions will increase through federal aid to other functions."[57]

Summary

From this review of past studies, emerges a unanimous agreement on the importance of the level of income as a factor affecting the level of state and local government expenditures. In addition, the distribution of income has been shown to be an important determinant of expenditure levels. While the relationship between the level of income and

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56. Ibid. For a similar conclusion regarding the stimulative impact of federal grants on the state and local governments see, Edward M. Gramlich, "The Behavior and Adequacy of the United States Federal Budget, 1952-1964," Yale Economic Essays, Vol. VI, No. 1, Spring 1966, pp. 99-159. Gramlich developed spending and taxation functions for the state and local governments as part of his total model. He found that the regression coefficients in the spending function summed to 1.54, indicating that, "On the average, states and localities spend all of the federal grant, and then match 54 per cent of it from their own sources." In other words, the finding is that federal grants "stimulate" state and local spending. For the tax functions, Gramlich found that the coefficients summed to 1.08. "Among other things, this implies that states and localities raise tax revenue by 58 per cent of the federal grant (which they match by only 54 per cent). In other words, according to these estimates, state and local governments are moved slightly into surplus every time the Federal Government makes a matching grant to these institutions." Ibid., pp. 130-131.

57. Osman, "The Dual Impact of Federal Aid on State and Local Government Expenditures," op. cit., p. 371.

expenditures has been positive, income distribution and expenditures have an inverse relationship, as a high percentage of low-income families is generally associated with low government expenditures.

The demographic factors of population density and the degree of urbanization have also been shown to have an important effect upon state and local government expenditures.

In addition, the age distribution of the population has an important bearing upon expenditures, especially for the education and public welfare functions.

Finally, federal aid to the state and local governments appears to be an important determinant of expenditure levels, presumably because it tends to "stimulate" lower-level government expenditures.

Working Models of State and Local Spending

The working models used in this study to estimate the response of state and local governments to federal grants rest upon the assumption that lower-level government expenditures from their own sources may be expressed as a function of a number of independent variables. Conceptually, the framework may be presented as follows:

Let: E_i = per capita state and local government expenditures from their own sources on the ith function

$X_1, X_2, \ldots X_n$ = "n" independent variables

Then, per capita state and local expenditures on the ith function would be given by:

$$E_i = f(X_1, X_2, \ldots X_n).$$

The Independent Variables

When per capita expenditures are treated in this fashion, the independent variables may be thought of as the "determinants" of the demand for public goods by state and local governments. However, it must be emphasized that this study does not seek to discover or identify all of the determinants of the demand for public goods by the lower-level governments.[58] Rather, it is concerned primarily with the impact of federal aid upon state and local government expenditures. Therefore, the following independent variables are introduced into the models for the purpose of placing federal aid in the proper perspective:

(1) Per capita personal income, (designated as Y).

(2) Degree of urbanization, that is, the percentage of a state's population living in cities of 50,000 or more in 1960,[59] (designated as U).

(3) Population density, as the number of persons per square mile, (designated as D).

(4) Per cent of families with income below $3,000 in 1959, (designated as Y_L).

(5) Per capita federal aid for the ith function, (designated as F_i).

These five independent variables will be used in all equations.

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58. For the most complete study in this area, see Jack W. Osman, "The Determinants of Interstate Variations in State and Local Government Expenditures in the United States," op. cit.

59. For a more detailed definition, see U.S. Bureau of the Census, U.S. Census of Population: 1960, Vol. I, Characteristics of the Population, Part 1, United States Summary, Washington: U.S. Government Printing Office, 1964, pp. xxvi-xxvii.

In addition, two measures of the age distribution of the population are introduced as "specific" variables for the functions of education, public welfare, and health and hospitals. They are:

(6) The per cent of the population between the ages of 5 and 19 years in 1960, (designated as A_{5-19}).

(7) The per cent of the population aged 65 and over in 1960, (designated as A_{65}).

The Dependent Variables

For the purpose of determining the extent of association between federal aid and state and local government expenditures, all dependent expenditure variables used in this study are net of federal aid. That is, all expenditure variables represent state and local expenditures from their own sources.

Specifically, the dependent variables are:[60]

(1) Per capita total general expenditures from internal sources, (designated as E_t).

(2) Per capita highway expenditures from internal sources, (designated as E_h).

(3) Per capita expenditures from internal sources for public welfare, (designated as E_w).

(4) Per capita education expenditures from internal sources, (designated as E_e).

(5) Per capita health and hospital expenditures from internal

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60. For a more detailed definition of the respective expenditure variables, see Appendix B, "Definitions of Expenditure Categories," pp. 212-214.

sources, (designated as E_{hh}).

(6) Per capita expenditures on the non-aided functions, that is, all expenditures from internal sources other than highways, public welfare, education, and health and hospitals, (designated as E_{na}).

Finally, to estimate the impact of federal aid on state and local fiscal effort:

(7) State and local government fiscal effort (FE), defined as general revenue from internal sources per $1,000 of personal income.[61]

The Regression Models

Two separate multiple regression models are used in this study to estimate the influence of the independent variables upon state and local government expenditures.[62] Specifically, they are known as an

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61. For limitations of this definition of fiscal effort, see Maxwell, Financing State and Local Governments, op. cit., pp. 41-43. For attempts to devise various measures of the concept of fiscal effort, see Advisory Commission on Intergovernmental Relations, Measures of State and Local Fiscal Capacity and Tax Effort, Washington: U.S. Government Printing Office, 1962.

62. For a description of the methodology and techniques of multiple linear regression used in this study, see Ezekiel and Fox, op. cit., pp. 151-203, and M. A. Efroymson, "Multiple Regression Analysis," in Anthony Ralston and Herbert S. Wilf, eds., Mathematical Methods for Digital Computers, New York: John Wiley & Sons, Inc., 1960, pp. 191-203.

Efroymson notes: "A multiple regression solution gives the least squares 'best' value of the (regression) coefficients for a particular sample of observations. The solution also gives a measure of the reliability of each of the coefficients so that inferences can be made regarding the parameters of the population from which the sample of observations was taken." Ibid., p. 191.

The specific technique used in this study is that of "stepwise regression," in which "a number of intermediate regression equations are obtained, as well as the complete multiple regression equation. These equations are obtained by adding one variable at a time . . . . The variable added is that one which makes the greatest improvement in

"additive" regression model, and a "joint" regression model.

The additive regression model assumes that the relationship between the variables is additive. That is, the impact of the independent variables upon the dependent variable is found by adding the separate effect of each of the individual factors. Therefore, the model is of the form:

$$Y = a + b_1X_1 + b_2X_2 + \ldots b_nX_n$$

where;

Y = the dependent variable

$X_1 \ldots X_n$ = "n" independent variables

a = the constant term

$b_1 \ldots b_n$ = the net regression coefficients, which "show the average number of units increase or decrease in the dependent variable which occur with each increase of a specified unit in the independent variable. Its exact size thus depends not only on the relation between the variables but also on the units in which each is stated."[63]

A basic feature of the additive model is that it implies that

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'goodness of fit.' The coefficients represent the best values when the equation is fitted by the specific variables included in the equation.

"An important property of the stepwise procedure is based on the facts that (a) a variable may be indicated to be significant in an early stage and thus enter the equation, and (b) after several other variables are added to the regression equation, the initial variable may be indicated to be insignificant." Ibid., pp. 191-192. For a discussion of the properties of stepwise estimates and the significance of the regression coefficients, see Arthur S. Goldberger and D. B. Jochems, "Note on Stepwise Least Squares," Journal of the American Statistical Association, Vol. LVI, No. 293, March 1961, pp. 105-110. See also, Draper and Smith, op. cit., pp. 173-177.

63. Ezekiel and Fox, op. cit., p. 147.

the change in the dependent variable resulting from a one unit change in one of the independent variables is the same, regardless of what the level of the other independent variables might be.[64] For example, the model assumes that a one unit change in per capita income would be associated with the same increase in per capita expenditures in both a high-income and a low-income state. The validity of such an assumption may be open to question. The state with the higher income level would be likely to incur a larger increase in expenditures than would the lower income state.[65]

A priori considerations indicate that more meaningful results may follow from a model that estimates the change in per capita expenditures for any given combination of independent variables, rather than for the separate effect of each one. Therefore, a joint regression model is also employed in the following form:

$$Y = A \; X_1^{c_1} \; X_2^{c_2} \; \ldots \; X_n^{c_n}.$$

The distinguishing feature of this model is the fact that the dependent variable (Y) is a function of the combination of the independent variables ($X_1 \ldots X_n$), so that the interactions between the independent

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64. Ezekiel and Fox note: "the linear (regression) equation is very limited in its logical meaning. By its very nature, it can represent only a situation where the change in the dependent variable for a unit change in the independent variable would be expected to be just the same regardless of how large or small the independent variable was; i.e., where the regression has the same slope throughout. This is a very precise and narrow relation." Ibid., p. 67.

65. See Ernest Kurnow, "Determinants of State and Local Expenditures Reexamined," National Tax Journal, Vol. XVI, No. 3, September 1963, pp. 252-255.

variables are explicitly recognized. In other words, it is assumed that the effect of a change in one independent variable is a function of the values of the other independent variables as well as of the size of the change. The model simply means that for any particular combination of values of $X_1 \ldots X_n$, there will be some particular value of Y.[66]

Another feature of the joint, or multiplicative, model is that it is "intrinsically linear"; it can be expressed, via a suitable transformation of the variables, into the standard linear form. "Taking logarithms (of the variables) to the base e converts the model into the linear form."[67] Therefore, the model becomes:

$$\log Y = \log A + c_1 \log X_1 + c_2 \log X_2 + \ldots c_n \log X_n.$$

For the purposes of this study, the most important aspect of the double-log transformation is that it changes the meaning of the regression coefficients from units to elasticities. That is, the regression coefficients in the joint model are estimates of the ratio of the per cent change in the dependent variable that is associated with a given per cent change in an independent variable. In other words, "The double-log transformation . . . corresponds to the assumption of a constant elasticity between Y and X and the simple application of linear methods to the logarithms of the variables produces directly an estimate of that elasticity."[68]

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66. For a detailed description of the joint regression model, see Ezekiel and Fox, op. cit., pp. 348-377.

67. N. R. Draper and H. Smith, Applied Regression Analysis, New York: John Wiley & Sons, Inc., 1966, p. 132.

68. J. Johnston, Econometric Methods, New York: McGraw-Hill Inc., 1963, pp. 48-49. Johnston notes that the equation $Y = AX^{\beta}$ may be

Estimating the Response to Grants

The major burden of estimating the response of state and local governments to federal grants rests on the statistical measures of the coefficient of multiple determination (R^2),[69] and the regression coefficients for the federal aid variables.

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rewritten as: $\log Y = \alpha + \beta \log X$ (where $\alpha = \log A$). "The elasticity of Y with respect to X is defined as $\frac{X}{Y}\frac{dY}{dX}$. For $\log Y = \alpha + \beta \log X$ this gives $\frac{X}{AX^{\beta}} A\beta X^{\beta-1} = \beta$." Ibid.

For the most extensive use of double long functions in statistical demand analysis, see Richard Stone, et. al., The Measurement of Consumers' Expenditure and Behavior in the United Kingdom, 1920-1938, Vol. I, Cambridge: The University Press, 1954. See especially pp. 275-278 for an explanation of the formulations adopted. Other applications of the double log technique are: Harold M. Groves and C. Harry Kahn, "The Stability of State and Local Tax Yields," American Economic Review, Vol. XLIII, No. 1, March 1952, pp. 87-102; Jeffery G. Williamson, "Public Expenditure and Revenue: An International Comparison," Manchester School of Economic and Social Studies, Vol. XXXIX, No. 1, January 1961, pp. 43-56; John B. Lansing, Jung-Chao Liu, and Daniel B. Suits, "An Analysis of Interurban Air Travel," Quarterly Journal of Economics, Vol. LXXV, No. 1, February 1961, pp. 87-95; and David G. Davies, "The Secular Income Elasticity and Revenue Stability of Motor Fuel Taxes," National Tax Journal, Vol. XVIII, No. 4, December 1965, pp. 380-387. For a discussion of the theoretical properties of the consumer demand function via a double log technique, see A. P. Barten and S. J. Turnovsky, "Some Aspects of the Aggregation Problem for Composite Demand Equations," International Economic Review, Vol. VII, No. 3, September 1966, pp. 231-259. See also, M. A. Girshick, "The Application of the Theory of Linear Hypotheses to the Coefficient of Elasticity of Demand," Journal of the American Statistical Association, Vol. XXXVII, No. 218, June 1942, pp. 233-237.

69. The coefficient of multiple determination measures that proportion of the variation in the dependent variable that is attributable to the independent variable(s).

Regarding the use of the coefficient of multiple determination, Frederic Mills notes: "The coefficient of determination is a highly useful measure, but one that is obviously open to misinterpretation. In the first place, the term itself may be misleading, in that it implies that the variable X stands in a determining or causal relationship to the variable Y. The statistical evidence itself never establishes the existence of such causality. All the statistical evidence can do is to

First, to determine the significance of federal aid as a "determinant" of state and local spending, the results of the regression equations excluding and including the federal aid variable are compared. If federal aid is an important factor in "explaining" the interstate variation in the level of per capita expenditures from internal sources, the addition of the aid factor should produce a significant increase in the per cent of the total variance accounted for by the independent variables. Should the addition of federal aid result in little or no increase in R^2, its use as an expenditure "determinant" would be highly suspect. Statistical tests of significance will tell whether the regression coefficients for the aid variable are significantly different from zero.

The questions of budget "distortion" and expenditure "stimulation" are analyzed via a detailed examination of the regression coefficients for the aid variables for specific functional categories. First, since expenditure "stimulation" is defined as a case where state and local expenditures from their own sources increase on a given function in conjunction with federal aid to that function, an operationally meaningful definition of stimulation would be that the regression coefficient for federal aid exceed zero, that is, $b_i > 0$, and that it be statistically

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define co-variation, the term being used in a perfectly neutral sense.

The second qualification has to do with the measure of variation employed. The additive relationship that permits the breaking of total variation into 'explained' and 'unexplained' components holds only for the variances. It does not hold for the standard deviations. The fact that variation is measured by the square of the standard deviation must be borne in mind when the coefficient of determination is cited." Frederic C. Mills, Statistical Methods, third ed., New York: Henry Holt and Company, 1955, pp. 268-269.

significant. This may be summarized as:

$b_i > 0$: Federal aid to a given function is associated with an increase in per capita state and local expenditures from internal sources on the aided function. This response would imply an elastic demand for the aided service.

$b_i = 0$: There is no change in state and local expenditures from their own sources associated with federal aid to the function. This would imply a unitary demand for the service, as the lower-level government would spend the federal funds, but would not increase its own expenditures on the function.

$b_i < 0$: Federal aid to a given function is associated with a reduction in state and local expenditures from internal sources on the aided function. In this case, the federal funds would be substituted for the state-local funds, implying an inelastic demand for the service.

The "distortion thesis" shall be examined via a regression equation in which state and local government expenditures for all non-aided functions is the dependent variable. If "distortion" does occur, the regression coefficient for federal aid should be negative and statistically significant. That is, it should indicate that an increase in federal aid is associated with a decrease in state-local expenditures on those functions not receiving the federal funds. Budget "distortion" would not be indicated should the regression coefficient be zero or positive. In fact, if the regression coefficient is positive, and statistically significant, it would indicate that "stimulation," rather than "distortion," of the non-aided functions was associated with federal aid.

A similar method of analysis will be used to determine the change in state-local fiscal effort associated with federal grants. If federal aid induces an increase in the proportion of a state's income that is devoted to the public sector, the regression coefficient for federal aid with respect to state and local fiscal effort will exceed zero. In summary:

$b_i > 0$: An increase in federal aid is associated with an increase in state and local fiscal effort.

$b_i = 0$: There is no relationship between federal aid and state-local fiscal effort.

$b_i < 0$: An increase in federal aid is associated with a reduction in fiscal effort, implying that federal tax sources are substituted for state-local tax sources.

CHAPTER V

THE RESPONSE TO FEDERAL GRANTS: EMPIRICAL FINDINGS

The objective of the present chapter is to empirically determine the response of the lower-level governments to federal grants via the two multiple regression models discussed in Chapter IV. The method of analysis is to first provide a proxy measure of the elasticity of demand for public goods. A priori estimates of the response to federal aid are then obtained by integrating the proxy elasticity measure with some of the theoretical considerations surrounding the demand for public goods. Finally, the response to grants is analyzed in terms of the a priori expectations.

The Theoretical Response to Grants

It was shown in Chapter III that the response of a lower-level government to a conditional grant-in-aid is determined by its price elasticity of demand for the subsidized service. In cases where the demand for the federally aided service is price elastic, state and local governments would be expected to increase expenditures from their own sources on the function following the introduction of the grant. Should the demand for the aided function be price inelastic, total expenditures (including grants) for the function would remain about the same or increase slightly, but the grant would act to release state-local funds which could be used to increase expenditures on other non-aided functions, to reduce taxes, or a combination of both. If the

funds are spent on non-aided services, they would be expected to be directed to those functions with the highest relative income elasticities.

Under the assumption of a fixed budget, the price elasticity of demand for the subsidized service would also determine the effect of a conditional grant upon the unsubsidized services. In cases where the demand for the aided activity is price elastic, the relatively large substitution effect would result in a transfer of funds from the non-aided activities to the aided activity, or budget "distortion." In contrast, where the demand for the subsidized service is price inelastic, the relatively large income effect would act to release funds for other purposes.

Theory and Reality: Some Problems

The ideal indicator of the response of the lower-level governments to federal grants would obviously be an empirical measure of the price elasticity of demand for public goods. Such a measure is impossible to obtain, however, due to the nature of public goods themselves. Public goods are not generally produced in physical units, or if they are, externalities of consumption limit the appropriateness of quantified output as the measure of actual output. Consequently, it is not possible to quantify either a "unit" of a public good, or its "price."[1] It is possible, however, to devise a proxy measure for the income elasticity

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1. For an excellent discussion of some of the problems involved in an attempt to quantify the demand for public goods, see William C. Birdsall, "A Study of the Demand for Public Goods," in Richard A. Musgrave, ed., Essays in Fiscal Federalism, Washington: The Brookings Institution, 1965, pp. 235-294.

of demand for public goods by relating per capita personal income to per capita state and local government expenditures from their own sources. This proxy measure is called the "income elasticity of expenditures."

The fact that a price elasticity of demand measure is needed to provide proper estimates of the response to grants, while only a proxy measure for the income elasticity of demand is available, means that it will not be possible to directly relate the theoretical aspects of the response to grants to the empirical evidence. However, to the extent that a conditional grant-in-aid increases the budget of a lower-level government via the income effect, it may be possible to draw some inferences about the response to grants from a consideration of the proxy income elasticity measure. Such an inference is based upon the assumption that a small income effect is associated with a function whose expenditures are income inelastic, and that a large income effect is associated with a function whose expenditures are income elastic. Consequently, the higher the income elasticity of expenditures for any given function, the larger the expenditure response associated with federal grants is expected to be.

Finally, it should be noted that the data are not sufficient to permit any assumptions regarding the relative strength or weakness of the substitution effect.

The Income Elasticity of Expenditures

The Model

The proxy measure used for the income elasticity of demand for public goods in this study is called the "income elasticity of

expenditures." The measure is obtained by means of a simple linear regression[2] between per capita personal income and per capita state and local expenditures from internal sources using cross-section data for the fifty states in 1960 and 1965. Specifically, the equation is of the form:

$$\log E_i = \log a + c \log Y$$

where:

E_i = per capita state and local government expenditures from their own sources on the ith function

Y = per capita personal income

a = the constant term

c = the regression coefficient[3]

Because the variables have been transformed into their logarithms, the regression coefficient, c, represents the elasticity between the variables.[4] Therefore, c is an estimate of the ratio of the per cent change in per capita expenditures from internal sources that is associated with a given per cent change in per capita personal income.

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2. For an explanation of the simple linear regression technique used, see Ezekiel and Fox, "Practical Methods for Working Out Two-Variable Correlation and Regression Problems," Chapter 8, op. cit., pp. 134-146, and William S. Peters and George W. Summers, Statistical Analysis for Business Decisions, "Linear Regression," Chapter 14, unpublished manuscript, the University of Arizona, September 1966, pp. 109-144.

3. It should be emphasized that the regression coefficient in the simple regression model is termed a "gross" regression coefficient. "The term gross is added here to indicate that it shows the apparent, or gross, relation between (E_i, the dependent variable) and (Y, the independent variable) without considering whether that relation is due to (Y) alone, or partly or wholly to other independent variables associated with (Y)." Ezekiel and Fox, op. cit., p. 154.

4. Johnston, op. cit., pp. 48-49.

The Results

The coefficients for the "income elasticity of expenditures" for selected functional categories are presented in Table 8. They indicate the percentage change in per capita state and local expenditures from their own sources that is associated with a one per cent increase in per capita personal income. All of the coefficients are significant at the .01 level, except for highways, where the coefficients are not insignificantly different from zero in either 1960 or 1965 as measured by the F-ratio.[5]

It should be emphasized that the income elasticities refer to the elasticity of expenditures to income, as between states. For example, the coefficient of 0.820 for total per capita expenditures indicates that a one per cent increase in per capita income, from one state to another, is associated with an increase in per capita expenditures of approximately 0.82 per cent.

With respect to the four functions receiving substantial federal grants, public welfare is the most income elastic, as each one per cent increase in per capita income in 1965 was associated with an increase in per capita expenditures of about 1.49 per cent. Expenditures for health and hospitals exhibit an income elasticity slightly greater than unity in both years, with a 1965 coefficient of 1.28. Although state and local education expenditures are significantly related to income, the coefficients for both 1960 and 1965 indicate expenditures for the

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5. See Appendix E, pp. 223-227.

TABLE 8

INCOME ELASTICITY OF EXPENDITURES:

1960 and 1965

	1960	1965
Total Expenditures	0.820*	1.025*
Total Aided[a]	0.612*	0.936*
Non-Aided[b]	1.286*	1.936*
Highways	0.054	0.618
Public Welfare	1.332*	1.492*
Education	0.626*	0.729*
Health and Hospitals	1.106*	1.284*

* F-ratio significant at the .01 level.

Notes:

a "Total Aided" = sum of Highways, Public Welfare, Education, and Health and Hospitals.

b "Non-Aided" = sum of all functions other than "Total Aided."

function to be income inelastic.[6] For each one per cent increase in per capita income in 1965, per capita education expenditures rose by only about 0.73 per cent. Finally, per capita state-local highway expenditures exhibit no significant relationship with per capita personal income, indicating that expenditures for the highway function are highly income inelastic.

