EQUITY AND EFFICIENCY IN STATE AID TO PUBLIC SCHOOLS*

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I. INTRODUCTION

Legal and legislative battles concerning state aid to education have placed the issue of state aid at or near the top of the list of priorities regarding public education. Already several states have adopted new state aid schemes, and a move is afoot to reform other existing state aid formulas.

Until very recently, the most common method of state financing of public schools has been based on the so-called foundation program. Several states have recently adopted a variant of the foundation program which is known as the percentage equalizing plan. Other states have used another variant of the foundation program which is known as the guaranteed valuation or resource equalizer plan. The newest breed of state aid schemes is the district power equalization plan, which is supposed to insure that educational funds raised by any district will be entirely unrelated to community wealth.[1]

There is a degree of equalization in all of the aid formulas. However, sufficient evidence has been presented to indicate that the foundation or percentage equalizing approaches do not eliminate considerable variation in educational expenditures by school districts. Community wealth remains an important determinant of a district's ability to raise educational funds. Whether such a situation is unconstitutional or simply undesirable is a matter that should be left to the courts or the political decision-making process, respectively. What is of concern to economists is the degree to which a given state aid scheme is shown to result in greater equalization or other outcomes (such as a reduction in the local property tax burden).

To gain a measure of understanding of the effect of state aid on local revenues and expenditures for education, a number of scholars have studied the determinants of educational expenditures. Some studies employed single-equation models, combining supply and demand variables in a single equation (examples are Miner [1963], Brazer [1959], Renshaw [1960], Bishop [1964], and Sacks [1972]). Other studies have attempted to describe supply and demand structures for educational expenditures (examples are McMahon [1970] and Booms and Hu [1971]). Although the conclusions differ from study to study, the majority of studies indicate a regression coefficient for state aid between 0 and 1, suggesting that state aid is both substitutive (some of the state aid money is used for other public goods or for a reduction in the tax burden) and stimulative (*total* educational expenditures will increase due to state aid).

In Section II, the effect of state aid on educational expenditures and revenue will be studied along with its effect on three other variables: nonpublic enrollment rates, average school size, and bond sales.

II. A CROSS-SECTIONAL, INTERSTATE MODEL: 1967-68

The empirical model presented here provides additional insights regarding the effect of state aid on educational expenditures, employing both a new structure and more recent data. The model also provides a first attempt to study the effect of state aid on three variables: average school size, nonpublic enrollment rates, and bond sales. A fifth variable to be studied is local revenues.

In addition to the state aid variables, each of the variables to be investigated here is also a function of other factors. First, some of the (endogenous) variables mentioned above might influence one another. For instance, per pupil expenditures in a given state are likely to be a function of school size, as several studies (to be discussed below) have indicated. Or, local revenues may be a function of the percent of enrollment in nonpublic schools. Furthermore, other (exogenous) factors may influence the variables under investigation. For example, the degree of urbanization in the state is likely to affect average school size, local revenues, and per pupil expenditures. Local revenues and expenditures may also be affected by the perceived "quality" of the public schools. Two measures of "quality" are average teachers' salaries and the student/teacher ratio.

The Model

Let $Y_1, Y_2, \ldots, Y_5$ denote the endogenous variables, and $X_1, X_2, \ldots, X_{10}$ the exogenous variables. Both variable sets are defined in Table 1. The empirical model is given in Equations (1) through (5).

$$(1)\quad Y_1 = f_1(Y_3, Y_4, Y_5;\ X_1, X_2, X_6, X_7 X_8)$$

$$(2)\quad Y_2 = f_2(Y_1, Y_3, Y_4;\ X_1, X_4, X_5, X_6, X_7, X_{10})$$

$$(3)\quad Y_3 = f_3(Y_1, Y_2, Y_5;\ X_1, X_3, X_5, X_6, X_7, X_9, X_{10})$$

$$(4)\quad Y_4 = f_4(Y_2, Y_3, Y_5;\ X_1, X_3, X_5, X_6, X_7, X_{10})$$

$$(5)\quad Y_5 = f_5(Y_1, Y_3, Y_4;\ X_1, X_4, X_5, X_6, X_7, X_{10})$$

A linear form is assumed for each equation.

