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I. INTRODUCTION

IN HIS WELL KNOWN WORK dealing with the long term trend in government spending, Solomon Fabricant included a chapter dealing with an analysis of interstate public expenditure differentials. This section of his study has attracted a great deal of attention and has been the focus of much recent research.[1]

The primary objectives of this paper are (a) to question the interpretation of the results of Fabricant's and similar statistical analyses in light of some methodological and conceptual considerations, and (b) to present a more extensive analysis of the temporal pattern of the determinants of state and local government expenditures. A brief summary of the most relevant literature is presented in this section of the paper while the following two sections contain an analysis of two potentially severe limitations of the "determinants" studies—the existence of multicollinearity and the independence of the federal aid variable. The remainder of the paper contains an attempt to establish a temporal pattern of expenditure determinants by examining data for 1903, 1942, and 1962 using different sets of variables and alternative functional forms.

Fabricant was not the first to attempt to explain statistically the variability in governmental expenditures: Brecht, Colm, Davenport, and Berolzheimer had performed similar analyses previously.[2] However, Fabricant was the first to use what have since become known as the three basic variables (per capita income, population density, and urbanization) to analyze comprehensively the expenditure data of state and local governments of 48 states. Essentially, he attempted to evaluate the relative importance and joint effect of these three basic factors in explaining interstate differentials in the level of per-

* Assistant Professors of Economics, West Virginia University. The authors are indebted to Professors Solomon Fabricant, Glenn Fisher, James W. Martin, William Miernyk, and James H. Thompson for their helpful comments on an earlier draft of this paper.

1. Solomon Fabricant, *The Trend of Government Activity in The United States Since 1900.* (New York: National Bureau of Economic Research, 1952) pp. 112-139. Fabricant suggests that the main thread of the discussion in his book will not be lost by omitting this chapter.

2. Arnold Brecht, "Three Topics in Comparative Administration—Organization of Government Departments, Government Corporations, Expenditures in Relation to Population," *Public Policy* (Harvard University Press, 1941); Gerhardt Colm, *et al.*, "Public Expenditures and Economic Structures in the United States," *Social Research,* III (1936); Josef Berolzheimer, "Influences Shaping Expenditure for Operation of State and Local Governments," *The Bulletin of The National Tax Association,* XXXII, No. 6 (1947); Donald Davenport, *An Analysis of the Cost of Municipal and State Government and the Relation of Population To Cost of Government, Net Taxable Income, and Full Value of Real Property in the United States* (Albany, New York: 1926).

capita state and local government expenditures. He was successful in statistically explaining 72 per cent of state-to-state differences in per capita operating expenditures and from 29 to 85 per cent for various functional classes, and he concluded that interstate income disparities were the primary cause of interstate spending differences.

Fisher, using the same technique on 1957 data, expanded the analysis to a consideration of a number of additional demographic, economic, and socio-political variables.[3] His primary conclusions were twofold: (1) The distribution of income is an important explanatory factor, possibly because political resistance to increased government expenditure and thus higher taxes may be greater among low income groups. (2) When the true effect of a factor can best be described by more than one statistical series, multiple-partial correlation analyses enables a better evaluation of the relative importance of variable types, i.e., demographic, economic, etc., than does an examination of measures of separate effect such as beta or elasticity coefficients.

Sacks and Harris significantly increased explained variation by introducing state and federal aid as independent variables on 1957 and 1960 data.[4] Their conclusion was that an increasingly greater portion of interstate differentials in state and local government spending may be attributed to intergovernmental flows of funds both between and within states.

Kurnow has criticized the appropriateness of a linear regression model on the grounds that the levels of the basic variables are interdependent,[5] e.g., the relationship between density and expenditures is not independent of the levels of income and urbanization. By replacing the additive (linear) model with a multiplicative form, Kurnow was able to increase explained variation from .72 to .88 on 1942 data and from .53 to .78 on 1957 data.

The present authors, in an earlier work, attempted to extend the analysis to include the temporal pattern of government expenditures by regressing *changes* in selected independent variables on *changes* in governmental expenditures.[6] The primary conclusions of this analysis were (a) changes in the levels of federal aid and income have had the most pronounced effect on *changes* in government expenditures, and (b) the sensitivity of expenditures to changes in income and density can be more meaningfully estimated if a more homogeneous income-density group of states are analyzed.

