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ABSTRACT

This report combines a theoretical study of state school aid programs with an empirical study of school districts' responses to such programs. The author's theoretical investigation of existing systems of general state aid to school districts suggests two propositions: school districts do not maximize an ordinary utility function in the light of conventional budget constraints, and school districts are not likely to spend more equally under equalizing percentage grant systems. An analysis of data gathered from observations of 923 school districts in five states supports the first proposition and validates a specific model of school district decision-making. In addition, the author suggests that the same data will serve to test the second proposition after certain specification problems encountered in the course of the analysis have been resolved. (Author/JG)

FINAL REPORT

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FISCAL RESPONSE OF SCHOOL DISTRICTS TO ALTERNATIVE FORMS AND LEVELS OF GENERAL-PURPOSE SCHOOL AID

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I. Introduction

The fiscal response of political units to public subsidies from higher-level governments has received a good deal of attention in the public-finance literature.* Surprisingly, the pay-off of empirical work carried out in the area has been rather slight. To take one of the longest-established and best documented instances of intergovernmental subsidies--"equalizing" grants of state governments to school districts--, estimates of the elasticity of response of district school expenditures to state subsidies vary from 0.12 to 0.80 for comparable district populations, suggesting that empirical conditions for the measurement of response elasticities is less than ideal. Furthermore, most studies until recently have been concerned with the response of political units to flat grants, i.e. subsidies determined independently of the unit's own fiscal behavior. Even though "matching, "percentage", or "incentive" grants have been a frequent feature of public aid at all levels of government*, the work of public-finance analysts has not gone beyond a rough outline of the long-run equilibrium implication of "percentage" vs "flat" grants with hardly - ' effort at estimating the impact of incentive features on the fiscal behavior of recipients.

This has not prevented a steady rise of the enthusiasm of school-finance analysts in favor of certain types of percentage grants and the replacement of flat-grants by percentage-grant systems in eight states between 1958 and 1969.** Recent Court decisions setting forth criteria for the financing of schools within states have further encouraged the percentage-grant approach, although misinterpretation of the Court's

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* See part II for a review of the relevant literature

** Iowa, Massachusetts, New York, Pennsylvania, Rhode Island Utah, Vermont, Wisconsin , language have also fueled a powerful movement in favor of centralized state financing of all school operations.* The flat-grant alternative, still retained by a majority of the states, is viewed by most professionals as a large relic of the past, and its advocacy in whatever form is no longer in good taste. Yet, no empirical evidence has been marshalled in support of the position that percentage-grant systems in existence have resulted - or will result - in a distribution of services and fiscal burdens that is "better" by any criterion.

The present research, based on a large sample of school districts observed over a period of years, leads to the conclusion that the percentage approach to state school aid does not, in fact, constitute a desirable alternative. The central hypothesis which it develops is that the response of school districts to state grants deviates in some respects from assumptions ordinarily made by analysts, with the result that, under present modes of implementation, the theoretical expectations attaching to percentage-grant systems cannot be fulfilled. Moreover, a simple set of calculations also reveals that, were percentage-grant systems implemented more efficiently, i.e. so as to neutralize the impact of "deviant" district behavior and generate outcomes consistent with theoretical expectations, the resulting pattern of school expenditures and fiscal contributions would fail to satisfy commonly held standards of social equity. Whether or not the hypothesis is correct, therefore - and it is supported by substantial evidence - the case made over a decade and a half for a shift of state school aid to percentage-grant systems does not seem tenable and more promising alternatives must be sought.**

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* See footnote **p. 36

** If the hypothesis <u>is</u> correct, a by-product of its recognition will be to warn analysts against estimating parameters of district utility functions on the basis of behavioral assumptions that are not, in fact, realized.

II. The scope of the controversy

The two major "state-aid" contenders in the field of school finance can be described respectively as "equalizing flat grants" and "equalizing percentage grants", although designations have varied in time and space.*

(a) If k_i is the amount which district i can raise relative to some "average" district for any given level of fiscal effort (i.e. if k_i is the district's relative "ability-to-pay"), if $\bar{E}$ is a minimum state standard of school expenditure per pupil, and if $\bar{T}$ is the amount which the average district can raise for each of its pupils through a standard (reasonable) level of fiscal effort, the state subsidy received by each district under an equalizing "flat grant" system is the difference between $N_i\bar{E}$, the standard cost of educating N_i pupils, and $k_iN_i\bar{T}$, the amount which the district can raise if its fiscal effort is standard. On a per-pupil basis, the aid received is thus given by $R_i = \bar{E} - k_i\bar{T}$

(b) Under the "equalized percentage" alternative, the ratio of subsidy to school expenditure occuring above when the expenditure and fiscal effort are standard, i.e. $1-k_i\frac{\bar{T}}{\bar{E}}$, is applied to whatever the district actually spends on schools to determine the state subsidy. In other words, the subsidy per pupil is now $R_i = (1-k_i\frac{\bar{T}}{\bar{E}})E_i$, where E_i is the expenditure per pupil in district i. The portion of expenditures to be raised out of local taxes is $k_i\frac{\bar{T}}{\bar{E}}E_i$; i.e. for any chosen level of expenditures per pupil, E_i, it is strictly proportional to the district's ability to pay. Put another way, the expenditure per pupil achievable

*"Equalizing flat grants" are better known as "Foundation" or "Strayer-Haig Formula" aid.

by any district depends only on the district's level of fiscal effort.*

This is not the place for a detailed discussion of the many distortions of each formula introduced in their practical implementation. These take the form of ceilings and floors applied to almost every component and in all cases include a zero or positive floor of state aid. The important observation is that subsidies under a "percentage" system depends on a decision of the district concerning E_i, while subsidies paid under a "flat" system are determined strictly by reference to district characteristics (k_i).

The merits claimed by supporters of percentage grants are at least three: (1) Assuming that districts have similar propensities to spend in support of school education, continued application of a formula that makes expenditures per pupil strictly dependent on local effort should lead to similar levels of expenditure among districts; (2) A given-size subsidy to the district will result in higher school expenditures if achieved via a reimbursement proportional to expenditure than if given as a flat addition to the district's resources. The desirability of this additional "substitution effect" in favor of school expenditure rests, in part, on a judgement that decision makers in most districts do not accord education the importance it deserves. Since poor districts also tend to be low-effort districts, the intense "substitution effect" associated with the high percentage of aid they receive is expected to

* If a district selects a school expenditure equal to the standard, $\bar{E}$ its reimbursement is $\bar{E}(1-k_i\bar{T}/\bar{E}) = \bar{E}-k_i\bar{T}$, just as under the corresponding flat grant system. As developed p.20, however, the set of aid ratios derived from the aid and expenditures of standard-effort districts under a flat grant system induces a higher level of effort on the part of districts than the flat grant itself, so that districts formerly producing a "standard effort" will exhibit a larger effort and much larger expenditures than before. There is no way to adjust aid ratios so that "standard-effort" districts will produce the same effort and enjoy the same school expenditure as under the flat grant, i.e. the establishment of a percentage equalizing grant system forces a re-specification of what is "standard effort" and "standard expenditure."

bring up their expenditure (and level of effort) to par with that of more affluent districts. (3) The percentage system, by removing "ability-to-pay" as a determinant of school expenditures, places states in apparent conformity with recent Court decisions (more recently shattered by the U.S. Supreme Court) concerning acceptable school financing practices under the "Equal Protection" clause of the 14th Amendment.*

The flat-grant approach has none of the above-listed advantages. It will be shown, however, that an equalizing flat-grant system setting an ambitious standard cost of education, $\overline{E}$, and making payments of the subsidy conditional on the production of a minimum fiscal effort by the district, would serve progressive social objectives better than the percentage-grant alternative. If the minimum required level of effort is that incorporated in the subsidy computation, such an "all-or-nothing" offer guarantees that almost all districts will raise enough in local taxes to achieve the standard expenditure $\overline{E}$ with the help of state aid. By contrast, districts with a low propensity to spend on education are only mildly incited by percentage grants, so that major inequalities in expenditure per pupil continue to flourish once equalizing percentage grants have been put into effect. Inequalities tied to effort differentials are relieved only to the extent that low-effort districts are more often low-wealth districts enjoying a high percentage of state-aid.

Percentage equalization is plagued by other problems. One result of high-aid percentages for low-wealth districts of moderate or high propensity to spend is that the substitution effect - assuming elasticities of substitution observed under flat-grant conditions to remain constant - can drive their school expenditure to staggering levels. That such levels

* See Footnote *p. 35

do not materialize in states where a percentage-equalizing formula is in effect is due to a combination of three factors: one is that the elasticity of substitution of school expenditure for other items of public and private budgets must increase rapidly as the expenditure per pupil reaches contemporary standards of "plushiness"; another is the quasi-universal imposition of a ceiling on the expenditure to which the aid percentage is applied;* the last one is a probable failure of districts to adjust their school expenditure rationally in the light of options presented by the percentage grant. This failure and its outcomes are the main object of the present research, and they will be analyzed in some detail below. Even if we discard it, however, it is apparent that the first two factors alone are enough to dampen the impact of high aid-percentages considerably - to the point, in fact, where a majority of districts find their equilibrim expenditure close to the "reimbursement limit".

To facilitate comparisons, the next section provides projections of school expenditure and state aid for a simulated distribution of districts under four alternative policies; traditional equalizing flat grants, equalizing flat grants conditional on a minimum required effort, open-ended equalizing percentage grants, and equalizing percentage grants with a limit on applicable expenditure. The general nature of available empirical findings concerning school expenditures under flat grants suggests that the decision-model of school districts is not of the traditional type, i.e., districts act as if they felt subject to a social obligation either to spend on schools beyond their optimum in response to exogenous state aid (hypothesis I) or to sink a standard minimum amount of their resources into

* Among the Eastern group of states operating under equalizing percentage aid, only Rhode Island and Vermont put no limit on the applicable expenditure.

schools before seeking an optimum of "additional" school expenditures (hypothesis II). Projections in the next and following sections are developed by reference to hypothesis I, the alternate projections under hypothesis II being presented in a later appendix. The problem of central concern to the present research, i.e. a special type of irrational behavior (called "short-sighted" behavior) in the context of percentage grants, is not analyzed until section IV, building upon the elementary theoretical structure developed below and using the same simulated sample of districts for illustration.

III. Comparisons of aid systems under long-sighted district behavior

(1) Traditional Equalizing Flat Grant

The simulated sample consists of three classes of districts, the relative ability-to-pay of each class being 0.5, 1 and 1.5 respectively. Under a traditional equalizing flat-grant system setting a per-pupil expenditure standard of $1000 and an expected local contribution by average districts (relative ability-to-pay = 1) of $500 per pupil, the local contribution, state aid, and school expenditure per pupil are assumed observed as follows:

SEE TABLE p. 8

Table 1: Expenditure level and composition under traditional equalizing flat-grant system

		Low-effort district		Medium-effort district	High-effort district	Total
I Low Ability to pay (0.5)	Expenditure	900		1000	1100	3000
	Contribution	150		250	350	750
	Aid	750		750	750	2250
		A	B			
II Av. Ability to pay (1.0)	Expenditure	650	800	1000	1200	3650
	Contribution	150	300	500	700	1650
	Aid	500	500	500	500	2000
III High Ability to pay (1.5)	Expenditure			1000	1300	2300
	Contribution			750	1050	1800
	Aid			250	250	500

It will be obvious to readers familiar with school expenditure data that the tabulation excludes "very rich" districts (relative ability-to-pay 2.0 or more) who would, under a strict application of the formula, get zero or negative state aid -- and who usually get some positive amount under a protective clause of the implementing legislation. It will also be evident that the proposed aid and expenditure levels are a bit ahead of the times.

The elimination of low-effort, high-ability districts in the table reflects their empirical rarity: High ability-to-pay usually goes with a mix of high income and education and, thus, a positive attitude toward schooling. Given the measures of ability-to-pay selected for the calculation of state aid, however, the correlation of family income (or any "progressive" function of income) with ability-to-pay is by no means perfect. States rely primarily on the market value of real estate per pupil, and the ratio of such a value to family income is larger than average in low-income communities with heavy concentrations of farm land, non-resident property or large industrial and commercial facilities. While the latter two do provide an additional fiscal revenue to districts, such revenue (net of associated municipal costs) is a far smaller portion of district income than corresponding property values are of the district's total valuation. Thus, many districts treated by the state as of average ability-to-pay are, in fact, poor districts whose level of aid is unfairly low. Accordingly, two different low-effort districts are identified in the table under class II (average ability-to-pay): The first (A), with a school expenditure of $650, is a low-income district; the second (B), with a school expenditure of $800, enjoys an average income. In all other cases, the ability-to-pay measure is assumed consonant with the district's income position.

(2) Preliminary specification of district utility functions

The utility functions of districts are specified by reference to point-elasticities of substitution observable in the table above - substitution of school expenditure, E, for expenditure on "other things", A. Both E and A are expressed on a per family basis; on the assumption (closely approximated in reality) of a one-to-one ratio of pupils to families in all districts, E is also the expenditure per pupil. The expression for the elasticity, $-\gamma$, at any point of the district's utility function is

(1) $\quad -\gamma = \frac{\partial E}{\partial A} \frac{A}{E}$

The budget line under flat grants has equation

(2) $\quad A = (Y + R) - E,$

where Y is the average adjusted family income of the district (net of direct federal and state taxes and increased by non-family fiscal resources of the district) and R is the flat grant received per family (or pupil).

If we assume rational maximization of utility by the district, the marginal rate of substitution must be equal to the slope of the budget line at the observed equilibrium (A_f, E_f), i.e.

(3) $\quad -1 = \frac{\partial A}{\partial E} = -\frac{1}{\gamma_o} \frac{A_f}{E_f}$,

where γ_o designates the elasticity at that point.

In view of the budget-line equation (3), we obtain

(4) $\quad \gamma_o = \frac{(Y+R) - E_f}{E_f}$

The absolute elasticities, γ_o , are calculated by reference to (4) in each district and listed in table 2, after specifying average adjusted family income in districts of each class as 6,000 (class I), 10,000 (class II) and 14,000 (class III), except that the low-effort district A in class II has the $6,000 income associated with class I.

SEE TABLE p. 11

Table 2: Calculated elasticities of substitution

	Low effort district		Medium effort district	High-effort district
I Low ability to pay	6.50		5.75	5.14
	A	B		
II Average ability to pay	10.00	12.12	9.50	7.75
III High ability to pay			13.25	9.96

It is apparent, however, that the above model of district expenditure decisions is not valid. Rewriting (4) as

$$E_f = \frac{1}{\gamma_o+1}(Y+R) , \qquad (5)$$

the marginal effect of flat aid on the school expenditure is measured by $\frac{1}{\gamma_o+1}$. If we believe our elasticity measures, this means that school expenditures increase 10¢ per dollar of school aid for the average of the nine districts or, if each district observation is weighted by the amount of aid received, 11.5¢. The figures are smaller still if "very-rich" districts are incorporated. This does not check with available estimates of the marginal effect of school aid which vary from 0.12 to 0.80, with a midpoint somewhere near 0.30. Unless the latter are even worse than one must suspect them to be, it follows that the elasticity measures in table 2 and, thus, the assumption of rational utility maximization on which they are based, are erroneous.