It is hypothesized in Equation (1) that the larger the percentage of pupils enrolled in nonpublic schools, the smaller would the average school size be, other things equal. It also appears plausible that the variable Y_4 should be related to school size, but there are two conflicting forces; on the one hand, if proceeds from bond elections are used to build larger schools, the effect on relative size would be positive; on the other hand, if such proceeds are used to reduce crowding by building additional

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[1] For a discussion of these and other plans, consult Cohn (1974).

TABLE 1
MEANS, STANDARD DEVIATIONS, DEFINITIONS, AND SOURCES OF VARIABLES

Variable	Mean	Standard Deviation	Definitions of Variables
Endogenous			
Y_1	392.59	144.18	Relative size of schools (pupils in ADA per school) 1967-1968.
Y_2	$625.48	125.83	Current expenditures per pupil in ADA (Average Daily Attendance), 1967-1968.
Y_3	0.10	0.061	Percent of pupils enrolled in nonpublic schools, 1967-1968.
Y_4	$465.99	364.64	Total approved par value of bond issues, 1962-1971, per pupil enrolled in public elementary and secondary schools.
Y_5	$379.60	152.26	Local revenue per pupil, 1967-1968.
Exogenous			
X_1	$275.41	111.42	State aid per pupil in ADA, 1967-1968.
X_2	23.09	2.12	Percent of total population enrolled in public schools, 1967-1968.
X_3	$2,955.10	506.12	Personal income per capita, 1967.
X_4	$13,999.59	3,348.94	Personal income per pupil in ADA, 1967.
X_5	5.07	1.12	Equalization score of state, 1968-1969.
X_6	11.74	12.21	Negro enrollment in public schools as a percent of total enrollment, 1968.
X_7	65.42	14.44	Urban population as a percent of total population, 1970.
X_8	13.36	5.57	Incidence of poverty, 1969 (percentage points).
X_9	$7,161.59	1,025.38	Average teachers' salary, 1967-1968.
X_{10}	0.023	0.0019	Number of students per 1,000 teachers, 1967-1968.

SOURCES:

1. Richard H. Barr and Geraldine J. Scott, *STATISTICS OF STATE SCHOOL SYSTEMS, 1967-1968* (Washington, D.C.: U.S. Office of Education, 1970) -- for the following variables: Y_1, Y_2, Y_5, $X_1 - X_4$, X_9, X_{10}.

2. Roe L. Johns and Richard G. Salmon, "The Financial Equalization of Public Support Programs in the United States for the Year 1968-1969," in *STATUS AND IMPACT OF EDUCATIONAL FINANCE PROGRAMS*, Vol. 4, ed. by Roe L. Johns, et al. (Gainesville, Florida: National Educational Finance Project, 1971), p. 137-- for X_5.

3. U.S. Bureau of the Census, *STATISTICAL ABSTRACT OF THE UNITED STATES: 1969, 1970, and 1971 EDITIONS* (Washington, D.C.: Government Printing Office, 1969, 1970 and 1971) -- for Y_3, X_6-X_8.

4. Irene A. King, *BOND SALES FOR PUBLIC SCHOOL PURPOSES* (Washington, D.C.: U. S. Office of Education, 1972) -- for Y_4.

schools (not necessarily of larger average size), then the effect on average school size might be negative. For the same reason, it is not clear *a priori* how Y_5 and Y_1 are related.

Among the exogenous variables in the set, five were included in the equation. For state aid, a negative coefficient is expected, as additional state aid might reduce incentives for school reorganization. The variable X_2 (percent of population enrolled in public schools) indicates the relative demand for public educational facilities in the state. The greater the demand, the greater the average school size is expected to be, other things equal. It is further expected that school size will be directly related to the percentage of Negro enrollment because of the observed overcrowding in areas where large concentrations of Negroes exist. Also, because urban areas are likely to have far greater population densities, greater urbanization should be positively related to school size, other factors remaining the same. Finally, the variable X_8 has been added to the equation to account for the expected negative relationship between school size and poverty in states where considerable rural poverty exists.