The objectives of this paper—a reinterpretation of previous results in light of methodological and conceptual considerations, and a more extensive analysis of the temporal pattern of the determinants of governmental ex-

3. Glenn W. Fisher, "Determinants of State and Local Government Expenditures: A Preliminary Analysis," *National Tax Journal,* XIV (December, 1961), pp. 349-355. Glenn W. Fisher, "Interstate Variation in State and Local Government Expenditure" *National Tax Journal* XVII (March, 1964), pp. 57-74.

4. Seymour Sacks and Robert Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Funds," *National Tax Journal* XVII (March, 1964), pp. 75-85.

5. Ernest Kurnow, "Determinants of State and Local Expenditures Reexamined", *National Tax Journal* XVI (September, 1963), pp. 252-55.

6. Roy W. Bahl and Robert J. Saunders, "Determinants of Changes in State and Local Government Expenditures," *National Tax Journal* XVIII (March, 1965), pp. 50-57.

penditures—may be accomplished by a comparative analysis of multiple linear and curvilinear regressions on data for 1903, 1942, and 1962. Federal aid is added to the three basic factors as an independent variable in the 1942 and 1962 cross-sectional analyses (a) to test the Sacks-Harris hypothesis of the increasing relative importance of intergovernmental flows of funds and (b) to demonstrate that Fabricant's evaluation of the relative importance of the three basic factors may have been distorted by multicollinearity. To supplement this comparative statics approach (a) changes in expenditures between 1942 and 1962 are regressed on changes in the explanatory factors, and (b) the three basic factors are regressed on 1903 data to test Fabricant's hypothesis that the time path of state and local expenditures may be adequately described by including a trend factor in the cross-sectional regression equation. Finally, Kurnow's contention that a non-additive type model is more appropriate and yields better results is examined by fitting a semi-logarithmic function to the data.

II. The Problem of Multicollinearity

Interpretation of the results of statistical analyses of state and local expenditure patterns has been based largely on the statistical significance of regression coefficients, which has in turn been taken to imply the importance of the independent variables. However, while statistical inference offers a method of ascertaining significance, it offers no corresponding method for determining importance when there is a high degree of interdependence among independent variables.[7] If two independent variables are highly interrelated (collinear) their standard errors tend to be large,[8] and a simple t test may lead to the conclusion that one or the other of the net regression coefficients is not significantly different from zero. This can happen for one of two reasons: (a) the independent variable is actually not related to the dependent variable and thus not important, or (b) the independent variable is related to the dependent variable but collinearity has caused its standard error to blow up. Consequently, only after a detailed consideration of the intercorrelations among the independent variables can an attempt be made to infer the true importance of any explanatory factors. Where there is substantial correlation among independent variables, measures of separate effect such as partial correlation, elasticity, and beta coefficients have little meaning when interpreted out of context.

Fisher's suggestion that partial correlation analysis yields a more accurate measure of separate effect under certain conditions is subject to the same criticism, since intercorrelations among the independent variables bias the estimate of the partial determination coefficient. A partial determination coefficient shows the effect on explained variation of introducing a variable or set of variables into the model given the effect of the variables *which are already in the model.* Thus Fisher is actually suggesting a measure of "incre-

7. See Roy W. Bahl and Robert J. Saunders, "Fabricant's Determinants After Twenty Years: A Critical Reappraisal", *The American Economist* (Spring, 1966), pp. 27-41.

8. J. Johnston, *Econometric Methods* (New York: McGraw-Hill Book Co., Inc. 1963), p. 204.

mental effect" or a measure of the marginal contribution of a given set of variables. It will be a measure of net effect only if there exists no intercorrelation among demographic, economic, and socio-political variables.

III. The Validity of Federal Aid as a "Determinant": a Digression

The use of federal aid as a "determinant" of the level of state and local government expenditures may be questioned on two counts: (1) If the importance of the federal grants variable in the regression models is due solely to a strong correlation with general revenues, it contributes little to an understanding of the pattern of interstate expenditure disparities. (2) The direction of causality between expenditures and federal grants is extremely nebulous.