The observed performance of school districts is better explained under either of. two hypotheses:

Hypothesis I: Under flat grants in the empirical range, school districts view school aid, so labeled, as imposing an obligation to stretch their school expenditure beyond their optimum. The extent of the stretch can be assumed to be proportional to the district's income effect on school expenditures and to some function of R, G(R), with initially positive but decreasing derivative, i.e. the actual equilibrium can be expressed as:

$$(6) \qquad E_f = \frac{1}{\gamma_o+1}(Y+R) + \frac{G(R)}{\gamma_o+1}$$

$$= \frac{1}{\gamma_o+1} Y + \frac{R + G(R)}{\gamma_o+1}$$

If we simplify by writing G(R) = gR, we have

$$(7) \qquad E_f = \frac{1}{\gamma_o+1} Y + \frac{1+g}{\gamma_o+1} R$$

The marginal effect of aid on school expenditures is $\frac{1+g}{\gamma_o+1}$, and a rough estimate of g can be obtained by reference to the "average" district as follows:

(a) $\frac{1+g}{\gamma_o+1} = 0.30$ (from empirical estimates of the aid effect)

(b) $\frac{E_f}{Y+R} = \frac{1}{\gamma_o+1} + \frac{R}{Y+R} \frac{g}{\gamma_o+1} = \frac{1 + 0.05g}{\gamma_o+1} = 0.11$ (from table 1)

This gives g = 2 and an "average" elasticity close to the value previously computed. Individual elasticities are re-calculated in table 2' for g = 2 under the simplifying assumption G(R) = g R.*

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* From (7), we have $\gamma_o = \frac{Y + (1+g)R - E_f}{E_f}$

Table 2': Revised elasticities of substitution

	Low-effort district		Medium-effort district	High-effort district
I Low ability to pay	8.17		7.25	6.50
	A	B		
II Average ability to pay	10.54	13.37	10.50	8.58
III High ability			13.75	10.35

Hypothesis II: Districts in any given state refer to a standard minimum expenditure per pupil which they deduct "automatically" from their total budget, then exercise options in terms of (a) the reduced budget and (b) a utility function of "school expenditures above minimum" and "expenditures on other things". If, as is likely, the standard minimum is closely related to the general level of school aid in the state, a comparison of school expenditures between states would reveal a substantial "independent" effect of aid levels on school expenditures -- even though aid differentials among districts in the state affect expenditures in accordance with their impact on aggregate district budgets.

Consistently with the empirical evidence, the standard minimum may be specified as the sum of a basic low district contribution (e.g., \$150) and 30% of the state aid paid the average district, or a total of \$150 + \$150 = \$300 for the simulated sample. If this amount is designated by B, and if D designates the school expenditure above minimum, we have the new relations:

$$(1') \quad -\gamma' = \frac{\partial D}{\partial A} \frac{A}{D}$$

$$(2') \quad A = (Y-B+R) - D$$

$$(3') \quad -1 = \frac{\partial A}{\partial D} = -\frac{1}{\gamma'_o} \frac{A_f}{D_f}$$

$$(4') \quad \gamma'_o = \frac{(Y-B+R) - D_f}{D_f} = \frac{Y + R - E_f}{E_f - B} \qquad (E_f = D_f + B)$$

$$(5') \quad E_f = \frac{1}{\gamma'_o+1}(Y-B+R) + B = \frac{Y+R}{\gamma'_o+1} + B\frac{\gamma'_o}{\gamma'_o+1}$$

Given the optima observed in table I, the incomes listed for each district, and B = 300, the set of elasticities γ'_o is calculated by (4') as follows:

Table 3: Elasticities of substitution in terms of school expenditures above the minimum standard

	Low-effort district		Medium-effort district	High-effort district
I Low ability to pay	9.75		8.21	7.06
	A	B		
II Average ability to pay	16.71	19.40	13.57	10.33
III High ability to pay			18.93	12.95

To facilitate exposition, the analysis in the remainder of this theoretical exposition will be carried out in terms of hypothesis I. Corresponding results under hypothesis II are presented and discussed in an appendix following this part (part I) of the report.

It is assumed in the following that, in the neighborhood of the observed equilibria, elasticities measured at points of slope (-1) are constant, i.e. the expansion path for small relative variations in the district's total budget is linear through the origin. If we interpret elasticities listed in any one column of table 2' as those of a specific district observed at different income levels, it is apparent that the above "weak homogeneity" assumption is not valid over the whole utility function. On the other hand, it is likely that income is more than an external constraint on the expenditure equilibrium: It also stands as a determinant of the utility function through its association with social-class attitudes toward education. Given the difficulty to separate those effects, no obvious or significant bias is introduced by the proposed local approximation of the expansion path. By reference to the point elasticities calculated in table 2', the assumption provides elasticity measures at all potential optima of each district as long as state grants are exogenously determined, i.e. preserve the slope of the budget line. Clearly, additional assumptions will be required when the aid system under consideration generates a budget line of slope other than (-1).

(2) Equalizing flat grant conditional on production of a minimum fiscal effort

As a way to reduce discrepancies in expenditure-per-pupil resulting from unequal effort levels among districts, payment to the district of its equalizing flat grant can be made conditional on production of a fiscal effort at least equal to that incorporated as standard in the grant computation. In the example, this would mean a minimum local contribution of \$250 by districts in class I, \$500 by districts in class II, and \$750 by districts in class III, leading to a minimum \$1000 expenditure-per-pupil in all conforming districts. An alternative formulation, in effect in a number of states, consists in specifying that state payments cannot exceed the difference between actual district expenditure and the district's school-tax yield under the standard level of fiscal effort.*

As depicted in diagram 1 for a district of average ability-to-pay, this all-or-nothing offer will be accepted unless the indifference curve going through m, the optimum position in the absence of aid, runs above S, the combination obtaining with a \$1000 school expenditure and a \$500 state aid (the latter shifting the district's budget line to the right of its original position). The question does not arise, of course, if the equilibrium, M, under the same amount of unconditional aid occurs to the right of S. It can easily be shown, on the assumption of a constant elasticity, γ, that refusal of the offer and selection of m by the district becomes the more likely as the amount of aid offered is smaller, the required local contribution larger and the elasticity

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* A "minimum effort" condition is incorporated in most of the equalizing flat grant systems in effect. However, in some cases the minimum effort is less than that needed to insure an expenditure equal to the standard (i.e. less than the standard effort incorporated in the aid computation); in many others, a relatively high aid floor is guaranteed all districts irrespective of performance; and in others still the expenditure and effort standards are too low to make the condition effective.

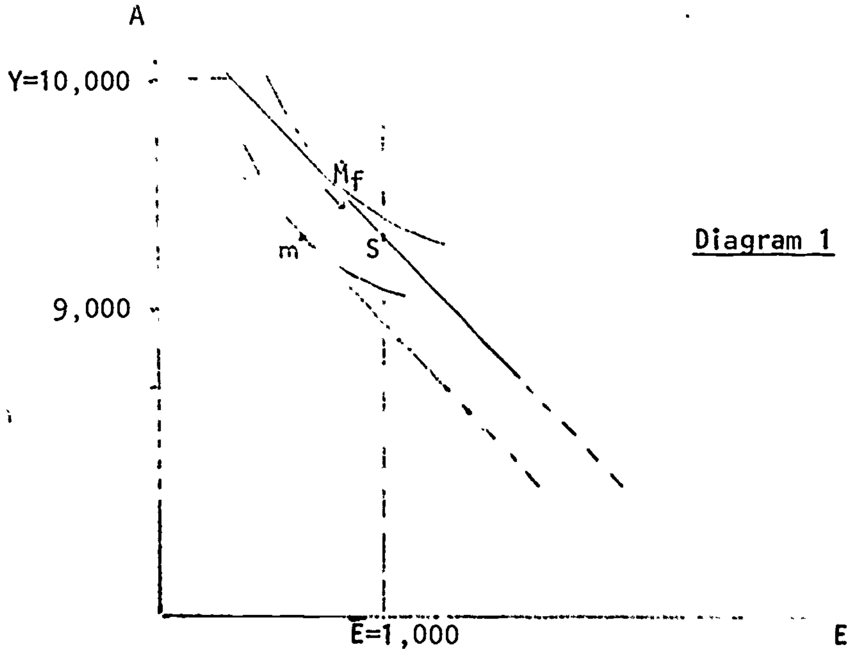

Diagram 1

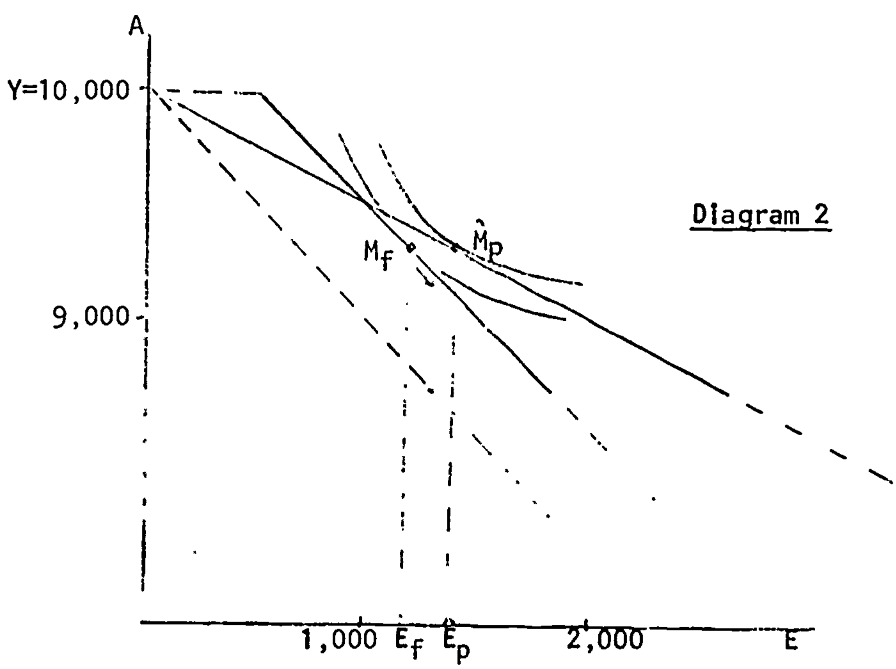

Diagram 2

of substitution greater.* The practical importance of this eventuality, however, is very slight. Clearly, little is lost in the way of expenditure per pupil if the refusal is associated with a low level of state aid. Where the aid is substantial, combinations of required local contribution and elasticities capable of producing rejection by the district are beyond the empirical range, as verified in table 4.

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* If the expenditure guaranteed by the minimum required effort is designated by $\bar{E}$, the condition for acceptance of the offer can be written

$$Z = \frac{\frac{Y+R-\bar{E}}{\bar{E}} \; \bar{E}^{1+1/\gamma}}{\gamma \left(\frac{Y}{1+\gamma}\right)^{1+1/\gamma}} < 1$$

It can be verified that $\frac{\partial Z}{\partial R} > 0$, $\frac{\partial Z}{\partial \gamma} < 0$, $\frac{\partial Z}{\partial \bar{E}} < 0$, when E_0 is larger than the free expenditure $\frac{Y + R}{1 + \gamma}$

Values of Z are calculated in the table below for combinations of incomes and elasticities in the empirical range, all on the basis of a moderate $250 state aid and a $1000 expenditure guarantee. The mention NA occurs where the "free" expenditure exceeds $1000.

Table 4: Calculation of impact of conditional flat grant (aid offer accepted if $Z < 1$)

		Elasticities of substitution				
		25	20	10	5	
Income per family	6,000		1.04 (0.95)	0.985 (0.90)	0.95 (0.87)	($750 aid)
	10,000	Out of empirical range	1.01 (0.975)	0.98 (0.95)	NA	($500 aid)
	14,000		0.99	NA	NA	
	20,000	0.99	0.99	NA	NA	

For the simulated sample of districts, the distribution of expenditure, local contribution and aid for per pupil under a conditional equalizing flat grant is described in Table 5. Comparison with Table 1 reveals the expected equalization of per pupil expenditures achieved through imposition of the minimum effort requirement. High-effort districts continue to show an advantage, but children in no district are deprived of the expenditure established as a state standard.

Table 5: Expenditure level and composition under a conditional equalizing flat grant

		Low-effort district		Medium-effort district	High-effort district	Total
I Low ability to pay	Expenditure	1000		1000	1100	3000
	Contribution	250		250	350	750
	Aid	750		750	750	2250
		A	B			
II Av. ability to pay	Expenditure	1000	1000	1000	1200	4200
	Contribution	500	500	500	700	2200
	Aid	500	500	500	500	2000
III High ability to pay	Expenditure			1000	1300	2300
	Contribution			750	1050	1800
	Aid			250	250	500

(4) Equalizing percentage grant with no limit on applicable expenditure

As illustrated in diagram 2, the district's budget line under such a system has a slope with absolute value less than one (slope measure is dA/dE), reflecting the proportionality of state reimbursements to school expenditure selected by the district. More precisely, we have

(2) $A = (Y + R) - E$

(7) $R = cE$, where c is the aid ratio, and by substitution

(8) $A = Y - E(1-c)$

The optimum position is obtained at $\hat{M}_p$, where the slope of the budget line, $-(1-c)$, is equal to the marginal rate of substitution . Designating the optimum quantities as $\hat{E}_p$ and $\hat{A}_p$, and knowing the elasticity, $-\gamma_c$, of substitution of E for A at the optimum, we have:

(9) $$-(1-c) = \frac{\partial A}{\partial E} = -\frac{1}{\gamma_c}\frac{\hat{A}_p}{\hat{E}_p}$$

$$\hat{A}_p = (1-c)\gamma_c\hat{E}_p$$

and, in view of (8)

(10) $$\hat{E}_p = \frac{Y}{(1-c)(1+\gamma_c)}$$

Expression (10) allows the optimum per pupil expenditure to be calculated for any district, given information on Y, c and γ_c. Since the slope of the indifference curve at the optimum differs from -1, the assumption made earlier concerning the constancy of γ at the level initially measured is no longer sufficient. To obtain an estimate of γ_c, we shall assume that, for a range of A values (expenditure on "other things") in the neighborhood of the initial level, the absolute elasticity of substitution at different points of the utility surface increases systematically as the absolute slope of the indifference curve decreases. More specifically:

$$\gamma_i = \gamma_o + h\,\frac{1-S_i}{S_i}$$

where γ_i is the absolute elasticity at point (A_i, E_i), γ_o is the absolute elasticity initially measured at slope -1, S_i is the absolute value of slope $\partial A_i/\partial E_i$. A credible measure of h is 4.25, calculated on the assumption that the "average" district in the simulation would spend \$1500 per pupil (the presumed expenditure of "very-rich" districts) if it could do so without increasing its contribution, i.e. if state aid was available at the rate of 2/3 its expenditure.* Since, at the optimum under percentage grants, the slope of the indifference curve must be $-(1-c)$, we therefore write

$$\gamma_c = \gamma_o + 4.25 \frac{c}{1-c}$$

In diagram 2, the absolute slope $(1-c)$ is equal to 0.5, as it would for a district of average ability to pay if the selected aid ratio is that prevailing at a standard level of local tax effort under the flat grant system previously outlined. The diagram also shows levels of expenditure, local contribution and aid for the same district under the flat grant system: the increase in expenditure per pupil from flat grant to percentage grant is \$200, with increased aid accounting for \$139 and increased local taxes for \$61 of that total.

Since the selection of aid ratios occurring under the flat grant system at a standard effort level results in a higher overall level of local contribution (effort level) and state aid than the flat grant system itself, the aid ratios must be adjusted for purposes of making the equalizing percentage grant system comparable to its flat grant counterpart.

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* For the district of average ability and average effort, γ_o in table 2' is calculated as 10.50. Substituting $\hat{E}_p = 1500$, $Y = 10{,}000$ and $c = 2/3$ in expression (10), we have

$$1+\gamma_c = 10{,}000/(1/3 \times 1500) = 20 \qquad \gamma_c = 19$$

Substituting $\gamma_i = \gamma_c = 19$, $\gamma_o = 10.5$ and $S_i = 1-c = 1/3$ in the expression for γ_i, we have:

$$h = (19-10.5)/2 = 4.25$$

The adjustment may be made by reference to the "average" district (in terms of ability to pay and disposition toward local tax effort), allowing it the same per pupil school expenditure or enticing it to the same effort level as under the flat grant system. Unfortunately, the first option results in an increased level of fiscal effort, the second in a decreased per pupil expenditure. Alternatively, the adjustment may be toward generating the same aggregate of state aid to districts of average ability to pay as under the flat grant, thus generating some increase in both school expenditures and tax effort, but without addition to the share of school expenditures financed by the state (at least with regard to that class of districts).