Perhaps the most striking feature of the "income elasticity of expenditures" shown in Table 8 is the vast contrast between the elasticity coefficients of the aided and non-aided functions in both 1960 and 1965. In 1960, a one per cent increase in per capita income was associated with an increase in per capita expenditures on the aided functions of about 0.61 per cent, while the same increase in income was accompanied by an increase in per capita expenditures on the non-aided functions of approximately 1.29 per cent. In 1965, the difference

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6. Most other studies on the income elasticity of education expenditures have also found a coefficient less than unity. In his 1942 analysis of state and local expenditures, Solomon Fabricant found the income elasticity coefficient to be 0.78. Fabricant, op. cit., p. 125. Using 1949 median family income and 1953 per capita operating expenditure data, Harvey Brazer found the income elasticity for education in forty large cities to be 0.73. Brazer, City Expenditures in the United States, op. cit., p. 58. Werner Hirsch computed a "property elasticity of education expenditures," using the average assessed valuation of real property per pupil in average daily attendance for the St. Louis City-County area in 1951-52 and 1954-55. He found the "average quasi-income elasticity of education" to be 0.594 in 1951-52, and 0.593 in 1954-55. A breakdown of the five major expenditure categories yielded the following elasticity coefficients: 0.29 for fixed charges, 0.42 for instruction, 0.50 for general control, 0.55 for plant operation, and 1.15 for auxiliary services. The finding the instruction had the second lowest income elasticity prompted Hirsch to conclude: "even as funds become available for public schools, there is no assurance that they will be channeled into those activities where they are needed most." Werner Z. Hirsch, "Income Elasticity of Public Education," International Economic Review, Vol. II, No. 3, September 1961, pp. 330-339.

between the coefficients is again about double, as per capita expenditures on the aided functions had approximate unitary income elasticity (0.94), but per capita expenditures on the non-aided activities were highly income elastic, with a one per cent increase in income being associated with an expenditure increase of about 1.94 per cent.

The sharp contrast between the income elasticities of the aided and the non-aided functions raises several questions regarding the nature of the demand for these services. Specifically, the income inelasticity observed with respect to education and highways could imply that these two services are regarded as necessities by the lower-level governments, while the non-aided activities might be regarded as luxuries.[7] To permit a closer breakdown of the non-aided functions, additional regressions were run to obtain the income elasticities for the following functional categories in 1965: local schools, higher education, police, fire, sewerage, sanitation, parks and recreation, financial administration, general control, interest on general debt, and all other.[8] The "income elasticities of expenditures" in 1965 for the thirteen functions are presented in Table 9, in decreasing order of magnitude.

None of the nine functions comprising the "non-aided" activities

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7. Charles E. Ferguson notes: "'necessities' are goods possessing low income elasticities and 'luxuries' are goods having relatively high income elasticities. One should be warned, however, that such associations are very rough and highly sensitive to the particular definitions of the commodities in question." Ferguson, op. cit., p. 38.

8. Excluding a differentation between capital outlay and current operation for certain items, this is the limit of the detail available. See U. S. Bureau of the Census, Governmental Finances in 1964-65, Series GF-No. 6, Washington: U.S. Government Printing Office, 1966, Table 22.

TABLE 9

INCOME ELASTICITY OF EXPENDITURES: 1965

Total Expenditures	1.025**
Total Aided[a]	0.936**
Non-Aided[b]	1.936**
Parks and Recreation	2.261**
Fire	1.924**
Interest on General Debt	1.652**
Sewerage	1.539**
Public Welfare	1.492**
Police	1.482**
Health and Hospitals	1.284**
General Control	1.279**
All Other	1.177**
Financial Administration	1.093**
Sanitation	0.945*
Education	0.729**
Local Schools	0.884**
Higher Education	0.177
Highways	0.618

* F - ratio significant at the .05 level.
** F - ratio significant at the .01 level.

Notes:

a Total Aided = sum of Highways, Public Welfare, Education and Health and Hospitals

b Non-Aided = sum of all functions other than Total Aided

exhibit an inelastic relationship between income and expenditures. Moreover, only sanitation, financial administration, and "all other" have a unitary income elasticity. The relatively high value of the coefficients for most of the non-aided functions indicates that these services are highly income elastic and implies that they might be regarded as luxuries by the lower-level governments.

A Summary of the Expected Response to Federal Grants

A combination of some of the theoretical considerations of Chapter III, concerning the response of state and local governments to federal grants, with the "income elasticity of expenditures" should provide estimates of the response to grants which can be empirically tested.

The impact of total per capita federal aid upon total per capita state and local expenditures from internal sources may be expected to show some differences between 1960 and 1965. With an income elasticity somewhat less than unity in 1960 (0.82), state and local governments may not be expected to respond to federal aid by increasing their own expenditures substantially. However, due to the fact that the elasticity coefficient is about equal to unity in 1965 (1.03), a larger expenditure response may be expected in 1965 than in 1960.

With respect to the various functional categories, the relatively high elasticity coefficients for public welfare and health and hospitals should mean that there is a relatively strong income effect associated with conditional grants-in-aid to these functions. In addition, the fact that the elasticity coefficients for public welfare

(1.33 in 1960, 1.49 in 1965) are higher than those for health and hospitals (1.11 in 1960, 1.28 in 1965) implies that the expenditure response will be greater for the welfare function than for health and hospitals.

The income inelasticity observed for both education and highways implies that federal aid to these two functions is not associated with a very strong income effect. Therefore, the expenditure response may be expected to be rather small in these two areas.

Finally, the sharp contrast between the elasticity coefficients of the aided and non-aided functions in both 1960 and 1965 might be taken to imply that the income effect associated with grants to specific functions would also lead to increased expenditures on the non-aided activities. Therefore, the a priori indication seems to be that budget "distortion" is not associated with federal aid. Furthermore, some differences may be expected in the effect of federal aid on the non-aided functions in 1965 as compared to 1960. The fact that the elasticity coefficient for the non-aided functions is about unitary in 1960 (1.29), may mean that federal aid will not have a significant impact on lower-level government expenditures for the non-aided activities. In contrast, the extremely high coefficient in 1965 (1.94), should mean that higher expenditures on the non-aided functions will be associated with federal grants. In any case, budget "distortion" appears to be precluded by the fact that the income elasticity of the aided functions in both years is about one-half that of the non-aided functions.

A Note on the Regression Models

Two different regression models were used to estimate the response of state and local governments to federal grants, using cross-section data for the fifty states in 1960 and 1965. Briefly, the additive regression model assumes that the impact of the independent variables upon the dependent variable may be found by adding the separate effects of each of the individual factors. In contrast, the joint regression model assumes the dependent variable to be a function of the combination of the independent variables.[9] Although the two models were expected, a priori, to yield different outcomes, they produced almost identical results in terms of the per cent of "explained" variation of the dependent variable.[10] Therefore, the main discussion of the text shall be based upon the more common "additive" model, with the results of the "joint" model being presented in footnotes.

The Expenditure Response to Federal Grants

Total Expenditures

To ascertain the significance of federal aid as a factor "determining" the level of total per capita state and local government expenditures from their own sources, and to identify the nature of the expenditure response associated with federal aid, two regressions were run for each of the 1960 and the 1965 data. The first regression contained the

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9. See above, pp. 107-113, for a detailed explanation of these two models.

10. See Appendix D, "A Comparison of the Additive and Joint Regression Models," pp. 219-221.

independent variables of: per capita personal income (Y), the degree of urbanization (U), population density (D), and the per cent of families with income below $3,000 ($Y_L$).[11] In the second regression, total per capita federal aid (F_t) was added to the basic factors. If federal aid is an important "determinant" of state and local expenditures, the coefficient of multiple determination (R^2) should be increased substantially with the introduction of the aid variable, and its regression coefficient should be significantly different from zero and positive.[12]

The 1960 additive regression equations excluding and including federal aid are:[13]

Ea: $E_t = 199.62 + .0451Y + .3548U - .0942D^{**} - 2.3894Y_L^{*}$
$\qquad\qquad\qquad\quad (.0305) \quad (.3240) \quad (.0351) \quad\quad (1.2006)$

$R^2 = 0.581$

IIa: $E_t = 199.66 + .0459Y + .3365U - .0946D^{**} - 2.3810Y_L^{*} - .0225F_t$
$\qquad\qquad\qquad\quad (.0032) \quad (.4348) \quad (.0361) \quad\quad (1.2211) \quad\quad (.3503)$

$R^2 = 0.581$

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11. Hereafter, these four variables are referred to as the "basic factors."

12. For a more advanced statistical technique to test the importance of federal aid via the F-ratio, see Appendix E, "Test for Significant Contribution from Federal Aid as an Additional Independent Variable," pp. 222-227.

13. The standard errors are presented in parenthesis below the net regression coefficients.
* denotes significance at the .10 level.
** denotes significance at the .05 level.
*** denotes significance at the .01 level.
The determination of the significance of a regression coefficient is based upon the t-ratio, or the ratio of a coefficient to its standard error. "The t-ratio is used to estimate the probability that an observed value of b might have been obtained by chance in random sampling from a population in which the true regression coefficient was zero." Ezekiel and Fox, op. cit., p. 396. Since the data has 44 degrees of freedom, a regression coefficient is significant at the .10 level if t exceeds 1.684; it is significant at the .05 level if t exceeds 2.015; and it is significant at the .01 level if t exceeds 2.691.
R^2 = the coefficient of multiple determination, which measures

Equation IIa may be interpreted as follows: At given levels of the other variables, an increase of one person per square mile is associated with a decline in per capita expenditures from internal sources of approximately nine cents. A one percentage point increase in the proportion of families with less than $3,000 income is associated with a reduction in per capita expenditures of about $2.38, assuming the other factors constant. Per capita income, the degree of urbanization, and total per capita federal aid apparently have no significant relationship with lower-level government expenditures from internal sources.[14] These same general results also hold for the joint regression model.[15]

Quite significantly, the equations indicate that total per capita federal aid was not an important "determinant" of total per capita lower-level government expenditures from internal sources in 1960. The addition of the federal aid variable to the four basic factors in the

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the proportion of the variation in the dependent variable that is attributable to the independent variables.

14. This finding is similar to Fisher's in that income distribution, rather than income level, is the more important expenditure "determinant." See Fisher, "Interstate Variation in State and Local Government Expenditures," op. cit.

15. The 1960 joint equations are:

Ij: $E_t = 1.6205\ Y^{0.3426}\ U^{0.0147}\ D^{-0.0327*}\ Y_L^{-0.2630*}$
(.3099) (.0168) (.0187) (.1565)
$R^2 = 0.569$

IIj: $E_t = 1.4517\ Y^{0.3458}\ U^{0.0194}\ D^{-0.0185}\ Y_L^{-0.2697*}\ F_t^{0.0824}$
(.3122) (.0186) (.0304) (.1581) (.1392)
$R^2 = 0.572$

Equation IIj indicates that a one per cent increase in the proportion of families with income below $3,000 is associated with a decline in total per capita expenditures from internal sources of about 0.27 per cent, assuming constant levels of the other factors. None of the other variables appear to have a significant relationship with expenditures.

additive model had virtually no effect upon the per cent of explained variation in per capita expenditures. Moreover, the net regression coefficient for federal aid is not significantly different from zero. In short, there is no significant relationship between federal aid and state and local government expenditures from their own sources in 1960.[16]

In addition to the finding that federal aid was not an important expenditures "determinant" in 1960, the fact that the regression coefficients for the aid variable in both the additive and the joint models are not significantly different from zero implies that federal aid had no stimulative effect upon total expenditures from internal sources in 1960. This finding is an apparent contradiction of the studies by Sacks and Harris,[17] Bahl and Saunders,[18] and Osman,[19] all of which found that federal aid exerted a stimulative effect upon state and local expenditures. The difference in findings may be explained by the fact that all previous studies have considered total expenditures (including federal aid) as the dependent variable. In this study, the dependent variable is net of federal aid, so that only state and local government

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16. The absence of association between federal aid and expenditures is further evidence by the fact that the simple correlation coefficients between the two variables are almost zero. The coefficient for the arithmetic values of the variables is 0.004. For the logarithms of the variables, the coefficient is -0.039.

17. Sacks and Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Fund," op. cit.

18. Bahl and Saunders, "Factors Associated with Variations in State and Local Government Spending," op. cit.

19. Osman, "The Dual Impact of Federal Aid on State and Local Government Expenditures," op. cit.

expenditures from their own sources are considered.[20]

Although no significant relation between federal aid and state and local expenditures from internal sources was found in 1960, a different picture appears to have emerged by 1965. In both the additive and the joint regression models, the addition of federal aid to the four basic factors increases the R^2, and the regression coefficients for federal aid are significantly different from zero and positive. These results indicate that federal aid has become an important expenditure "determinant" and that lower-level government expenditures are stimulated by federal aid.

The importance of federal aid, in 1965, as a determinant of state and local government expenditures from their own sources is indicated by the fact that the R^2 was increased by almost thirteen percentage points when the aid variable was added to the four basic factors. The 1965 regressions are:

IIIa: $E_t = 90.07 + .1295Y^{***} - .5762U - .1382D^{***} - 2.4045Y_L^*$
(.0345) (.4213) (.0423) (1.4043)

$R^2 = 0.689$

IVa: $E_t = 75.45 + .0924Y^{***} + .5729U - .1197D^{***} - 2.1428Y_L^* + .7551F_t^{***}$
(.0276) (.3875) (.0330) (1.0923) (.1367)

$R^2 = 0.816$

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20. The 1960 regressions using total expenditures as the dependent variable are:

Additive: $E = 199.55 + .0460Y + .3354U - .0945D^{**} - 2.3799Y_L^* + .9769F_t^{***}$
(.0332) (.4348) (.0361) (1.2212) (.3503)

$R^2 = 0.644$

Joint: $E = 1.0246\ Y^{0.3947*}\ U^{0.0094}\ D^{-0.0159}\ Y_L^{-0.1954}\ F_t^{0.2384**}$
(.2387) (.0142) (.0232) (.1208) (.1064)

$R^2 = 0.675$

The extent of the simulative force of federal aid upon expenditures may be estimated from the regression coefficient for federal (equation IVa) of 0.7551, which is significant at the .01 level. This indicates that each additional dollar of total per capita federal aid is associated with an increase in total per capita expenditures from internal sources of approximately 76 cents, assuming constant levels of the other factors.[21] Once again, the joint regression model yields similar results.[22]

In summary, the data indicate that a significant shift has occurred between 1960 and 1965 regarding the expenditure response of state and local governments to federal aid payments. Total federal aid was found to be neither a determinant nor a stimulator of expenditures in 1960. In contrast, the lower-level governments demonstrate a

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21. The regression coefficients of the other variables in equation IVa indicate the following: each additional dollar of per capita personal income is associated with an increase in per capita expenditures of approximately nine cents, at constant levels of the other variables; each additional person per square mile is accompanied by an expenditure decline of about twelve cents per capita, at given levels of the other factors; finally, a one percentage point increase in the proportion of families with income below $3,000 is associated with a reduction in per capita expenditures of approximately $2.14, assuming the other factors constant.

22. The joint regressions for the 1965 data are:

$$\text{IIIj:}\quad E_t = 0.2903\ Y^{0.7631***}\ U^{0.0060}\ D^{-0.0779***}\ Y_L^{-0.1959**} \qquad R^2 = 0.799$$
$$(.2237)\quad (.0119)\quad (.0133)\quad (.0963)$$

$$\text{IVj:}\quad E_t = -0.2495\ Y^{0.7743***}\ U^{0.0136}\ D^{-0.0565***}\ Y_L^{-0.1831*}\ F_t^{0.1167*} \qquad R^2 = 0.813$$
$$(.2188)\quad (.0124)\quad (.0178)\quad (.0944)\quad (.0644)$$

The regression coefficient for federal aid (equation IVj) of 0.1167 indicates that a one per cent increase in per capita federal aid is associated with an increase in per capita expenditures of approximately 0.12 per cent, at given levels of the other variables.

significant response to federal aid in 1965, as each additional dollar of total per capita federal aid is associated with an increase in total per capita expenditures from internal sources of about 76 cents.

It is highly probable that the observed shift in the expenditure response to federal grants is due, in part, to the increase in the "income elasticity of expenditures" noted earlier.[23] The lack of expenditure response in 1960 is not surprising in view of the fact that the "income elasticity of expenditures" was less than unity (0.82), while the elasticity coefficient of 1.03 in 1965 indicates, a priori, that a positive expenditure response may occur. However, the more direct causes of the shift in the total expenditure response of the lower-level governments to federal aid may be due to a change in the response to grants for one or more functional categories. To ascertain where the shift may have been concentrated, the functions of highways, public welfare, education, health and hospitals, and the non-aided activities are now analyzed.

Highways

Given the finding that state and local highway expenditures were highly income inelastic in both 1960 and 1965, it was concluded, a priori, that federal aid to the function would not have a large stimulative effect upon expenditures.[24] The empirical evidence, however, is just to the contrary, as a significant positive expenditure response to federal highway grants is evident in both 1960 and 1965.

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23. See above, Table 8.

24. See above, Table 8 and p. 124.

The stimulative impact of federal aid upon lower-level government highway expenditures in 1960 is indicated by the regression coefficient of 0.3808 for the aid variable in the additive model. It implies that each additional dollar of per capita highway aid is associated with an increase in per capita expenditures from internal sources of about 38 cents. The equation is:

$$E_h = \underset{}{27.95} + \underset{(.0091)}{.0015Y} - \underset{(.1166)}{.0152U} + \underset{(.0195)}{.007D} - \underset{(.3806)}{.0683Y_L} + \underset{(.1655)}{.3808F_h}^{**}$$

$$R^2 = 0.209$$

Although a strong stimulative effect is also evident in the joint regression model,[25] the conclusion that federal aid induces a positive expenditure response is somewhat weakened by the fact that the per cent of explained variation (R^2) in per capita highway expenditures is quite small, indicating that there are a great many other factors affecting highway expenditures which have not been accounted for.

The stimulative impact is still evident in the 1965 data, but it is much smaller in magnitude. The regression coefficient in the additive model is 0.1866 (significant at the .01 level), which indicates that each additional dollar of per capita federal aid is associated with an increase in per capita highway expenditures of approximately 19 cents.

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25. The 1960 joint equation is:

$$E_h = -1.8575 \; \underset{(.6162)}{Y^{0.6009}} \; \underset{(.0338)}{U^{0.0275}} \; \underset{(.0452)}{D^{0.1487}}^{***} \; \underset{(.3090)}{Y_L^{0.2296}} \; \underset{(.1435)}{F_h^{0.6371}}^{***}$$

$$R^2 = 0.315$$

The regression coefficient for the aid variable of 0.6371 indicates that a one per cent increase in per capita federal aid is associated with an increase in state and local highway expenditures from their own sources of approximately 0.64 per cent.

The 1965 additive equation is:

$$E_h = -.2592 + \underset{(.0067)}{.0293Y^{***}} - \underset{(.0981)}{.4385U} + \underset{(.0081)}{.0009D} + \underset{(.2693)}{.4082Y_L} + \underset{(.0489)}{.1866F_h^{***}}$$

$$R^2 = 0.722$$

The decline in the simulative effect of federal highway grants is also expressed in the joint model,[26] but it is likely due to the increased significance of the income variable in the 1965 regressions. The greater importance of per capita income in 1965 may also account for most of the increase in R^2 from 1960 to 1965, as the percentage of explained variation rose from .21 to .72.

In summary, it would appear that a paradox exists in the case of highways, as there is significant expenditure stimulation evident in the case of an inelastic relationship between expenditures and income. However, it might well be that the income effect associated with federal highway grants is offset by the substitution effect.

Another possible explanation may lie in the fact that maintaining the National System of Interstate and Defense Highways is the sole responsibility of the states. For example, it has been estimated that the average cost of maintaining one mile of interstate highway is about $5,000 per year. At that rate, the state highway departments will be spending approximately $205,000,000 a year on maintenance alone by the

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26. The 1965 joint equation is:

$$E_h = -3.0485\ Y^{\underset{(.4237)}{1.2172^{***}}}\ U^{\underset{(.0240)}{-0.0469^{*}}}\ D^{\underset{(.0386)}{-0.0172}}\ Y_L^{\underset{(.1845)}{0.3084}}\ F_h^{\underset{(.0939)}{0.1770^{*}}}$$

$$R^2 = 0.511$$

The coefficient of 0.1770 indicates that a one per cent increase in per capita federal aid is associated with an increase in per capita expenditures of about 0.18 per cent, assuming the other factors constant.

time the entire system is completed.[27]

Public Welfare

The expenditure response of the lower-level governments to federal welfare grants in both 1960 and 1965, conforms with the a priori expectations based upon the finding that state and local welfare expenditures are relatively income elastic.[28] In fact, federal aid to the lower-level governments for public welfare proved not only to be an important expenditure determinant, but it also exerted a stronger stimulative effect upon expenditures than that observed for any other functional category.

The importance of federal welfare grants in 1960 as a determinant of expenditure levels is illustrated by the fact that the addition of the aid variable to the four basic factors more than doubled the per cent of explained variation in per capita expenditures in both the additive and the joint models.[29]

A specific demand variable for state and local welfare expenditures, in the form of the per cent of the population aged 65 and over in 1960 (A_{65}), was also included in the regressions. The introduction of the age distribution variable increased the R^2 in both models, but it did not have a notable impact upon the significance or size of the

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27. Matthew J. Kulick, Financing the Maintenance of the National System of Interstate and Defense Highways, Research Series No. 7, Kingston, Rhode Island: Bureau of Government Research, University of Rhode Island, 1964, pp. 29-31.

28. See above, p. 124.

29. The coefficient of multiple determination rose from 0.265 to 0.610 in the additive model with the introduction of the aid variable. In the joint model, the R^2 rose from 0.318 to 0.642.

federal aid coefficient.

The substantial positive expenditure response to federal welfare grants in 1960, is evident in the coefficient for the aid variable of 0.6182, which is significant at the .01 level. This indicates that each additional dollar of per capita federal welfare aid is associated with an increase in per capita welfare expenditures from internal sources of approximately 62 cents, assuming constant levels of the other factors. The 1960 additive equation is:

$$E_W = -1.74 + \underset{(.0027)}{.0028Y} - \underset{(.0294)}{.0003U} + \underset{(.0033)}{.0023D} - \underset{(.1116)}{.3515Y_L}^{***}$$

$$+ \underset{(.2438)}{.8501A_{65}}^{***} + \underset{(.0956)}{.6182F_W}^{***}$$

$$R^2 = 0.696$$

The coefficient for the income distribution variable (Y_L) of -0.3515 indicates that each percentage point increase in the proportion of families with income below $3,000 is associated with a decrease in per capita welfare expenditures of about 35 cents, assuming the other factors constant. Similarly, each percentage point increase in the proportion of the population aged 65 and over is accompanied by an increase in per capita welfare expenditures of approximately 85 cents, at constant levels of the other factors. These same results are indicated in the joint model.[30]

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30. The 1960 joint welfare equation is:

$$E_W = -0.8942\ Y^{\underset{(.5427)}{0.5447}}\ U^{\underset{(.0298)}{-0.0168}}\ D^{\underset{(.0372)}{0.0179}}\ Y_L^{\underset{(.2864)}{-0.9248}^{***}}$$

$$A_{65}^{\underset{(.1654)}{0.5786}^{***}}\ F_W^{\underset{(.1184)}{0.7424}^{***}}$$

$$R^2 = 0.721$$

The coefficient of 0.7424 for the aid variable indicates that a

The additive estimating equation for 1965 state and local welfare expenditures from their own sources is:

$$E_w = \underset{}{4.08} + \underset{(.0028)}{.0053Y^*} - \underset{(.0352)}{.0448U} + \underset{(.0034)}{.0008D} - \underset{(.1142)}{.3289Y_L^{***}}$$

$$+ \underset{(.2792)}{.5728A_{65}^{***}} + \underset{(.0894)}{.6133F_w^{***}}$$

$$R^2 = 0.681$$

The coefficient of 0.6133 for the federal aid variable indicates almost no change in the extent of the expenditure response to welfare grants. It indicates that each additional dollar of per capita welfare aid is associated with an increase in lower-level government welfare expenditures from their own sources of about 61 cents, assuming the other factors constant.