With reference to the first question, to the extent that variations in any revenue source are closely associated with variations in total general revenues, the covariability of the particular revenue source with expenditures will naturally be strong. If variations in the ratio of federal aid to total general revenue are not closely associated with variations in per capita federal aid, it could be concluded that the effect of federal aid on expenditures is more than just as a component of general revenues. However, the data in Table 1 do not indicate this to be the case. Federal aid is significantly and positively related to the federal aid-general revenue ratio indicating that, via its relationship with general revenues, federal aid should be related to per capita state and local government expenditures. When (see Table 2) federal aid is correlated with per capita expenditures net of federal aid, the relationship between federal grants and expenditures is significantly reduced. It is possible that this reduction is a result of the elimination of at least part of the influence of federal aid as a direct component of general revenue.[9]

TABLE 1

Coefficients of Simple Correlation Between Per Capita Federal Grants to State and Local Governments and the Ratio of Federal Grants to Total General Revenue: 48 States and 15 High Income-High Density[a] States for 1942 and 1962

	1942	1962
15 states	.72	.61
48 states	.73	.62

[a] See footnote 13.

TABLE 2

Coefficients of Simple Correlation Between Per Capita Federal Grants and Four Expenditure Variables, 1962: For 48 States

Expenditure Variables	Coefficient of Correlation
Total Current Expenditures	.45
Total Current Expenditures Less Federal Aid	.03
Total General Expenditures (Including Capital Outlays)	.60
Total General Expenditures Less Federal Aid	.32

9. The data in Table 2 also suggests that federal aid is more closely related to variation in capital outlays among states than to operating expenditures.

The direction of the causality between federal aid and expenditures may be questioned on a priori grounds. Fisher has suggested that for certain expenditure functions the direction of causality may actually be reversed, i.e., the level of expenditures determines the level of federal aid.[10] For example, many public assistance grants are open-ended as far as the number of recipients is concerned; thus some state welfare expenditure decisions may actually determine the amount of federal aid received. The direction of the causality implied here is of course opposite that usually assumed when federal aid is considered a determinant of state and local expenditure levels. Therefore it must be concluded that in view of (a) the "source of funds" effect of federal aid on expenditures and (b) the questionable direction of causation between federal aid and expenditures, the inclusion of federal aid as a "determinant" of expenditures is subject to reservation. Certainly federal grants to state and local governments is not a determinant in the same sense as the three basic factors mentioned above. If the only justification for its inclusion is that it is closely related to expenditures (i.e., that it substantially improves explained variation), an excellent case could also be made for the inclusion of property tax revenue, sales tax receipts, and other revenue sources as "determinants."

On the other hand, there are at least two possibilities for justifying 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. Sacks and Harris have demonstrated that in those areas where the government has taken a direct interest, the variability in federal aid is most closely associated with the variability in the level of expenditures.[11] However, the justification of the Sacks-Harris hypothesis that the level of total expenditures is not independent of the means by which revenues are raised may lie with a second interpretation of the effect of federal aid. 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 states view a federal grant at least partially as a *complement* to internal funds rather than as a *substitute,* then federal aid could conceivably have a multiple effect on state and local expenditures.

IV. Analysis of 1942-1962 Regressions

The importance of urbanization. Equation A of Table 3 is a replication of the results of Fabricant's analysis of 1942 data. On the basis of these results, he concluded that income was the most important of the independent variables, while ". . . urbanization is by itself a minor factor, much less important than

10. Fisher suggested this point in his paper, Fisher, *op. cit.,* p. 72, and again in a letter to the authors.

11. Sacks and Harris, *op. cit.,* pp. 81-82.

TABLE 3

LINEAR REGRESSION EQUATIONS[a] OF PER CAPITA CURRENT EXPENDITURES ON SELECTED INDEPENDENT VARIABLES: FOR 15 AND 48 STATES, 1942 AND 1962