Given the importance attached to control of the state share of school expenditures in the political evaluation of state school aid systems, the alternative of maintenance of total state aid to districts of average ability to pay is selected in subsequent calculations. It is found that, for the four districts in class II of the simulated sample to receive an aggregate of $2000 in aid (as in the flat grant alternative), their aid ratio must be close to $c = 0.46$. The contribution ratio, $1-c$, of the class II districts is thus 0.54. According to our specifications, the contribution ratio of districts of low ability to pay must be half that amount, or 0.27, giving them an aid ratio of 0.73; the contribution ratio of districts of high ability to pay must be $1.5 \times 0.52 = 0.81$, for an aid ratio of 0.19. The resulting set of expenditures, local contributions and state aid per pupil is projected in Table 6.

Table 6: Expenditure leve. [illegible] composition under an equalizing percentage grant with no limit on applicable expenditures

		Low-effort district		Medium-effort district	High-effort district	Total
Low ability to pay c = 0.728	Expenditure	1074		1124	1167	3365
	Contribution	292		306	317.5	915.5
	Aid	782		818	849.5	2449.5
		A	B			
Av. ability to pay c = 0.467	Expenditure	731	1026	1221.5	1400	4378.5
	Contribution	497	557	663.5	761	2378.5
	Aid	334	469	558	639	2000
High ability to pay c = 0.185	Expenditure			1093	1395	2488
	Contribution			891	1137	2028
	Aid			202	258	460

It will be noted that the total state aid ($4910) exceeds the amount paid under the flat grant scheme by a small amount ($160). The creation of "reverse" inequalities in expenditure-per-pupil, with the districts of average-ability-to-pay spending more than those of high-ability, may be accidental (i.e. tied to our choice of γ_i estimate). Of main interest is the fact that there is little change in overall expenditure equalization as compared with the initial system. Comparison with table 5 will show that the conditional flat grant system achieves a higher degree of equalization with an equitable distribution of local tax contributions, although it does not generate the same high levels of expenditure per pupil.

(5) Percentage equalizing grant with limits on applicable expenditure

One way to limit the expenditure growth generated by a pure percentage-equalizing system is to place a ceiling on the amount of expenditure per pupil to which the aid ratio may be applied. This is a feature of the formula in a majority of the states where percentage grants are in effect, and it would no doubt have become one in other states had not the high magnitudes occuring in Table 6 been prevented by failures of the optimization process on the part of districts (see section IV). The imposition of ceilings, where they exist, has been justified on fairly obvious grounds: The desire to have the state reimburse a fair portion of school expenditures (50% has been a popular target for some years) and yet not spend excessive amounts on that account.

The impact of a ceiling, $\overline{E}$, on applicable expenditures is illustrated in diagram 3. The budget locus has slope $-(1-c)$ until the expenditure $\overline{E}$ is reached, then continues with slope -1 from that point on. The fixed state aid incorporated in the second portion is

$$\overline{R} = c\,\overline{E}$$

and the line has equation

$$A = (Y+c\overline{E}) - E \tag{11}$$

Were (11) to represent the whole budget line, districts would find their optimum at (A_o, E_o) such that

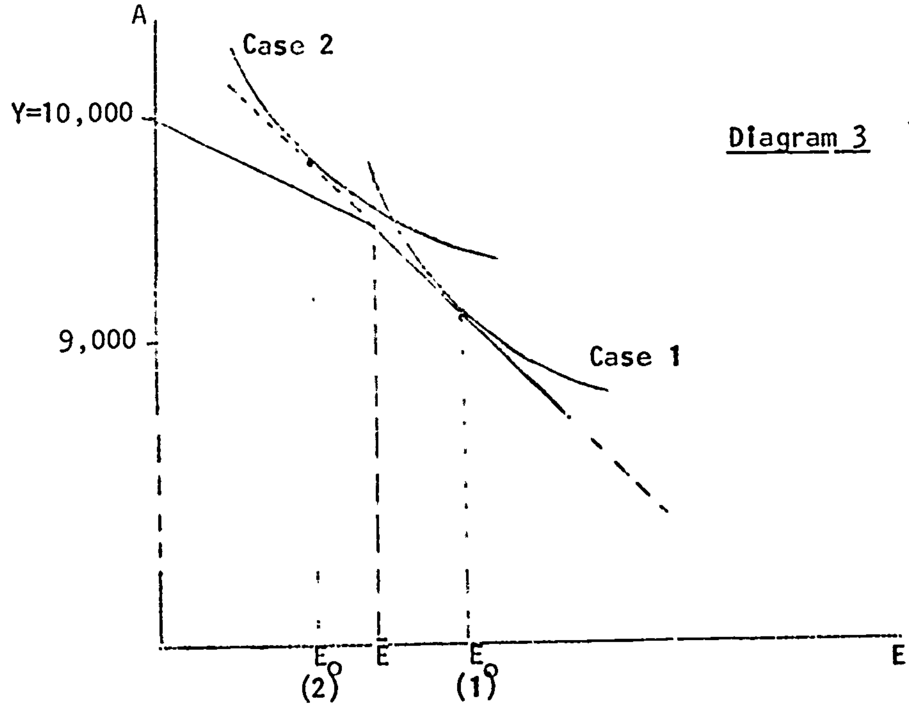
$$-1 = \frac{\partial A}{\partial E} = -\frac{1}{\gamma_o}\frac{A_o}{E_o}$$

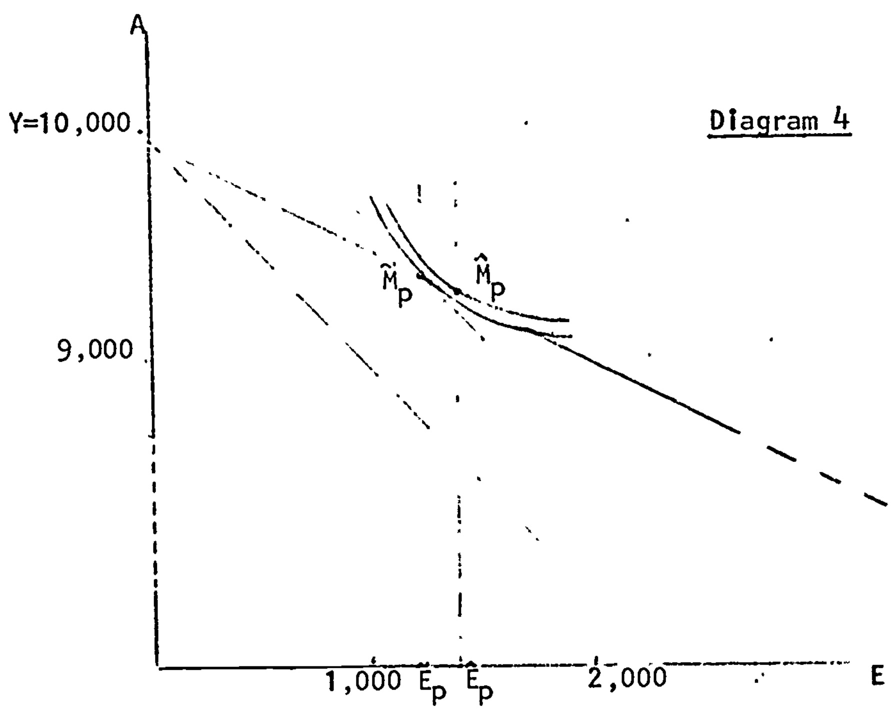
$$A_o = \gamma_o E_o$$

and, in view of (11),

$$E_o = \frac{Y+c\overline{E}}{1+\gamma_o} \tag{12}$$

The optimum school expenditure, $\hat{E}_p$, of districts that spend no more than $\overline{E}$ in the absence of ceiling is unaffected by the ceiling, i.e. if, in view of (10), we have $\frac{Y}{(1-c)(1+\gamma_c)} < \overline{E}$, then $\hat{E}_p = \frac{Y}{(1-c)(1+\gamma_c)}$


A
Case 2
Y=10,000
Diagram 3
9,000
Case 1
E_o (2)
$\bar{E}$
E_o (1)
E


A
Y=10,000
Diagram 4
$\tilde{M}_p$
$\hat{M}_p$
9,000
1,000
$\tilde{E}_p$
$\hat{E}_p$
2,000
E

For districts with $\frac{Y}{(1-c)(1+\gamma_c)} > \bar{E}$, the optimum school expenditure depends on the position of $\bar{E}$ relative to E_o:

- if $E_o > \bar{E}$, the optimum occurs at tangency of the convex budget locus with the indifference field, i.e., $\hat{E}_p = E_o = \frac{Y + c\bar{E}}{1 + \gamma_o}$

- if $E_o \leq \bar{E}$, the optimum is found at the "corner" of the budget locus, i.e. $\hat{E}_p = \bar{E}$.

The above analysis does not take account of the expenditure stretch associated with a fixed state aid when the expenditure limit is effective. The equilibrium under stretch when (11) is treated as the budget line is

$E_o' = \frac{Y + (1+a)c\bar{E}}{1+\gamma_o}$. The equilibrium of the district when all possibilities are scanned is determined as the optimum above, with E_o' substituted for E_o.

The schedule of expenditures, local contributions and state aids resulting for the simulated sample of districts is shown in Table 7, after setting the maximum applicable expenditure per pupil at $1000, the "standard" expenditure specified under the flat grant system. The aid ratio required to provide a total aid of $2000 to districts of average ability to pay is just under c = 0.53, giving aid ratios of 0.765 and 0.295 respectively for low-ability and high-ability districts. The results are similar to those achieved under the conditional flat grant system, except for a continued low expenditure of districts with an inflated measure of ability to pay, and with nothing to show for the complex accounting required of both district and state officials under limited equalizing percentage grants.

Table 7: Expenditure level and composition under an equalizing percentage grant with limit of $1000 on applicable expenditure

		Low-effort district A	Low-effort district B	Medium-effort district	High-effort district	Total
Low ability to pay c = 0.765	Expenditure	1000		1005.5	1106	3111.5
	Contribution	236		240.5	341	816.5
	Aid	765		765	765	2295
Av. ability to pay c = 0.529	Expenditure	781	1000	1007.5	1209.5	3998
	Contribution	368	471	478.5	680.5	1998
	Aid	413	529	589	589	2000
High ability to pay c = 0.294	Expenditure			1004	1311	2320
	Contribution			715	1017	1732
	Aid			294	294	588

IV. Percentage equalizing grants under "short-sighted" behavior of districts

The previous analysis of the impact of percentage equalizing grants has been based on the assumption of rational optimization by districts, describing the district expenditure decision for a given budget-year in the light of its utility function of expenditures and of state aid offers tied to school expenditures in that year. The fact, however, is that in all states operating under the percentage system, state aid is paid during the course of a budget-year by reference to school expenditures incurred during the previous year.*

* In the case of Massachusetts, the fiscal year during which reimbursements are made begins six months after the close of the school-budget year of reference. Pennsylvania moves closest to simultaneity by making an April payment of aid based on aid computed for the previous school year and a seemed payment in November which, added to the first, covers aid computed for the school year ending the previous June. Vermont abandoned simultaneous payments two years after initiating its percentage equalizing system.

Such a lag in reimbursements does not affect the long run equilibrium of the district as long as the district pursues a rational maximization of its utility over time. It can be shown, on the other hand, that a district maximizing its utility yearly by reference to a lagged percentage aid which it treats as exogeneous will reach its equilibrium at some school expenditure level $\tilde{E}_p$, below the true optimum $\hat{E}_p$.

The contention of this report, supported by empirical evidence, is that school districts do indeed behave in accordance with the latter model, so that, at the very least, percentage equalization fails to generate the "substitution effect" it promises. In addition, it will be shown with reference to the simulated sample of districts that the resulting pattern of expenditures per pupil is far less "equalized" than that obtained under a conditional flat grant system -- is worse, indeed, than the pattern achieved under traditional flat grants.

The overt rationale for lagging state reimbursements appears to be primarily one of administrative ease: Expenditures of the various districts during a given fiscal year are not known at the time state budgets for that same year are under discussion, so that funds for "simultaneous" grants would have to be appropriated by reference to uncertain district expenditures. Furthermore, actual expenditures of districts may differ from budgeted amounts, so that adjustments of already paid grants would be required after expenditures of districts have been fully audited. By allowing reference to know district budgets at the time of state appropriations and to audited expenditures during the payment periord, the retardation of state payments removes such handicaps.

Clearly, however, the difficulties involved in tying grants to current district expenditures are not insuperable.* Familiarity with the legislative

* A survey of federal matching grants turns up one program (Special Incentive Grants - Educationally Deprived Children ESEA Title I) in which federal funding is in proportion to an "effort index" of the

record in at least one state (Massachusetts) suggests that state legislators may have wished to soften their acceptance of the incentive principle with the imposition of a drag on its annual cost. It is well within the states' capability to implement percentage equalizing grants on a "simultaneous" basis, and thereby to neutralize the impact of whatever misperceptions affect district behavior under lagged state repayments. This is no great consolation, however, since it was shown in Section III that unhampered district optimization in response to percentage equalizing grants results in a financing pattern that is no better than conditional flat grants under the best of circumstances (limit on applicable expenditures) and can be much worse if appropriate safeguards are not introduced.

(1) Behavioral model of school districts under lagged percentage aid

Decision makers in the school district - which, at the limit, means all district voters - are assumed to seek maximization of

$$U = h(U_0, U_i, \ldots, U_t)$$

where $U_t = U(E_t, A_t)$ is an annual utility function in terms of real school expenditure and real expenditure on other items of private and public consumption; t goes from 0, the year in which the expenditure decision is effective (called "budget year"), to T the limit of the decision horizon.

The assumption that utility in any year depends strictly on consumptions in that year is only valid within certain limits. School districts are fully aware of the interdependence of school expenditures over succesive years in providing educational benefits to pupils - and of similar interdependences in other areas of public and private service. Strictly speaking,

state measured in the second preceding fiscal year. In general, however, matching grants are paid concurrently with corresponding expenditures on the basis of estimated espenditures approved ahead of time by the responsible federal agency. Where there is some uncertainty concerning the number of individuals that will qualify for the subsidized state service in a given quarter (e.g. Public Assistance), federal payments may be adjusted in accordance with actual need.

then, the utility derived each year is a function of expenditures during, before and after that year. Given the state of the information available to district decision-makers, however, it is doubtful that their perception of the benefits derived from different levels of education expenditure goes beyond the following:

(a) an evaluation of the annual long-run benefits obtained for different sustained levels of annual educational expenditure;

(b) a realization that substantial annual deviations from the expenditure trend are both difficult to implement and unpredictable in their results;

(c) an intuition that, under steady increase (decrease) of the annual expenditure toward some equilibrium level, annual education benefits rise (decline) toward those achieved in the long-run at the sustained equilibrium level.

Under the circumstances, it is good strategy for the district to approximate the benefits of each annual expenditure in an asymptotic sequence by those expected under sustainance of that expenditure, and to maximize U (with $U(E_t, A_t)$ specified accordingly) on the expectation that the solution will indeed consist of an expenditure series moving steadily toward its limit.

Maximization of the district's utility is constrained by expected annual incomes of the district community (exclusive of taxes paid to external agencies but inclusive of flat grants received from them) and by available options for adjusting annual consumption away from annual income. Such options include saving and dissaving (quite restricted through public budgets* but not so at the household level), and, conspicuously, the determination of state aid in

* In the case of services provided by plant and durable equipment, efficiency considerations often lead to purchase of these capital items by the district and to their bond financing. Only to the extent that fixed annual financing charges continue beyond, or stop before, the life of the facility, is

year t + 1 through the school expenditure selected for year t. To minimize interference with the process of interest, it is assumed that the district expects equal annual incomes over its decision horizon, and that the marginal rate of discount of utility accruing in year t + 1 over utility accruing in year t is equal to the rate of interest for equal yearly utilities.