The coefficient in the joint model points to only a slight reduction in the expenditure response.[31]

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one per cent increase in federal aid is associated with an increase in welfare expenditures of about 0.62 per cent, at constant levels of the other variables.

31. The 1965 joint welfare equation is:

$$E_w = -1.0400 \; \underset{(.4624)}{Y^{0.6216}} \; \underset{(.0245)}{U^{-0.0150}} \; \underset{(.0290)}{D^{-0.0398}} \; \underset{(.2021)}{Y_L^{-0.6467***}}$$

$$\underset{(.1371)}{A_{65}^{0.3109**}} \quad \underset{(.0900)}{F_w^{0.6225***}}$$

$$R^2 = 0.712$$

The coefficient of 0.6225 for the aid variable indicates that a one per cent increase in federal aid is associated with an increase in welfare expenditures of about 0.62 per cent, at constant levels of the other variables.

Aside from the strong stimulative impact of federal aid, one of the more interesting observations obtained from these estimating equations of welfare expenditures is the negative relationship between expenditures and the per cent of low income families, but the positive association between expenditures and the proportion of the population aged 65 and over. These results strongly suggest that the expenditure preferences of the lower-level governments lie with the aged rather than the needy. The results also support Selma Mushkin's hypothesis that the states are spending more money for old-age assistance than for general assistance, not because state funds are matched in the first instance and not in the second, but rather, because the aged are a strong political force.[32]

In summary, the sizeable positive expenditure response associated with federal welfare grants in both 1960 and 1965, is in conformance with the a priori expectation that state and local expenditures from their own sources would increase when federal aid is directed to a function whose expenditures are income elastic via a strong income effect.

Education

The expenditure response of state and local governments to federal education grants show signs of a substantial change from 1960 to 1965. A significant negative relationship between federal aid and expenditures is evident in both regression models in 1960, indicating

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32. See Selma J. Mushkin, "Barriers to a System of Federal Grants-in-Aid," op. cit., esp. pp. 212-213.

that the lower-level governments substituted federal education funds for their own. In contrast, the 1965 relationship is not as clear, with the two models yielding different signs and weaker associations. This implies, however, that the substitution of federal for local funds observed in 1960 had declined considerably.

In addition to the four basic variables and federal aid, a specific demand variable for education was included, in the form of the per cent of the population between the ages of 5 and 19 in 1960 (A_{5-19}). The addition of this variable not only produced a much higher R^2, but it also had a substantial impact upon the significance and size of the income and federal aid variables in both regression models.[33]

The additive equation for 1960 education expenditures is:

$$E_e = -165.50 + \underset{(.0189)}{.0618Y}^{***} - \underset{(.1601)}{.1381U} - \underset{(.0157)}{.0581D}^{***} - \underset{(.5535)}{.4115Y_L}$$

$$+ \underset{(1.9404)}{5.9495A_{5-19}}^{***} \quad \underset{(.5717)}{-1.5261F_e}^{**}$$

$$R^2 = 0.631$$

The regression coefficient for the federal aid variable is -1.5261, and is significant at the .05 level. This indicates that each additional dollar per capita of federal aid to education is associated with a reduction in per capita state and local education expenditures from their own sources of approximately $1.53, assuming constant levels

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33. The 1960 additive equation with A_{5-19} is:

$$E_e = 88.43 \quad \underset{(.0159)}{.0247Y} - \underset{(.1721)}{.0520U} - \underset{(.0162)}{.0733D}^{***} - \underset{(.5667)}{.9987Y_L} - \underset{(.5585)}{.7447F_e}$$

$$R^2 = 0.551$$

of the other variables.[34]

In contrast, the 1965 additive model yields a regression coefficient for federal aid that is positive, but not significantly different from zero. The equation is:

$$E_e = -70.36 + \underset{(.0212)}{.0407Y^*} + \underset{(.2214)}{.0959U} - \underset{(.0204)}{.0840D^{***}} - \underset{(.6726)}{1.6695Y_L^{**}}$$

$$+ \underset{(2.7136)}{5.5783A_{5-19}^{**}} + \underset{(.7774)}{.5868F_e}$$

$$R^2 = 0.656$$

This indicates that federal aid to education in 1965 bore no relationship to state and local expenditures from their own sources on the function. This finding implies that the lower-level governments no longer substitute federal education funds for their own.[35]

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34. A substitution of federal for local funds is also evident in the 1960 joint model:

$$E_e = -4.0556\ Y^{\underset{(.4271)}{1.1448^{**}}}\ U^{\underset{(.0161)}{0.0117}}\ D^{\underset{(.0257)}{-0.0912^{***}}}\ Y_L^{\underset{(.1712)}{-0.0169}}$$

$$A_{5-19}^{\underset{(.5994)}{1.6882^{***}}}\ F_e^{\underset{(.0493)}{-0.1368^{***}}}$$

$$R^2 = 0.619$$

The federal aid coefficient of -0.1368 (significant at the .01 level), indicates that a one per cent increase in per capita education grants is associated with a reduction in per capita expenditures of about 0.14 per cent, assuming constant levels of the other factors.

35. However, this conclusion is weakened by the fact that the regression coefficient for federal aid in the joint model is negative and statistically significant at the .10 level. But the smaller value of the coefficient (-0.0897) and its lower level of significance imply that the substitution effect has at least weakened. The 1965 joint education equation is:

$$E_e = -3.7442\ Y^{\underset{(.3407)}{1.2135^{***}}}\ U^{\underset{(.0134)}{0.0202}}\ D^{\underset{(.0196)}{-0.1118^{***}}}\ Y_L^{\underset{(.1169)}{-0.0833}}$$

$$A_{5-19}^{\underset{(.4735)}{1.4527^{***}}}\ F_e^{\underset{(.0459)}{-0.0897^{*}}}$$

$$R^2 = 0.743$$

It may be possible to explain the observed negative expenditure response to federal education grants in 1960, and the lack of response in 1965, in terms of the income inelasticity of expenditures for the education function.[36] A priori, the inelastic relationship should mean that lower-level government expenditures for the function would be unresponsive to federal aid, and could even imply that federal funds might be viewed as substitutes for state-local funds. Moreover, the substitution might have been encouraged by the fact that most federal aid to education in 1960 and 1965 was for special programs and projects carrying little, if any, matching requirements, or was for federally impacted areas.[37] Finally, the increase in the income elasticity of education expenditures from 0.63 in 1960, to 0.73 in 1965, may account for part of the decline in the substitution of federal for local funds.

Health and Hospitals

The extent of association between federal aid to health and hospitals and lower-level government expenditures for the function is very weak in both 1960 and 1965. Apparently, federal health and hospital grants have very little impact upon state-local health expenditures.

To obtain an estimating equation of health and hospital expenditures, a specific demand variable in the form of the per cent of the

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36. See above, Table 8.

37. For a description of the various federal grant programs to education, see U. S. Department of Health, Education, and Welfare, Grants-in-Aid and Other Financial Assistance Programs Administered by the U.S. Department of Health, Education, and Welfare, 1964-65 Edition, Washington: U.S. Government Printing Office, 1965, pp. 169-260.

populating aged 65 and over in 1960 (A_{65}) was included, in addition to the four basic factors and federal aid. Surprisingly, the coefficient for A_{65} was not significantly different from zero in any of the four regressions run. This finding implies that state and local government expenditure decisions for health and hospitals are not influenced by the proportion of the aged population.

The 1960 additive equation is:

$$E_{hh} = -21.67 + \underset{(.0036)}{.0108Y***} + \underset{(.0527)}{.1332U**} - \underset{(.0042)}{.0034D} + \underset{(.1414)}{.1862\ Y_L}$$

$$+ \underset{(.3620)}{.3762A_{65}} + \underset{(1.0803)}{1.7794F_{hh}}$$

$$R^2 = 0.531$$

The only variables to exhibit a significant relationship to per capita health and hospital expenditures are per capita personal income, and the per cent of the population living in urban areas, both of which are positively related to expenditures.[38]

There is some slight evidence in the 1965 regressions of a negative relationship between federal aid and state-local health and

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38. In the 1960 joint health equation, per capita income and population density are the only variables significantly related to per capita expenditures:

$$E_{hh} = -4.5233\ Y^{\underset{(.5129)}{1.6026***}}\ U^{\underset{(.0298)}{0.0163}}\ D^{\underset{(.0345)}{0.0594*}}\ Y_L^{\underset{(.2527)}{0.2777}}$$

$$A_{65}^{\underset{(.1509)}{-0.0969}}\ F_{hh}^{\underset{(.1321)}{0.0825}}$$

$$R^2 = 0.508$$

hospitals expenditures.[39] This is especially true in the joint regression model, where the federal aid coefficient is negative and significant at the .05 level.[40]

Although the federal aid coefficient is also negative in the additive model, it is significantly different from zero only at the .20 level, which is a probability of four in five that the true value of the regression coefficient in the population is different from zero. The 1965 additive equation is:

$$E_{hh} = -5.45 + \underset{(.0052)}{.0120Y^{**}} + \underset{(.0648)}{.0271U} - \underset{(.0067)}{.0026D} + \underset{(.2065)}{.1920Y_L}$$

$$- \underset{(.5212)}{.5798A_{65}} - \underset{(.8623)}{1.2269F_{hh}}$$

$$R^2 = 0.379$$

However, any conclusions regarding the expenditure response to health and hospital grants must recognize that the six independent variables were able to account for only about 40 per cent of the interstate

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39. Although the simple correlation coefficients between federal aid and health and hospital expenditures indicate a negative relationship between the variables for both 1960 and 1965, it appears to be stronger in 1965. The coefficients between the arithmetic values of the variables for 1960 and 1965, respectively, are -0.185 and -0.380. The respective coefficients between the logarithms of the variables are -0.347 and -0.437.

40. The 1965 joint health equation is:

$$E_{hh} = -1.8699\ Y^{\underset{(.6027)}{0.9982}}\ U^{\underset{(.0315)}{-0.0331}}\ D^{\underset{(.0368)}{0.0423}}\ Y_L^{\underset{(.2520)}{0.1197}}$$

$$A_{65}^{\underset{(.1749)}{-0.2891}}\ F_{hh}^{\underset{(.1308)}{-0.2897^{**}}}$$

$$R^2 = 0.393$$

The federal aid coefficient of - 0.2897 indicates that a one per cent increase in per capita health grants is associated with a reduction in per capita health expenditures of about 0.29 per cent, assuming the other factors constant.

variation in per capita expenditures for the function in 1965. There are obviously a great many other factors which must be considered before much can be said about expenditure decisions for the activity.

The Non-Aided Functions and Budget "Distortion"

To examine the nature of the expenditure response on the non-aided functions associated with federal aid, and to test for budget "distortion," regressions were run using per capita expenditures on the non-aided activities[41] as the dependent variable.

In conformance with a priori expectations based upon the "income elasticity of expenditures,"[42] there is no evidence that federal grants have induced the lower-level governments to "distort" their budgets. In fact, while there was no significant relationship between federal aid and the non-aided functions in 1960, the 1965 data indicate a positive expenditure response on the non-aided activities, implying that grants act to "release" funds from the aided services.

In 1960, the regression coefficients for the federal aid variables are positive, but not significantly different from zero in both regression models.[43] In other words, there is no significant relationship between

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41. That is, all functions other than highways, public welfare, education, and health and hospitals.

42. See above, pp. 124-125.

43. The 1960 joint equation is:

$$E_{na} = 1.4510\ Y^{0.2550}\ U^{0.0372}\ D^{0.0101}\ Y_L^{-0.5564**}\ F_t^{0.1245}$$
$$(.4479)\quad (.0267)\quad (.0436)\quad (.2267)\quad (.1996)$$

$$R^2 = 0.619$$

total per capita federal aid and per capita expenditures on the non-aided functions.

The 1960 additive equation is:

$$E_{na} = 39.93 + \underset{(.0175)}{.0189Y} + \underset{(.2283)}{.3463U} - \underset{(.0190)}{.0167D} - \underset{(.6413)}{.8317Y_L} + \underset{(.1840)}{.0059F_t}$$

$$R^2 = 0.533$$

In sharp contrast to the lack of association between federal grants and expenditures on the non-aided functions observed in 1960, both 1965 regressions indicate there to be a significant positive relationship between grants and non-aided expenditures. The 1965 additive equation is:

$$E_{na} = -42.64 + \underset{(.0184)}{.0387Y^{**}} + \underset{(.2585)}{.5753U^{**}} - \underset{(.0220)}{.0203D} - \underset{(.7285)}{.5302Y_L} + \underset{(.0912)}{.3821F_t^{***}}$$

$$R^2 = 0.671$$

Stimulation of the non-aided activities, rather than "distortion," is indicated by the regression coefficient for the federal aid variable of 0.3821, which is significant at the .01 level. This indicates that each additional dollar of total per capita federal aid is accompanied by an increase in per capita expenditures on the non-aided functions of approximately 38 cents, assuming constant levels of the other variables.[44]

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44. Stimulation of the non-aided activities is indicated by the coefficient of 0.2522 in the 1965 joint model. It indicates that a one per cent increase in per capita grants is associated with an increase in per capita non-aided expenditures of about 0.25 per cent. The equation is:

$$E_{na} = -1.2259\ Y^{\underset{(.4501)}{0.9494^{**}}}\ U^{\underset{(.0255)}{0.0303}}\ D^{\underset{(.0366)}{-0.0149}}\ Y_L^{\underset{(.1943)}{-0.4091^{**}}}\ F_t^{\underset{(.1366)}{0.2522^{*}}}$$

$$R^2 = 0.705$$

These results imply that a major effect of conditional grants-in-aid to state and local governments in 1965 has been to release funds for expenditure on those functions not receiving federal support.

The stimulation of non-aided expenditures in 1965, and the lack of stimulation in 1960, appear reasonable in light of the "income elasticity of expenditures" for the various functions.[45] The fact that the income elasticity of the non-aided functions was only slightly greater than unity in 1960 (1.286), may well explain why the conditional grants were not associated with increased expenditures on those functions not directly aided. Similarly, the very high income elasticity for the non-aided functions of 1.936 in 1965, should account for much of the observed stimulation of expenditures on the non-aided activities.

Finally, the observed stimulation of non-aided functions in 1965, where none occured in 1960, is probably a major factor accounting for the change in the over-all response of total expenditures from internal sources to total federal grants noted above.[46]

Summary

In summary, a major effect of conditional federal grants-in-aid in 1965 appears to be a stimulation of state-local expenditures on those functions not receiving direct federal assistance. This implies that even though the grants are tightly conditioned, they tend to subsidize a wide range of services. Furthermore, this subsidization of the non-aided activities appears to be a very recent development, as it was not

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45. See Table 8.

46. See pp. 130-131.

evident in 1960, but is very strong in 1965.

The estimated expenditure response of state and local governments to federal aid payments is summarized in Table 10. No response in 1960 is indicated for total per capita expenditures from internal sources, for health and hospital expenditures, or for expenditures on the non-aided functions. A positive expenditure response is evident for highways and public welfare. In contrast, a negative expenditure response is indicated for the education function, implying a substitution of federal for state and local funds.

In 1965, federal aid was associated with a positive expenditure response for total expenditures, highways, public welfare, and the non-aided functions. No response was indicated for education or health and hospitals in the additive model.[47]

In most cases, the direction of the observed expenditure responses to federal grants appear reasonable in light of the "income elasticity of expenditures" for the various functions, the only exception being highways and health and hospitals. In spite of the income inelasticity of expenditures for highways, a positive expenditure response was evident in both 1960 and 1965. However, this may have been due to a strong substitution effect. In contrast, although expenditures for health and hospitals were slightly income elastic, there was no significant expenditure response.

Finally, a great deal of insight into the shift in the expenditure

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47. The joint model yielded a slight negative response for both of these functions in 1965.

TABLE 10

A SUMMARY OF THE ESTIMATED EXPENDITURE RESPONSE OF STATE AND LOCAL GOVERNMENTS TO FEDERAL AID PAYMENTS: 1960 AND 1965

Assuming other factors constant, a one dollar increase in per capita federal aid is associated with a per capita expenditure change of approximately:

	1960	1965
Total Expenditures	$None	$0.76
Highways	0.38	0.19
Public Welfare	0.62	0.61
Education	-1.53	None
Health and Hospitals	None	None
Non-Aided	None	0.38

TABLE 10 (Continued)

Assuming other factors constant, a one per cent increase in per capita federal aid is associated with a per capita expenditure change of approximately:

	1960	1965
Total Expenditures	None %	0.12 %
Highways	0.63	0.18
Public Welfare	0.74	0.62
Education	-0.14	-0.09
Health and Hospitals	None	-0.29
Non-Aided	None	0.25

response from 1960 to 1965 is provided by the shift in the income elasticities for certain functions. This is especially true in the case of the non-aided activities, where the elasticity coefficient rose from about 1.3 in 1960, to about 1.9 in 1965. Moreover, the stimulation of non-aided expenditures in 1965, where none occurred in 1960, may account for much of the shift in the response of total expenditures from internal sources to federal grants during the period.

The Fiscal Response to Federal Grants

The finding of a positive expenditure response in 1965 for total expenditures, and for the functions of highways, public welfare, and the non-aided activities, raises a question regarding the fiscal response of the lower-level governments to federal aid. The observed stimulation of expenditures for services not directly aided precludes the possibility of budget "distortion" to finance the additional expenditures for highways and public welfare. Therefore, *a priori* considerations indicate that the lower-level governments may tend to increase their fiscal effort [48] as a means of providing the additional revenues.

To test the hypothesis that federal aid induces state and local governments to increase their fiscal effort, regressions were run with state and local fiscal effort as the dependent variable. The independent variables were: per capita personal income, the degree of urbanization, population density, the per cent of families with income below $3,000, and total per capita federal aid. The hypothesis may be considered to

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48. "Fiscal effort" is defined as state and local revenues from their own sources per $1,000 of state personal income.

be supported by a regression coefficient for the federal aid variable which is positive and significantly different from zero.

The regression equations for both 1960 and 1965, indicate there to be no significant relationship between federal aid and state-local fiscal effort on the basis of the above criteria. Three of the four signs are positive, but none of the coefficients for federal aid are significantly different from zero.

The 1960 additive equation is:

$$FE = 198.95 - \underset{(.0139)}{.0353Y^{**}} + \underset{(.1821)}{.1351U} - \underset{(.0151)}{.0291D^{*}} - \underset{(.5114)}{1.0291Y_L^{**}} + \underset{(.1467)}{.2191F_t}$$

$$R^2 = 0.320$$

The equation indicates that per capita income, population density, and the per cent of low income families all have a negative relationship with fiscal effort.[49]

Again, in 1965, similar relationships are indicated by both regression models.[50] The additive equation is:

$$FE = 211.10 - \underset{(.0119)}{.0211Y^{*}} + \underset{(.1669)}{.0014U} - \underset{(.0142)}{.0378D^{**}} - \underset{(.4704)}{.9117Y_L^{*}} + \underset{(.0589)}{.0496F_t}$$

$$R^2 = 0.340$$

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49. Similar results are indicated by the 1960 joint equation:

$$FE = 4.7073\ Y^{\underset{(.2621)}{-0.7201^{**}}}\ U^{\underset{(.0156)}{0.0180}}\ D^{\underset{(.0255)}{-0.0392}}\ Y_L^{\underset{(.1327)}{-0.2766^{**}}}\ F_t^{\underset{(.1166)}{0.0832}}$$

$$R^2 = 0.342$$

50. The 1965 joint equation is:

$$FE = 3.6325\ Y^{\underset{(.2203)}{-0.3542}}\ U^{\underset{(.0125)}{0.0045}}\ D^{\underset{(.0179)}{-0.0579^{**}}}\ Y_L^{\underset{(.0951)}{-0.1184}}\ F_t^{\underset{(.0669)}{-0.0284}}$$

$$R^2 = 0.392$$

In other words, these equations indicate that although a significant positive expenditure response is associated with federal aid, there is no fiscal response.[51] Furthermore, since the measure of fiscal effort represents the proportion of a state's income that is allocated to the public sector, the results imply that federal aid does not induce the lower-level governments to reallocate resources from the private to the public sectors.

However, the conclusion of no association between federal aid and state-local fiscal effort must be tempered by a recognition of the fact that the five independent variables were able to account for only slightly more than one-third of the interstate variation in fiscal effort. In contrast, the same independent variables were able to account for over four-fifths of the interstate variation in per capita total expenditures from internal sources in 1965. This finding implies that expenditures and fiscal effort are functions of a different set of factors.

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51. For an analysis of the fiscal response of local governments to federal grants, see Robert F. Adams, "The Fiscal Response to Intergovernmental Transfers in Less Developed Areas of the United States," Review of Economics and Statistics, Vol. XLVIII, No. 3, August 1966, pp. 308-313. Adams examined the local fiscal effort (revenue from internal sources divided by personal income) for 1,249 county areas in 1957 with six independent variables. Since he used counties of light population density (those between 15 and 50), the large matching grant programs of urban renewal and low-rent public housing designed for densely populated areas did not apply, with the result that over half of his grant programs contained no matching provisions. Therefore, a priori, he expected an increase in federal aid to be associated with a reduction in fiscal effort. He found, "The results with respect to federal aid indicate, as expected, that communities absorb only part of the increments of income received as federal grants into the consumption of public services . . . Generally speaking, federal aid is less likely to raise the overall level of public services and more likely to reduce the financial responsibility of smaller political units than is state aid." (p. 311).

In an attempt to find other factors which may account for the interstate variations in fiscal effort, two additional independent variables were tested--the per cent of the population between 5 and 19 years old in 1960 (A_{5-19}), and the per capita outstanding debt in 1960 and 1965. The per cent of school age population was added on the hypothesis that as an important determinant of school expenditures, it may also be an important factor in explaining fiscal effort. The debt variable was added on the hypothesis that a large outstanding debt would tend to reflect a liberal attitude on the part of the community regarding public activities. Therefore, a large volume of outstanding debt should be associated with a heavier fiscal effort.