Equation	Year	n	Constant Term	Per Capita Income	Population Density	Per Cent Urban	Per Capita Federal Grants	Coefficient of Determination[b]
A	1942	48	3.3246	.0822*	—.0396*	.1271		
				(.0178)	(.0132)	(.1516)	NI[c]	.7225
				.8752	—.3524	.1723		
B	1942	48	0.6593	.0391*	—.0197*	.3813*	1.9975*	
				(.0108)	(.0097)	(.1050)	(.3256)	.8553
				.4278	—.1713	.4355	.4621	
C	1962	48	81.5049	.0757*	—.0636*	.0494		
				(.0120)	(.0265)	(.0973)	NI	.4579
				.7766	—.2912	.0554		
D	1962	48	73.8401	.0645*	—.0224	.0532	.5025*	
				(.0113)	(.0268)	(.0875)	(.1491)	.5622
				.6616	—.1026	.0597	.3669	
E	1942	15	.6035	.0235	—.0346	.7691*		
				(.0218)	(.0192)	(.3134)	NI	.2737
				.2728	—.6910	.9651		
F	1962	15	—52.4505	.0858*	—.0827*	1.6674*		
				(.0230)	(.0346)	(.6102)	NI	.4406
				.7746	—.6469	.7189		

[a] Standard errors of regression coefficients appear in parenthesis below each coefficient. Beta coefficients appear below the standard errors. Asterick denotes significance at .05 level.

[b] All coefficients of determination are adjusted for sample size.

[c] Not included.

income and not more important than density."[12] In light of a relatively high degree of intercorrelation between the explanatory variables in 1942, it is not surprising that Fabricant did not find urbanization to be a significant explanatory variable. However, as suggested above, this lack of statistical significance does not necessarily imply a lack of importance. In states with relatively homogeneous levels of income and density, there appears to be no reason to assume that per capita expenditure levels will not be responsive to interstate differentials in the degree of urbanization.

While the isolated effect of urbanization on expenditures cannot be tested empirically—because it is impossible to abstract from the interrelations with income and density—it is possible to reduce the variability of the income and density factors. By grouping 15 high income-high density states,[13] the coefficient of variation for income in 1942 is reduced from 32.7 per cent (for 48 states) to 15.7 per cent (for 15 states), and that for density from 140.8 per cent to 84.1 per cent. In 1962 the coefficient of variation for income is reduced from 20.7 per cent (for 48 states) to 11.7 per cent.

When the three standard variables are regressed on the 1942 per capita expenditures of the 15 states, urbanization is found to be statistically significant while the regression coefficients of neither income nor density differ significantly from zero. A comparison of the beta coefficients of the 1942 15-state and 48-state models (see equations A and E of Table 3) also implies a greater relative importance of the urbanization variable when it is examined in this more homogeneous income-density context. Fabricant's 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 these results.

The results of the three-variable regressions on 15 states are similar for 1942 and 1962 in that urbanization is an important explanatory factor in both years, but differ in that income and density are significant only in the later year. In fact, the relative size of the beta coefficients in equation F of Table 3 implies that the three basic variables were of approximately equal importance in 1962.

The effects of federal aid. Recent empirical analyses have focused on the relationship between the level of per capita expenditures and the level of federal grants to states. When used as an independent variable, per capita federal aid has, without exception, significantly increased the per cent of variation explained.

Equation B of Table 3 shows that by introducing federal aid into Fabricant's original 1942 three-variable model, the amount of variation explained is increased almost 13 per cent and all four independent variables are significant. Again, urbanization is apparently more than ". . . a minor factor, much less important than income and not more important than

12. Fabricant, *op. cit.*, p. 127.

13. California, Connecticut, Illinois, Indiana, Delaware, New Hampshire, New Jersey, New York, Massachusetts, Maryland, Michigan, Ohio, Pennsylvania, Rhode Island, and Wisconsin.

density."[14] In fact, as shown in equation B, Table 3, a comparison of beta coefficients implies that urbanization is of approximately the same importance as federal aid and income, and of greater importance than density.