Given the district's per-family/per-pupil income, Y, and the aid percentage, c, it can be shown that the eventual equilibrium of a fully optimizing district under these conditions is precisely the static optimum $\hat{M}_p$ depicted in diagram 2, i.e. the school expenditure under variable elasticity of substitution in $U(E_t,A_t)$ is that calculated by expression (10) above:

$$(10) \qquad \hat{E}_p = \frac{Y}{(1-c)(1+\gamma_c)}$$

Consider, however, the situation where the district neglects the impact of its school expenditure on future state aid, treating instead the aid it receives as exogenous and expecting aid in future years to be equal to that promised by the state for the budget year. Under our assumptions, this means that the district needs only maximize its utility $U(E_o,A_o)$ under the income and aid constraints effective in the budget year -- with the expectation that the same expenditure pattern will be repeated in succeeding years. With t now designating the budget year in a sequence of annual decisions, the utility function $U(E_t,A_t)$ is maximized each year under the constraint

$$(13) \qquad A_t = (Y+R_t) - E_t,$$

---

there dissaving or saving.

Note, also, that the decision to purchase capital goods implies that the price at which associated services are available in each year of the horizon depends on the use of such services over the whole sequence of years. This interdependence can be neglected in the present analysis, however, to the extent that the services in question are incorporated in the large expenditure mass, A_t, while school expenditures subject to the aid programs under discussion refer strictly to current operations (i.e. exclude capital purchases and expenses on debt service).

where income, Y, and state aid, R_t, are treated as exogenous. Under constant elasticity, $-\gamma_o$, and calling the optimized expenditures in year t $\mathring{A}_t$ and $\mathring{E}_t$, we have as in (3) above:

$$-1 = -\frac{1}{\gamma_o}\frac{\mathring{A}_t}{\mathring{E}_t}$$

By substitution into (13), we obtain

$$(14) \qquad \mathring{E}_t = \frac{Y+R_t}{\gamma_o+1}$$

With inclusion of the expenditure stretch identified in Section 2, the equilibrium, $\mathring{E}'_t$, is determined as

$$(15) \qquad \mathring{E}'_t = \frac{Y + (1+g)R_t}{\gamma_o+1}$$

However, the exogenously treated reimbursement R_t is, in fact, proportional to E_{t-1}: $\qquad R_t = c\mathring{E}'_{t-1}$

Substituting into (15), we have the first-order difference equation

$$\mathring{E}'_t - \frac{c(1+g)}{\gamma_o+1}\mathring{E}'_{t-1} = \frac{Y}{\gamma_o+1}$$

Thus, E_t tends toward the limit:

$$(16) \qquad \tilde{E}_p = \frac{Y/(\gamma_o+1)}{1-c(1+g)/(\gamma_o+1)} = \frac{Y}{\gamma_o + 1 - c - cg}$$

and, since $0 < \frac{c(1+g)}{\gamma_o+1} < 1$, it does so steadily.*

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* In Massachusetts, the aid percentage is applied to the district's contribution, i.e. $E_{t-1} - R_{t-1}$, rather than to the expenditure E_{t-1}. Thus:

$$(17) \qquad R_t = c(\mathring{E}'_{t-1} - R_{t-1})$$

From (15) above, we have:

$$R_{t-1} = \frac{\mathring{E}'_{t-1}(\gamma_o+1) - Y}{1+g}$$

$$R_t = \frac{\mathring{E}'_t(\gamma_o+1) - Y}{1+g}$$

(continued)

Direct inspection will show that $\tilde{E}_p$ is different from the limit $\hat{E}_p$ calculated under a fully rational adjustment. Rewriting $\hat{E}_p$ as $\frac{Y}{\gamma_c + 1-c-c\gamma_c}$, the difference between denominators of the $\tilde{E}_p$ and $\hat{E}_p$ expressions is $D = (\gamma_o + 1-c-cg)-(\gamma_c + 1-c-c\gamma_c) = \gamma_o-cg-\gamma_c(1-c)$

$$\text{Since : } \quad \gamma_c = \gamma_o + 4.25 \frac{c}{1-c}$$

$$D = c(\gamma_o - 4.25-g)$$

Without expenditure stretch (g=0), the difference D is always positive for the range of calculated elasticities, γ_o , so that $\tilde{E}_p < \hat{E}_p$. With the expenditure stretch, $\tilde{E}_p$ may equal or exceed $\hat{E}_p$ for small values of γ_o .

A more general treatment would be desirable, but is not indispensable. Once the existence of an equilibrium is accepted, the static determination of positions reached under each behavioral mode is a simple matter. Diagram 4 above reproduces the portion of diagram 2 relative to the equilibrium, $\hat{M}_p$, achieved under a rationally exploited percentage grant. The corresponding "short-sighted" equilibrium, $\tilde{M}_p$, for g = 0 must be consistent with the aid system, i.e. be located on the line YP with slope - (1-c).

Substituting into (17), we obtain:

$$\tilde{E}'_t + \frac{c(\gamma_o - g)}{\gamma_o + 1} \tilde{E}'_{t-1} = \frac{Y(c+1)}{\gamma_o+1}$$

The solution of this first order difference equation is a path of expenditures leading to the equilibrium:

$$\tilde{E}_p = \frac{Y(c+1) \;/\; (\gamma_o+1)}{1+ c(\gamma_o-g) \;/\; (\gamma_o+1)} = \frac{Y}{\gamma_o + 1-d-dg} \qquad (d = \frac{c}{1+c})$$

The limit is thus the same as under a standard aid percentage system with aid ratio $d=\frac{c}{1+c}$ (as is the optimum under rational behavior).

However, we expect $-1 < - \frac{c(\gamma_o - g)}{\gamma_o + 1} < 0$, so that E_t fluctuates with decreasing amplitude toward its limit.

On the other hand, the slope of the indifference curve through $\tilde{M}_p$ must be -1 since aid is treated as exogenous. These two conditions determine $\tilde{M}_p$ as shown, and $\tilde{M}_p$ always lies to the left of $\hat{M}_p$ on YP since the indifference curve through $\tilde{M}_p$ (slope-1) is steeper than through $\hat{M}_p$ (slope $-(1-c)$). For $g > 0$, line YP is replaced by a line of slope $-(1-c-cg)$, to allow for an extra-expenditure $gc\tilde{E}'_p$ at the equilibrium. As can be seen, the main impact of "short'sighted" behavior on the part of the district is to remove the "substitution effect" in favor of school expenditures expected under a percentage grant.

(2) <u>Implications of the short-sighted adjustment for expenditure equalization</u>

Evidence supporting the hypothesis of "short-sighted" behavior on the part of districts is presented in subsection (3) below and in the empirical study which follows. Meanwhile, its implications for expenditure equalization among districts can be analyzed by reference to the simulated sample.

Making use of expression (16) to calculate the expenditure equilibrium, we find that the aid ratio to districts of average ability-to-pay must be 0.546 for their total aid to equal $2000. Given the set of abilities to pay, corresponding aid ratios are 0.773 for districts of low ability and 0.319 for districts of high ability. Entering these in expression (16) together with specified incomes and elasticities, the following schedule of expenditures, local contributions and state aids is obtained.

Table 8: Expenditure level and distribution under an equalizing percentage grant with no limit on applicable expenditure (short-sighted behavior)

		Low-effort district	Medium-effort district	High-effort district	Total
Low ability to pay c = 0.773	Expenditure	876	1012	1158	3046
	Contribution	199	230	263	692
	Aid	677	782	895	2354
Av. ability to pay c = 0.546	Expenditure	606 785.5	1014	1259	3664.5
	Contribution	275 356.5	461	572	1664.5
	Aid	331 429	553	687	2000
High ability to pay c = 0.319	Expenditure		1015	1347.5	2362.5
	Contribution		691	917.5	1608.5
	Aid		324	430	754

As could be expected, the increases in school expenditure obtained under rational optimization do not materialize, although the total aid bill is $350 above its flat aid level ($4750). The imposition of a reasonable limit on applicable expenditures hardly affects the expenditure level of districts, as a comparison of Tables 8 and 9 will show:

Table 9: Expenditure level and composition under an equalizing percentage grant with $1000 limit on applicable expenditure (short-sighted behavior)

		Low-effort district		Medium-effort district	High-effort district	Total
Low ability to pay c = 0.794	Expenditure	883.5		1016	1117.5	3017
	Contribution	182.0		222	323.5	727.5
	Aid	701.5		794	794	2289.5
Av. ability to pay c = 0.587	Expenditure	613.5	793	1022.5	1227.5	3656.5
	Contribution	253.5	327	435.5	640.5	1656.5
	Aid	360	466	587	587	2000
High ability to pay c = 0.381	Expenditure			1026.5	1334	2360.5
	Contribution			645.5	953	1598.5
	Aid			381	381	762

The striking result is that school expenditures, with or without a limit on the applicable expenditure, are less equalized than under an uncontrolled flat grant system of the traditional type (see Table 1).

Thus, if our hypothesis concerning district behavior is correct, percentage-equalization grants established in the past have served no useful purpose, and those more recently proposed in response to Court decisions (calling for removal of wealth as a determinant of school expenditure)* will fail again to prevent the occurence of substandard school-support levels rooted in different local propensities to spend. The option of making state aid payments simultaneous with the expenditure to which they are proportional does, of course, remain open, but it was shown earlier that much simpler aid formulas will perform as well as, or better than, a rationally utilized percentage grant system. Short of full state centralization of school finances - unwelcome for many reasons-, the most promising method for bringing all expenditure levels close to desirable standards is that described earlier as "conditional flat grant", i.e. an equalizing flat grant system under which payments of aid are made conditional on the production of a minimum local fiscal effort toward education.

This in no way detracts from the progress achieved in association with percentage grant systems over the last fifteen years. The state contribution

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* The principal references are a decision of the Supreme Court of California (Serrano vs. Priest, August 30, 1971) and a judgement - recently reversed by the Supreme Court - of a Texas Federal Court. Both struck at state school financing systems for their failure to grant "equal protection" under the Fourteenth Amendment. However, both fall short of imposing uniform expenditure standards in all publicly supported schools, placing all their emphasis on the removal of local wealth as a determinant of school expenditure. They leave standing any system under which disparities of school expenditure among districts can be shown to stem from different levels of local tax effort and not from differences in local wealth.

Concerning the "right" of districts to choose their level of fiscal effort, the California court addresses the issue in only one instance, dismissing the relevance of defendents' argument in its favor as fallacious 'We need not decide whether such decentralized financial decision-making is a compelling state interest, since under the present financial system, such fiscal free-will is a cruel illusion for the poor school districts". At no point, therefore, does the Court object to letting voters in each district decide how much of a fiscal effort they wish to devote to local education. It refrains from deciding whether such freedom is a compelling state interest, and does not even consider the question of whether its exercise may conflict with the right of children to equal protection (equal access to education). The Court only points out that under the present (California) financial system, the freedom of districts to spend for education only becomes meaningful as the district gets richer.

to school funding has been raised to levels consonant with effective equalization and significant strides have been made toward the use of more equitable measures of ability-to-pay. Indeed, the recommended shift to conditional flat grants cannot be implemented fairly in the absence of some serious reform of our fiscal criteria for school finance.* But the time has come to turn away from the two dominant voices in school finance today: The voice of "percentage grant" reformers of fifteen years ago, still enthusiastic about a formula that refuses to work, and the voice of the new analphabetes calling for central state financing in the name of Court decisions they are unable to read.** The more sensible path is a return to the old "foundation" system - or its retention in the majority of states where it is in effect -, shifting to more progressive and accurate measures of district ability-to-pay and holding districts to the minimum effort needed for adequate school spending.

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* It is significant that a main impetus for shifting to percentage equalizing grants at the turn of the sixties was a widespread despair that fair measures of ability-to-pay could ever be implemented. While the requirement of a minimum effort under equalizing flat grants would impose twice the ordinary burden on a district with 100% overevaluation of its ability to pay, or else force it to go without aid, percentage aid would allow the district to seek a position somewhere between these two extremes. See, for instance, Mort, Reusser and Polley: Public School Finance, McGraw Hill, 1960, p.267-70.

** There has been widespread misunderstanding of the Court decisions discussed in footnote * p.35, and a common interpretation is that local taxation has been disallowed as a source of school finance. The most recent "authoritative" statement concerning desirable school-finance systems is that of the National Educational Finance Project (NEFP), contained in a series of volumes published around 1971. Volume 5 (Alternative Programs for Financing Education) blithely concludes: "If the decision of the Supreme Court of California in August, 1971 is upheld in the United States Supreme Court, complete state and federal support of the public schools or complete equalization of local ability by a Strager-Haig model (equalizing flat grant with state-determined rate of local school taxation) will be the only legal alternatives. The California Supreme Court ruled that the use of local property taxes to finance schools violated the 14th Amendment to the federal constitution."

This piece of misinformation is not the only weakness of the NEFP study. Major emphasis in the evaluation of alternative finance programs is placed on the NEFP scores for expenditure equalization and tax progressiveness, both of which are calculated by reference to characteristics of state programs (school finance and taxation) rather than performance projections by district. This procedure excludes the criterion of equalized

(3) Evidence on district behavior

The most convincing evidence of a short-sighted behavior of districts in response to lagged percentage aid would be an econometric finding that the school expenditure of districts operating under such an aid formula tends toward the sub-optimum, $\tilde{E}_p$, rather than toward $\hat{E}_p$. Such a test, which requires independent measures of the utility function of districts and, under typically changing conditions from year to year (including frequent changes in parameters of the aid formula), an extended time series of school expenditures and other relevant variables, is carried out in the empirical study and reveals a short-sighted adjustment of districts to state aid.

Short of analyzing this kind of information, we can examine the broad record of percentage aid in two of the states where it has been operational over an extended period of time. Where the percentage aid formula has been applied without limits on the applicable expenditure, however, our analysis fails to reveal any distinguishing feature of district expenditure

expenditure per dollar of local tax rate (implicitly sanctioned by the Courts) and it takes no account of possible differences in "propensity to spend" among districts.

An alternative evaluation based on predicted district performance is also made available (and fully computerized) by NEFP. Descriptive inputs include specification of a local tax "leeway", i.e. the maximum local school tax above standard allowed any district, for which there seems to be no empirical counterpart. Furthermore, all computations but one are based on the assumption that "all districts levy the legal limit of taxes permitted by the state", and the one exception (dealing with percentage equalizing plans) calls for individual predictions of district effort without providing any clue as to where they should be obtained. In effect, then, the quantitative evaluations proposed by NEFP fail altogether to deal realistically with district behavior under alternative constraints imposed by the state-aid system.

patterns under alternative types of district behavior. The evidence, in the state that qualified (Rhode Island), can only serve to illustrate the failings of percentage equalization whatever the district response may be: The per-pupil expenditure in 1971-72 (12 years after inauguration of percentage equalizing grants) varies from a low $615 to a high $1127, and the five districts receiving the highest percentage of aid have an average expenditure of only $742, substantially below the average for all districts ($876).* Rationality should be better testable in states where relatively high limits on the applicable expenditure have been in effect, since a rational adjustment would bring all districts enjoying moderate or high aid percentage up to the spending limit. Such a test is difficult, however, as the qualifying state (New York) imposes a minimum fiscal-effort requirement (as under the conditional flat grant scheme) and, in addition, has raised the expenditure limit over time at a rate exceeding the growth of school-input costs (at least up to 1967). It is nevertheless significant that, of the districts spending substantially below the limit in 1963-64 (second year of aid payments under percentage equalization), nearly all were still under the limit in 1969-70. Furthermore, the two counties with highest expenditure per pupil spent 57% more than the two counties with lowest expenditure in 1969-79, while the difference between the same pairs of counties was only 44% in 1961-62.**

* Rhode Island Department of Education: 1971-72 Statistical Tables

** Computed from New York State Education Department: Annual Educational Summary, New York State, 1961-62, 1963-64 and 1969-79.

The high levels of local effort, school expenditure and school-expenditure equalization achieved in New York under equalizing flat grants in the years prior to 1962 is directly traceable to that state's high level of school aid <u>and</u> to its imposition of a minimum effort requirement as described in the "conditional flat grant" model.

The same pattern occurs in other Northeastern states, although their history of percentage-aid is either too short or too checkered to allow a fair assessment of the formula's performance.