Surprisingly, none of the coefficients for the new variables were significantly different from zero in the full seven variable model, nor did their introduction have any significant effect upon the coefficients for federal aid. Apparently, there is no significant association between fiscal effort and the per cent of school age population, or per capita outstanding debt.[52]

The 1960 additive equation is:

$$FE = \underset{}{169.27} + \underset{(.0230)}{.0207}\ Debt + \underset{(1.8924)}{.9737}A_{5-19} - \underset{(.0193)}{.0360}Y^* + \underset{(.1879)}{.0905}U$$

$$- \underset{(.0160)}{.0277}D^* - \underset{(.5564)}{1.0637}Y_L^* + \underset{(.1574)}{.2017}F_t$$

$$R^2 = 0.340$$

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52. The 1960 joint equation is:

$$FE = \underset{}{4.2744}\ Debt^{\underset{(.0687)}{0.0177}}\ A_{5-19}^{\underset{(.5366)}{0.1370}}\ Y^{\underset{(.4073)}{-0.6707}}\ U^{\underset{(.0161)}{0.0173}}$$

$$D^{\underset{(.0309)}{-0.0376}}\ Y_L^{\underset{(.1551)}{-0.2576}}\ F_t^{\underset{(.1215)}{0.0829}}$$

$$R^2 = 0.344$$

The insignificance of the debt and age distribution variables is emphasized by the fact that their introduction increased the R^2 by only two percentage points over the five variable model.[53]

Again, in 1965, the lack of association is evident in both models.[54] The additive model is:

$$FE = \underset{}{122.23} + \underset{(.0152)}{.0074Debt} + \underset{(1.8873)}{2.3283A_{5-19}} - \underset{(.0159)}{.0127Y} - \underset{(.1765)}{.0477U}$$

$$- \underset{(.0147)}{.0330D^{**}} \; \underset{(.4992)}{-.8294Y_L} + \underset{(.0648)}{.0201F_t}$$

$$R^2 = 0.368$$

To obtain a truer estimate of the relationship between the independent variables and fiscal effort, some of the variables may be dropped from the equation when their introduction does not increase the proportion of the variance in fiscal effort attributed to regression.[55] Therefore, the final regression equation contains only those variables whose regression coefficients are significantly different from zero. For example, this procedure yields an equation in the 1965 additive model in which the per cent of school age population, population density,

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53. See above, p. 150.

54. The 1965 joint equation is:

$$FE = 2.2918\ Debt^{\underset{(.0544)}{0.0215}}\ A_{5-19}^{\underset{(.4031)}{0.4286}}\ Y^{\underset{(.3078)}{-0.1704}}\ U^{\underset{(.0132)}{0.0026}}$$

$$D^{\underset{(.0202)}{-0.0544***}}\ Y_L^{\underset{(.1027)}{-0.0784}}\ F_t^{\underset{(.0758)}{-0.0387}}$$

$$R^2 = 0.411$$

55. The elimination of a variable is based upon the F-ratio, which is a probability estimate that the variance between means is not due to chance. See Appendix D for the technique.

and the per cent of low income families, bear a significant relationship with state and local fiscal effort. The equation is:

$$FE = 56.15 + \underset{(1.4328)}{3.3779A_{5-19}}{}^{**} - \underset{(.0129)}{.0370D}{}^{***} - \underset{(.2740)}{.5173Y_L}{}^{*}$$

$$R^2 = 0.350$$

The equation indicates that at given levels of density and income distribution, a one per cent increase in the proportion of school age population is associated with an increase in state and local government fiscal effort of about $3.38. At given levels of the other variables, an increase of one person per square mile is associated with a reduction in fiscal effort of about four cents. Finally, a one per cent increase in the percentage of low income families, with density and age distribution constant, is accompanied by a decline in fiscal effort of approximately 52 cents. The introduction of the debt, income, urbanization, and federal aid variables adds less than two percentage points to the proportion of explained variation is fiscal effort and apparently acts to "suppress" the age and income distribution variables.[56]

In conclusion, the finding of no association between federal aid and state-local fiscal effort, in conjunction with the earlier findings of a positive expenditure response to grants, indicates that the lower-level governments are able to finance the "stimulated" expenditures without a proportionate increase in the percentage of resources devoted to the public sector.

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56. For a discussion of "suppressant variables," see Peters and Summers, op. cit., pp. 255-259.

CHAPTER VI

THE RESPONSE OF INDIVIDUAL STATES TO FEDERAL GRANTS

The purpose of the present chapter is to analyze the nature of the response of individual states to federal grants over the time period 1957 - 1965. The analysis is primarily concerned with empirical answers to the following questions: (1) What are the relationships between per capita federal grants and per capita expenditures from internal sources for selected functions over time in the individual states? (2) Are changes in per capita expenditures significantly related to changes in per capita income and/or to changes in per capita federal aid? (3) Is there a significant fiscal response associated with federal aid over time? (4) How might the individual states be expected to respond to a system of unconditional grants, such as that proposed by the "Heller Plan"?

The Concept of "Intertemporal Elasticity"

Answers to questions one, three, and four, above are developed in terms of the elasticity between variables over time, or "intertemporal elasticity." Specifically, three measures are used. First, the elasticity between per capita federal grants and per capita lower-level government expenditures from internal sources over time is called the "intertemporal grant elasticity of expenditures." Therefore, it represents the trend relationship, if any, between grants and expenditures over time. Second, the elasticity between federal grants and state-local

fiscal effort over time is called the "intertemporal grant elasticity of fiscal effort." Again it represents the trend between the two variables over time. Finally, the elasticity between per capita income and per capita expenditures over time is called the "intertemporal income elasticity of expenditures."[1]

It must be emphasized that since these elasticity measures are used to determine the nature of the relationship between particular variables over time, they represent rather specialized uses of the concept of elasticity.

The "Intertemporal Grant Elasticity of Expenditures"

To determine the nature of the relationship between the level of per capita expenditures for selected functions, and the level of per capita federal grants over time, the level of per capita expenditures is assumed to be a function of the level of per capita grants. The equation used is of the form:

$$\log E_{ij} = \log a + c \log F_{ij}$$

where;

E_{ij} = per capita state and local expenditures from internal sources on the ith function, in the jth state

F_{ij} = per capita federal grants to the ith function, in the jth state

a = the constant term

c = the regression coefficient

Once again, the transformation of the variables into logarithms provides

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1. For use of this concept to analyze intersectoral resource allocation, see Herber, op. cit., pp. 9-10.

a regression coefficient that is an estimate of the elasticity between the two variables. In this case, "c" represents the "intertemporal grant elasticity of expenditures."

A regression coefficient significantly different from zero will indicate the existence of a "gross"[2] relationship between the two variables, while the size of the coefficient will provide an estimate of the expenditure response associated with federal grants in the individual states.

Total Expenditures

The regression coefficients representing the "intertemporal grant elasticity of expenditures" are presented in Table 11. They indicate that a significant relationship exists between the level of per capita federal aid and the level of total per capita state and local expenditures from internal sources in all but three of the forty-eight[3] states from 1957 to 1965. Only the states of Connecticut, New Hampshire, and Kansas exhibit a lack of association between per capita grants and per capita expenditures from their own sources. Furthermore, the high degree of association between the two variables is indicated by the fact that the coefficients are significant at the .01 level for forty-three states.[4]

The wide range in the value of the coefficients implies that individual states respond quite differently to federal grants. Mississippi

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2. See footnote 2, p. 117.

3. Alaska and Hawaii were omitted from the analysis due to the lack of comparable data before their statehood.

4. Iowa and New Mexico have coefficients significant at the .05 level.

TABLE 11

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL EXPENDITURES ON PER CAPITA FEDERAL GRANTS: BY STATES, 1957-1965

I. States with high grant elasticity of expenditures (.600 - .900)

Mississippi	0.900	California	0.690
Missouri	0.872	North Carolina	0.689
New Mexico	0.806*	Wisconsin	0.681
Colorado	0.764	Alabama	0.677
Kentucky	0.703	Nebraska	0.646
Texas	0.696	Nevada	0.632

II. States with medium grant elasticity of expenditures (.400 - .599)

Oklahoma	0.590	West Virginia	0.445
Arkansas	0.581	Utah	0.445
Iowa	0.567*	Minnesota	0.444
North Dakota	0.558	South Dakota	0.435
South Carolina	0.522	Pennsylvania	0.429
Washington	0.502	Wyoming	0.425
Florida	0.500	Tennessee	0.425
New York	0.494	Michigan	0.421
Rhode Island	0.487	Montana	0.418
Georgia	0.486	Arizona	0.417
Oregon	0.480	Idaho	0.408
Maryland	0.465	Maine	0.402
Delaware	0.450		

III. States with low grant elasticity of expenditures (0 - .399)

Virginia	0.393	Ohio	0.286
Indiana	0.380	Louisiana	0.229
Kansas	0.334°	Vermont	0.173
Illinois	0.328	New Hampshire	0.171°
Massachusetts	0.317	Connecticut	0.072°
New Jersey	0.289		

* Significant at the .05 level.

° Not significantly different from zero.

All others significant at the .01 level.

indicates the highest response, where a one per cent increase in per capita federal aid is associated with an increase in per capita expenditures from internal sources of approximately 0.90 per cent. In contrast, a one per cent increase in federal aid to Vermont is associated with an expenditure increase of only about 0.17 per cent. It should be noted, however, that twenty-five states indicate an expenditure change ranging from 0.40 to 0.60 per cent for each one per cent increase in federal grants.

To determine whether there is any significant relationship between a state's rank grant elasticity of expenditures and its rank per capita income in 1960, (that is, whether a high income state also has a high grant elasticity), Spearman's Rank Correlation Coefficient was calculated by the formula:[5]

$$r = 1 - \frac{6\sum d^2}{n^3 - n}$$

where;

r = the rank correlation coefficient

d = the difference between rankings

n = the number of observations

A coefficient of r = 1.0 would indicate a perfect positive correlation between the two rankings, while r = - 1.0 would indicate a perfect negative correlation between the two rankings. The rank correlation coefficient was r = - 0.2350, indicating a slight inverse relationship between the two rankings. This implies that the lower income states tended to

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5. Frederic A. Mills, Statistical Methods, op. cit., p. 311.

have a somewhat higher rank grant elasticity in the period under consideration.[6]

In summary, these results indicate that per capita state and local expenditures from internal sources are significantly related to per capita grants in forty-five of the forty-eight states in the 1957-1965 period. But perhaps more importantly, they imply that the individual states respond quite differently to federal aid.

Highways

In contrast to the earlier finding that variations in per capita highway grants had a significant positive relationship with variations in per capita state-local highway expenditures in both 1960 and 1965,[7] the time-series data emphasize the lack of association between grants and expenditures in most states. As shown in Table 12, there was a significant trend relationship between federal highway grants and lower-level government expenditures for the function in only 10 states from 1957 to 1965. This finding would seem to imply that state and local highway expenditure decisions, over time, are not significantly affected by federal grants.

With respect to the ten states where there is a significant relationship between grants and expenditures, five states exhibit a positive expenditure response, while five others exhibit a negative expenditure response. The positive coefficients in Nevada, New Mexico,

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6. However, the coefficient is significantly different from zero only at the .20 level. The t value of the coefficient is - 1.6397, which is just slightly less than the - .1.6449 needed for significance at the .10 level.

7. See above, pp. 131-134.

TABLE 12

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL HIGHWAY EXPENDITURES ON PER CAPITA FEDERAL HIGHWAY GRANTS: BY STATES, 1957-1965

"Grant Elasticity of Highway Expenditures"

Nevada	0.406*	New Hampshire	-0.091*
New Mexico	0.388*	Vermont	-0.122*
Nebraska	0.381**	Massachusetts	-0.178*
Mississippi	0.344**	Maryland	-0.278*
Kentucky	0.304*	Connecticut	-0.393*
Alabama	0.078	New Jersey	-0.041
Arizona	-0.243	New York	0.077
Arkansas	0.099	North Carolina	-0.278
California	0.106	North Dakota	0.125
Colorado	-0.108	Ohio	-0.063
Delaware	0.266	Oklahoma	-0.013
Florida	-0.002	Oregon	0.082
Georgia	0.045	Pennsylvania	0.146
Idaho	-0.050	Rhode Island	0.185
Illinois	-0.219	South Carolina	0.081
Indiana	0.058	South Dakota	0.119
Iowa	0.035	Tennessee	0.090
Kansas	-0.171	Texas	0.089
Louisiana	-0.046	Utah	-0.013
Maine	0.036	Virginia	-0.038
Michigan	-0.135	Washington	-0.024
Minnesota	0.069	West Virginia	0.123
Missouri	0.227	Wisconsin	0.114
Montana	0.103	Wyoming	0.255

* Significant at the .05 level.
** Significant at the .01 level.

Nebraska, Mississippi, and Kentucky indicate that a one per cent increase in per capita highway grants is associated with an increase in state-local highway expenditures ranging from 0.3 to 0.4 per cent. In contrast, the negative coefficients in New Hampshire, Vermont, Massachusetts, Maryland, and Connecticut, imply that federal highway funds are viewed as substitutes for state and local funds.[8]

In summary, the contradictory findings of the cross-section analysis for 1960 and 1965 and the time-series analysis, 1957 - 1965, apparently indicate that although the interstate variation in per capita state and local highway expenditures from internal sources is positively associated with variations in per capita highway grants, there is little relationship over time between grants and expenditures in most states. However, it should be noted that the time-series results are not seriously out of line with the income inelasticity of highway expenditures over time.[9]

Public Welfare

The divergent response of the individual states to federal grants over time is clearly evident with respect to the public welfare function. As shown in Table 13, grants and expenditures have a significant positive relationship in twenty-eight states, a negative relationship in only two

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8. A very slight substitution effect is also indicated in fifteen other states (Arizona, Colorado, Florida, Idaho, Illinois, Kansas, Louisiana, Michigan, New Jersey, North Carolina, Ohio, Oklahoma, Utah, Virginia, and Washington), but the large standard errors cast doubt on the value of the coefficients.

9. See below, Table 21.

TABLE 13

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL WELFARE EXPENDITURES ON PER CAPITA FEDERAL WELFARE GRANTS: BY STATES, 1957-1965

"Grant Elasticity of Welfare Expenditures"

South Carolina	2.490**	Maryland	0.795**
Virginia	1.815**	California	0.764**
New Mexico	1.464**	Indiana	0.592*
North Carolina	1.404**	Rhode Island	0.570*
South Dakota	1.174**	Ohio	0.544**
Minnesota	1.164*	Idaho	0.543**
West Virginia	1.146**	Pennsylvania	0.496**
Kentucky	1.079*	Michigan	0.481**
Illinois	1.070**	Massachusetts	0.407*
Wisconsin	0.972**	Connecticut	0.393**
New Hampshire	0.921*	New Jersey	0.391**
North Dakota	0.836*	New York	0.327**
Alabama	0.827*	Kansas	0.288*
Iowa	0.813**	Louisiana	-0.320*
Texas	0.813**	Montana	-2.409*

Arizona	0.377	Nebraska	0.078
Arkansas	0.666	Nevada	0.421
Colorado	0.236	Oklahoma	0.272
Delaware	0.409	Oregon	0.527
Florida	0.608	Tennessee	0.956
Georgia	-0.013	Utah	0.167
Maine	0.439	Vermont	0.329
Mississippi	0.595	Washington	-0.149
Missouri	0.330	Wyoming	-0.432

* Significant at the .05 level.
** Significant at the .01 level.

states, while eighteen states exhibit no significant association between aid and expenditures. The wide range in the value of the coefficients also emphasizes the differing response to federal grants. For example, a one per cent increase in per capita welfare grants to South Carolina is associated with an increase in per capita welfare expenditures from internal sources of about 2.49 per cent. The same increase in federal aid to Kansas is associated with an increase in expenditures of only about 0.29 per cent. It is also significant that only Louisiana and Montana appear to view welfare grants as substitutes for their own funds, although it is quite sizeable in Montana, where a one per cent increase in per capita grants is associated with a decline in per capita expenditures of approximately 2.41 per cent.

Quite importantly, the lack of expenditure response evident in eighteen states indicates that state and local public welfare expenditure decisions over time are made independently of federal aid considerations. Moreover, the lack of income homogeneity among these states emphasizes the independence of action. Ranked by 1960 per capita income, five states were in the highest third, six were in the middle group, and seven were in the lowest third.

In summary, although more than one-half of the states exhibited a significant positive expenditure response to federal welfare grants over the 1957 - 1965 period, the wide range in the value of the coefficients, in addition to the absence of association between grants and expenditures in eighteen states, imply that state and local governments have not been forced into a uniform pattern of response by the conditions and matching requirements of the public assistance grants.

The Non-Aided Functions

The conclusion that the lower-level governments do not lose financial freedom by accepting conditional grants-in-aid is strongly supported by the significant positive relationship[10] between per capita grants and per capita state-local expenditures on the non-aided functions in all but five states over the 1957 - 1965 period.

The elasticity coefficients between grants and non-aided expenditures shown in Table 14 indicate that the expenditure response ranged from a high in Mississippi (where a one per cent increase in total per capita federal aid was associated with an increase in per capita expenditures on the non-aided activities of about 0.98 per cent), to a low in Vermont (where the same increase in grants was associated with an increase in expenditures of approximately 0.30 per cent). The only states in which there was no significant association between grants and non-aided expenditures were: Iowa, Kansas, New Hampshire, New Mexico, and West Virginia.

The fact that not a single state had a negative coefficient also supports the earlier conclusion that federal grants have not induced the lower-level governments to "distort" their budgets.[11] Over the time period under consideration, a major effect of conditional grants-in-aid has been apparently to release state and local funds for expenditure on those activities which are not directly supported.

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10. The coefficients for thirty-nine states are significant at the .01 level, while those for Kentucky, Arizona, Rhode Island, and Florida are significant at the .05 level.

11. See above, pp. 143-145.

TABLE 14

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL EXPENDITURES FOR THE NON-AIDED FUNCTIONS ON TOTAL PER CAPITA FEDERAL GRANTS: BY STATES, 1957-1965

"Grant Elasticity of Non-Aided Expenditures"

Mississippi	0.979	Virginia	0.474
Missouri	0.879	Maryland	0.471
California	0.829	Rhode Island	0.464*
Oklahoma	0.802	Idaho	0.463
Texas	0.791	Minnesota	0.454
Nebraska	0.790	Delaware	0.451
North Carolina	0.748	South Dakota	0.446
Kentucky	0.743*	Utah	0.436
Colorado	0.705	Pennsylvania	0.426
Washington	0.686	Wyoming	0.416
Wisconsin	0.677	Florida	0.409*
South Carolina	0.673	Maine	0.398
Nevada	0.601	Louisiana	0.385
Tennessee	0.593	Massachusetts	0.381
Alabama	0.580	Oregon	0.375
Georgia	0.533	Ohio	0.353
Arizona	0.524*	Connecticut	0.343
Arkansas	0.576	Illinois	0.336
North Dakota	0.515	Montana	0.329
Michigan	0.491	Indiana	0.312
New York	0.480	New Jersey	0.302
		Vermont	0.301

Iowa	0.478^{o}	New Mexico	0.599^{o}
Kansas	0.293^{o}	West Virginia	0.327^{o}
New Hampshire	0.310^{o}		

* Significant at the .05 level.

o Not significantly different from zero.
All others significant at the .01 level.

Summary

A summary of the expenditure response of individual states to federal grants is presented in Table 15. The stimulative impact of total per capita federal aid is evidenced by the fact that only three of the forty-eight states did not exhibit a significant positive relationship between grants and expenditures from internal sources. But perhaps of greater significance is the finding that federal grants, over the 1957 - 1965 period, apparently tended to release state and local funds for expenditure on the non-aided activities in forty-three states. The thesis that conditional grants have released funds is further supported by the fact that fourteen states[12] showed no significant relationship between highway grants or welfare grants and expenditures for these two functions, but did exhibit a strong relationship between grants and the non-aided activities. This implies that federal aid to highways and public welfare to these fourteen states released state and local funds for expenditure on those functions not directly aided.

The Response to Annual Changes in Federal Grants

The finding of a significant association between the level of total per capita federal grants and the level of total per capita state and local expenditures from internal sources in forty-five of the forty-eight states from 1957 - 1965, raises a question concerning the relationship between changes in per capita grants and changes in per capita expenditures for the individual states. Specifically, do changes in per

12. Arizona, Arkansas, Colorado, Delaware, Florida, Georgia, Maine, Missouri, Oklahoma, Oregon, Tennessee, Utah, Washington, and Wisconsin.

TABLE 15

A SUMMARY OF THE SIGNIFICANT EXPENDITURE RESPONSES TO FEDERAL GRANTS: BY STATES

"Gross" of all other factors, a one per cent increase in per capita federal aid is associated with a percentage expenditure change of approximately:

	Total	Highways	Welfare	Non-Aided
Alabama	0.677	---	0.827	0.580
Arizona	0.417	---	---	0.524
Arkansas	0.581	---	---	0.576
California	0.690	---	0.764	0.829
Colorado	0.764	---	---	0.705
Connecticut	---	-0.393	0.393	0.343
Delaware	0.450	---	---	0.451
Florida	0.500	---	---	0.409
Georgia	0.486	---	---	0.533
Idaho	0.408	---	0.543	0.463
Illinois	0.328	---	1.070	0.336
Indiana	0.380	---	0.592	0.312
Iowa	0.567	---	0.813	---
Kansas	---	---	0.288	---
Kentucky	0.703	0.304	1.079	0.743
Louisiana	0.229	---	-0.320	0.385
Maine	0.402	---	---	0.398
Maryland	0.465	-0.278	0.795	0.471
Massachusetts	0.317	-0.178	0.407	0.381

TABLE 15 (continued)

	Total	Highways	Welfare	Non-Aided
Michigan	0.421	---	0.481	0.491
Minnesota	0.444	---	1.164	0.454
Mississippi	0.900	0.344	---	0.979
Missouri	0.872	---	---	0.879
Montana	0.418	---	-2.409	0.329
Nebraska	0.646	0.381	---	0.790
Nevada	0.632	0.406	---	0.601
New Hampshire	---	-0.091	0.921	---
New Jersey	0.289	---	0.391	0.302
New Mexico	0.806	0.388	1.464	---
New York	0.494	---	0.327	0.480
North Carolina	0.689	---	1.404	0.748
North Dakota	0.558	---	0.836	0.515
Ohio	0.286	---	0.544	0.353
Oklahoma	0.590	---	---	0.802
Oregon	0.480	---	---	0.375
Pennsylvania	0.429	---	0.496	0.426
Rhode Island	0.487	---	0.570	0.464
South Carolina	0.522	---	2.490	0.673
South Dakota	0.435	---	1.174	0.446
Tennessee	0.425	---	---	0.593
Texas	0.696	---	0.813	0.791
Utah	0.445	---	---	0.436
Vermont	0.173	-0.122	---	0.301

TABLE 15 (continued)

	Total	Highways	Welfare	Non-Aided
Virginia	0.393	---	1.815	0.474
Washington	0.502	---	---	0.686
West Virginia	0.445	---	1.146	---
Wisconsin	0.681	---	---	0.677
Wyoming	0.425	---	0.972	0.416

capita grants have an significant relationship to changes in per capita expenditures over time in the individual states?

To obtain an estimate of the relationship between changes in grants and changes in expenditures, changes in total per capita expenditures from internal sources are assumed to be a function of: 1) changes in per capita personal income in the current year, and 2) changes in total per capita federal grants in the current year. The equation is of the form:[13]

$$\Delta E_{tj} = a + b_1 \Delta Y_j + b_2 \Delta F_{tj}$$

where;

ΔE_{tj} = change in total per capita state and local government expenditures from internal sources in the jth state

ΔY_j = change in per capita personal income in the current year of the jth state

ΔF_{tj} = change in total per capita federal aid in the current year to the jth state

a = the constant term

b_1, b_2 = the net regression coefficients

Since the variables are expressed in terms of dollars, the regression coefficients will be estimates of the dollar change in total per capita expenditures from internal sources that is associated with a one dollar

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13. The use of first differences also avoids most of the problems of "multicollinearity," that is, the tendency of economic time series to move together over time. "If two or more economic time series are intercorrelated as the result of trends which may not reflect logical or causal relations between them, the use of first differences will typically reduce the intercorrelation and increase the probability that the regression coefficients obtained will represent meaningful relationships. If there is positive autocorrelation in the residuals from an analysis based on original values, residuals from the corresponding first-difference analysis typically show lower and/or non-significant autocorrelation." Ezekiel and Fox, op. cit., pp. 340, 342.

change in either per capita personal income or per capita federal grants.