Equation D, of Table 3, shows that when four independent variables (the three basic factors and per capita federal grants) are regressed on 1962 expenditures, only income and federal aid are found to be significant. When federal aid was introduced into the 1942 model, the importance of the income variable declined markedly, whereas the introduction of federal aid into the 1962 model was accompanied by no such substantial decline in the importance of income.[15] This result is consistent with recent empirical analyses which have shown a definite trend toward the greater equalizing effects of federal grants.[16] In 1942 the level of federal aid was positively related to the level of income, but the distribution of grants among the states has since altered markedly in favor of the poorer states. Consequently, in 1962, no significant correlation is observed between per capita federal aid and per capita income.

An alternate functional form. Kurnow found that the amount of explained variation in per capita expenditures could be increased through the use of a non-linear functional form. In the present analysis a semi-log equation of the form, $Y = a + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4$ was fitted to the 1942 and 1962 data. The results of the two regressions are shown in Table 4. In

TABLE 4

SEMI-LOG REGRESSION EQUATIONS[a] OF PER CAPITA CURRENT EXPENDITURES ON SELECTED INDEPENDENT VARIABLES: FOR 48 STATES, 1942 AND 1962

Equation	Year	Constant Term	Per Capita Income	Population Density	Percent Urban	Per Capita Federal Grants	Coefficients of Determination[b]
A	1942	−188.77	65.8336*	−4.7279	27.0933*	30.6362*	
			(14.9855)	(3.3180)	(11.8982)	(11.3451)	.8666
			.5550	−.1730	.2687	.3287	
B	1962	−1042.34	327.0032*	−1.8249	11.8110	106.5096*	
			(47.5058)	(10.4392)	(24.7619)	(32.2189)	.6445
			.7025	.0258	.0464	.4715	

the earlier year the improvement in explained variation was very slight (less than 1 per cent), while in 1962 the amount explained was increased from 56 per cent for the linear model to 64 per cent in the semi-log model. Thus Kurnow's contention, that a non-additive regression function would improve explained variation because of the interdependence among the levels of the independent variables, appears to be justified only by the results of the 1962 analysis. In neither year, however, does a comparison of the results of the

14. Fabricant, *op. cit.*, p. 127.

15. See Equations A, B, C, and D of Table 3.

16. See James A. Maxwell, "The Equalizing Effect of Federal Grants," *Journal of Finance,* Vol. IX (May, 1954), p. 209, and M. A. Haskell, "Federal Grants and the Income Density Effect," *National Tax Journal,* XV (March, 1962), p. 105.

curvilinear and the linear analyses suggest a substantial difference in the relative importance of the independent variables.

The temporal importance of the basic factors. Sacks and Harris have concluded that the diminished explanatory power of the three basic variables (see equations A and C in Table 3) is a result of the increasing importance of intergovernmental flows of funds.[17] A comparison of equations B and D with A and C of Table 3 reveals that the marginal contribution of federal aid to explained variation does not differ significantly between 1942 and 1962. Thus Sacks and Harris' hypothesis of the *increasing* importance of federal aid as a determinant of interstate spending levels is not supported by the data.[18]

At least three other explanations may be offered for the decline in the explanatory power of the three basic variables. First, the form in which the income and density variables are expressed may be a source of increasing inaccuracy through time.[19] The denominator of the per capita income measure (total population) tends to depress income figures for areas with large proportions of non-producers, namely, housewives, children, handicapped persons, and elderly persons. An empirical analysis has revealed that the variability in income differentials may be reduced by 20 to 25 per cent by adjusting for nonproducers.[20] The changing age distribution of the population and nature of retirement benefits suggests that the degree of this inaccuracy may have changed through time. The form of the population density measure is also open to question in that it includes as the denominator the land area of the entire state. This measure may yield little accurate information as to scale effects when the analysis includes both sparsely populated states such as Nevada and heavily populated states such as Massachusetts.

Second, the declining importance of the basic variables may reflect the fact that individual functional expenditures are responding to different sets of needs factors, possibly as a result of more sophisticated planning techniques. Table 5 reveals that the intercorrelations between selected expenditure categories tended to decline between 1942 and 1962, which may suggest that the same set of variables does not account for as much of the interstate variability in all functions in the later years. Consequently, interstate differentials in income, density, and urbanization may be less accurate indicators of the levels of certain types of expenditures than variable forms more closely associated with needs for specific expenditure programs, e.g., school age population, housing density, and proportion of substandard dwelling units.