Another bit of econometric evidence should also be retrievable from the expenditure performance of districts in the state of Massachusetts. As shown in footnote, p.30, the fact that, in that state, the aid percentage is applied to a previous-year expenditure net of state aid (i.e. roughly, to the local-tax contribution of the district), generates dampened oscillations along the path to the short-sighted equilibrium. It can also be shown that the path under rational behavior of the district will rise (or fall in empirically rare situations) steadily toward the optimum expenditure. The empirical discovery of oscillations would thus constitute a test of short-sighted behavior on the part of Massachusetts districts.

Unfortunately, the normal difficulties associated with annual shifts in education costs and district incomes are compounded in Massachusetts by a six-month overlap of the school and state fiscal years, and by an annual prorating of calculated state aid designed to bring total state payments down to whatever amount is available from earmarked financing sources. The identification of an oscillatory component of school expenditures under these conditions is no simple matter. It is significant, however, that what has become known in Massachusetts as the "yo-yo effect" was quickly recoanized by local school finance experts as a potential outcome of the aid system although never considered a major handicap.

The explanation, based on simple numerical examples, did incorporate the assumption of an exogenous treatment of state aid by districts. That assumption, moreover, was never made explicit, for the simple reason that it was not recognized as a possible departure from reality, i.e. most if not all individuals concerned with the state aid system did not conceive of a district behavior other than "short-sighted". Such a perception of district behavior by experts and buffs alike does not, of course, establish that districts did behave accordingly, but the close contact with many members of the school-finance establishment have maintained with school committees across the state and their own participation in school affairs at the local level suggest that they do reflect accurately the attitudes of district decision makers.

The exogeneity assumption pervades all discussions of the aid formula's performance in the one state (Massachusetts) with which the author is familiar. Typically, projections of the impact of a change in parameters of the formula carried out by bodies ranging from legislative committees to the League of Women Voters are obtained by applying the new formula to actual expenditures of districts in the current or previous year and letting the resulting state aid stand as a long-run prediction (to be modified only by cost inflation and variations in pupil population). Such a technique incorporates more than the assumption of aid exogeneity - it also assigns a zero-substitution of state aid for local school tax revenues.

Since the assumption of zero-substitutability is contradicted by substantial empirical evidence, some doubt is cast on the accuracy of local analysts in interpreting district behavior - including the presumed exogenous treatment of state aid. The two assumptions do not have equal status, however. All individuals concerned do recognize that some state aid will be substituted for local contributions, and they justify their neglect of this factor by pointing to the difficulty of tracing the path of substitutions over time. Because they are suspicious of analytic techniques beyond their competence and disturbed by the use of admittedly poor estimates of the behavioral parameters of districts, they opt for the clarity and simplicity of an arbitrary model, rationalizing that they need only some rough indicator of the directional impact of contemplated aid systems. On the other hand, no one -- including enthusiasts of the "incentive" feature of percentage aid -- exhibits any kind of awareness that districts might consider the impact of their school expenditures on future state aid. The exogenous treatment of aid by districts has the status of a self-evident truth, and such a universal belief on the part of people well versed in the budgetary process of districts must have some roots in reality.

That districts should, indeed, treat lagged percentage state aid as beyond their control is understandable enough in the case of Massachusetts. Changes (or discussions of change) in the parameters of the aid formula have been so frequent, and the annual prorating of calculated aid in accordance with available funds has introduced such a high note of uncertainty, that any attempt by districts at tracing rational expenditure paths in the light of scheduled aid percentages would have been an exercise in futility. A sophisticated decision model could still have been developed, taking account of some probability distribution of effective aid percentages over time, as well as of incomes, school enrollments and prices; but school committee members and district voters were in no position to formulate the problem, still less to undertake the necessary calculations. They knew, however, how to compare their options under the fairly safe assumption that state aid would keep rising from year to year, more or less in line with prices and enrollments; this led to the simple strategy of maximizing utility each budget year in the perspective of a repetitive sequence of real income and real school aid, the level of the sequence to be adjusted in each future annual budget decision by reference to income and aid in those years.

The situation is not greatly different for districts in states where percentage aid has been administered under relatively stable conditions. Even under the simplest assumptions (i.e. those incorporated in our analytical models), the systematic determination of an optimum expenditure path in response to lagged percentage aid is entirely beyond the capabilities of any local school committee or committee member. Members do understand that increases in expenditure for the budget-year under discussion will result in higher state aid in the following year. The "spenders" among them are bound to remind their colleagues of that potential bonus in their arguments for a higher budget, only to hear their opponents argue that the committee is dealing with the present budget, that taxes are too high right now, and that getting some small amount of additional aid at some future date is a poor reason to increase present educational expenditures beyond what "they need to be". The decision outcome is not likely to be affected by such considerations, mostly because no one can successfully demonstrate the long-run advantages of a specific path of expenditure increases, and all - including those most eager to anticipate future aid - are constrained to think within the confines of a model they can handle, i.e. a repetitive sequence of incomes, school aid and enrollments at the levels achieved in the immediate budget year.

School committee members are further encouraged in this attitude by an apparent reluctance of the electorate to let public bodies engage into savings on its account (except where such savings are performed via investment in long-lasting public facilities). The school committee knows that selling higher school expenditures (school taxes) this year as a means of reducing the share of local school financing in future years is an insurmountable task. Thus, whatever the expenditure decision, it must be justified in terms of a model that excludes intertemporal transfers, i.e. in terms of a repetitive sequence of relevant constraints, including lagged state aid.

Appendix to Part I

The analysis and computations under hypothesis II concerning utility functions (i.e., sinking of a standard minimum school expenditure, B, and maximization of a utility function of A and D, where D is school expenditure above the minimum) are similar to those outlined under hypothesis I, with the following adjustments:

(a) $E = D + B$

(b) Equilibrium values of D are calculated with the formulas used for corresponding equilibrium values of E under hypothesis I, with

$g = 0$

Y replaced by Y-B under flat grants

by Y-B(1-c) under percentage grants

(in the latter case, the state aid Bc applied to the standard minimum is added to the "reduced budget".)

We therefore have:

$$\hat{D}_p = \frac{Y - B(1-c)}{(1-c)\ (\gamma_c'+1)} \qquad \hat{E}_p = \hat{D}_p + B = \frac{Y + B(1-c)\gamma_c'}{(1-c)\ (\gamma_c' + 1)}$$

$$\tilde{D}_p = \frac{Y-B(1-c)}{\gamma_o' + 1-c} \qquad \tilde{E}_p = \tilde{D}_p + B = \frac{Y + B\gamma_o'}{\gamma_o' + 1-c}$$

and, for the alternate equilibrium under limits of the applicable expenditure:

$$D_o = \frac{Y-B + c\bar{E}}{\gamma_o' + 1} \qquad E_o = D_o + B = \frac{Y + c\bar{E} + B\gamma_o'}{\gamma_o' + 1}$$

With B = 300, and with reference to the elasticities listed in table 3, equilibrium values can be calculated under alternative formulas. First, however, γ_c' must be obtained as a function of γ_o' and c consistently with the methodology used under hypothesis I. We write again

$$Y_i' = Y_0' + h' \frac{1 - s_i}{s_i}$$

and calculate h' so that the average district in the simulation would spend \$1500 per pupil when state aid is available at the rate of 2/3 its expenditure. This gives $h' = 5.20$,* so that at the rate of substitution - (1-c) prevailing at the optimum under percentage grants, we have

$$Y_c' = Y_0' + 5.20 \frac{c}{1-c}$$

The newly computed tables of equilibrium values are then as follows:

1)	Tables 1' and 5'	as tables 1 and 5
2)	Tables 6' to 9'	See following two pages

The results are substantially the same under hypotheses II as under hypotheses I, so that the conclusions developed in the main body of the analysis remain unaffected.

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* For the district of average ability and average effort, Y_c' in table 3 is calculated as 13.57. Substituting $D_p = 1500-300 = 1200$, $Y = 10,000$, $B = 300$ and $c = 2/3$ in expression (10), we have:
$1 + Y_c' = (1000-100) / 1/3(1500-300) = 25$ $\quad Y_c' = 24$
Substituting $Y_i' = Y_c' = 24$, $Y_0' = 13.57$, $S_i = 1-c = 1/3$ in the expression for Y_i', we have:

$$h' = (24-13.57)/2 = 5.20$$

Table 6' Expenditure level and composition under an equalizing percentage grant with no limit on applicable expenditures

		Low-effort district		Medium-effort district	High-effort district	Total
Low ability to pay c = 0.783	Expenditure	1139		1193	1238.5	3570.5
	Contribution	247		259	503.5	1009.5
	Aid	892		934	735	2561
		A	B			
Av. ability to pay c = 0.445	Expenditure	780.5	1022	1246	1444	4492.5
	Contribution	433.5	567	691	801	2492.5
	Aid	347	455	555	643	2000
High ability to pay c= 0.168	Expenditure			1088	1402	
	Contribution			905	1166	
	Aid			183	236	

Table 7' Expenditure level and composition under an equalizing percentage grant with limit of $1000 on applicable expenditure

		Low-effort district		Medium-effort district	High-effort district	Total
Low ability to pay c = 0.762	Expenditure	1000		1001.5	1102	3103.5
	Contribution	238		239.5	340	717.5
	Aid	762		762	762	2286
		A	B			
Av. ability to pay c = 0.524	Expenditure	817	1000	1002	1202	4021
	Contribution	389	476	478	678	2021
	Aid	428	524	524	524	2000
High ability to pay c = 0.286	Expenditure			1002	1302.5	2304.5
	Contribution			716	1016.5	1727.5
	Aid			286	286	572

Table 8' Expenditure level and composition under an equalizing percentage grant with no limit on applicable expenditure (short-sighted behavior).

		Low-effort district		Medium-effort district	High-effort district	Total
Low ability to pay c = 0.774	Expenditure	894.5		1003	1114	3011.5
	Contribution	202.5		227	252	681.5
	Aid	692		776	862	2330
		A	B			
Av. ability to pay c = 0.547	Expenditure	641.5	797	1003.5	1215	3657
	Contribution	290.5	361	454.5	551	1657
	Aid	351	436	549	664	2000
High ability to pay c = 0.321	Expenditure			1003.5	1312	2315.5
	Contribution			681.5	891	1572.5
				322	421	743

Table 9' Expenditure level and composition under an equalizing percentage grant with a limit of $1000 on applicable expenditure (short-sighted behavior).

		Low-effort district		Medium-effort district	High-effort district	Total
Low ability to pay c = 0.79	Expenditure	896		1004.5	1105	3005.5
	Contribution	188		214.5	315	717.5
	Aid	708		790	790	2288
		A	B			
Av. ability to pay c = 0.58	Expenditure	643	798	1005.5	1207.5	3654
	Contribution	269	334	424.5	626.5	1654
	Aid	374	464	581	581	2000
High ability to pay c = 0.37	Expenditure			1006	1308.5	2314.5
	Contribution			636	938.5	1574.5
	Aid			370	370	740

Part II

Review of the Literature*

Introduction

A substantive reason for studying the fiscal response of state and local governments to grants-in-aid is the basic policy need for comparative information about alternative forms of intergovernmental support. Surprisingly, though, despite the fact that in the past few years the public finance literature has swelled with numerous research efforts directed at this question, such meaningful information has just not been available. Most studies have not been concerned with analyzing either one particular program or one type of program. Most have been concerned simply with measuring "the effects of aid in general," sometimes for different public services, but typically with reference only to the level of aid for those services. This type of analysis clearly treats aid as a uniform concept, and essentially ignores the relevance of grant structure; it therefore yields little information about the effects of different forms of aid.

Until recently, a major responsibility for this type of treatment and for many inadequacies of previous aid impact studies in general, particularly the earliest ones, has rested with the lack of a substantive framework within which to view the intergovernmental aid process, one which is both theoretically meaningful for organizing the role of aid in a local or state fiscal context and empirically operational for deriving testable relations of activity level with aid and relevant economic, fiscal, and demographic variables. Any normative evaluation of a particular aid program which is to be reasonably objective must stem from a positive analysis which details the precise nature of the particular

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*Compiled and written by Mr. Robert Gough, principal research associate of the Project.

distribution and the context within which the distribution operates. Previous attempts at formulating such an analysis have either been totally lacking or, at best, incomplete.

The lack of such positive analysis has been due in no small part to the nature of the research from which aid impact studies have stemmed. Research on the fiscal effects of grants-in-aid is a direct outgrowth of research on the determinants of public spending, a relatively broader question concerned simply with identifying the important forces behind governmental fiscal activity. The popular procedure of these determinant investigations was the use of single-equation models, with sets of independent variables being generated somewhat arbitrarily without reference to a formal framework from which relevant relationships could be derived. The emerging concern for identifying modifications in fiscal behavior introduced by grants-in-aid simply maintained the use of the same approach, with the level of aid being one more independent variable in the relevant sets.

However, in recent years, an important development in explaining governmental behavior, particularly aid-induced changes in it, has been an increased attention afforded to theoretical considerations. This has brought about the gradual emergence of a realistic framework within which to analyze the intergovernmental aid process. But despite this development, the approach to investigating the aid impact question is still far from complete. Although theoretical distinctions of the properties and effects of alternative grant structures have in general been adequately demonstrated, these distinctions have rarely been specified in precise mathematical form and carried through to influence the derivation of empirical specifications.

In the past five years, most studies have been conducted from rather narrow perspectives: either theoretical or statistical. Those studies focusing on theoretical considerations have generally ignored whether or not the theory is empirically verifiable. And those interested in empirical questions have usually assumed that all types of grants affect state and local fiscal behavior in much the same way, disregarding a well-developed theory that postulates they do not; they have been little concerned with whether or not estimated coefficients violate *a priori* theoretical or institutional constraints.

This definitive lack of interaction between theory and empirical work has therefore perpetuated the belief that all grants can be empirically handled in the same way. In turn, it has consequently maintained the absence of meaningful comparative information about the fiscal impact of alternative forms of aid. Clearly, therefore, the present responsibility for this absence rests not with the lack of a relevant theoretical model of the state/local fiscal environment, but rather with the superficial adaption of recent theoretical developments in empirical work. The following discussion briefly outlines the nature of the theoretical framework within which the existing body of analysis has taken place, and the peculiar evolution of empirical work which has flowed from it, or perhaps more accurately, has *not* flowed from it.

The framework and the nature of empirical studies

In modeling the fiscal environments of intergovernmental aid recipients, various classification schemes can indeed be used to specify and organize the different forces which affect the fiscal behavior of these recipients. The choice of a particular scheme, although it may seem somewhat arbitrary in some studies, depends almost exclusively upon what aspects of the impact of aid on local (or state) fiscal activity are of specific interest to the analysis to be undertaken. Indeed, this is what is observed across studies. Those studies which have either directly or indirectly addressed the question of the effects of fiscal effort on the intergovernmental aid process have utilized a classification scheme which depends upon need, fiscal ability, and fiscal effort.[1] Those which have been concerned with deriving a cost-inclusive type of model and which therefore have taken account of the effects of input utilization within this process have used a supply-demand type of framework.[2] Area studies which have concentrated on a specific demographic or geographic domain have implicitly utilized a broader classification scheme whereby the recipient government environment is separated into a constituency dimension and an external government authority dimension. And finally, the earliest studies which were of a more aggregate nature classified independent variables according to economic, socioeconomic, and demographic status.[3]

Clearly, all of these classification schemes represent meaningful ways of organizing the derivation of an estimable local fiscal model, and are therefore all relevant for analyzing various aspects of aid in the local fiscal context. An interesting and important feature of these schemes is that regardless of the specific aspect which each is best suited to investigate, as a group, all have been developed to be used in studies which essentially have a common concern, namely to explain in some way -

albeit from different theoretical perspectives - the nature of the fiscal response of a recipient government to an intergovernmental subsidy. What is peculiar, therefore, about their usage in such studies is the deficiency that in not one scheme is the importance of grant structure afforded a central or even corollary emphasis.