The regression equations relating changes in expenditures to changes in income and grants for the individual states are presented in Table 16. The most impressive finding of the analysis is the lack of association between changes in expenditures and changes in either income or federal grants. In fact, neither variable is significantly related to expenditures in thirty-nine states. The coefficients for changes in income are significantly different from zero in only four states: Massachusetts, Nevada, New Mexico, and Texas. A significant relationship between changes in federal grants and changes in expenditures is evident in only seven states: California, Massachusetts, Nebraska, New Hampshire, New Mexico, Virginia, and Wisconsin.

The insignificance of the coefficients, in conjunction with the low R^2 in many states, indicate that there are a great number of other factors affecting changes in state and local government expenditures which have not been accounted for.[14]

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14. For a detailed time-series study of state government expenditures, see Elliott Morss, J. Eric, Fredland, and Saul H. Hymans, "Fluctuations in State Expenditures: An Econometric Analysis," Southern Economic Journal, Vol. XXXIV, No. 3, February 1967, pp. 496-517. The authors conducted a study of the factors influencing the short-run expenditure decisions of state governments over the period 1951-1962. Specifically, they sought to explain the annual per cent changes in total and capital expenditures by means of economic, demographic, and political variables. The independent variables included in the final analysis were: (1) the state deficit in the previous year as a percentage of the previous year's total state expenditures, (2) the ratio of the average deficit to average total expenditures for the previous five years, (3) the annual percentage change in population, (4) the number of years from the last gubernatorial election, (5) the number of years to, or the number of years from, a gubernatorial election, whichever is less, (6) a time variable to test for non-linearity in the change in expenditures through time, (7) the per cent change in a state's personal income lagged one year, (8) per capita state income lagged one year, (9) the regression

TABLE 16

REGRESSION EQUATIONS OF ANNUAL CHANGES IN PER CAPITA STATE AND LOCAL EXPENDITURES ON CHANGES IN PER CAPITA INCOME AND CHANGES IN TOTAL PER CAPITA FEDERAL GRANTS: BY STATES, 1957-1965

	a	ΔY	ΔF_t	R^2	S_e
Alabama	2.13	0.0771 (.0444)	0.8392 (.4365)	0.794	4.70
Arizona	28.46	-0.2135 (.2099)	-0.2158 (.6836)	0.466	12.93
Arkansas	9.60	-0.0054 (.0473)	-0.0166 (.6675)	0.052	7.42
California	8.01	0.0021 (.1293)	3.8739* (1.7950)	0.730	13.14
Colorado	19.70	0.1600 (.2058)	0.9694 (1.0507)	0.598	13.48
Connecticut	12.42	0.0065 (.1707)	-1.7007 (2.9248)	0.284	29.87
Delaware	25.36	0.0592 (.1627)	-1.1076 (1.3916)	0.338	33.82
Florida	9.16	0.0466 (.1111)	-0.0273 (1.0741)	0.188	13.63
Georgia	12.45	0.1506 (.1146)	-3.3507 (1.8813)	0.681	13.12
Idaho	8.53	0.0312 (.0653)	0.2098 (.5329)	0.395	11.87
Illinois	18.92	-0.0062 (.0671)	-1.2289 (1.4581)	0.354	13.25
Indiana	12.16	0.0322 (.0228)	-0.3929 (.5910)	0.553	4.87
Iowa	18.20	0.0170 (.0528)	-1.0399 (.7338)	0.583	10.84

TABLE 16 (continued)

	a	ΔY	ΔF_t	R^2	S_e
Kansas	17.74	-0.0472 (.0977)	-0.7011 (.7779)	0.382	13.91
Kentucky	16.03	0.0751 (.2643)	-1.4293 (1.8166)	0.502	23.26
Louisiana	7.99	0.0366 (.0853)	-0.3364 (.5794)	0.272	10.42
Maine	14.24	-0.0362 (.0974)	-0.4905 (.9153)	0.295	14.89
Maryland	7.34	0.0599 (.0732)	-0.4656 (1.2967)	0.367	10.22
Massachusetts	-8.89	0.2914*** (.0648)	-2.4294** (.7982)	0.905	6.35
Michigan	16.80	-0.0167 (.0211)	-0.2921 (.9403)	0.368	7.32
Minnesota	20.92	-0.0895 (.0911)	0.7661 (.7520)	0.518	10.08
Mississippi	15.89	-0.1851 (.1649)	2.0002 (1.9408)	0.462	12.49
Missouri	13.14	0.0593 (.0710)	-1.5659 (.8778)	0.624	8.88
Montana	16.16	-0.0544 (.0377)	0.1583 (.5252)	0.586	12.18
Nebraska	5.09	0.0368 (.0410)	1.7374** (.5662)	0.836	6.59
Nevada	34.50	-0.1121* (.0510)	0.1927 (.2962)	0.731	13.34
New Hampshire	6.98	0.0867 (.0805)	-1.2566** (.3322)	0.883	7.21
New Jersey	5.98	0.1281 (.0659)	-1.8909 (2.1258)	0.658	9.02
New Mexico	21.67	-0.1623*** (.0373)	1.1347*** (.1555)	0.956	3.66
New York	42.41	-0.0906 (.0878)	-3.3618 (3.1172)	0.693	9.45

TABLE 16 (continued)

	a	ΔY	ΔF_t	R^2	S_e
North Carolina	0.85	0.1315 (.0967)	-0.6261 (.7585)	0.535	6.14
North Dakota	15.82	-0.0010 (.0121)	0.4855 (.3098)	0.577	9.40
Ohio	14.52	-0.0098 (.0365)	-1.0447 (.6513)	0.593	8.14
Oklahoma	14.37	-0.0491 (.1419)	0.1135 (.7733)	0.161	20.03
Oregon	4.08	0.0507 (.0984)	1.3735 (2.1890)	0.315	10.26
Pennsylvania	12.93	-0.0266 (.0823)	0.5593 (1.3859)	0.203	12.59
Rhode Island	11.09	0.0877 (.1773)	-0.5684 (1.0964)	0.291	21.87
South Carolina	-0.27	0.0821 (.0586)	0.5773 (.7397)	0.541	6.25
South Dakota	18.88	-0.0056 (.0349)	-0.5947 (.5534)	0.567	13.96
Tennessee	12.09	-0.0067 (.0701)	-0.2541 (.7018)	0.173	7.25
Texas	7.33	0.1057* (.0475)	-0.6318 (.4235)	0.762	4.89
Utah	25.59	-0.0987 (.2134)	0.0058 (.6967)	0.206	16.56
Vermont	25.23	-0.1224 (.1183)	-0.2206 (.2939)	0.528	17.60
Virginia	15.75	0.0960 (.0792)	-2.6157** (.9447)	0.807	6.68
Washington	11.00	0.1082 (.1637)	-0.6102 (1.5242)	0.297	23.49
West Virginia	14.13	-0.0329 (.0650)	-0.1535 (.4407)	0.343	9.48

TABLE 16 (continued)

	a	ΔY	ΔF_t	R^2	S_e
Wisconsin	37.94	-0.1002 (.0522)	-3.8670** (1.0855)	0.875	9.00
Wyoming	5.47	0.4499 (.2412)	-0.8923 (.4721)	0.684	20.79

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.

The standard errors are presented in parenthesis below the net regression coefficients.

The regression coefficients for the seven states in which changes in per capita federal aid are significantly related to changes in per capita expenditures are presented in Table 17. California, Nebraska, and New Mexico, exhibit a positive relationship between changes in grants and changes in expenditures, while the association is negative in Massachusetts, New Hampshire, Virginia, and Wisconsin.

In summary, although there is evidence of a significant relationship between the level of per capita federal grants and the level of per capita state and local government expenditures from internal sources, there is no indication of a significant relationship between changes in grants and changes in expenditures in most states over the 1957 - 1965 period.

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coefficient for a dummy variable reflecting legislative cooperation when the governor is Democratic, (10) the regression coefficient for a dummy variable reflecting legislative cooperation when the governor is Republican, (11) a dummy variable when the governor is Democratic, and (12) a dummy variable when the governor is Republican. The authors concluded from their analysis that "the fiscal position of the state at the beginning of a year, as measured either by last year's budget deficit or the average of the last five years' budget deficit, exerts a restraining influence on the rate of increase in expenditures. Neither short nor long run rate of change in population, nor per capita state debt are helpful in explaining the differences in expenditures over states . . . (the) particular formulations of political variables, such as the distribution of the lower legislative house by party affiliation, the governor's party, and the governor's per cent of the popular vote, did not consistently help to explain the expenditure behavior of individual states. The covariance analysis employing pooled data over states and time corroborated the importance of financial variables, particularly long run financial conditions in the case of capital expenditures. In addition, inter-party competition, the degree of cooperation between legislature and governor as measured by party affiliation, and (as yet) unidentified time- and state-specified effects were revealed to have an important impact on expenditure behavior." (p. 517).

TABLE 17

REGRESSION COEFFICIENTS OF ANNUAL CHANGES IN PER CAPITA STATE AND LOCAL EXPENDITURES ON CHANGES IN PER CAPITA INCOME AND CHANGES IN TOTAL PER CAPITA FEDERAL GRANTS: SELECTED STATES, 1957-1965

	$\triangle Y$	$\triangle F_t$	R^2
California	a + 0.0021	+ 3.8739*	.730
	(.1293)	(1.7950)	
Massachusetts	a + 0.2914**	- 2.4294**	.905
	(.0648)	(.7982)	
Nebraska	a + 0.0368	+ 1.7374**	.836
	(.0410)	(.5662)	
New Hampshire	a + 0.0867	- 1.2566**	.883
	(.0805)	(.3322)	
New Mexico	a - 0.1623***	+ 1.1347***	.956
	(.0373)	(.1555)	
Virginia	a + 0.0960	- 2.6157**	.807
	(.0792)	(.9447)	
Wisconsin	a - 0.1002	- 3.8670**	.875
	(.1522)	(1.1855)	

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.

The standard errors are presented in parenthesis below the net regression coefficients.

The Fiscal Response to Grants Over Time

The finding of a significant positive relationship between per capita federal aid and per capita lower-level government expenditures from internal sources in forty-five of the forty-eight states from 1957 to 1965,[15] raises a question regarding the fiscal response, if any, associated with federal aid over time. More specifically, is there also a positive relationship between per capita federal aid and state-local fiscal effort in the individual states?

To determine the nature of the relationship between grants and fiscal effort, an equation of the following form was employed:

$$\log FE_j = \log a + c \log F_{tj}$$

where;

FE_j = state and local government fiscal effort (general revenue from internal sources per $1,000 of personal income) in the jth state

F_{tj} = total per capita federal aid to the jth state

a = the constant term

c = the regression coefficient

The log transformation yields a regression coefficient which represents the elasticity between the two variables, which is called the "inter-temporal grant elasticity of fiscal effort."

The regression coefficients for the "grant elasticity of fiscal effort" in the individual states are presented in Table 18. Although the coefficients are "gross" of all other factors,[16] they indicate a

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15. See above, pp. 157-160, and Table 11.

16. See footnote 2, p. 117.

TABLE 18

REGRESSION COEFFICIENTS OF STATE AND LOCAL FISCAL EFFORT ON PER CAPITA FEDERAL GRANTS: BY STATES, 1957-1965

	"Grant Elasticity of Fiscal Effort"		
Missouri	0.541	Pennsylvania	0.275
Texas	0.478	Indiana	0.273
Delaware	0.471	Iowa	0.266*
California	0.441	Illinois	0.239
Alabama	0.374	Idaho	0.232*
New York	0.355	Oklahoma	0.232*
Arizona	0.354	New Jersey	0.226
Wisconsin	0.348*	Connecticut	0.225
Kansas	0.338	Maine	0.218
Washington	0.337	Montana	0.209
Colorado	0.335	Georgia	0.204*
West Virginia	0.316	Nevada	0.203*
Michigan	0.305	Wyoming	0.201
Maryland	0.304	Utah	0.186
Florida	0.303	South Carolina	0.176*
Nebraska	0.303	Massachusetts	0.174
North Carolina	0.301	Louisiana	0.169
Rhode Island	0.291	Tennessee	0.166*
Minnesota	0.290	Virginia	0.155*
Kentucky	0.283	Arkansas	0.148
Ohio	0.276	Oregon	0.136*
		Vermont	0.109*
Mississippi	0.153°	New Mexico	0.498°
North Dakota	0.177°	South Dakota	0.123°
New Hampshire	0.123°		

* Significant at the .05 level.
o Not significantly different from zero.

All others significant at the .01 level.

significant positive relationship between grants and fiscal effort in forty-three of the forty-eight states.[17] Only the states of Mississippi, North Dakota, New Hampshire, New Mexico, and South Dakota exhibit a lack of association between grants and fiscal effort.

Perhaps the more significant aspect of these findings is the highly inelastic relationship between grants and fiscal effort in most states. Only four states (Missouri, Texas, Delaware, and California), have an elasticity coefficient greater than 0.40, while fully one-half of the states have coefficients less than 0.28. This would seem to imply that the fiscal response to grants, over time, is quite small. However, it must be emphasized that the simple regression model cannot consider any other factors which may be associated with fiscal effort. A more detailed multi-variate analysis would be called for before stronger conclusions could be drawn.

A Look Into The Future: The "Heller Plan"

As a final consideration, estimates of the response of individual states to a system of unconditional grants-in-aid will be made via an analysis of the "income elasticity of expenditures" for selected functions from 1957 to 1965. More specifically, tentative answers to the following questions shall be sought: (1) Will the states tend to use the unconditional grants to increase the level of public services, or will they tend to view the grants as substitutes for their own funds and keep service levels about the same? (2) If the grants are used to

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17. The coefficients are significant at the .01 level in thirty-two states, and significant at the .05 level in eleven states.

expand the provision of public goods, what functions may be expected to receive most of the aid?

The "Heller Plan" of Unconditional Grants

The recent interest[18] in the establishment of a system of unconditional federal grants-in-aid to the lower-level governments is largely an outgrowth of a proposal made by Walter W. Heller. In essence, his plan calls for the distribution of a specified portion of federal individual income tax revenues to the states each year on a per capita basis, with as few strings as possible. The distribution would be over and above existing and future conditional grants-in-aid.[19]

Specifically, the proposal is that the federal government set aside and distribute to the states one to two per cent of the federal individual income tax base (the amount reported as net taxable income by all individuals). The money would be distributed to the states via a special trust fund, generally in proportion to their population, but

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18. See "Congress Shows Increasing Interest in Tax-Sharing," Congressional Quarterly, Weekly Report, Vol. XXV, No. 14, April 7, 1967, pp. 523-525.

19. See Heller, New Dimensions of Political Economy, op. cit., Chapter III; Joseph A. Pechman, "Financing State and Local Governments," Proceedings of a Symposium on Federal Taxation, New York: The American Bankers Association, 1965, pp. 71-84; and Wray O. Candilis, "Revenue Sharing: A Solution to State Financial Problems," Banking: Journal of the American Bankers Association, Vol. LIX, No. 2, August 1966, pp. 39-40, 100-102. Bernard P. Herber notes that the plan is based upon two premises: "(1) the recognized need of state and local governments for additional revenues to meet expanding functional expenditure requirements in such areas as education, health, and welfare, and (2) the probable existence of a federal budgetary surplus at full employment under the present federal tax structure." Herber, op. cit., pp. 171-172.

with some adjustments made for the specific needs of each state.[20] Other than a provision that the funds not be used for highways (already financed via a special trust fund), the plan calls for giving the states wide latitude in the use of their revenue shares. However, Heller notes: "Those who fear that some states will simply use the revenue shares to rest on their fiscal oars would put in a further condition: that the shares of those states which lowered their fiscal effort would be reduced."[21]

The Response to Unconditional Grants: Theoretical Aspects

It was noted in Chapter III[22] that a basic feature of an unconditional grant is that it amounts to an income subsidy for the recipient. The grant serves to increase the community's public budget, thereby

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20. Heller notes: "Per capita sharing would transfer some funds from states with high incomes--and therefore high per capita income tax liabilities--to low-income, low-tax states. If the modest equalization implicit in per capita sharing were deemed too limited, a percentage--say 10 to 20 per cent--could be set aside for supplements to states with low per capita income, or a high incidence of poverty, dependency, or urbanization." New Dimensions of Political Economy, op. cit., pp. 146-147. For an estimate of the effects of various "equalization" portions on the amount of revenues shared with each state with estimates of the functional uses of the funds with varying degrees of equalization, see James L. Plummer, "Federal-State Revenue Sharing," Southern Economic Journal, Vol. XXIII, No. 1, July 1966, pp. 120-126.

21. Heller, New Dimensions of Political Economy, op. cit., p. 147. It should be noted that Heller does not apparently share this view: "With expenditure demands on state and local governments rising by 7 to 8 per cent a year, the fiscal dividends from the Federal Government would not often go into tax reduction. And if, in part, they did result in slower increases in sales, property, and excise taxes--or even in an occasional cut in such taxes--I do not view this as original fiscal sin. Who is prepared to say that slowing down the reduction of the progressive and relatively equitable Federal income tax in order to relieve pressure on regressive, inequitable, and inefficient property and consumer taxes is a bad trade?" (p. 152).

22. See above, pp. 59-61.

permitting it to consume more public goods with no additional outlay from its own sources. Furthermore, if the grant is financed out of existing federal taxes, as Heller proposes, there should be no decrease in the community's consumption of private goods and services.

With regard to the allocation of the funds within the public budget, it was shown that the service with the highest relative income elasticity would be expected to receive the most support from the unconditional grant. On the other hand, if the community had an inelastic demand for all public goods, it would be expected to view the grant monies as a substitute for its own funds, so that it would respond by reducing the size of its own public budget, keeping the total level of public services about the same.

An Estimate of the Expenditure Response to Unconditional Grants

Given the above theoretical considerations of the response to unconditional grants, tentative estimates of the response of individual states may be made with reference to their income elasticity of demand for public goods.

The following analysis is based upon a proxy measure for the income elasticity of demand which was developed from the following equation:

$$\log E_{ij} = \log a + c \log Y_j$$

where;

E_{ij} = per capita state and local government expenditures from their own sources on the ith function, in the jth state

Y_j = per capita personal income in the jth state

a = the constant term

c = the "gross" regression on coefficient

The regression coefficient, c, represents the "intertemporal income elasticity of expenditures," or the elasticity between per capita income and per capita expenditures over time.

The Overall Response:

The coefficients for the "income elasticity of expenditures" in individual states are presented in Table 19. They indicate the per cent change in per capita total expenditures from internal sources that was associated with a one per cent increase in per capita personal income from 1957 to 1965. The fact the coefficients are greater than unity in forty-four of the forty-eight states implies that the demand for public goods in most states is income elastic over time. Therefore, the great majority of states would be expected to view unconditional grants as complements to their own funds and respond by increasing their provision of public goods.

The only states with an income elasticity less than unity are Connecticut, Vermont, North Dakota, and Louisiana. Consequently, they might be expected to view the unconditional grant as a substitute for their own funds and respond by reducing the size of their public budgets.

Spearman's Rank Correlation Coefficient[23] was calculated to determine whether there is any significant relationship between a state's rank income elasticity and its rank per capita income in 1960. The coefficient was found to be r = 0.1528, which is not significantly different from zero. Therefore, there appears to be no significant association

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23. See above, p. 169.

TABLE 19

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL EXPENDITURES ON PER CAPITA INCOME: BY STATES, 1957-1965

I. States with high income elasticity of expenditures (1.700-2.500)

Kentucky	2.422
Delaware	2.310*
West Virginia	2.263
Wisconsin	2.218
Missouri	1.986
Texas	1.953
Pennsylvania	1.949
Utah	1.831
Wyoming	1.822
Idaho	1.755
Montana	1.766
California	1.756
Oregon	1.717

II. States with medium income elasticity of expenditures (1.300-1.699)

New Mexico	1.671
Alabama	1.664
Nevada	1.644
Rhode Island	1.631
Washington	1.605
Mississippi	1.602
Indiana	1.602
New York	1.578
New Jersey	1.548
Iowa	1.536
Colorado	1.524
Illinois	1.473
Maine	1.471
Oklahoma	1.454
Nebraska	1.451
Michigan	1.443
Tennessee	1.435
Virginia	1.411
Ohio	1.405
Florida	1.403
Maryland	1.350
Arizona	1.348
Minnesota	1.329
North Carolina	1.322

TABLE 19 (continued)

III. States with low income elasticity of expenditures (0.700-1.200)

Georgia	1.188
South Carolina	1.182
Arkansas	1.151
Massachusetts	1.105
New Hampshire	1.089
South Dakota	1.027
Kansas	1.005
Louisiana	0.936
North Dakota	0.890*
Vermont	0.812
Connecticut	0.706*

* Significant at the .05 level.
All others significant at the .01 level.

between a state's per capita income and its income elasticity of expenditures.[24]

In summary, the data indicate that most states would tend to use any unconditional grants to increase their provision of public goods due to the high "income elasticity of expenditures" found during the period.

The Allocation of the Grants:

A comparison of the relative income elasticities for selected functions (Table 20) strongly suggests that the bulk of any unconditional grants would be devoted to education in most states,[25] assuming that preferences will not change radically from the 1957-1965 experience. As shown in Table 21, the education function has the highest relative intertemporal income elasticity in thirty-one states.[26] Public welfare is a

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24. The rank correlation coefficient between a state's elasticity of expenditures and its income elasticity of expenditures is r = 0.4396, which is highly significant at the .01 level. This indicates that there is a strong tendency for those states with a high income elasticity of expenditures to also have a high grant elasticity of expenditures.

25. For similar conclusions that education would receive the major share of any unconditional grants, see Plummer, op. cit., pp. 122-124, and George F. Break, Intergovernmental Fiscal Relations in the United States, Washington: The Brookings Institution, 1967, p. 137.

26. The finding that education expenditures have the highest relative intertemporal income elasticity in most states over the 1957-1965 period would appear to contradict the earlier finding (pp. 119-120) that expenditures for education were income inelastic in both 1960 and 1965. To the contrary, however, these findings support one another. The basic difference lies in the contrast between time-series data for individual states and cross-section data between states at single points in time. The inelastic relationship evident in the cross-section data may be taken to imply that education is viewed as a "necessity" by the lower-level governments. Consequently, if education is viewed as a necessity, the lower-level governments would be expected to allocate a major portion of any increase in revenues over time to the function. Therefore, education expenditures in individual states, over time, should be income elastic.