Concerning Equation (2), the determinants of expenditures include three endogenous and six exogenous variables. Because scale economies are expected to occur in public school operations, the hypothesized relationship between Y_1 and Y_2 is negative.[2] (A parabolic relationship, indicating a U-shaped relation between the two variables, was found to be nonsignificant; hence, only the linear term has been left in the equation.) It is also hypothesized that the greater the percentage of pupils enrolled in nonpublic schools, the higher would Y_2 be because local educational revenues collected from all citizens without regard to school enrollment would be distributed over a relatively smaller student population. Furthermore, it is expected that higher values of Y_4 would be directly correlated with Y_2 because the variable Y_4 is indicative of the citizens' attitude toward education. If they are willing to approve bond issues, they would probably also desire higher per pupil expenditures.

The variable X_4 is included in the equation to account for differences in wealth per pupil among states. It is hypothesized that a higher equalization score would be commensurate with higher per pupil expenditures, that expenditures are lower in states with large Negro enrollments but higher in urban areas, and that greater school quality requires more expenditures, so that X_{10} and Y_2 should be negatively correlated. A positive coefficient for X_1 is expected.

Three endogenous and seven exogenous variables are included in Equation (3). It is hypothesized that as school size increases, especially because of overcrowding, more parents will send their children to private schools. But if per pupil expenditures are greater, fewer parents will seek private education for their children. The effect of Y_5 on Y_3 is not unambiguously clear. On the one hand, more local revenues imply more local expenditures, with the likelihood that greater quality in public schools would encourage parents to send their children to public schools. However, if Y_5 is directly related to community wealth, the relationship between Y_5 and Y_3 might be positive. It is possible, of course, that Y_5 might be greater not because of greater wealth but because of greater tax effort, implying a more favorable attitude toward--and therefore greater rates of attendance in--public education.

Since X_3 provides a measure of average wealth it is expected to be directly related to nonpublic enrollment rates. It is also hypothesized that greater equalization would lead to greater nonpublic enrollments, as would be the case for greater levels of the variables X_6 and X_7. On the other hand, greater school "quality" in the form of higher salaries or *lower* student/teacher ratios should be negatively related to private enrollment rates. The *a priori* effect of state aid is not clear: on the one hand, if more state aid is synonymous with greater *equalization* the effect on Y_3 might be positive. On the other hand, if more state aid is synonymous with greater educational *quality*, the coefficient might be negative. Hence, no *a priori* expectations are stated in this case.

Three endogenous and six exogenous variables form the specification of Equation (4). It is hypothesized that Y_2 is indicative of a community's attitude toward support of public education; hence, a direct relationship between Y_2 and Y_4 is anticipated. Conversely, if a greater proportion of pupils attend nonpublic schools, parents would be more reluctant to support the public schools. It also appears that greater local revenues imply less need for bond financing. However, since Y_5 could also be a proxy for local capacity to absorb the financing of the bond as well as community's attitude, it is not clear what sort of relationship one should expect between Y_5 and Y_4.

If per capita income (X_3) is indicative of a community's attitudes, a positive correlation between X_3 and Y_4 would be expected. Such a relationship would be strengthened when it is recognized that wealthier communities are likely to be able to absorb the cost of bond financing with relatively greater ease than is the case in poorer districts. On the other hand, it is expected that a higher value of X_5 would result in lower bond sales since incentives for long-term indebtedness by local governments are reduced. Moreover, because of the general deterioration of the urban areas in the United States, especially in cities where the percentage of nonwhite population is relatively large, it is expected that a negative correlation between X_6 and Y_4, as well as between X_7 and Y_4, will be found. Since a smaller student/teacher ratio requires more facilities, a negative relationship between X_{10} and Y_4 is expected. Finally, since state aid could be substituted for local financing, a negative coefficient for X_1 is hypothesized.