Regardless of the classification scheme chosen, if an analysis is at all concerned with assessing the local expenditure and/or tax effects of a grant-in-aid offering from a higher-level government, a complete assessment must incorporate somewhere within the scheme a detailed consideration of the different effects of various types of intergovernmental subsidies. If it does not, there is a good possibility that the resulting empirical model may not be correctly specified. However, even such detailed consideration is no guarantee that empirical relations will be properly specified. Some of the above schemes have been utilized within formal theoretical frameworks which <u>have</u> distinguished one type of grant from another, but which have assumed away the importance of the distinction in the empirical analysis.

A meaningful and to date most productive way of modeling local government fiscal behavior in a manner which allows for the importance of grant structure is within a community choice type of framework, a collective demand adaptation of the standard theory of consumer behavior which presents a realistic and empirically convenient analytical representation of the fiscal decision process confronting an aided government unit. In general, the recipient local unit is viewed as an individual decision maker faced with the responsibility of apportioning a fixed budget among alternative local public and private uses. It is assumed to do this in such a way as to ensure the resulting combination to be optimal. Specifically, the establishment of such an optimum is assumed to be consistent with the maximization of a "community utility function"[4] of the following form:

$$U = U\ (E,\ Z,\ X)$$

where

E = current local public expenditures

Z = local expenditures on either other public or private goods and services

X = vector of relevant forces which influence local activity, i.e., socioeconomic, demographic, and fiscal structure characteristics,

subject to a given budget constraint, which, in the presence of statutory restrictions on borrowing for current purposes, is simply the sum of local community income net of taxes independently levied in the jurisdiction, i.e. local disposable income Y_d, and the amount which can be generated externally in the form of grants-in-aid from higher-level governments, R. The constraint therefore takes the form

$$E + Z \leq Y_d + R$$

where B may be a (linear) function of Z and E.

What is most significant about viewing the intergovernmental aid process within such a framework is that the nature of the decision process, i.e., the mazimization of a utility function under linear constraints, provides a relevant and operational quantitative basis from which meaningful estimable local fiscal relations can be derived. Specifically, maximizing this system with respect to relevant endogenous variables and solving the first order conditions for one or more such variables of interest, say, expenditures, yields the optimal local expenditure function:(5)

(1) $\hat{E} = E\ (Y_d + R,\ X)$

some version of which can be applied directly for estimation purposes. The precise nature of the applied version will be dictated largely by assumptions made about the local preference function, specific deviations from rational mazimization behavior. The particular type of grant distribution in effect, and the extent of linear approximations carried out in its derivation. In other words, the propriety of using such relations as a basis for empirical work rests exclusively with the "correctness" of the community decision model from which they stem. This correctness, i.e., how well in fact the model represents the local fiscal context and intergovernmental aid process in question, ultimately depends upon the reasonability of these assumptions.

It is quite apparent that the application of the principles of standard consumer demand theory to the fiscal behavior of a grant-receiving government presents a valid and, perhaps more important, empirically operational model within which to analyze the fiscal effects of intergovernmental aid. The substantial degree of flexibility offered by the model, particularly for handling alternative assumptions about grant-in-aid structure, clearly facilitates the derivation of meaningful functional relationships which can be used directly for empirical purposes. This is particularly significant given the importance of grant structure in the intergovernmental aid process and the need for empirical specifications to be derived via a procedure which takes this structure into account.

The general adaptation of this type of framework for the collective demand context was originally proposed in 1968 in separate studies by James Henderson and Edward Gramlich, largely for the purpose of exposing and emphasizing the important role played by local budget constraints.(6) However, as the major import of these two studies has become to be the uncovering of the implication that the local response to changes in variables exogenous to the local decision process, particularly aid, is more complicated than would be naively recognized, their most substantial contribution has been to the progress of research into the aid impact question. They represent an important and definitive demarcation in the evolution of this research, and, as a result, present a convenient taxonomic scheme for organizing it.

Very simply, all aid impact studies can easily be classified according to whether they fall into pre- or post-Gramlich-Henderson periods. Those in the "pre" period were conducted without theoretical foundation; those in the "post" were conducted with a meaningful and workable theoretical framework at their disposal. However, these later studies must be further broken down into a majority which has been "empirically negligent" about the theoretical distinctions and a very recent few which have just begun to deal with the significance of these distinctions in empirical terms.

Specifically, some form of equation (1) has been estimated in almost all the empirical studies dealing with the question of the fiscal impact of intergovernmental aid. This has been done typically on a one-year, cross-sectional basis. The major difference between earlier versions and more recent ones is that earlier specifications simply related some form of expenditures to a number of available and plausibly relevant independent variables with little or no reference to an explicit theoretical model. The more recent versions have benefitted from the development of this theoretical framework which has helped to identify the most pertinent independent variables to consider, and not insignificantly, to lend justification to many variables commonly included in the earlier studies.

One of the earliest and most simplified attempts at measuring the expenditure impact of aid was that by George Bishop,(7) who fitted the following equation to school district data from the New England states for 1961/62:

(2) $E/N = b_0 + b_1 R/N + b_2 V/N + b_3 N$

where

E = current school district expenditures

R = state aid for current expenditures

V = equalized valuation of property

N = number of pupils in average daily membership

From a sample of 1400 districts in six states, point estimates of b_1 were found for each state which ranged from 0.06 to 0.80, i.e., an additional dollar of state aid was associated with an increase in per pupil expenditures varying from 6 to 80 cents, indicating that state school aid had an impact ranging from being substantially substitutive in New Hampshire (0.06) to being reasonably stimulative in Massachusetts (0.80).

The significance of Bishop's study(8) is that it apparently established a precedent for the format of subsequent empirical work into the fiscal effects of grants-in-aid. Most empirical models which followed employed essentially the same approach, the only change being that more detailed attention became to be focused on narrow problems of statistical estimation. The distinguishing characteristics of these earlier studies, and one which has remained in empirical work up to the present time, is that all aid is described by the volume of funds transferred.(9) No attention was given to the nature of the influence of the funds for different types of formulas, i.e., no distinction was made between a grant which changes relative prices and one which does not.

Not until the work of Hendersod and Gramlich was such a distinction made. But despite the significance of this, and the fact that their formulations offered at that time the most improved approach to investigating the fiscal impact of intergovernment grants, both studies suffer from the fact that all aid is treated as being exogenously determined.(10) The fiscal interdependencies in both models depend upon the statutory restrictions against borrowing for current purposes and not upon the form of the grant. As did past studies, Gramlich used the dollar amount of matching aid to measure the fiscal effects of variable matching aid. Even if it is appropriate to use the dollar amount of such aid as an independent variable in a reduced-form equation, the variation in the matching rate both among programs and communities implies that such an equation cannot be used to infer the total fiscal impact of a matching distribution precisely because the price effect entailed by matching (i.e., the discount on the recipient's purchase price of the aided public service) is ignored. Only an income effect at best could possibly be inferred.

Two other studies of equal "transitional importance" to those of Henderson and Gramlich, and which appeared at about the same time, are those by James Wilde (11) and Thomas Pogue and L. G. Sgontz. (12) The latter study was the first to bring out that a reverse causation effect running from expenditures to aid may bias single equation estimates of the effects of aid in the case of matching grants. This prompted Pogue and Sgontz to regress aid variables from different public services on a set of independent variables of which aid is usually a part. Consistently high correlations were observed, which suggests that aid and expenditures were either simultaneously determined, that aid was a strict function of expenditures, or that certain factors determining expenditures also influenced aid.

Wilde's study was more theoretical in nature. In fact, in response to growing skepticisms about the intuitive sense of some studies results, it was the first definitive theoretical treatment of the intergovernmental aid process. He was one of the first to question the substantial stimulative findings of some studies, in some cases, expenditure responses to aid significantly in excess of unity. He argued that given the assumptions of the conventional utility maximization model, such effects are inconsistent with rational behavior. Whether a grant is matching or nonmatching, its fiscal impact should not exceed the income effect and that therefore grants should be primarily substitutive. (13)

Wilde's study too, though, is not without its deficiencies. Despite his cogent presentation, Wilde unfortunately left the study incomplete; it was not extended to any empirical analysis. Few investigators in fact have developed complete analytical models to facilitate the empirical treatment of different types of grants. This is a common failure of most studies since the Gramlich/Henderson works. Two important studies which have attempted to develop such models are those by Stephen Barro (14) and Gail Wilensky. (15) But even their examinations both suffer from certain inadequancies, particularly the failure to make meaningful transitions to the empirical analysis. Despite these failures, though, it is nevertheless instructive to consider these works, if for no other reason than for the contributions they make to the progress of studying the intergovernmental aid process.

Wilensky establishes a very careful and concise theoretical description of the constrained utility maximization framework within the school district context. However, in the empirical part of her study, no attempt is made to estimate the parameters of the analytical model. She derives measures of local expenditure response not from regression estimates but from asumptions of extreme values of the income elasticity of demand for education, e_y. The use of this approach was justified in the Michigan context on the basis that all general purpose educational aid in Michigan is distributed almost entirely in unconditional block grant form, which has only an income effect.

Specifically, an expenditure response is estimated for each of 52 districts assuming an e_y of .7 and 1.3, chosen on the basis of previous studies. (16) Using these figures and the observed variation in E/Y, boundaries are established on the change in expenditures as a per cent of income change. (17) A deficiency of this approach is precisely in the assumed boundary conditions on e_y, the lack of consideration of other factors influencing local fiscal behavior, and in general, the observation of a district's expenditure response independent of these other factors. The analysis is not supplemented with any regression estimates to determine the reliability of the simple boundary estimates.

Barro engages in a much more detailed empirical treatment than Wilensky but does not provide an explicit link between his analytical model and his statistical estimation.(18) In his theoretical discussion, he introduces some interesting and pertinent considerations such as the possibility of incorporating the actual matching rate of percentage equalization formulas into a testable expenditure function. But the methodology selected and the lack of relevant data forces the eventual abandonment of this and other factors. Instead, he attempts to infer probable effects of matching forces by estimating the expenditure response to changes in relative prices, measured by a relative price index composed of salary data of instructional personnel. However, because of data constraints on this term, it measures variations only in nation-wide unit costs and not those among states or districts.

Another drawback of Barro's work is the fact that all variables are measured in average state amounts rather than in actual amounts from individual districts, which is a third criticism of most previous studies in general. Except for the Wilensky and Bishop studies, all conventional empirical models estimate their parameters from a sample of state measurements, i.e., they focus on aggregate effects of aid by examining variations among states and not among districts. An advantage to this type of study is that it does offer an overall view of the impact of aid by internalizing the interactions among governments within one state. As such it is valuable for identifying the influences of interstate variations in the distribution of state/local responsibility for providing and financing various public services.

But this type of analysis does have its disadvantages. One unfortunate effect, particularly when only one service is being examined, is the reduction it causes in the sample range of variations. This is particularly damaging to estimates of matching grant effects in the education area precisely because in this area only eight states depend substantially on percentage equalizing distributions, thus providing only eight relevant observations.(19) Therefore, few studies have attempted to measure the matching effects of educational aid.

Perhaps the most important disadvantage in general of the use of state data in a study examining the local effects of state aid is the fact variables are typically introduced in average terms, thus being constant for all districts within a state. This means that attention is not directed at the actual decision-making units of government, which in the final analysis are the individual local governments. Of course, depending upon the goal of the study, this indeed may not be a disadvantage. However, if the goal is in fact one of analyzing the tax and expenditure effects of aid, it very much is.

Despite the drawbacks of the Wilensky and Barro studies, they are valuable in terms of hinting at the type of studies which are needed to arrive at meaningful and unbiased estimates of the fiscal impact of alternative types of intergovernmental aid, viz., studies which explicitly account for the nature of alternative distribution structures in their empirical analysis. Only the most recent phase of research into this problem has produced what may be termed substantive attempts at dealing directly with this need. These attempts are three: by Stephen Dresch, David Stern, and Edward Gramlich.

The distinguishing characteristic of these latest studies is the concern with devising a scheme for measuring the impact of matching grants. Essentially, all have done this by employing the matching rate as a price variable, with the price elasticity presumably capturing the total response of recipient expenditures to a matching form of subsidy. In the first of these attempts,[20] Stephen Dresch assumes that recipient localities react in a direct linear way to the discount offered by matching aid. He therefore enters what he terms the "aid rate", the percentage of total local spending supported by state aid, i.e., $r = R/E$, as an independent variable in an ordinary least squares regression. To compare the impact of matching aid with other forms of aid, he obtains the derivative $dE/dR = \frac{dE/dr}{dR/dr}$ where dR/dr results from the assumption that $\hat{R} = r\hat{E}$. That is, since $R = rE$, and given equation (1), this can be rewritten as $R = r\left[Y_d + R, X\right]$. The estimated version of (1) yields an implicit estimate of R, $\hat{R}$.

Although Dresch's specifications impute a substantial degree of rationality to the decision process of localties, and his a priori restriction that the expenditure relation is linear may be very weak, his results are not intuitively unappealing. Estimates of b_1, i.e., $^{dE}/_{dR}$ range from 0.13 to 0.27, indicating that (as Wilde contended) even the effects of matching aid are not very stimulative.

David Stern[21] also attempts to distinguish the influence of matching aid from nonmatching in empirical work. He does so by trying to deal directly with the nonlinearities inherent in a matching scheme, i.e., he uses a nonlinear estimating technique to estimate the effects of matching aid, with the matching rate being one of the variables entering his derived expenditure equation nonlinearly. However, his analysis is particularly restrictive in that the specification of his expenditure equation is constrained by the very specific nonlinear "community utility function" he chooses. The form of this function implies a particular response to price thereby precluding an independent estimate of it directly from the data.

Edward Gramlich's "second attempt" at dealing with the influence of matching aid is the very latest to appear in the literature.[22] Unfortunately, it falls short of the impact of his first attempt. Despite the fact that this time he carries through the matching grant effects to influence his empirical specifications, he eventually assumes away the nonlinearities by including an instrumental estimate of matching aid which only approximates the inflow of funds from this source. Nevertheless, his analysis does underscore the contention made in the first section of this report that matching grants increase expenditures more the higher is the elasticity of demand. What are missing are meaningful estimates of the price elasticities to support this.

Conclusion

The major value of the constrained utility maximization approach to understanding the effects of grants-in-aid on the decision-making processes of an aided government is that predictive empirical models can be derived from a theoretical framework which is meaningful and reasonably representative of the aided government's budgetary behavior and of the political and community preference factors which influence that behavior. Prior to the development of this framework, the conventional assumption that grant offers do in fact influence the fiscal behavior of a recipient provided the only basis for empirical studies investigating their impact. No formal model guided the construction of these earlier studies, such as Bishop's. In part, this may explain their simple approach. But more realistically, it probably stems directly from the nature of the expenditure determinant studies from which the grant impact question is an apparent offspring.

The formulation of the diagramatic version of this framework subsequently lent theoretical content to these simple models. It established a meaningful perspective from which to view the effects of grants-in-aid. It has been particularly useful in demonstrating the comparatave effects of different types of grants, the effects of such school aid stipulations as floors and ceilings, and minimum tax requirements. But, unfortunately, the subtleties of the framework have been little exploited for the purposes of empirical work. As a result, most empirical studies have suffered numerous weaknesses, the most blatant being a lack of concern with the specific characteristics of grant systems. No work, either empirical or theoretical, has been definitive about the correct specification of intergovernmental grants in a model of local government spending. Therefore, the parameters of local government spending and the intergovernmental aid process in particular have yet to be estimated in a convincing way.

End Notes & References

(1) For example, see Ann R. Horowitz, "A Simultaneous-Equation Approach to the Problem of Explaining Interstate Differences in State and Local Government Expenditures," The Southern Economic Journal, XXXIV (April, 1968).

(2) Most intergovernmental aid studies have used constant price models. For a variation on this, see Walter W. McMahon, "An Economic Analysis of Major Determinants of Expenditures on Public Education," The Review of Economics and Statistics, LII (August, 1970).