Finally, some portion of the increase in state and local government expenditures may be attributed to price inflation. To the extent there exist interstate differentials in this inflationary effect, the diminished explanatory power of the

17. Sacks and Harris, *op. cit.*, p. 78.

18. We reached a different conclusion on this point in an earlier study primarily because a shorter time span was analyzed. See Bahl and Saunders, "Determinants of Changes in State and Local Government Expenditures," *op. cit.*, p. 57.

19. See Wilbur R. Thompson, *A Preface to Urban Economics* (Resources for the Future, The Johns Hopkins Press, Baltimore, 1965), p. 64.

20. Frank A. Hanna, *State Income Differentials* (Durham: Duke University Press, 1959).

TABLE 5
COMPARISON OF INTERCORRELATIONS AMONG SELECTED PER CAPITA EXPENDITURE CATEGORIES: 1942 AND 1962[a]

	Local Schools	Highways	Police and Fire
Total Current	(.92) .85	(.63) .32	(.68) .61
Local Schools		(.53) .17	(.51) .46
Highways		—	(.13) −.16

[a] The simple correlation coefficient for 1942 is shown in parenthesis above the corresponding 1962 coefficient.

basic variables may be affected. Given the disparities in government employee wage rates among different size cities, a hypothesis concerning interstate differentials in the extent of the inflationary effect on state and local government expenditures does not seem untenable.

V. A COMPARISON OF 1903, 1942 AND 1962 MODELS

Fabricant hypothesized that the relationships among his basic variables would be similar if computed using 1903 data.[21] He concluded that rising income was the chief cause of rising per capita expenditures during the 1903-1942 period, since he found per capita income to be the most important of the explanatory variables in 1942. However, as was shown above, Fabricant's failure to include federal aid as an independent variable may have resulted in an exaggeration of the importance of income. In fact, the four-variable model of the present analysis produces a slightly more accurate estimate of the average level of 1903 per capita expenditures than does Fabricant's three-variable model. He overestimated mean 1903 expenditures by $4.94 while the four-variable model of the present study underestimates 1903 expenditures by $3.62.[22]

Since estimates of 1900 per capita income are now available, it is possible to regress the basic variables on 1903 per capita expenditures. In Table 6, the actual 1903 equation is compared with Fabricant's three-variable and the present four-variable models.

While a comparison of the magnitude of the regression coefficients is subject to a degree of inaccuracy because of the difference in 1903 and 1942 price levels, it is apparent that the relationships existing among the variables in the 1903 equation and in Fabricant's 1942 model are similar. However, it may be noted that the regression coefficient of income in Fabricant's 1903 equation is significantly larger than the actual 1903 income regression coefficient. This again suggests that the exaggerated importance of income in Fabricant's 1942 regression caused the overestimation of 1903 expenditures.

The fact that the actual 1903 equation explains 80 per cent of interstate

21. Fabricant, *op. cit.*, pp. 135-137.

22. Because adequate data are not available, the average amount of federal aid in 1903 is assumed to be zero. The estimated 1903 mean expenditures were obtained by substituting mean 1903 income, urbanization and density values into the respective 1942 regression equations.

TABLE 6
REGRESSION EQUATIONS[a] OF PER CAPITA CURRENT EXPENDITURES ON SELECTED INDEPENDENT VARIABLES: 1903 AND 1942

Equation	Constant Term	Per Capita Income	Population Density	Per Cent Urban	Per Capita Federal Grants	Coefficient of Determination[b]
Fabricant's 1942 equation	3.3246	.0822* (.0178)	—.0396* (.0132)	.1271 (.1516)	NI	.7225
Computed 1903 equation	—1.42	.0679* (.0076)	—.0122 (.0073)	.1403* (.0315)	NI	.8032
Bahl & Saunders 1942 equation	.6593	.0391* (.0108)	—.0197* (.0097)	.3813* (.1050)	1.9975* (.3256)	.8553

expenditure variations is consistent with recent findings concerning the diminished explanatory power of the three basic variables. In 1942, 72 per cent of the variability in expenditures was explained, while by 1962 only 46 per cent of the interstate differences could be attributed to the basic variables.