TABLE 20

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL EXPENDITURES FOR SELECTED FUNCTIONS ON PER CAPITA INCOME: BY STATES, 1957-1965

"Income Elasticity of Expenditures"

	Total	Education	Highways	Welfare	Health	Total Aided[a]	Non-Aided
Alabama	1.664	2.079	1.109°	2.051*	1.598	1.753	1.418
Arizona	1.348	1.563	-0.034°	1.152*	0.884	1.228	1.610
Arkansas	1.151	1.511	0.495*	1.386	1.122	1.205	0.929*
California	1.756	1.944	0.389°	1.984	0.697*	1.553	2.140
Colorado	1.524	2.347	-0.561°	0.530°	1.694	1.574	1.367
Connecticut	0.706*	1.782	-1.919°	1.772	-0.539°	0.322°	1.628
Delaware	2.310*	2.209°	3.003°	0.977°	1.324°	2.289*	2.420*
Florida	1.403	1.906	0.547°	1.248*	1.759	1.505	1.209
Georgia	1.188	1.486	0.252°	0.793°	1.371	1.185	1.196
Idaho	1.775	2.462	0.055°	1.340	2.291*	1.760	1.830
Illinois	1.473	2.376	-1.432°	3.527	1.676	1.529	1.347*
Indiana	1.602	2.263	0.638*	0.562°	1.068	1.788	1.051
Iowa	1.536	2.036	0.507°	1.198	1.543	1.500	1.054°
Kansas	1.005	1.839	-0.375°	0.329*	1.244	1.043	0.862
Kentucky	2.422	2.337	2.155	2.321	2.607	2.308	2.504*
Louisiana	0.936	1.289	-0.267°	-0.430°	0.956	0.693	1.493
Maine	1.471	2.336	0.459°	1.785	-0.474°	1.458	1.505
Maryland	1.350	2.045	-0.398°	2.366	1.550	1.382	1.289
Massachusetts	1.105	1.982	-0.260°	1.065	0.392°	1.043	1.219

TABLE 20 (continued)

	Total	Education	Highways	Welfare	Health	Total Aided[a]	Non-Aided
Michigan	1.443	2.053	-1.131*	0.663°	1.377	1.342	1.712
Minnesota	1.329	1.814	0.302°	1.911	0.546*	1.347	1.291
Mississippi	1.602	1.693	1.092	2.248*	2.220	1.592	1.639
Missouri	1.986	2.331	1.694*	0.471°	1.866	1.993	1.967
Montana	1.766	2.644	0.788°	1.013°	0.163°	1.910	1.371
Nebraska	1.451	1.682	1.080	0.636°	0.654*	1.381	1.672
Nevada	1.644	2.172	1.211*	1.281	1.293	1.775	1.458
New Hampshire	1.089	1.684	-0.153°	1.581	-0.119°	0.871	1.709
New Jersey	1.548	1.933	0.824°	1.677	0.943	1.557	1.530
New Mexico	1.671	2.148	0.439°	2.563	0.349°	1.699	1.583
New York	1.578	2.151	0.384°	1.359	1.351	1.623	1.505
North Carolina	1.322	1.564	0.686°	2.016	0.947	1.329	1.305
North Dakota	0.890*	1.294*	0.550*	0.804°	0.307°	0.979	0.691°
Ohio	1.405	2.078	0.133°	1.318*	0.315°	1.381	1.468
Oklahoma	1.454	1.698	0.537°	1.331°	1.697	1.357	1.850
Oregon	1.717	2.565	0.711°	1.519	0.420°	0.989	1.169
Pennsylvania	1.949	2.365	1.369	2.179	0.726°	1.964	1.910
Rhode Island	1.631	2.279	1.256	1.495	0.062°	1.711	1.631
South Carolina	1.182	1.359	0.580*	1.491	1.273	1.192	1.162
South Dakota	1.027	1.410	0.624*	1.094	0.430°	1.087	0.823*
Tennessee	1.435	1.478	0.599°	1.059	1.668	1.243	1.868
Texas	1.953	2.507	0.520°	1.381	1.326	1.896	2.110
Utah	1.831	2.279	0.468°	0.557°	1.349*	0.976	1.797
Vermont	0.812	1.506	-0.766°	0.936*	-0.166°	0.654*	1.366

TABLE 20 (continued)

	Total	Education	Highways	Welfare	Health	Total Aided[a]	Non-Aided
Virginia	1.411	1.933	0.237°	2.874	0.486*	1.115	1.639
Washington	1.605	2.192	0.431*	0.018°	-0.755°	1.374	2.172
West Virginia	2.263	2.287	2.621	4.043	2.261*	2.466	1.465°
Wisconsin	2.218	3.168	0.622°	1.840	1.360	2.232	2.184
Wyoming	1.822	2.300	1.317°	2.102*	1.113°	1.872	1.668

[a] "Total Aided" is the sum of education, highways, welfare, and health and hospitals.

* Significant at the .05 level.

o Not significantly different from zero.

All others significant at the .01 level.

TABLE 21

THE FUNCTION HAVING THE HIGHEST RELATIVE INTERTEMPORAL INCOME ELASTICITY, BY STATES, 1957-1965

Education

Alabama
Arkansas
Colorado
Connecticut
Florida
Georgia
Idaho
Indiana
Iowa
Kansas
Maine
Massachusetts
Michigan
Missouri
Montana
Nebraska
Nevada
New Jersey
New York
North Dakota
Ohio
Oregon
Pennsylvania
Rhode Island
South Dakota
Texas
Utah
Vermont
Washington
Wisconsin
Wyoming

Public Welfare

Illinois
Maryland
Minnesota
Mississippi
New Mexico
North Carolina
South Carolina
Virginia
West Virginia

Non-Aided Functions

Arizona
California
Delaware
Louisiana
New Hampshire
Oklahoma
Tennessee

Health and Hospitals

Kentucky

very poor second, ranking first in only nine states. In seven states, the non-aided functions had the highest relative income elasticity, while only Kentucky had the highest elasticity for health and hospitals.

It would therefore appear that most lower-level governments might be expected to respond to a system of unconditional grants-in-aid, or tax-sharing, by increasing the level of educational services.

Summary

The time-series analysis of the response of individual states to federal grants points to the following answers to the questions posed at the beginning of the chapter.[27] First, there was a significant positive relationship between per capita grants and per capita expenditures from internal sources in all but three states during the 1957 - 1965 period. Furthermore, the fact that per capita grants were significantly related to per capita expenditures on the non-aided functions in forty-three states implies that a major effect of federal aid during the period has been to stimulate expenditures on functions other than those receiving direct federal support. Second, annual changes in per capita expenditures in the individual states were not found to be significantly related to annual changes in either per capita grants or per capita income in most states. Third, although there is evidence of a significant positive relationship between per capita federal aid and state-local fiscal effort, it is a highly inelastic one. This would seem to imply that the fiscal response to grants, over time, is rather small. Finally, estimates of the intertemporal income elasticity of expenditures for

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27. See above, p. 155.

selected functions indicate that the lower-level governments might be expected to use any unconditional grants to increase their provision of public goods, and that most of the funds would tend to be allocated to education.

CHAPTER VII

SUMMARY AND CONCLUSIONS

This last chapter will be devoted to a brief review of the purpose of the study and the method of investigation, with major emphasis upon the conclusions of the research and their implications for public policy. Finally, some of the unanswered questions will be reviewed which may give rise to further research and enquiry.

Purpose of the Study

The primary objective of this study is to determine the nature of the response of state and local governments to federal grants-in-aid. Of special interest is the empirical validity of the "distortion thesis," which holds that the matching requirements of the present conditional grants tend to induce the lower-level governments to redistribute their budgets, transferring funds from activities which receive no federal support to those which do.

The ultimate objective of the study is to attempt to explain the observed response to grants in terms of the demand for public goods by state and local governments. For example, since the matching ratios act to reduce the cost of a specific program to a lower-level government, the response to grants should tend to be a function of the elasticity of demand for the service in question. Therefore, aid to a function with an elastic demand should be associated with an increase in state-local expenditures from their own sources on the function. In contrast,

aid to a function with an inelastic demand should result in little or no change in state-local expenditures from internal sources on the function. Similarly, budget "distortion" may occur because the elasticity of demand for the aided function is greater than that of the non-aided activities. "Distortion" would thus be precluded in cases where the elasticity of demand is greater for the non-aided functions than for the aided ones.

In addition, the study seeks to analyze not only the average response of state and local governments to federal grants at a given point in time via cross-section analysis, but also to examine the response of individual states to grants over time.

Brief Review of the Method

A theory of the demand for public goods by state and local governments was developed which emphasized the political nature of the provision of public goods by the lower-level governments. Specifically, it was assumed that elected government officials seek to maximize the probability of their reelection, a probability assumed to be dependent upon their ability to "produce" a mixture of tax and expenditure policies which appeals to a majority of the electorate. The legislative preferences for public goods are therefore thought to be fairly accurate reflections of the demand for public goods by the people. The response of the lower-level governments to federal grants was then analyzed in terms of the legislative indifference curve between public goods and private goods, and between different types of public goods.

More specific estimates of the response to grants were made via a combination of the theoretical considerations with a proxy measure for

the income elasticity of demand for public goods, called the "income elasticity of expenditures."

Estimates of the actual response to grants were obtained by means of multiple regression analysis for cross-section data in 1960 and 1965. The response of individual states to grants was analyzed via simple regression models using time-series data, 1957 - 1965. The significance and size of the regression coefficients for the federal aid variable provided the empirical measures of the lower-level governments' response to grants. Finally, the observed response was compared with the a priori expectations based upon the income elasticity for selected functions.

Conclusions of the Analysis

The Expenditure Response to Federal Grants

A major finding of this study was the existence of a substantial shift in the expenditure response of state and local governments to federal aid from 1960 to 1965. Federal grants were not significantly related to either total expenditures from internal sources or expenditure on the non-aided functions in 1960. In contrast, there was a significant positive expenditure response in both cases in 1965. However, the shift appears reasonable in view of the "income elasticity of expenditures." The observed expenditure stimulation in 1965, where none occurred in 1960, may well be explained by the increase in the income elasticity for both total expenditures and for the non-aided functions. This implies a greater willingness on the part of the electorate to support both higher taxes and higher expenditures.

Quite significantly, the finding of a positive expenditure response in the case of the non-aided functions in 1965, implies that a major effect of the present conditional grant-in-aid system is to stimulate expenditures on functions other than those receiving direct federal support. The "distortion thesis" was therefore found to be invalid, as federal grants apparently released state-local funds for expenditure on the non-aided activities, rather than drawing funds away from them. In short, this implies that even though the grants are tightly conditioned, they tend to subsidize a wide range of services. Furthermore, the implicit assumption of the "distortion thesis" was found to be invalid (that is, that the elasticity of demand for the aided activities is greater than that for the non-aided services). In both 1960 and 1965, the "income elasticity of expenditures" for the non-aided functions was about twice that of the aided functions.

With respect to the specific functional categories, federal aid was found to have a stimulative effect upon state and local expenditures from their own sources on public welfare and highways, but not for health and hospitals or education.

The observed expenditure responses for public welfare and education appear reasonable in light of the "income elasticity of expenditures" for these two functions. However, the same can not be said for highways or health and hospitals. The positive response for public welfare is consistent with the finding that expenditures for the function were income elastic in both 1960 and 1965. Similarly, the fact that expenditures for education were income inelastic, as between states, in both years may well account for the substitution of federal for local funds

observed in 1960, and the lack of response evident in 1965. The increase in the elasticity coefficient during the period (from 0.6 to 0.7) may also account for the shift from substitution to no response.

State and local expenditures for highways were found to be highly income inelastic in both years, implying a small income effect associated with federal highway grants. However, a positive expenditure response was evident in both 1960 and 1965. It is possible that the substitution effect associated with the grants was the major cause of increased highway expenditures.

Expenditures for health and hospitals were slightly income elastic in both years, yet there was little relationship evident between federal aid and expenditures.

As a general rule, however, consideration of the income elasticity provided valuable insight into the response of the lower-level governments to federal grants. This was especially true in the case of the non-aided functions, where much of the expenditure response in 1965 appears to have been concentrated. In conclusion, it appears that the major response to federal aid is the stimulation of expenditures on activities which are not supported directly by the federal government.

The Fiscal Response to Federal Grants

In contrast to the finding of a significant relationship between federal grants and state and local expenditures from their own sources, there appears to be no association whatever between federal aid and lower-level government fiscal effort. Quite significantly, the lack of association between grants and fiscal effort indicates that the expenditures "stimulated" by federal aid are not financed via increased fiscal

effort. In other words, the allocation of a state's income between the public and private sectors is apparently not affected by federal aid considerations. This also carrys the implication that the lower-level governments have not viewed federal funds as substitutes for their own.

The Response of Individual States to Federal Grants

The conclusion, drawn from the cross-section analysis, that a major effect of federal grants has been the stimulation of expenditures on the non-aided functions, is strongly supported when the response of individual states are analyzed over time. Over the period 1957 - 1965, there was no evidence of any state "distorting" its budgets, that is, reducing expenditures on the non-aided functions. Furthermore, all but five states expressed a significant positive relationship between grants and non-aided expenditures.

The stimulation of expenditures on the non-aided functions is even more impressive in view of the fact that only five states exhibited expenditure stimulation for the highway function, with five states substituting federal highway grants for their own funds. In addition, federal welfare grants were associated with increased state-local welfare expenditures in twenty-eight states, while two states substituted the aid for their own funds.

In summary, the data indicate that federal aid has had the effect of stimulating state and local government expenditures from their own sources over time, particularly on those functions not directly supported.

In spite of the strong association between the level of federal grants and the level of expenditures in most states, changes in per

capita grants were found to have no relationship with changes in total per capita expenditures from internal sources in forty-one states. This finding apparently implies that annual changes in per capita grants are not large enough to substantially affect changes in per capita expenditures.

The analysis of the fiscal response of individual states to grants over time yielded a significant positive relationship between federal aid and fiscal effort in forty-three states. However, the relationships were highly inelastic.

Finally, the response of individual states to a system of unconditional grants was estimated via the "intertemporal income elasticity of expenditures." Given the finding of an income elasticity of at least unity in forty-four states over the period 1957 - 1965, it was concluded that the great majority of states could be expected to increase expenditures with the unconditional grants, rather than cut taxes and fiscal effort. Furthermore, only two states (Connecticut and Vermont) had an income elasticity less than 0.9, implying that they might be the only states who would tend to substitute the unconditional grants for their own funds.

With respect to the functional allocation of the unconditional grant, it was concluded that education would be the prime beneficiary due to the fact that it had the highest relative income elasticity in thirty-one states and was ranked either first or second in forty-three states.

Implications for Public Policy

The finding that a major effect of the present system of conditional grants-in-aid appears to be the subsidization of a wide range of services other than those directly aided, carrys an important implication for public policy in the area of intergovernmental fiscal relations. Specifically, it implies that a system of grants-in-aid is needed in place of the present patchwork approach. The purpose and objectives of intergovernmental transfers need to be delineated and grant programs designed to achieve the stated objectives.

In addition, as much consideration as possible should be given to the preferences of the lower-level governments for specific programs and services. For example, in cases where the demand for a service is highly elastic, a relatively small federal matching ratio should induce the lower-level governments to increase their expenditures on the function. In contrast, in cases where the demand is highly inelastic, the federal government should assume a much greater portion of the cost, assuming that the objective is to increase the level of the service provided.

Another important policy implication concerns the desirability of a system of unconditional grants, or tax-sharing. Although the evidence indicates that very few states could be expected to view the funds as substitutes for their own, and that most would tend to channel the funds into education, the question of which level, or levels, of government should receive the funds has not been appropriately answered. The case for unconditional grants would tend to be much stronger if the

funds were being distributed to those governmental units with highly inelastic revenue sources and rapidly increasing demand for public services, than if the funds were distributed to units with more elastic revenue sources.

Further Research and Enquiry

This study has sought to determine the response of state and local governments to federal aid payments. Although numerous questions have been answered, others have been raised. An enumeration of these questions may open the way for further research.

Perhaps the major question left unanswered by this study is the effect of federal aid upon the revenue systems of the lower-level governments. The evidence indicates that federal grants have a stimulative effect on state and local expenditures from their own sources. However, no relationship was found between federal aid and state-local fiscal effort, leaving the question of how the stimulated expenditures are financed as yet unanswered.

A study of the revenue sources used to finance the stimulated expenditures could have far-reaching implications. For example, if federal aid is associated most strongly with regressive tax sources such as property and consumer taxes, the case for unconditional grants financed out of the progressive federal income tax may be much stronger. It would also be interesting to investigate the relationship between federal aid and the non-tax revenue sources such as user charges. Furthermore, all too little is known about the determinants of the interstate variations in revenue sources. Federal aid may, or may not, be

an important factor.

A second problem area, somewhat related to the above, is the question of what factors account for the interstate variations in fiscal effort. In essence, this is the question of what factors explain the allocation of resources between the public and private sectors at the state and local levels. Factors such as the level and distribution of per capita personal income, urbanization, density, federal aid, outstanding per capita debt, and the percentage of school age population have been examined, but only population density yielded very significant results. Other variables which might be examined are the use of "exportable" taxes, reliance upon regressive versus progressive taxes, the role of user charges and fees, the impact of state aid, and different measures of the age distribution of the population.

Third, the factors accounting for <u>charges</u> in per capita expenditures in the individual states warrant further investigation. Changes in per capita personal income and per capita federal aid were found to have little explanatory power in most states. A possible approach may be to take a longer time span, such as two or three years, and include population shifts, changes in state aid, and a proxy for shifts in the composition of the legislative bodies.

Further enquiry may also be warranted regarding the impact of federal aid upon the non-aided functions to determine which of the non-aided activities benefit the most from the "releasing effect" of conditional grants. It might also be interesting to divide expenditures into current and capital outlay to examine the relationship between federal aid and the capital expenditures of the lower-level governments.

Finally, a great deal of additional work is needed to analyze the probable impact of a system of unconditional grants-in-aid. Among the more important questions to be answered are the effect of various distribution formulas on expenditure patterns, the relative need for funds by various governmental units, the effect of the trust fund system of financing, and the impact upon federal stabilization policies.

APPENDICES

APPENDIX A

GLOSSARY OF TERMS

APPENDIX A

GLOSSARY OF TERMS

Additive Regression Model

A model in which the impact of the independent variables upon the dependent variable is assumed to be a function of the separate effects of each of the individual factors.

Budget "Distortion"

A reallocation of funds within the budget of a lower-level government with increased expenditures on a function receiving federal support coming at the expense of those functions not federally aided.

Expenditure "Determinant"

A factor which helps to account for the interstate variation in state and local expenditure levels.

Expenditure Response to Grants

A change in state and local expenditures which is associated with federal grants-in-aid.

Expenditure Stimulation

A positive expenditure response to grants in which an increase in state and local government expenditures from internal sources is associated with an increase in federal aid.

Fiscal Effort

State and local general revenue from internal sources per $1,000 of personal income.

Fiscal Response to Grants

A change in state and local fiscal effort which is associated with federal aid.

Income Elasticity of Expenditures

The ratio of the per cent change in per capita state and local government expenditures from their own sources, as between states, that is associated with a given per cent change in per capita personal income, as between states, at a given point in time.

Intertemporal Grant Elasticity of Expenditures

The ratio of the per cent change in per capita expenditures from internal sources, within a given state, that is associated with a given per cent change in per capita federal aid to the state, over time.

Intertemporal Grant Elasticity of Fiscal Effort

The ratio of the per cent change in state-local fiscal effort, within a given state, that is associated with a given per cent change in per capita federal aid to the state, over time.

Intertemporal Income Elasticity of Expenditures

The ratio of the per cent change in per capita expenditures from internal sources, within a given state, that is associated with a given per cent change in per capita income in the state, over time.

Joint Regression Model

A model in which the impact of the independent variables upon the dependent variable is assumed to be a function of the combination of the independent variables.

APPENDIX B

DEFINITIONS OF EXPENDITURE CATEGORIES

APPENDIX B

DEFINITIONS OF EXPENDITURE CATEGORIES[1]

General Expenditures

This category comprises all expenditures other than (a) benefit and refund payments of public-employee retirement and other social-insurance systems, and (b) spending for state and local liquor stores and for local water, electric, transit, and gas utilities.

Education: Local Schools

This includes all direct expenditure by local governments for education, other than expenditure for institutions of higher education, plus any direct state government spending for operation of elementary and high schools and for the provision of local school facilities and supplies (direct state payments to contractors for school construction, state purchases of "free" textbooks, school buses, etc.).

Education: Higher

This category pertains to publicly operated universities, colleges, junior colleges, and other schools beyond the high school level.

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1. See U. S. Department of Commerce, Bureau of the Census, Government Finances in 1964-65, Series GF-No. 6, Washington: U. S. Government Printing Office, 1966, pp. 1-14.

Highways

This group includes expenditure for the provision and maintenance of highway facilities, including toll turnpikes, bridges, and tunnels and ferries, as well as regular roads, highways, and city streets.

Public Welfare

This category includes cash assistance payments under the "categorical" programs of old age assistance, aid to families with dependent children, aid to the blind, aid to the disabled, and general assistance. (Only the area of general assistance is financed entirely by the state and local governments).

Health and Hospitals

This includes the construction, operation, and maintenance of public hospitals, payments to private hospitals for care of patients or for public support, as well as for public health services other than hospitals.

Sewerage

Includes expenditures for the provision and operation of sewerage facilities.

Sanitation

Expenditures for refuse collection and disposal and street cleaning.

General Control

This category covers legislative bodies; the administration of

justice, including the courts; and governmental chief executives and central staff agencies, other than those concerned primarily with finance.

Financial Administration

Includes tax administration and collection activities, and agencies concerned with auditing, budgeting, accounting, fund custody, and purchasing.

Interest on General Debt

Cash payments on general debt obligations. Not included is interest accrued but not paid during the fiscal year.

All of the expenditure categories used in this study are net of federal aid. That is, the expenditures are those from the state and local government's own sources.

APPENDIX C

SOURCES OF THE DATA

APPENDIX C

SOURCES OF THE DATA

Per Capita State and Local Government Expenditures:

U.S. Bureau of the Census, U.S. Census of Governments: 1957, Vol. III, No. 5, Compendium of Government Finances, Washington: U.S. Government Printing Office, 1959, Table 33.

_____, Governmental Finances
1958, Series G-GF58, No. 2, Table 17.
1959, Series G-GF59, No. 2, Table 17.
1960, Series G-GF60, No. 2, Table 17.
1961, Series G-GF61, No. 2, Table 19.
1962, Series G-GF62, No. 2, Table 20.
1963, Series G-GF63, No. 2, Table 21.
1963-64, Series G-GF64, No. 1, Table 21.
1964-65, Series GF, No. 6, Table 22.

Per Capita Federal Grants:

U.S. Department of Health, Education, and Welfare, Social Security Administration, Social Security Bulletin: Annual Statistical Supplement, 1957, Table 5.

_____, Social Security Bulletin: Annual Statistical Supplement, 1958, Table 5; 1960, Table 13; 1961, Table 17.

Sophie R. Dales, "Federal Grants to the State and Local Governments, 1958-59," Social Security Bulletin, Vol. XXIII, No. 7, July 1960, pp. 3-13.

Sophie R. Dales, "Federal Grants, 1961-62," Social Security Bulletin, Vol. XXVI, No. 6, June 1963, pp. 7-14.

Sophie R. Dales, "Federal Grants, 1962-63," Social Security Bulletin, Vol. XXVII, No. 6, June 1964, pp. 15-26.

Sophie R. Dales, "Federal Grants, 1963-64," Social Security Bulletin, Vol. XXVIII, No. 6, June 1965, pp. 3-13.

Sophie R. Dales, "Federal Grants, 1964-65," Social Security Bulletin, Vol. XXIX, No. 6, June 1966, pp. 10-24.