Three endogenous and six exogenous variables have been included in Equation (5). The first hypothesis is that because of anticipated scale economies, greater school size would be negatively related to local revenue requirements,

[2] For studies on scale economies, consult, for example, Cohn (1968), Cohn and Hu (1973), Riew (1966), and Sabulao and Hickrod (1971).

other things equal. The effect of Y_3 on Y_5 is not unambiguously clear. On the one hand, higher private enrollment rates indicate unfavorable attitudes toward the public schools, pointing to a smaller level of Y_5. On the other hand, states with higher private enrollment rates may also be associated with relatively wealthier districts, in which case revenues for an equal tax effort should be greater. A positive sign is expected for Y_4 for two reasons. First, the variable is indicative of community attitudes. Second, a greater value for Y_4 is also indicative of greater debt service requirement, which should increase the demand for local revenues.

Per pupil income, as a measure of wealth, should be positively correlated with Y_5. But X_5 is hypothesized to be negatively correlated with Y_5 because greater equalization is expected to reduce the incentives of many school districts to raise revenues from local sources. It is hypothesized that local revenues in areas with higher levels of the variables X_6 and X_7 would be smaller and that greater school "quality," measured by X_{10}, would require greater local revenues; hence, X_{10} and Y_5 should be negatively correlated. Finally, since the literature review produced both positive and negative coefficients for the effect of state aid on local expenditures, no *a priori* hypothesis is advanced in this case.

Data

To implement the model, data have been assembled from various sources, principally publications of the United States Office of Education. The unit of observation is the state, and data are available for forty-nine states. (Hawaii has been excluded because it is essentially one large school district and therefore is not suitable for the present analysis.) The definitions of the variables used in this study--along with some descriptive statistics--are provided in Table 1.

Although the data are (with exceptions) for the year 1967-68 and hence do not portray the *current* state of affairs in public education, the relationships which we seek to derive are probably as relevant today as they were during the 1967-68 period--and this despite the changes that have occurred since that period in educational finance and administration.

Regression Results

The regression results are reported in Table 2. For each of the Equations (1) through (5), the table reports the coefficients derived on the basis of the Two State Least Squares (TSLS) estimation procedure (that is, when Equations (1) through (5) are considered as a system of equations, and the coefficients in Equation (1') through (5') account for the interdependence among the equations).

Average School Size: The Interstate data explain almost 80 percent of the variations in average school size. Contrary to hypothesis, state aid appears to contribute positively to that variable. Since our study of the state aid formulas showed little, if any, incentives for attaining optimal school size, it is difficult to conclude that more state aid is the *cause* of larger school size. A possible explanation of the positive correlation is that states that happen to have larger schools are the ones that also happen to give more aid to local districts. Nevertheless, the negative correlation that we expected was definitely refuted by the data.

Concerning the other explanatory variables, five variables are statistically significant. As hypothesized, the sign of the coefficients of both X_6 and X_7 is positive, and the sign of X_8 is negative. Also, the results suggest that, as expected, when enrollments in nonpublic schools are greater, average school size is likely to be smaller. On the other hand, contrary to expectations, the data indicate that a greater relative demand for education, measured by the percentage of total population enrolled in public schools, is associated with smaller school size.

Expenditures Per Pupil: The data confirm the expected relationship between state aid and expenditures. For each $1.00 of state aid, expenditures per pupil are likely to increase by $0.36. The coefficient is statistically significant at 0.10 level. These results suggest that state aid is likely to be both stimulative and substitutive: on the one hand, more state aid implies higher expenditures (stimulative); on the other hand, the results suggest that *local* expenditures are reduced by $0.64 for each $1.00 of state aid.

Among the remaining explanatory variables in Equation (2'), the only variable that has a relatively large t-ratio (significant at the 0.10 level) is Y_4, suggesting a positive net correlation between expenditures and bond sales.

Nonpublic Enrollment Rates: Three variables are significant at the 0.05 level: Y_1, X_1, and X_9. The coefficient of Y_2 is significant at the 0.10 level. The coefficient of X_1 is *negative*, and the signs of the coefficients of Y_1 and X_9 are consistent with *a priori* expectations. The negative sign of X_1 provides a measure of credence to the hypothesis that state aid has a lesser impact on equalization than on overall improvement in the quality of education.

Approved Value of Bond Issues: The coefficient of X_1 is significantly negative at the 0.10 level, indicating lower bond sales in states where higher state aid is given. This is consistent with our *a priori* expectations. The only other significant variable is Y_3, which has a negative coefficient. This is consistent with recent reports of school bond election results in Detroit and other areas with large nonpublic enrollments.