If Fabricant's three-variable 1942 equation and the four-variable 1942 equation of the present analysis are used to predict 1962 expenditures, the equation which includes federal aid results in a substantially better estimate. There are two probable reasons for this. The omission of federal aid in Fabricant's 1942 model first tended to distort the relative importance of the independent variables, and secondly resulted in the exclusion of one of the two variables most closely associated with changes in expenditure level between 1942 and 1962.

In addition to modifying the constants (adding a trend factor) of the cross-sectional regression equations, the temporal pattern of interstate expenditure disparities may be examined by regressing 1942-1962 changes in the independent variables on 1942-1962 changes in per capita expenditures.[23] The only explanatory variables which prove to be significant in this "changes" regression model are income and federal aid. These two variables explain 35 per cent of the variation in the dependent variable or approximately 98 per cent of the amount explained by all four independent variables.[24]

The inability of the 1942-1962 changes model to explain a greater proportion of interstate variations in changes in per capita expenditures may be

23. The linear regression equation is of the form $Y = a + b_1\triangle X_1 + b_2\triangle X_2 + \ldots + b_n\triangle X_n$. A regression coefficient should be interpreted as the *change* in expenditures which is accompanied by a one unit *change* in the independent variable. In the one year cross-section model, a regression coefficient is interpreted as the *difference* in expenditures which results from a one unit *difference* in the independent variable.

24. The regression equation is $Y = a + .051X_1 + .436X_2$ where Y is the change in per capita expenditures, X_1 is the change in per capita income, and X_2 is the change in per capita federal aid. The beta coefficients were .433 and .365 respectively, which in this case gives a good indication of relative importance since the relationship between the two variables was almost zero ($r = .031$).

due to the length of the time interval considered. Recent findings suggest that the variation explained may be increased considerably by using a shorter time span.[25]

VI. Summary and Conclusions

The objective of this paper is to analyze 1903, 1942, and 1962 state and local government expenditure variations and to explore the implications of two major limitations of expenditure studies employing the multiple regression methodology: (a) multicollinearity and (b) the use of federal aid as an explanatory variable.

It is shown that when urbanization, one of Fabricant's three basic variables, is examined in a more homogeneous income-density context and also in conjunction with interstate differences in per capita federal aid, its explanatory power is much greater than Fabricant had concluded. While the introduction of the federal aid variable into the model for any given year increases explained variation significantly, it accounts for approximately the same increment in explained variation in both 1942 and 1962. This finding is contrary to the Sacks-Harris hypothesis and a previous conclusion of the present authors that the diminished explanatory power, through time, of the three basic variables is a result of the increasing importance of intergovernmental flows of funds.

Fabricant's contention that the relationship among his basic variables would be similar if computed using 1903 data is examined by actually examining 1903 data and shown to be substantially correct although he appears to have overestimated the relative importance of the income variable.

The results of this study are consistent with previous findings in that the explanatory power of the three basic variables is declining through time, i.e., explained variation was 80 per cent in 1903, 72 per cent in 1942, and 46 per cent in 1962. Consequently it may be suggested that government expenditure levels are responding to increasingly complex sets of factors. Further, with the growing use of sophisticated budget projection techniques and the increased coordination of physical and fiscal planning, the level of government spending for certain functions is responsive to particular needs factors, e.g., while the requirements for police expenditures are heavily influenced by population density and proportion of families in lower income brackets, education expenditures are heavily influenced by the age distribution of the population and the level of income.

Therefore, it is not surprising that recent attempts to explain the variability in aggregated state and local spending have met with increasingly limited success. It would seem that if future statistical studies of government spending variations are to have practical application to problems faced by fiscal and physical planners, expenditures should be analyzed by function rather than in aggregate. Finally, in addition to the aggregation problem, the use of a multiple regression technique in this type of analysis is subject to serious limitations primarily because of the amount of intercorrelation among the independent variables.

25. See Bahl and Saunders, *op. cit.*, pp. 51-52.