Per Capita Personal Income:

U.S. Department of Commerce, Office of Business Economics, "State Personal Income, 1948-65," Survey of Current Business, Vol. XLVI, No. 8, August 1966, pp. 11-13.

Degree of Urbanization and Population Density:

U.S. Bureau of the Census, U.S. Census of Population: 1960, Vol. I, Characteristics of the Population, Individual State Reports, Washington: U.S. Government Printing Office, 1963.

Per Cent of Families with Income Below $3,000:

U.S. Bureau of the Census, U.S. Census of Population: 1960, General Social and Economic Characteristics; United States Summary, Final Report (PC(1)-1C, Washington: U.S. Government Printing Office, 1962, Table 106.

Age Distributions of the Population:

U.S. Bureau of the Census, U.S. Census of Population: 1960, General Population Characteristics; United States Summary, Final Report (PC(1)-1B, Washington: U.S. Government Printing Office, 1961, Table 60.

State and Local Government Fiscal Effort:

U.S. Bureau of the Census, Governmental Finances, op. cit.
1957, Table 14.
1958, Table 14.
1959, Table 14.
1960, Table 14.
1961, Table 21.
1962, Table 22.
1963, Table 23.
1963-64, Table 23.
1964-65, Table 24.

APPENDIX D

A COMPARISON OF THE ADDITIVE AND JOINT REGRESSION MODELS

APPENDIX D

A COMPARISON OF THE ADDITIVE AND JOINT REGRESSION MODELS

One hypothesis of this study is that state and local government expenditures, expressed as a function of a number of independent variables, may be better approximated by a joint regression model than an additive one. More specifically, the hypothesis is that expenditures are more likely to be a function of the combination of the independent variables than a function of the summation of the separate effects of each of the explanatory variables.

One indication of the superiority of one model over the other may be obtained via a comparison of their respective coefficients of multiple determination. That is, given the same independent variables, which model is able to account for the highest portion of the variation in the dependent variable?[1]

A comparison of the coefficients of multiple determination for the two models in 1960 and 1965 is presented in Table 22. Quite significantly, there is very little difference between the two regression models in terms of the percentage of "explained" variation of the dependent variable. The greatest difference in R^2 occurs in the case of

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1. It should be emphasized that when the additive model is used, R^2 measures the proportion of the variation of Y (the dependent variable) that has been accounted for by the independent variables. In contrast, when the joint regression model, with a double-log function, is used, R^2 measures the proportion of the variation of the logarithm of Y that has been accounted for, which is not the same thing as the proportion of the variation of Y. See Arthur S. Goldberger, Econometric Theory, New York: John Wiley & Sons, Inc., 1964, pp. 213-218.

TABLE 22

THE ADDITIVE AND JOINT REGRESSION MODELS COMPARED:

THE COEFFICIENT OF MULTIPLE DETERMINATION

1960

	Additive	Joint
Total Expenditures	.581	.572
Highways	.209	.315
Public Welfare	.696	.721
Education	.631	.619
Health and Hospitals	.531	.508
Total Aided	.550	.512
Non-Aided	.533	.619

1965

	Additive	Joint
Total Expenditures	.816	.813
Highways	.722	.511
Public Welfare	.681	.712
Education	.656	.743
Health and Hospitals	.379	.393
Total Aided	.748	.747
Non-Aided	.671	.705

1965 highway expenditures, where the additive model (R^2 = 0.722) appears to be much better than the joint model (R^2 = 0.511). The similarity between the models, for the other functional categories, is illustrated by the fact that in both 1960 and 1965, five of the seven regressions had an R^2 that differed less than five percentage points. One regression in each year differed five to ten percentage points in R^2 between the models, with only one varying more than ten percentage points.

Therefore, the hypothesis that the joint model is superior to the additive model must be rejected. It apparently makes little difference whether the variables are expressed in their natural numbers in an additive model, or whether they are transformed into their logarithms in a joint regression model.

APPENDIX E

TEST FOR SIGNIFICANT CONTRIBUTION FROM FEDERAL AID AS AN ADDITIONAL INDEPENDENT VARIABLE

APPENDIX E

TEST FOR SIGNIFICANT CONTRIBUTIONS FROM FEDERAL AID AS AN ADDITIONAL INDEPENDENT VARIABLE

If federal aid is an important "determinant" of state and local government expenditures, the addition of federal aid as an independent variable must contribute to the predictive value of the dependent expenditure variable. In other words, the residual sum of squares must be reduced significantly by using a model including the aid variable rather than one without federal aid. "This is equivalent to a test of the hypothesis that the coefficients of the independent variables in the subgroup are all zero. Analysis of variance provides an exact test for this hypothesis."[1]

Analysis of variance is based upon the principle that, "The sum of squares of a set of observations about their mean can be represented as the sum of two independent sums of squares . . . a sum of squares of deviations of regression values from their mean and a sum of squares of deviations about the regression line."[2] The null hypothesis that the samples are random ones, from a common normally distributed population is tested by the F-ratio, which is defined as the mean square between groups divided by the mean square within groups.[3]

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1. Peters and Summers, op. cit., p. 181.
2. Ezekiel and Fox, op. cit., p. 396.
3. Ibid, p. 400.

For example, to determine whether the introduction of the federal aid variable significantly increases the proportion of the variance of 1960 total per capita expenditures from internal sources attributed to regression, the null hypothesis of no relationship between grants and expenditures is tested, that is, that $\beta = 0$. The F-ratio will provide a probability estimate upon which the hypothesis may be accepted or rejected. The hypothesis that $\beta = 0$ will be accepted when F is sufficiently small to indicate that the variation between the means may be due to chance. The hypothesis of no relationship will be rejected only when F is large, indicating that the variation between the means is significantly greater than it should be if it were due only to chance.[4]

The analysis of variance is conducted as follows:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Total	49	145,794.00	
Regression ("Basic Factors")	4	84,667.50	21,169.40
Additional Regression accounted for by federal aid	1	5.70	4,232.94
Residual	44	61,110.50	1,388.87

$$F = \frac{5.70}{1,388.87} = 0.004$$

For the hypothesis to be rejected at the .05 level of probability, the F-ratio must be at least 2.43 (with 5 and 44 degrees of freedom). Therefore, the hypothesis is of no relationship between grants and expenditures is accepted. In other words, total per capita federal aid has no significant relationship with total per capita state and local expenditures from internal sources in 1960.

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4. See Jerome C. R. Li, Statistical Inference, Vol. I, Ann Arbor: Edwards Brothers, Inc., 1964, p. 300.

The process may be repeated to determine whether there is any significant relationship between federal aid and expenditures in 1965. The analysis of variance is:

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Total	49	321,516.00	
Regression (per capita income)	1	165,470.00	165,470.00
Additional Regression accounted for by federal aid	1	73,043.00	46,213.00
Residual	47	83,002.80	1,766.02

$$F = \frac{73,043}{1,766.02} = 41.361$$

With 2 and 47 degrees of freedom, the hypothesis may be rejected at the .01 level, when F is greater than 5.09. Therefore, the hypothesis of no relationship between total per capita federal aid and total per capita expenditures from internal sources must be rejected in 1965.

The F-ratios for federal aid are presented in Table 23 for both the additive and the joint regression models in 1960 and 1965. Based upon the analysis of variance, the hypothesis of no relationship between federal aid and expenditures may be rejected in 1960 for: highways, public welfare, and education. The hypothesis of no relationship must be accepted for total expenditures, health and hospitals, and the non-aided functions.

In 1965, the hypothesis of no relationship may be rejected for: total expenditures, highways, public welfare, and the non-aided functions. The hypothesis must be accepted for health and hospitals.

TABLE 23

F-RATIOS FOR FEDERAL AID: 1960 AND 1965

1960

	Additive	Joint
Total Expenditures	0.004	0.351
Highways	11.937***	4.326***
Public Welfare	39.833***	25.583***
Education	6.801***	7.987***
Health and Hospitals	1.624	0.186
Non-Aided	0.001	0.683

1965

	Additive	Joint
Total Expenditures	41.361***	2.144
Highways	54.561***	26.334***
Public Welfare	37.442***	49.147***
Education	2.176	4.030***
Health and Hospitals	2.909	2.982
Non-Aided	14.723***	5.305***

** Denotes significance at the .05 level.
***Denotes significance at the .01 level.

TABLE 24

F-RATIOS FOR INCOME ELASTICITIES: 1960 AND 1965

	1960	1965
Total Expenditures	52.40	57.72
Total Aided	27.41	8.99
Non-Aided	60.11	27.71
Highways	0.05	2.79
Public Welfare	21.10	12.50
Education	21.36	19.88
Health and Hospitals	38.45	13.98
Local Schools		42.52
Higher Education		0.26
Police		78.70
Fire		63.76
Sewerage		16.21
Sanitation		5.79
Parks and Recreation		32.27
Financial Administration		22.66
General Control		39.64
Interest on General Debt		30.71
All Other		17.23

Note: An F-value exceeding 4.04 is significant at the .05 level.
An F-value exceeding 7.19 is significant at the .01 level.

APPENDIX F

REGRESSION EQUATIONS

APPENDIX F

REGRESSION EQUATIONS

Total Expenditures per capita, from own sources: 1960

Additive Model:

$$E_t = 199.66 + \underset{(.0332)}{0.0459}Y + \underset{(.4348)}{0.3365}U - \underset{(.0361)}{0.0946}D^{**}$$

$$- \underset{(1.2211)}{2.3810}Y_L^{*} - \underset{(.3503)}{0.0225}F_t$$

$R^2 = 0.581$ $\qquad$ $S_e = 37.27$

Reduced Additive Model:

$$E_t = 348.44 - \underset{(.0310)}{0.0650}D^{**} - \underset{(.5824)}{4.2866}Y_L^{***}$$

$R^2 = 0.538$ $\qquad$ $S_e = 37.86$

Joint Model:

$$E_t = 1.4517 \; Y^{\underset{(.3123)}{0.3458}} \; U^{\underset{(.0186)}{0.0194}} \; D^{\underset{(.0304)}{-0.0185}}$$

$$Y_L^{\underset{(.1581)}{-0.2697}*} \; F_t^{\underset{(.1392)}{0.0824}}$$

$R^2 = 0.572$ $\qquad$ $S_e = 0.0704$

Total Expenditures per capita, from own sources: 1965

Full Additive Model:

$$E_t = 75.45 + \underset{(.0276)}{0.0924Y^{***}} + \underset{(.3875)}{0.5729U} - \underset{(.0330)}{0.1197D^{***}} - \underset{(1.0923)}{2.1428Y_L^{*}} + \underset{(.1367)}{0.7551F_t^{***}}$$

$R^2 = 0.816$ $S_e = 36.64$

Reduced Additive Model:

$$E_t = 62.56 + \underset{(.0258)}{0.1082Y^{***}} - \underset{(.0317)}{0.1042D^{***}} - \underset{(1.1063)}{2.1063Y_L^{*}} + \underset{(.1170)}{0.6470F_t^{***}}$$

$R^2 = 0.807$ $S_e = 37.12$

Full Joint Model:

$$E_t = -0.2495\ Y^{\underset{(.2188)}{0.7743^{***}}}\ U^{\underset{(.0124)}{0.0136}}\ D^{\underset{(.0178)}{-0.0565^{***}}}\ Y_L^{\underset{(.0944)}{-0.1831^{*}}}\ F_t^{\underset{(.0664)}{0.1167^{*}}}$$

$R^2 = 0.813$ $S_e = 0.0486$

Reduced Joint Model:

$$E_t = 0.2161\ Y^{\underset{(.2185)}{0.7826^{***}}}\ D^{\underset{(.0109)}{-0.0742^{***}}}\ Y_L^{\underset{(.0945)}{-0.1888^{*}}}$$

$R^2 = 0.798$ $S_e = 0.0493$

Highway Expenditures per capita, from own sources: 1960

Full Additive Model:

$$E_h = 27.95 + \underset{(.0091)}{0.0015Y} \underset{(.1166)}{-0.0151U} + \underset{(.0105)}{0.0007D} - \underset{(.3806)}{0.0683Y_L} + \underset{(.1655)}{0.3808F_h}^{**}$$

$R^2 = 0.209$ $S_e = 10.86$

Reduced Additive Model:

$$E_h = 28.73 + \underset{(.1121)}{0.3873F_h}^{***}$$

$R^2 = 0.199$ $S_e = 10.46$

Full Joint Model:

$$E_h = 1.8575\ Y^{\underset{(.6162)}{0.6009}}\ U^{\underset{(.0338)}{0.0275}}\ D^{\underset{(.0452)}{0.1487}***}\ Y_L^{\underset{(.3090)}{0.2296}}\ F_h^{\underset{(.1435)}{0.6317}***}$$

$R^2 = 0.315$ $S_e = 0.1360$

Reduced Joint Model:

$$E_h = 0.5756\ D^{\underset{(.0412)}{0.1483}***}\ F_h^{\underset{(.1320)}{0.5551}***}$$

$R^2 = 0.281$ $S_e = 0.1348$

Highway Expenditures per capita, from own sources: 1965:

Full Additive Model:

$$E_h = -25.92 + \underset{(.0067)}{0.0293Y^{***}} - \underset{(.0981)}{0.4385U^{***}} + \underset{(.0081)}{0.0009D} + \underset{(.2693)}{0.4082Y_L} + \underset{(.0489)}{0.1866F_h^{***}}$$

$R^2 = 0.722$ $S_e = 8.89$

Reduced Additive Model:

$$E_h = 3.78 + \underset{(.0043)}{0.0219Y^{***}} - \underset{(.0947)}{0.4437U^{***}} + \underset{(.0477)}{0.1723F_h^{***}}$$

$R^2 = 0.708$ $S_e = 8.92$

Full Joint Model:

$$E_h = -3.0485\ \underset{(.4237)}{Y^{1.2172***}}\ \underset{(.0240)}{U^{-0.0469*}}\ \underset{(.0386)}{D^{-0.0172}}\ \underset{(.1845)}{Y_L^{0.3084}}\ \underset{(.0939)}{F_h^{0.1770*}}$$

$R^2 = 0.511$ $S_e = 0.0942$

Reduced Joint Model:

$$E_h = -0.4087\ \underset{(.1800)}{Y^{0.5540***}}\ \underset{(.0241)}{U^{-0.0446*}}\ \underset{(.0617)}{F_h^{0.1984***}}$$

$R^2 = 0.475$ $S_e = 0.0954$

Welfare Expenditures per capita, from own sources: 1960

Full Additive Model:

$$E_w = -1.74 + \underset{(.0027)}{0.0028Y} - \underset{(.0294)}{0.0003U} + \underset{(.0033)}{0.0023D}$$

$$- \underset{(.1116)}{0.3515Y_L}^{***} \quad \underset{(.2438)}{0.8501A_{65}}^{***} + \underset{(.0956)}{0.6182F_w}^{***}$$

$R^2 = 0.696$ $\qquad S_e = 3.25$

Reduced Additive Model:

$$E_w = 7.05 - \underset{(.0543)}{0.4694Y_L}^{***} + \underset{(.2339)}{0.8638A_{65}}^{***} + \underset{(.0906)}{0.6118F_w}^{***}$$

$R^2 = 0.680$ $\qquad S_e = 3.22$

Full Joint Model:

$$E_w = -0.8942 \; \underset{(.5247)}{Y^{0.5447}} \; \underset{(.0298)}{U^{-0.0168}} \; \underset{(.0372)}{D^{0.0179}}$$

$$\underset{(.2864)}{Y_L^{-0.9248}}^{***} \; \underset{(.1654)}{A_{65}^{0.5786}}^{***} \; \underset{(.1184)}{F_w^{0.7424}}^{***}$$

$R^2 = 0.721$ $\qquad S_e = 0.1222$

Welfare Expenditures per capita, from own sources: 1965

Full Additive Model:

$$E_w = -4.08 + \underset{(.0028)}{0.0053Y^*} - \underset{(.0352)}{0.0448U} + \underset{(.0034)}{0.0008D}$$

$$- \underset{(.1142)}{0.3289Y_L^{***}} + \underset{(.2792)}{0.5728A_{65}^{**}} + \underset{(.0894)}{0.6133F_w^{***}}$$

$R^2 = 0,681$ $S_e = 3.74$

Reduced Additive Model:

$$E_w = -1.42 + \underset{(.0025)}{0.0038Y} - \underset{(.1136)}{0.3303Y_L^{***}} + \underset{(.2739)}{0.5850A_{65}^{**}} + \underset{(.0848)}{0.5771F_w^{***}}$$

$R^2 = 0.668$ $S_e = 3.73$

Full Joint Model:

$$E_w = -1.0400\ Y^{\underset{(.4624)}{0.6216}}\ U^{\underset{(.0245)}{-0.0150}}\ D^{\underset{(.0290)}{-0.0398}}\ Y_L^{\underset{(.2021)}{-0.6467^{***}}}\ A_{65}^{\underset{(.1371)}{0.3109^{**}}}\ F_w^{\underset{(.0900)}{0.6225}}$$

$R^2 = 0.712$ $S_e = 0.1021$

Reduced Joint Model:

$$E_w = 1.3541\ Y_L^{\underset{(.0940)}{-0.8465^{***}}}\ A_{65}^{\underset{(.1268)}{0.2237^{*}}}\ F_w^{\underset{(.0915)}{0.6061^{***}}}$$

$R^2 = 0.677$ $S_e = 0.1046$

Education Expenditures per capita, from own sources: 1960

Full Additive Model:

$$E_e = -165.60 + \underset{(.0189)}{0.0618Y^{***}} - \underset{(.1601)}{0.1381U} - \underset{(.0157)}{0.0581D^{***}}$$

$$- \underset{(.5535)}{0.4115Y_L} + \underset{(1.9404)}{5.9495A_{5-19}^{***}} - \underset{(.5717)}{1.5261F_e^{**}}$$

$R^2 = 0.631$

Full Joint Model:

$$E_e = 0\ 4.0556\ \underset{(.4271)}{Y^{1.1448**}}\ \underset{(.0161)}{U^{0.0117}}\ \underset{(.0257)}{D^{-0.0912***}}$$

$$\underset{(.1712)}{Y_L^{-0.0169}}\ \underset{(.5994)}{A_{5-19}^{1.6882***}}\ \underset{(.0493)}{F_e^{-0.1368***}}$$

$R^2 = 0.619$ $S_e = 0.0668$

Reduced Joint Model:

$$E_e = -3.8963\ \underset{(.1699)}{Y^{1.1168***}}\ \underset{(.0219)}{D^{-0.0845***}}\ \underset{(.5166)}{A_{5-19}^{1.6610***}}\ \underset{(.0484)}{F_e^{-0.1368***}}$$

$R^2 = 0.614$ $S_e = 0.0658$

Education Expenditures per capita, from own sources: 1965:

Full Additive Model:

$$E_e = -70.36 + \underset{(.0212)}{0.0407Y^*} + \underset{(.2214)}{0.0959U} - \underset{(.0204)}{0.0840D^{***}}$$

$$- \underset{(.6726)}{1.6695Y_L^{**}} + \underset{(2.7136)}{5.5783A_{5-19}^{**}} + \underset{(.7774)}{0.5868F_e}$$

$R^2 = 0.656$ $S_e = 21.95$

Full Joint Model:

$$E_e = -3.7442\ Y^{\underset{(.3407)}{1.2135^{***}}}\ U^{\underset{(.0134)}{0.0202}}\ D^{\underset{(.0198)}{-0.1118^{***}}}$$

$$Y_L^{\underset{(.1169)}{-0.0833}}\ A_{5-19}^{\underset{(.4735)}{1.4527^{***}}}\ F_e^{\underset{(.0459)}{-0.0897^{*}}}$$

$R^2 = 0.743$ $S_e = 0.0562$

Health and Hospital Expenditures per capita, from own sources: 1960

Full Additive Model:

$$E_{hh} = -21.67 + \underset{(.0036)}{0.0108Y^{***}} + \underset{(.0527)}{0.1332U^{**}} - \underset{(.0042)}{0.0034D}$$

$$+ \underset{(.1414)}{0.1862Y_L} + \underset{(.3620)}{0.3762A_{65}} + \underset{(1.0803)}{1.7794F_{hh}}$$

$R^2 = 0.531$ $\quad S_e = 4.31$

Reduced Additive Model:

$$E_{hh} = -0.94 + \underset{(.0018)}{0.0074Y^{***}} + \underset{(.0333)}{0.0626U^{*}}$$

$R^2 = 0.481$ $\quad S_e = 4.34$

Full Joint Model:

$$E_{hh} = -4.5233\ Y^{\underset{(.5129)}{1.6026^{***}}}\ U^{\underset{(.0298)}{0.0163}}\ D^{\underset{(.0345)}{0.0594^{*}}}$$

$$Y_L^{\underset{(.2527)}{0.2777}}\ A_{65}^{\underset{(.1509)}{-0.0969}}\ F_{hh}^{\underset{(.1321)}{0.0825}}$$

$R^2 = 0.508$ $\quad S_e = 0.1117$

Reduced Joint Model:

$$E_{hh} = -2.4140\ Y^{\underset{(.1748)}{1.0709^{***}}}\ D^{\underset{(.0233)}{0.0437^{*}}}$$

$R^2 = 0.483$ $\quad S_e = 0.1095$

Health and Hospital Expenditures per capita, from own sources: 1965

Full Additive Model:

$$E_{hh} = -5.45 + \underset{(.0052)}{0.0120Y^{**}} + \underset{(.0648)}{0.0271U} - \underset{(.0067)}{0.0026D}$$

$$+ \underset{(.2065)}{0.1920Y_L} - \underset{(.5212)}{0.5798A_{65}} - \underset{(.8623)}{1.2269F_{hh}}$$

$R^2 = 0.379$ $S_e = 6.86$

Reduced Additive Model:

$$E_{hh} = 3.78 + \underset{(.0023)}{0.0086Y^{***}} - \underset{(.7565)}{1.2903F_{hh}^{*}}$$

$R^2 = 0.343$ $S_e = 6.74$

Full Joint Model:

$$E_{hh} = -1.8699\ Y^{\underset{(.6027)}{0.9982}}\ U^{\underset{(.0315)}{-0.0331}}\ D^{\underset{(.0368)}{0.0432}}$$

$$Y_L^{\underset{(.2520)}{0.1197}}\ A_{65}^{\underset{(.1749)}{-0.2891}}\ F_{hh}^{\underset{(.1308)}{-0.2897^{**}}}$$

$R^2 = 0.393$ $S_e = 0.1281$

Reduced Joint Model:

$$E_{hh} = -1.5428\ Y^{\underset{(.2652)}{0.8665^{***}}}\ F_{hh}^{\underset{(.1203)}{-0.2077^{*}}}$$

$R^2 = 0.341$ $S_e = 0.1278$

Total Aided Expenditures per capita, from own sources: 1960

Full Additive Model:

$$E_{ta} = 117.17 + \underset{(.0203)}{0.0212Y} + \underset{(.2665)}{0.3987U} - \underset{(.0241)}{0.0617D^{**}}$$

$$- \underset{(.7982)}{1.3597Y_L^{*}} + \underset{(.3058)}{0.7435F_{ta}^{**}}$$

$R^2 = 0.550$ $S_e = 24.37$

Reduced Additive Model:

$$E_{ta} = 173.12 + \underset{(.2566)}{0.4749U^{*}} - \underset{(.0241)}{0.0605D^{**}} - \underset{(.4341)}{2.0597Y_L^{***}} + \underset{(.3046)}{0.7751F_{ta}^{**}}$$