(3) See George A. Bishop, "Stimulative Versus Substitutive Effects of State School Aid in New England," National Tax Journal, XVII (June, 1964); Edward F. Renshaw, "A Note on the Expenditure Effects of State Aid to Education," Journal of Political Economy, 68 (April, 1960); Seymour Sacks and Robert Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flow of Funds," National Tax Journal, XVII (March, 1964); Jack W. Osman, "The Duel Impact of Federal Aid on State and Local Government Expenditures," National Tax Journal, XIX (December, 1966).

(4) The given set of preferences exhibited by the decisions of local policy makers are assumed to be reasonably consistent with those of individual constituents.

(5) See the Gramlich and Henderson articles for the first works detailing the derivation of expenditure functions from utility functions. Refer to note 6 for citations.

(6) Edward Gramlich, "Alternative Federal Policies for Stimulating State and Local Expenditures: A Comparison of Their Effects," National Tax Journal, XXI (June, 1968); ________________, "State and Local Governments and Their Budget Constraint," International Economic Review, X (June, 1969); James Henderson, "Local Government Expenditures: A Social Welfare Analysis," The Review of Economics and Statistics, L (May, 1968).

(7) See note 3.

(8) And the earlier study by Renshaw

(9) See note 3

(10) Although Gramlich admits that recipient governments do have come leeway in influencing the level of grants received, particularly in the case of matching grants, and that exogenous treatment of all aid does indeed do a slight disservice to reality, he justified the approach "as a matter of convenience - with the hope that . . . grants are such a bonanza to states (and localities) that the simultaneous equations bias is not serious." Quote from "State and Local Governments . . . ," p. 170.

(11) James A. Wilde "The Expenditure Effects of Grant-in-Aid Programs," National Tax Journal, XXI (September, 1968).

(12) Thomas F. Pogue and L. G. Sgontz, "The Effect of Grants-in-Aid on State-Local Spending," National Tax Journal, XXI (June, 1968).

(13) Given a fixed local budget and no aid for any public good except education, substantially large income effects for this good could be realized only if the income elasticity for alternative goods were zero, which is highly unlikely. Or even in the presence of aid for other public goods, assuming the various marginal propensities to spend on all other such goods to be greater than zero, it is improbable that much more than 100 percent of a general grant or a relatively loosely tied matching grant would be devoted to an aided category.

(14) Stephen M. Barro, "The Impact Grants-in-Aid on State and Local Education Expenditures," Rand Corporation, unpublished paper, 1971.

(15) Gail R. Wilensky, State Aid and Educational Opportunity (Beverly Hills: Sage Publications, 1970).

(16) Brazer estimated an income elasticity for education of .73 using data from 40 large cities in 1952. Harvey E. Brayer, City Expenditures in the United States, Occasional Paper No. 66 (New York: National Bureau of Economic Research, 1959). A University of Michigan doctoral dissertation to which she refers estimated e_y to be 1.31.

(17) Since $e_y = \frac{dE}{dy} Y/_E$, $dE = e_y dY\ (E/Y)$

(18) The equation he finally estimates is a modification of the Bishop type - specifically:

$$E = b_0 + b_1 \frac{R}{N} \frac{N}{H} + b_2 \frac{F}{N} \frac{N}{H} + b_3 (Y - T_y) + b_4 \frac{N}{PH}$$

where T_y = real income taxes per household

H = number of households in the district

F = federal aid

R = state aid

N = number of district pupils

p = an index of the relative price of education

(19) Matching arrangements are extensively used in many state aid programs for such specific purposes as pupil transportation. But the proportion of total aid given on this basis is usually quite small. It can also be reasonably assumed that transportation aid is inelastic relative to aid.

(20) Stephen Dresch and Raymond Struyk, "Grants-in-Aid and Local Fiscal Activity: Intra - and Interstate Analyses of the Local Governments' Economy: Three Essays," National Bureau of Economic Research, unpublished manuscript, 1970.

(21) David Stern, "Effects of Alternative State Aid Formulas on the Distribution of Public School Expenditures in Massachusetts," The Review of Economics and Statistics, LV (February, 1973).

(22) Edward Gramlich and Harvey Galper, "State and Local Fiscal Behavior and Federal Grant Policy," Brookings Papers on Economic Activity, No. 1, 1973.

Part III

Specification of Analytical Model for Empirical Analysis

As a further refinement of the basic model developed in part I, the utility function of districts is specified in terms of real expenditure per public school pupil and real expenditure on "other things" per district family. By real expenditure is meant the dollar expenditure divided by, respectively, the school-input price index (P_s) and the general consumer price index (P_c) - both indices with base $\frac{100}{100}$ in 1960. The school-input price index reflects both the rise in individual input prices and the shift in national average of inputs per child (change in the general perception of what constitutes a "unit" of school education).

(1) Measurement of district's elasticity of substitution under rational behavior of districts (Sample of districts receiving flat grants)

The elasticity of substitution of real school expenditure, E, for real expenditure on other things, A, has expression

(1') $$-\gamma = \frac{\partial E}{\partial A} \frac{A}{E}$$

where $\frac{\partial E}{\partial A}$ is the marginal rate of substitution at (E,A).

Under a flat grant situation, the budget line has equation,

(2') $$A = Y - KE + KR,$$

where R is real school aid per pupil and K, the slope of the budget line, is a "relative price" variable equal to $\frac{N}{Q} \frac{P_s}{P_c}$ (N/Q = ratio of public school pupils to families in the district).

Given some observation of the expenditures A_f, E_f of a district assumed to maximize its utility, and given the district's real income Y, and real grant, R, expression (1') and 2') become

$$-\gamma = -\frac{1}{K} \frac{A_f}{E_f}$$

$$A_f = Y - KE_f + KR$$

By substitution, we obtain

$$\gamma = \frac{Y/K + R - E_f}{E_f}$$

or

$$\frac{1}{1 + \gamma} = \frac{E_f}{Y/K + R}$$

The inverse expression is a measure of the effect of (adjusted) income on E_F and is a more convenient parameter of the utility function than in further applications.

(2) Estimate of district elasticity of substitution as a function of district characteristics under rational behavior of districts (Sample of districts receiving flat grants)

The income effect $\frac{1}{1 + \gamma}$ for any district over the range of observable school expenditure levels is assumed expressable as

(18) $\frac{1}{1 + \gamma} = f\ (Y, S, N, P, T, V, M, L) + \eta$

where η is independently distributed (N(0), and the listed variables have the following definitions

Y = adjusted real income per family in the district*

S = slope of indifference curve at selected point

N = number of public school pupils in the district

P = ration of non-public to total school pupils in the district

T = equalized municipal (non school) tax rate in the district

V = equalized valuation per family in the district

M = variable taking value 1 if the district is in a metropolitan area, zero otherwise

L = variable taking value 1 if the district is rural, zero otherwise

Given a random sample of school districts assumed to maximize their utility under annual flat grants, observations of (a) E, Y, K, R and

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* Family income is reduced by estimated federal and state personal taxes, increased by the estimated fiscal revenue from competitive local taxation of industrial and commercial establishments selling primarily outside the district (and thus unable to pass the tax back to local families).

(b) Y, S = K, N, P, T, U, M, L for each district in some fiscal year can be used to estimate (18). Variables in set (a) serve to measure $\frac{1}{1+\gamma}$, and that measure is regressed on variables derived or selected from set (b) on the assumption that the function in (18) is well approximated by the corresponding linear form. Since three of the sampled states impose some minimum local fiscal effort as a condition for the payment of state aid, the maximization condition (1') only holds with reference to districts in the states where aid is unconditional and to districts in the other three states for which the condition is uneffective (i.e., where expenditure substantially exceeds, or falls short of, the level achieved at the minimum effort). For purposes of the present analysis the available sample is accordingly reduced.

Following a scanning process described in part IV, the regression structure eventually retained and estimated from the available sample is

$$(19) \quad \frac{Ef}{Y/K + R} = a + b_y \frac{1}{Y} + b_s S + b_v V + b_m M + \eta, \quad (S=K),$$

where all parameters are significantly different from zero.

Parameter b_s has the expected positive sign, indicating that the income effect in school expenditures decreases (the absolute elasticity of substitution of E for A increases) as S decreases, or as less steep portions of the indifference field (slope $\partial A/\partial E$) are considered. Since the elasticity of substitution, $-\gamma$, is defined as $\frac{A}{E} \Big/ \frac{\partial A}{\partial E}$, there is some redundancy in estimating $\frac{1}{\gamma + 1}$, rather than the expenditure ratio, $\frac{A}{E}$, as a function of $S = \frac{\partial A}{\partial E}$. However, the expression for $\frac{1}{\gamma + 1}$ is convenient in subsequent computations and it refers to a standard concept in the literature.

(3) <u>Test of rationality of districts in adjusting to flat grants, and correction of elasticity estimates; hypothesis I (Sample of districts receiving flat grants)</u>

It is conceivable that districts under a flat grant situation may be encouraged to incur more than the optimum school expenditure if the size of the school grant is substantial, i.e., they may feel compelled to contribute a certain minimum out of local taxes.

For purposes of empirical estimation, we simplify the earlier specification of the additional aid effect to some function G(R) independent of the district's income effect, i.e., we write:

$$(20) \qquad E_f = \frac{1}{1+\gamma}(Y/K + R) + G(R)$$

so that $$\frac{1}{1+\gamma} = \frac{E_f - G(R)}{Y/K + R}$$

Since G(R) can be assumed positive, the measures $\frac{E_f}{Y/K + R}$ of $\frac{1}{1+\gamma}$ regressed under subsection (2) carry a positive bias In order to obtain unbiased measures and estimating functions of the income effect, as well as estimates of the parameters of G(R), recourse is first had to the following regression, based on equation (2) and structural equation (19) selected under (2) for $\frac{1}{1+\gamma}$:

$$(21) \qquad E_f = (a + b_y\frac{1}{Y} + b_sK + b_vV + b_mM)(Y/K + R) + b_rR + b_qR^2 + \epsilon$$
$$= a(Y/K + R) + b_y(Y/K + R)/Y + \ldots\ldots\ldots + b_rR + b_qR^2 + \epsilon$$

In this expression, G(R) is specified as a quadratic function of R.

Analysis of the results, however, reveals that the above specification of G(R) is not proper. It is found in part V that the additional effect of aid is better expressed as

$$G(R) = H(\bar{R}_i) + h(R - \bar{R}_i) ,$$

where $H(\bar{R}_i)$ is a function of $\bar{R}_i$, the aid going to a district of average ability to pay with real expenditure of $500 per pupil under the aid formula of state i, and h is a parameter. The increase of $H(\bar{R}_i)$ with $\bar{R}_i$ is sharp, while h, the intra-state aid affect, is acceptable as zero in all states except New York. An approach to the direct estimate of parameters under the new specification is proposed in part V but not carried out. However, an indirect estimate of $H(\bar{R}_i)$ and individual state estimates of h and parameters of the income-effect function can be obtained from the results of regression (21).

(4) Test of rationality of districts in adjusting to flat grants and estimation of modified elasticities; hypothesis II (Sample of districts receiving flat grants).

Another hypothesis is that districts refer to a standard minimum (real) school expenditure per pupil, B, whose value is deducted from their total budget (sunk) before any option is exercised. The option, then, is between school expenditures above the minimum and expenditures on other things, under the reduced budget.

The observed equilibrium is

$$(23) \qquad E_f = \frac{1}{1+\gamma'}\,(Y/K - B + R) + B = \frac{1}{1+\gamma'}\,(Y/K + R) + B\left(1 - \frac{1}{1+\gamma'}\right)$$

so that

$$\frac{1}{1+\gamma'} = \frac{E_f - B}{Y/K + R - B}$$

Since B is positive and the ratio $\frac{E_f}{Y/K+R}$ is less than one, the measures of $\frac{1}{1+\gamma'}$ must be smaller than those originally obtained for $\frac{1}{1+\gamma}$ under subsection (2).

It is further hypothesized that the standard minimum, B, is related to the general level of state aid in the state in which the district is located. To obtain estimating functions of the income effects and estimates of B in each of the five st[illegible]s sampled, recourse is had to the following expressions, based on equation (2[illegible] and structural equation (19) selected under (2) for $\frac{1}{1+\gamma}$.

$$(24) \qquad E_f = B + (a + b_y\frac{1}{Y} + b_s K + b_v V + b_m M)\,(Y/K - B + R) + \zeta$$

$$= B + a(Y/K - B + R) + b_y(Y/K - B + R)/Y + \ldots\ldots + \zeta$$

$$(25) \qquad E_f = (a + b_y \frac{1}{Y} + b_s K + b_v V + b_m M)\ (Y/K + R) + B(1 - \frac{1}{1+\gamma'}) + \varepsilon'$$
$$= a(Y/K + R) + b_y(Y/K + R)/Y + \ldots\ldots\ldots\ldots + B(1 - \frac{1}{1+\gamma'}) + \varepsilon'$$

Under (24), for each of a succession of values of B in the likely range (0-400), regression variables other than B (i.e., variables involving the term (Y/K-B+R)) are calculated for each sampled district and the parameters (including the "intercept" term B) are estimated through regression. The set of estimates finally selected is that for which the estimated intercept is closest to the value of B introduced in the calculation of terms in (Y/K-B+R). Under (25), for each of a succession of values of B in the likely range, the variable $(1-\frac{1}{1+\gamma'})$ is estimated for each district as $1-\frac{E_f - B}{Y/K + R-B}$ and the parameters (including the parameter B associated with $(1-\frac{1}{1+\gamma'})$ are estimated through regression. The set of estimates finally selected is that for which the estimated parameter B is closest to the value of B introduced in the calculation of $(1-\frac{1}{1+\gamma'})$

These unorthodox methods were selected as a way of overcoming the problem of identification in either regression. The work was started with expression (25), and the shift to (24) was initiated after it became evident that, in the case of at least two states (Massachusetts and Rhode Island), the selected specification led to estimates that could not be interpreted within its framework. Specifically, the estimates of B turned up strongly negative with compensatory high values of parameters contributing positively to E_f. An apparent explanation is that the term $B(1-\frac{1}{1+\gamma'})$ plays the role of an intercept ($1-\frac{1}{1+\gamma'}$ is close to 1 and exhibits relatively small variance) and is subject to large estimation errors given the concentration of observations on other variables over a limited range away from the origin. The estimated error in B is, indeed, large, and it does not even include the possible effect of misspecification, to which B would also be highly sensitive. It was hoped that the alternate approach through expression (24) would prove more successful. However, it only shifts the problem among states: it gives consistent results for Massachusetts while generating unacceptable values of B with high estimation errors in all other states.

Clearly, systematic analysis of the error and correlation structures is required so that adequate specifications may be developed. Such an analysis will be carried out in the final sequence of this project. Until this is done, the consistent results obtained under either expression for each state may be retained as preliminary findings.

The estimates, B_i, of B eventually obtained in each of the five states will be fitted to

$$B_i = F(\overline{R}_i)$$

where the function F has unspecified parameters and $\overline{R}_i$ is the aid going to a district of average ability to pay with real school expenditures of $500 per pupil, under the aid formula of state i.

(5) Test of district behavior in adjustment to percentage state; hypothesis I
(Sample of districts receiving flat grants in initial year, percentage grants in later sequence of years)

Given information on the elasticity of substitution, γ_t, the real income, Y_t, and the state aid percentage, c_t, of a district in year t, formulas (10) and (16) can be used after appropriate adjustments to calculate the school expenditure optimum $\hat{E}_t$ and the short-sighted equilibrium $\tilde{E}'_t$ occuring in long-run equilibrium of the district under the constraints effective in year t. Given a sample of districts observed over successive years following initiation of a percentage aid system, we may then test whether the actual expenditure E tends toward $\hat{E}_t$ or $\tilde{E}'_t$ over time. In calculating $\hat{E}_t$ and $\tilde{E}'_t$ each year, all constraining variables are empirically observable; the elasticity, γ_t, or the income effect $\frac{1}{1+\gamma_t}$, are obtained each year by reference to their measure in the last "flat-grant" year available and to shifts in relevant district characteristics in succeeding years. The expenditure stretch, $G_t(R_t)$, is obtained as $G_t(R_t) = H(\bar{R}_{it}) + h(R_t - \bar{R}_{it})$, with $H(\bar{R}_{it})$ as estimated under (3) and h set at the average of h values obtained for each state under (3).