Local Revenue: State aid (X_1) is the only variable with a statistically significant coefficient. The negative sign of the coefficient indicates that, on the average, some substitution of state for local funds takes place.

III. CONCLUSIONS

The model provides several insights into the economic effects of state aid. With the exception of average school size, our *a priori* expectations of such effects were confirmed by the analysis. The results indicate that a greater level of state aid is associated with greater per

TABLE 2
REGRESSION RESULTS
(TWO-STAGE LEAST SQUARES)

(1') $Y_1 = 1097.66 - \underset{(2.23)}{2{,}018.28}Y_3 - \underset{(0.34)}{0.018}Y_4 + \underset{(0.56)}{0.22}Y_5 + \underset{(3.33)}{0.40}X_1 - \underset{(19.47)}{41.91}X_2 + \underset{(1.87)}{4.20}X_6 + \underset{(5.97)}{6.40}X_7 - \underset{(2.02)}{7.60}X_8$

$\bar{R}^2 = 0.79$, SEE = 65.86, F = 27.00

(2') $Y_2 = 761.15 + \underset{(0.70)}{0.28}Y_1 + \underset{(0.90)}{1{,}347.14}Y_3 + \underset{(1.87)}{0.23}Y_4 + \underset{(1.70)}{0.36}X_1 - \underset{(0.24)}{0.006}X_4 - \underset{(0.97)}{13.38}X_5 - \underset{(0.40)}{1.03}X_6 - \underset{(0.23)}{0.56}X_7 - \underset{(1.26)}{16{,}420.16}X_{10}$

$\bar{R}^2 = 0.88$, SEE = 42.69, F = 41.99

(3') $Y_3 = 0.22 + \underset{(2.18)}{0.00089}Y_1 + \underset{(1.95)}{0.00077}Y_2 + \underset{(0.01)}{17.86}Y_5 - \underset{(2.57)}{0.00048}X_1 + \underset{(0.55)}{0.000035}X_3 + \underset{(0.85)}{0.0091}X_5 - \underset{(1.71)}{0.004}X_6 - \underset{(1.49)}{0.0034}X_7 - \underset{(2.66)}{0.000088}X_9 - \underset{(0.21)}{2.95}X_{10}$

$\bar{R}^2 = 0.35$, SEE = 0.04, F = 3.90

(4') $Y_4 = -1{,}780.68 + \underset{(1.24)}{2.70}Y_2 - \underset{(2.94)}{4{,}791.11}Y_3 + \underset{(0.84)}{0.10}Y_5 - \underset{(1.80)}{1.43}X_1 + \underset{(1.23)}{0.32}X_3 + \underset{(1.54)}{66.31}X_5 - \underset{(0.37)}{1.60}X_6 - \underset{(1.02)}{4.62}X_7 + \underset{(0.38)}{19{,}830.68}X_{10}$

$\bar{R}^2 = 0.38$, SEE = 286.74, F = 4.29

(5') $Y_5 = 593.44 + \underset{(0.56)}{0.22}Y_1 + \underset{(0.01)}{17.86}Y_3 + \underset{(0.84)}{0.10}Y_4 - \underset{(2.79)}{0.58}X_1 + \underset{(0.92)}{0.022}X_4 - \underset{(1.39)}{18.46}X_5 - \underset{(1.31)}{3.25}X_6 - \underset{(0.03)}{0.067}X_7 - \underset{(1.20)}{15{,}034.51}X_{10}$

$\bar{R}^2 = 0.81$, SEE = 66.18, F = 23.90

Notes: Numbers in parentheses are t-ratios; $\bar{R}^2 = R^2$ adjusted for degrees of freedom; SEE = standard error of estimate; N = 49.

pupil expenditures, lower local revenues for education, lower rates of nonpublic enrollments, and lower bond sales. A surprising result is that school size is positively associated with the amount of state aid.

The only adverse effect of state aid that the data reveal is its impact on local incentives to raise revenue on a short- or long-term basis (Y_5 and Y_4, respectively). It appears to have a favorable effect on school size, expenditures, and public enrollments.

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