$R^2 = 0.539$ $S_e = 24.40$

Full Joint Model:

$$E_{ta} = 0.2752\ \underset{(.3001)}{Y^{0.4865}}\ \underset{(.0169)}{U^{0.0203}}\ \underset{(.0278)}{D^{0.0117}}$$

$$\underset{(.1507)}{Y_L^{-0.1421}}\ \underset{(.1175)}{F_{ta}^{0.2992^{**}}}$$

$R^2 = 0.512$ $S_e = 0.0673$

Reduced Joint Model:

$$E_{ta} = -0.4912\ \underset{(.1113)}{Y^{0.7247^{***}}}\ \underset{(.0584)}{F_{ta}^{0.1956^{***}}}$$

$R^2 = 0.486$ $S_e = 0.0668$

Total Aided Expenditures per capita, from own sources: 1965

Full Additive Model:

$$E_{ta} = 99.74 + \underset{(.0197)}{0.0560Y^{***}} + \underset{(.2803)}{0.0541U} - \underset{(.0240)}{0.0937D^{***}}$$

$$- \underset{(.7937)}{1.3405Y_L^{*}} + \underset{(.1241)}{0.5128F_{ta}^{***}}$$

$R^2 = 0.748$ $S_e = 26.45$

Reduced Additive Model:

$$E_{ta} = 98.97 + \underset{(.0182)}{0.0574Y^{***}} - \underset{(.0227)}{0.0923D^{***}} - \underset{(.7850)}{1.3436Y_L^{*}} + \underset{(.1036)}{0.5000F_{ta}^{***}}$$

$R^2 = 0.747$ $S_e = 26.16$

Full Joint Model:

$$E_{ta} = -0.0160\ Y^{\underset{(.2205)}{0.7241^{***}}}\ U^{\underset{(.0124)}{0.0069}}\ D^{\underset{(.0192)}{-0.0685^{***}}}$$

$$Y_L^{\underset{(.0952)}{-0.0797}}\ F_{ta}^{\underset{(.0644)}{0.0718}}$$

$R^2 = 0.747$ $S_e = 0.0490$

Reduced Joint Model:

$$E_{ta} = -0.5830\ Y^{\underset{(.0915)}{0.9061^{***}}}\ D^{\underset{(.0107)}{-0.0837^{***}}}$$

$R^2 = 0.735$ $S_e = 0.0486$

Non-Aided Expenditures per capita, from own sources: 1960

Full Additive Model:

$$E_{na} = 39.93 + \underset{(.0175)}{0.0189Y} + \underset{(.2283)}{0.3463U} - \underset{(.0190)}{0.0167D}$$

$$- \underset{(.6413)}{0.8317Y_L} + \underset{(.1840)}{0.0059F_t}$$

$R^2 = 0.533$ $S_e = 19.57$

Reduced Additive Model:

$$E_{na} = -14.57 + \underset{(.0082)}{0.0364Y***} + \underset{(.1493)}{0.2607U*}$$

$R^2 = 0.507$ $S_e = 19.45$

Full Joint Model:

$$E_{na} = 1.4510\ Y^{\underset{(.4479)}{0.2550}}\ U^{\underset{(.0267)}{0.0372}}\ D^{\underset{(.0436)}{0.0101}}$$

$$Y_L^{\underset{(.2267)}{-0.5564**}}\ F_t^{\underset{(.1996)}{0.1245}}$$

$R^2 = 0.619$ $S_e = 0.1010$

Reduced Joint Model:

$$E_{na} = 2.7243\ Y_L^{\underset{(.0800)}{-0.6723***}}$$

$R^2 = 0.595$ $S_e = 0.0996$

Non-Aided Expenditures per capita, from own sources: 1965

Full Additive Model:

$$E_{na} = -42.64 + \underset{(.0184)}{0.0388Y^{**}} + \underset{(.2585)}{0.5753U^{**}} - \underset{(.0220)}{0.0203D}$$

$$\underset{(.7285)}{-0.5302Y_L} + \underset{(.0912)}{0.3821F_t^{***}}$$

$R^2 = 0.671$ $S_e = 24.43$

Reduced Additive Model:

$$E_{na} = -77.37 + \underset{(.0110)}{0.0473Y^{***}} + \underset{(.2436)}{0.4921U^{**}} + \underset{(.0900)}{0.3941F_t^{***}}$$

$R^2 = 0.660$ $S_e = 24.29$

Full Joint Model:

$$E_{na} = -1.2259\ Y^{\underset{(.4501)}{0.9494^{**}}}\ U^{\underset{(.0255)}{0.0303}}\ D^{\underset{(.0366)}{-0.0149}}$$

$$Y_L^{\underset{(.1943)}{-0.4091^{**}}}\ F_t^{\underset{(.1366)}{0.2522^{*}}}$$

$R^2 = 0.705$ $S_e = 0.1000$

Reduced Joint Model:

$$E_{na} = -1.4497\ Y^{\underset{(.4419)}{1.0263^{**}}}\ Y_L^{\underset{(.1918)}{-0.3817^{*}}}\ F_t^{\underset{(.0778)}{0.2196^{***}}}$$

$R^2 = 0.695$ $S_e = 0.0995$

State and Local Government Fiscal Effort: 1960

Full Additive Model:

$$FE = \underset{}{169.27} - \underset{(.0193)}{0.0360Y^{*}} + \underset{(.1879)}{0.0905U} - \underset{(.0160)}{0.0277D^{*}} - \underset{(.5564)}{1.0637Y_{L}^{*}}$$

$$+ \underset{(1.8924)}{0.9737A_{5-19}} + \underset{(.0230)}{0.0207Debt} + \underset{(.1574)}{0.2017F_{t}}$$

$R^2 = 0.340$ $S_e = 15.73$

Reduced Additive Model:

$$FE = \underset{}{43.86} - \underset{(.1415)}{0.0266D^{*}} + \underset{(1.2629)}{2.6134A_{5-19}^{**}}$$

$R^2 = 0.267$ $S_e = 15.68$

Full Joint Model:

$$FE = \underset{}{4.2744}\ Y^{\underset{(.4073)}{-0.6707}}\ U^{\underset{(.0161)}{0.0173}}\ D^{\underset{(.0309)}{-0.0376}}\ Y_{L}^{\underset{(.1551)}{-0.2576}}$$

$$A_{5-19}^{\underset{(.5366)}{0.1370}}\ Debt^{\underset{(.0687)}{0.0177}}\ F_{t}^{\underset{(.1215)}{0.0829}}$$

$R^2 = 0.344$ $S_e = 0.0604$

Reduced Joint Model:

$$FE = \underset{}{1.0511}\ D^{\underset{(.0139)}{-0.0295^{**}}}\ A_{5-19}^{\underset{(.2875)}{0.7257^{**}}}$$

$R^2 = 0.284$ $S_e = 0.0596$

State and Local Government Fiscal Effort: 1965

Full Additive Model:

$$FE = \underset{}{122.23} - \underset{(.0159)}{0.0127Y} - \underset{(.1765)}{0.0477U} - \underset{(.0147)}{0.0330D^{**}} - \underset{(.4992)}{0.8294Y_L}$$

$$+ \underset{(1.8874)}{2.3283A_{5-19}} + \underset{(.0152)}{0.0074Debt} + \underset{(.0648)}{0.0201F_t}$$

$R^2 = 0.368$ $\quad S_e = 15.80$

Reduced Additive Model:

$$FE = \underset{}{56.15} + \underset{(1.4328)}{3.3779A_{5-19}^{**}} - \underset{(.0129)}{0.0370D^{***}} - \underset{(.2740)}{0.5173Y_L^{*}}$$

$R^2 = 0.350$ $\quad S_e = 15.30$

Full Joint Model:

$$FE = 2.2918 \; \underset{(.3078)}{Y^{-0.1704}} \; \underset{(.0132)}{U^{0.0026}} \; \underset{(.0201)}{D^{-0.0544***}} \; \underset{(.1027)}{Y_L^{-0.0784}}$$

$$\underset{(.4031)}{A_{5-19}^{0.4286}} \; \underset{(.0544)}{Debt^{0.0215}} \; \underset{(.0758)}{F_t^{-0.0387}}$$

$R^2 = 0.411$ $\quad S_e = 0.0493$

Reduced Joint Model:

$$FE = 1.5731 \; \underset{(.2293)}{A_{5-19}^{0.4319*}} \; \underset{(.0112)}{D^{-0.0436***}}$$

$R^2 = 0.395$ $\quad S_e = 0.0473$

Total Expenditures (including Federal Aid), per capita: 1960

Full Additive Model:

$$E = 199.55 + \underset{(.0332)}{0.0460Y} + \underset{(.4348)}{0.3354U} - \underset{(.0361)}{0.0945D^{**}}$$

$$- \underset{(1.2212)}{2.3799Y_L^{**}} + \underset{(.3503)}{0.9769F_t^{***}}$$

$R^2 = 0.644$ $\quad S_e = 37.27$

Reduced Additive Model:

$$E = 195.56 + \underset{(.0298)}{0.0571Y^{*}} - \underset{(.0349)}{0.0877D^{**}} - \underset{(1.2097)}{2.2866Y_L^{*}} + \underset{(.2629)}{0.7993F_t^{***}}$$

$R^2 = 0.640$ $\quad S_e = 37.10$

Full Joint Model:

$$E = 1.0246\ Y^{\underset{(.2387)}{0.3947^{*}}}\ U^{\underset{(.0142)}{0.0094}}\ D^{\underset{(.0232)}{-0.0159}}$$

$$Y_L^{\underset{(.1208)}{-0.1954}}\ F_t^{\underset{(.1064)}{0.2384^{**}}}$$

$R^2 = 0.675$ $\quad S_e = 0.0538$

Reduced Joint Model:

$$E = -0.4961\ Y^{\underset{(.0862)}{0.7616^{***}}}\ F_t^{\underset{(.0478)}{0.2576^{***}}}$$

$R^2 = 0.653$ $\quad S_e = 0.0538$

APPENDIX G

SIMPLE CORRELATION COEFFICIENTS

TABLE 25

SIMPLE CORRELATION COEFFICIENTS BETWEEN INDEPENDENT VARIABLES: 1960

(Arithmetic)

	Urbanization	Population Density	Per Cent of Families With Income Below $3000	Per Capita Federal Grants	Per Cent of Population Aged 65 and Over	Per Cent of Population Between 5 and 19
Per Capita Income	0.585	0.416	-0.899	-0.043	-0.079	-0.738
Urbanization		0.602	-0.517	-0.618	-0.041	-0.570
Population Density			-0.380	-0.439	0.161	-0.545
Per Cent of Families with Income Below $3000				0.063	0.040	0.603
Per Capita Federal Grants					0.097	0.141

(Logarithmic)

Per Capita Income	0.161	0.107	-0.929	-0.219	-0.101	-0.741
Urbanization		0.516	-0.119	-0.676	0.260	-0.312
Population Density			-0.154	-0.866	0.427	-0.419
Per Cent of Families with Income Below $3000				0.246	0.107	0.608
Per Capita Federal Grants					0.117	0.395

TABLE 26

SIMPLE CORRELATION COEFFICIENTS BETWEEN INDEPENDENT AND DEPENDENT VARIABLES: 1960 (ARITHMETIC)

Dependent Variables	Independent Variables						
Per Capita Expenditures	Per Capita Income	Degree of Urbanization	Population Density	Per Cent of Families with Income Below $3000	Per Capita Federal Grants[a]	Per Cent of Population Aged 65 and Over	Per Cent of Population Between 5 and 19
Total	0.692	0.382	0.075	-0.703	0.004		
Education	0.502	0.127	-0.230	-0.542	0.112		-0.099
Highways	0.041	-0.218	-0.143	-0.105	0.446		
Welfare	0.478	0.395	0.251	-0.483	0.242	0.341	
Health and Hospitals	0.665	0.549	0.310	-0.542	-0.185	-0.021	
Non-Aided	0.689	0.548	0.295	-0.675	-0.156		

[a]Per capita grants are those for the respective function.

TABLE 27

SIMPLE CORRELATION COEFFICIENTS BETWEEN INDEPENDENT AND DEPENDENT VARIABLES: 1960 (LOGARITHMIC)

Dependent Variables	Independent Variables						
Per Capita Expenditures	Per Capita Income	Degree of Urbanization	Population Density	Per Cent of Families with Income Below $3000	Per Capita Federal Grants[a]	Per Cent of Population Aged 65 and Over	Per Cent of Population Between 5 and 19
Total	0.723	0.087	-0.051	-0.719	-0.039		
Education	0.555	-0.088	-0.364	-0.531	0.172		-0.129
Highways	0.031	0.023	0.101	-0.038	0.289		
Welfare	0.553	0.154	0.121	-0.544	0.129	0.307	
Health and Hospitals	0.667	0.262	0.268	-0.589	-0.347	-0.042	
Non-Aided	0.746	0.216	0.147	-0.771	-0.217		

[a]Per Capita grants are those for the respective function.

TABLE 28

SIMPLE CORRELATION COEFFICIENTS BETWEEN INDEPENDENT VARIABLES: 1965

(Arithmetic)

	Urbanization	Population Density	Per Cent of Families With Income Below $3000	Per Capita Federal Grants	Per Cent of Population Aged 65 and Over	Per Cent of Population Between 5 and 19
Per Capita Income	0.627	0.481	-0.877	0.023	0.001	-0.774
Urbanization		0.606	-0.517	-0.456	0.041	-0.510
Population Density			-0.384	-0.290	0.152	-0.546
Per Cent of Families with Income Below $3000				-0.064	0.040	0.603
Per Capita Federal Grants					0.156	0.151

(Logarithmic)

Per Capita Income	0.210	0.231	-0.907	-0.151	-0.029	-0.776
Urbanization		0.586	-0.119	-0.640	0.260	-0.312
Population Density			-0.171	-0.798	0.405	-0.431
Per Cent of Families with Income Below $3000				0.074	0.107	0.608
Per Capita Federal Grants					0.238	0.326

TABLE 29

SIMPLE CORRELATION COEFFICIENTS BETWEEN INDEPENDENT AND DEPENDENT VARIABLES: 1965 (ARITHMETIC)

Dependent Variables	Independent Variables						
Per Capita Expenditures	Per Capita Income	Degree of Urbanization	Population Density	Per Cent of Families with Income Below $3000	Per Capita Federal Grants[a]	Per Cent of Population Aged 65 and Over	Per Cent of Population Between 5 and 19
Total	0.717	0.236	0.018	-0.716	0.493		
Education	0.501	0.124	-0.216	-0.596	0.380		-0.116
Highways	0.255	-0.423	-0.195	-0.224	0.729		
Welfare	0.488	0.356	0.253	-0.478	0.346	0.268	
Health and Hospitals	0.550	0.402	0.193	-0.422	-0.380	-0.100	
Non-Aided	0.717	0.397	0.223	-0.673	0.351		

[a]Per Capita grants are those for the respective function.

TABLE 30

SIMPLE CORRELATION COEFFICIENTS BETWEEN INDEPENDENT AND DEPENDENT VARIABLES: 1965 (LOGARITHMIC)

Dependent Variables	Independent Variables						
Per Capita Expenditures	Per Capita Income	Degree of Urbanization	Population Density	Per Cent of Families with Income Below $3000	Per Capita Federal Grant[a]	Per Cent of Population Aged 65 and Over	Per Cent of Population Between 5 and 19
Total	0.752	-0.087	-0.278	-0.756	0.318		
Education	0.558	-0.110	-0.436	-0.574	0.341		-0.147
Highways	0.253	-0.476	-0.483	-0.207	0.595		
Welfare	0.531	0.084	0.088	-0.543	0.292	0.213	
Health and Hospitals	0.547	0.086	0.159	-0.476	-0.437	-0.115	
Non-Aided	0.776	0.063	-0.027	-0.788	0.137		

[a]Per Capita grants are those for the respective function.

APPENDIX H

"INTERTEMPORAL INCOME ELASTICITY OF EXPENDITURES": SELECTED FUNCTIONS

TABLE 31

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL EDUCATION EXPENDITURES ON PER CAPITA INCOME: BY STATES, 1957-1965

	"Income Elasticity of Education Expenditures"		
Wisconsin	3.168	Maryland	2.045
Montana	2.644	Iowa	2.036
Oregon	2.565	Massachusetts	1.982
Texas	2.507	California	1.944
Idaho	2.462	New Jersey	1.933
Illinois	2.376	Virginia	1.933
Pennsylvania	2.365	Florida	1.906
Colorado	2.347	Kansas	1.839
Kentucky	2.337	Minnesota	1.814
Maine	2.336	Connecticut	1.782
Missouri	2.331	Oklahoma	1.698
Wyoming	2.300	Mississippi	1.693
West Virginia	2.287	New Hampshire	1.684
Rhode Island	2.279	Nebraska	1.682
Utah	2.279	North Carolina	1.564
Indiana	2.263	Arizona	1.563
Delaware	2.209°	Arkansas	1.511
Washington	2.192	Vermont	1.506
Nevada	2.172	Georgia	1.486
New York	2.151	Tennessee	1.478
New Mexico	2.148	South Dakota	1.410
Alabama	2.079	South Carolina	1.359
Ohio	2.078	North Dakota	1.294*
Michigan	2.053	Louisiana	1.289

Note: The coefficient for Delaware is not significantly different from zero; that for North Dakota is significant at the .05 level. All others are significant at the .01 level.

TABLE 32

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL HIGHWAY EXPENDITURES ON PER CAPITA INCOME: BY STATES, 1957-1965

"Income Elasticity of Highway Expenditures"

West Virginia	2.621**	Nebraska	1.080**
Kentucky	2.155**	Indiana	0.638*
Missouri	1.694*	South Dakota	0.624*
Pennsylvania	1.369**	South Carolina	0.580*
Rhode Island	1.256**	North Dakota	0.550*
Nevada	1.211*	Arkansas	0.495*
Mississippi	1.092**	Michigan	-1.131*

Alabama	1.109	Montana	0.778
Arizona	-0.034	New Hampshire	-0.153
California	0.389	New Jersey	0.824
Colorado	-0.561	New Mexico	0.439
Connecticut	-1.919	New York	0.384
Delaware	3.003	North Carolina	0.686
Florida	0.547	Ohio	0.133
Georgia	0.252	Oklahoma	0.537
Idaho	0.055	Oregon	0.711
Illinois	-1.432	Tennessee	0.599
Iowa	0.507	Texas	0.520
Kansas	-0.375	Utah	0.468
Louisiana	-0.267	Vermont	-0.766
Maine	0.459	Virginia	0.237
Maryland	-0.398	Washington	0.431
Massachusetts	-0.260	Wisconsin	0.622
Minnesota	0.302	Wyoming	1.317

* Significant at the .05 level.
** Significant at the .01 level.

TABLE 33

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL WELFARE EXPENDITURES ON PER CAPITA INCOME: BY STATES, 1957-1965

"Income Elasticity of Welfare Expenditures"

West Virginia	4.043**	New Hampshire	1.581**
Illinois	3.527**	Oregon	1.519**
Virginia	2.874**	Rhode Island	1.495**
New Mexico	2.563**	South Carolina	1.491**
Maryland	2.366**	Arkansas	1.386**
Kentucky	2.321**	Texas	1.381**
Mississippi	2.248*	New York	1.359**
Pennsylvania	2.179**	Idaho	1.340**
Wyoming	2.102*	Ohio	1.318*
Alabama	2.051*	Nevada	1.281**
North Carolina	2.016**	Florida	1.248*
California	1.984**	Iowa	1.198**
Minnesota	1.911**	Arizona	1.152*
Wisconsin	1.840**	South Dakota	1.094**
Maine	1.785**	Massachusetts	1.065**
Connecticut	1.772**	Tennessee	1.059**
New Jersey	1.677**	Vermont	0.936*
		Kansas	0.329*

Colorado	0.530	Missouri	0.471
Delaware	0.977	Montana	1.013
Georgia	0.793	Nebraska	0.636
Indiana	0.562	North Dakota	0.804
Louisiana	-0.430	Oklahoma	1.331
Michigan	0.663	Utah	0.557
		Washington	0.018

* Significant at the .05 level.
** Significant at the .01 level.

TABLE 34

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL HEALTH AND HOSPITAL EXPENDITURES ON PER CAPITA INCOME: BY STATES, 1957-1965

"Income Elasticity of Health Expenditures"

Kentucky	2.607**	New York	1.351**
Idaho	2.291*	Utah	1.349*
West Virginia	2.261*	Texas	1.326**
Mississippi	2.220**	Nevada	1.293**
Missouri	1.866**	South Carolina	1.273**
Florida	1.759**	Kansas	1.244**
Oklahoma	1.697**	Arkansas	1.122**
Colorado	1.694**	Indiana	1.068**
Illinois	1.676**	Louisiana	0.956**
Tennessee	1.668**	North Carolina	0.947**
Alabama	1.598**	New Jersey	0.943**
Maryland	1.550**	Arizona	0.884**
Iowa	1.543**	California	0.697*
Michigan	1.377**	Nebraska	0.654*
Georgia	1.371**	Minnesota	0.546*
Wisconsin	1.360**	Virginia	0.486*

Connecticut	-0.539	Ohio	0.315
Delaware	1.324	Oregon	0.420
Maine	-0.474	Pennsylvania	0.726
Massachusetts	0.392	Rhode Island	0.062
Montana	0.163	South Dakota	0.430
New Hampshire	-0.119	Vermont	-0.166
New Mexico	0.349	Washington	-0.755
North Dakota	0.307	Wyoming	1.113

* Significant at the .05 level.
** Significant at the .01 level.

TABLE 35

REGRESSION COEFFICIENTS OF PER CAPITA STATE AND LOCAL EXPENDITURES FOR NON-AIDED FUNCTIONS ON PER CAPITA INCOME: BY STATES, 1957-1965

"Income Elasticity of Non-Aided Expenditures"

Kentucky	2.504*	Louisiana	1.493
Delaware	2.420*	Ohio	1.468
Wisconsin	2.184	Nevada	1.458
Washington	2.172	Alabama	1.418
California	2.140	Montana	1.371
Texas	2.110	Colorado	1.367
Missouri	1.967	Vermont	1.366
Pennsylvania	1.910	Illinois	1.347*
Tennessee	1.868	North Carolina	1.305
Oklahoma	1.850	Minnesota	1.291
Idaho	1.830	Maryland	1.289
Utah	1.797	Massachusetts	1.219
Michigan	1.712	Florida	1.209
New Hampshire	1.709	Georgia	1.196
Nebraska	1.672	Oregon	1.169
Wyoming	1.668	South Carolina	1.162
Mississippi	1.639	Indiana	1.051
Virginia	1.639	Arkansas	0.929*
Rhode Island	1.631	Kansas	0.862
Connecticut	1.628	South Dakota	0.823*
Arizona	1.610		
New Mexico	1.583		
New Jersey	1.530	Iowa	1.054
Maine	1.505	North Dakota	0.691
New York	1.505	West Virginia	1.465

* Significant at the .05 level.
Iowa, North Dakota and West Virginia--not significantly different from zero.

All others significant at the .01 level.

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