In the following, t is measured from the year preceding the first payment of state aid under the percentage grant system, i.e., t = 1 in the first payment year.

(a) Estimation of $\frac{1}{1+\gamma_t}$

For each sampled district, observations of school expenditures and relevant constraints are available for year 0 preceding payments under the percentage grant system. The income effect can thus be obtained individually for each district in that year as

$$\frac{1}{1+\gamma_o} = \frac{E_o - G_o(R_o)}{Y_o/K_o + R_o}$$

Given the linear form of the estimate, Γ, of $\frac{1}{1+\gamma}$ obtained in subsection (3), i.e.,

$$\Gamma_o = a + \sum_m b_j x_j \ ,$$

where each x_j (j= 1 to m) is a measure of district characteristics, we have

$$(26) \quad \begin{aligned} \Gamma_t - \Gamma_o &= \Sigma\, b_j(x_{jt} - x_{jo}) \\ \Gamma_t &= \Gamma_o + \Sigma\, b_j(x_{jt} - x_{jo}) \end{aligned}$$

where $(x_{jt} - x_{jo})$ is the change in district characteristic j between year 0 and year t. Given the available measure of Γ_o, Γ_t is obtained for any future year by reference to (26), after measuring changes in district characteristics from year 0. The common set of parameters b_j used for all state projections is the set of average b_j estimates for all five states obtained under (3).

The only two variables exhibiting significant variation over the years are $\frac{I}{Y}$ and S and they are the only two retained for projection purposes. The latter must be distinguished from the relative price term K_t appearing in subsequent calculations: For purposes of estimating $\frac{1}{1+\gamma_t}$ in the range of the expenditure optimum, the measure required is that of the slope of the district's indifference curve in that range. Thus, the proper measure of S is K_t in the case of a short-sighted equilibrium, but $(1-c)K_t$ under rational optimization.

(b) Estimation of $\hat{E}_t$ and $\tilde{E}'_t$

Expressions (10) and (16) for $\hat{E}_p$ and $\tilde{E}'_p$ calculated in part II must be modified for (1) the expression of expenditures per pupil and income per family in real terms, (2) the payment to districts of flat grants from state and federal sources in addition to percentage aid, (3) adjustments of the school expenditure to which the aid percentage is applied in calculating percentage aid, and (4) the new specification of the expenditure stretch.

If we designate real flat aid per pupil in year t by F_t and the real downward adjustment of the expenditure per pupil is W_t (the deflator being, in each case, the index of school-input prices), the budget-line equation takes the form

$$(27) \quad A_t = Y_t + K_tF_t - K_t(1-c_t)E_t - K_tc_tW_t$$

Under a rational adjustment, we have

$$\gamma_t = \frac{\hat{A}_t}{\hat{E}_t} \frac{1}{K_t(1 - c_t)} \qquad \hat{A}_t = \gamma_t \hat{E}_t K_t (1 - c_t)$$

and, after substitution into (24)

$$(28) \qquad \hat{E}_t = \frac{Y_t/K_t + F_t - c_t W_t}{(1-c_t)\ (1+\gamma_t)}$$

Under a short-sighted adjustment we have at the optimum:

$$\gamma_t = \frac{\tilde{A}_t}{\tilde{E}_t} \frac{1}{K_t} \qquad \tilde{A}_t = \gamma_t \tilde{E}_t K_t$$

and, after substitution into (27)

$$(29) \qquad \tilde{E}_t = \frac{Y_t/K_t + F_t - c_t W_t}{1 + \gamma_t - c_t}$$

However, the equilibrium $\tilde{E}'_t$ incorporates the expenditure stretch, so that

$$\tilde{E}'_t = \frac{Y_t/K_t + (F_t - c_t W_t)(1 + h + h\gamma_t) + H(\bar{R}_{1t})(1 + \gamma_t)}{1 + \gamma_t - c_t - hc_t(1 + \gamma_t)}$$

The same formulas hold in the case of Massachusetts after making the following substitution:

$$\frac{F_t}{1 + c_t} \text{ for } F_t \qquad \frac{c_t}{1 + c_t} \text{ for } c_t$$

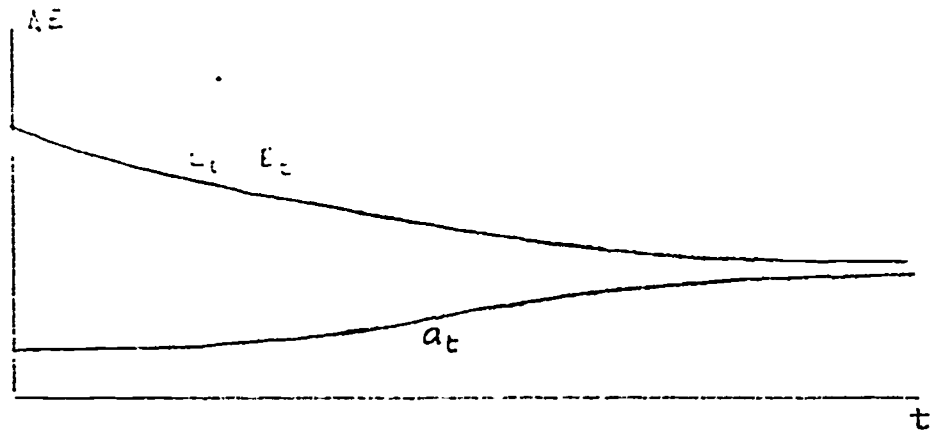
The two equilibria are appropriately modified (see part I) to take account of limits effective in year t on the applicable school expenditure for purposes of computing state aid.

(c) Tes of expenditure path

With E_t designating the observed real expenditure per pupil in year t, the difference $\hat{E}_t - E_t$ is assumed to move steadily and with decreasing error toward some level, a_t, not necessarily zero, according to

$$(30) \qquad \hat{E}_t - E_t = a_t + \frac{\hat{E}_t - E_o - a_t}{1 + b_t t} + \frac{\epsilon}{1 + b_t t}$$

where E_o is the observed expenditure in year zero (last year before payment of aid under a percentage system), a_t and b_t are functions of time to be specified, and ϵ is independently distributed N(0).



Expression (30) can also be written

$$E_o - E_t = a_t b_t t - b_t(\hat{E}_t - E_t) + \epsilon$$

We expect the limiting difference a_t to be proportional to the gap between $\hat{E}_t$ and $\tilde{E}'_t$, i.e.,

$$a_t = a'(\hat{E}_t - \tilde{E}'_t)$$

with $a' = 1$ if the district is behaving short-sightedly, $a' = 0$ if it is optimizing.

We also expect b_t to be proportional to the gap between the initial expenditure, E_o and $\hat{E}_t$, i.e.,

$$b_t = b'(\hat{E}_t - E_o)$$

Expression (30) thus becomes

$$(31) \quad E_t - E_o = b'(\hat{E}_t - E_o)(\hat{E}_t - E_t)t - a'b'(\hat{E}_t - \tilde{E}'_t)(\hat{E}_t - E_o)t + \epsilon$$

Given a sample of districts for which direct observations of E_t, E_o and derived observations of $\hat{E}_t$, $\tilde{E}'_t$ are available over a sequence of years, regression of $(E_t - E_o)$ on the variables associated with b' and a'b' allows estimation of both parameters and, thus, identification of a' and b'. The value of a' obtained in the regression (expected to fall between zero and one) is a measure of district behavior, i.e., the closer to one it is the more short-sighted is the adjustment to percentage grants.

(d) Sampling restrictions

Since the two equilibria, as well as the path leading to them, are similar for districts spending above the limit of applicable expenditures from the inception of percentage aid, only districts spending under the limit in the first or second year of observation are retained for this stage of the analysis.

(6) Test of district behavior in adjustment to percentage grants; hypothesis II
(Sample of districts receiving flat grants in initial year, percentage grants in later sequence of years).

The test is similar to that carried out under hypothesis I, except that the standard minimum, B_{it}, must be estimated each year, for each state, rather than the expenditure stretch. The standard B_{it} is estimated by the formula derived at the end of subsection (4) above, by reference to the aid formula effective in district i for year t.

(a) Estimation of $\frac{1}{1 + \gamma'_t}$

The income-effect is obtained indirectly for each district in year 0 as

$$\frac{1}{1 + \gamma'_o} = \frac{E_o - B_{io}}{Y_o/K_o + R_o - B_{io}}$$

$\frac{1}{1 + \gamma'_t}$ is derived from $\frac{1}{1 + \gamma'_o}$ as before, referring to the appropriate estimates of the parameters of $\frac{1}{Y}$ and S in subsection (4).

(b) Estimation of $\hat{E}_t$ and $\tilde{E}_t$

Referring to expressions (10') and (14') in the appendix to part I, we obtain

$$(31)\quad \hat{E}_t = \frac{Y_t/K_t + F_t - c_t W_t + B_{it}\ (1-c_t)\gamma_t}{(1-c_t)\ \ (1+\gamma_t)}$$

$$(32)\quad \tilde{E}_t = \frac{Y_t/K_t + F_t - c_t W_t + B_{it}\ \gamma_t}{1 + \gamma_t - c_t}$$

(c) Test of expenditure path

The test proceeds as under hypothesis I

Part IV

Summary Description of the Sample

The sample consists of observations on 923 school districts over periods averaging six years for each district. The number of districts and the years of observation are tabulated below by state. Years shown between parentheses are years during which state aid was distributed as a flat grant, state aid in all other years having been on a percentage basis.

	Massachusetts	New York	Rhode Island	Pennsylvania	Vermont
No. of districts	318	390	36	55	124
Years	(1964)	(1959)	(1956)	1966	(1963)
	(65)	(61)	(59)	67	(65)
	67	63	61	68	67
	68	65	63	69	69
	69	67	65	70	70
	70	69	67		
			69		

The distribution of sampled districts by size of pupil population (1968 figures) is shown in the following table for the total sample. All computations were carried out twice, once with the full complement of sampled districts and once with districts of less than 500 pupils removed ("reduced sample" of 801 districts). Of all districts in the sample, 480, or 52%, were included within metropolitan areas.

Number of sampled district_ by size class

Size class	Number of districts	Size class	Number of districts
500	122	2500 - 4999	219
500 - 999	114	5000 - 9999	162
1000 - 1499	77	10,000	121
1500 - 2499	108	Total	923

The selection of districts from the available population (five states) was approximately random within each size class, the representation in each size class increasing with size. However, only districts operating both primary and secondary schools were retained in order to minimize data problems.

The variables measured or estimated for each district-year and incorporated in each district-year "file-card" were as follows:

State Code	
District Code	
Year	School year
Expenditure limit effectiveness	1 if state aid to the district was applied to the actual expenditure of the district 0 if . tate aid was applied to the limit of applicable expenditures
Expenditure limit	Maximum applicable expenditure per pupil in ADA
Formula year	Year <u>minus</u> year previous to first payment year under percentage aid
Public-school pupils	Number of resident pupils in average daily attendance in public schools
Families	Number of families
Income	Average family income

Valuation per family	Equalized valuation (for tax purposes) per family
Current school expenditure	School expenditures incurred on behalf of resident pupils during school year, net of (1) debt service, (2) capital outlays, and (3) transportation expenses
Reference expenditure	Current school expenditure in the preceding year (net of school aid in Massachusetts)
Deduction	Deduction from current school expenditure for purposes of school aid calculation
Total school aid	School aid from all sources paid in school year
Percentage aid	State aid paid as a percentage of previous expenditure or applicab'e expenditure
Federal tax percentage	Percentage of average family income paid as federal income tax
State tax percentage	Percentage of average family income paid as state taxes
Consumer price index	1960 base
School-input price index	1960 base
Municipal tax	Municipal (non-school) local tax per $1000 of equalized valuation
Metropolitan	1 if in metropolitan area, 0 otherwise
Rural	1 if rural (not in any SMSA), 0 otherwise
Size	Number of resident school pupils, 1968
Private ratio	Percentage of resident pupils in other than public schools

Although carried through intermediate processes, the information on aid percentages was not retained in the file. Effective percentages were calculated in computations by reference to percentage aid received and adjusted expenditure of reference.

Sources are listed in appendices A, B, C, D. Data items for which figures were not directly available from listed sources are identified below, together with an explanation of their derivation.

Number of Families . Based on a sample of all 351 districts in Massachusetts, where all school districts are coterminous with municipalities and, thus, included whole in U.S. Census tabulations. From the sample, the following estimate of the number of families per resident pupil was obtained through regression for 1966:

$$\frac{\text{Families}}{\text{Resident pupils}} = 1.12 - \frac{0.17}{10^4} Y + \frac{0.64}{10^5} \rho - \frac{0.40}{10^{10}} \rho^2 + 0.20\, M + 0.09\, L,$$

where Y is average family income interpolated from 1960 and 1970 U.S. Census figures or estimated from NEFP sources (see below), ρ is number of resident pupils (size), M and L are the metropolitan and rural dummy variables.

A first estimate of the ratio was then obtained from each sampled district, each year, by application of the above formula to annual measures of Y, ρ, M and L. The result was then adjusted by reference to the annual movement of the (inverse of the) average number of children under 18 per family for the whole United States. (Department of Commerce, Bureau of the Census, Current Population Reports, Series P-20). Finally, the adjusted ratio was multiplied by the number of resident pupils in the district-year.

Average Family Income

1) Districts with average (A) and median (B) family income data for 1969 (1970 Census) and median (C) family income data for 1959 (1960 Census)

Growth rate: $G = a^{\frac{\log_a B/C}{10}}$

Income in year t: $A\,G^{t-1969}$

2) Districts with average (A) and median (B) family income data for 1969 (1970 Census); no 1960 Census data.

a) Computation of preliminary 1966 family income (Y_1) from NEFP sources, specifically: Dewey Stellar and Gerald Boardman: Personal Income by School Districts in the United States, National Educational Finance Project, 1971. The column used was that showing Adjusted Gross Income per Pupil. In a reversal of the NEFP procedure to calculate the average, the total adjusted gross income of district families for 1966 was obtained by multiplying the listed average by number of public school pupils in average daily attendance in 1968, and the approximate adjusted gross income per family was calculated through division of the total by number of resident pupils in 1966 (Families/Resident Pupils $\sim$ 1).

b) Growth rate based on a sample of all 351 districts in Massachusetts, where the 1959-69 grow..ı could be computed from Census data for all districts. From the sample, the following estimate of 10-year growth (Z) was obtained through regression, with all variables measured in 1966.

$$Z = 1.45 + \frac{0.31}{10^4} Y_1 - \frac{0.82}{10^5} \rho + \frac{0.59}{10^{10}} \rho^2 - 0.04\,M + 0.07\,L$$

An estimate of Z was obtained for each sampled district by application of the above formula to 1966 measures of Y, ρ, M and L.

The growth rate was then calculated as

$$G = a^{\frac{\log_a Z}{10}}$$

c) The income in year t was finally obtained as

$$A\,G^{t-1969}$$

3) Districts with no Census data

a) Computation of preliminary 1966 family income (Y_1) from NEFP sources as in 2) above.

b) Computation of corrected 1966 average family income. Based on a sample of all 351 districts in Massachusetts, where average family income (Y), interpolated for 1966 from Census data, could be compared to Y_1, and the ratio $Y/Y_1 = W$ regressed against district characteristics. The following estimate of W was obtained:

$$W = 0.94 + \frac{0.14}{10^4} Y_1 + \frac{0.14}{10^5} \rho - \frac{0.15}{10^{10}} \rho^2 - 0.11 M + 0.06L.$$

An estimate of W was obtained for each sampled district by application of the above formula to 1966 measures of Y, C, M, L. The corrected income per family for 1966 was then calculated as

$$Y = W \times Y_1$$

c) Growth rates of income were computed as in 2) above

d) The income in year t was finally obtained as

$$Y\,G^{t-1966}$$

Equalized Valuation per Family

Obtained through division of total equalized valuation of district by estimated number of families.

Equalized valuation was tabulated for only two years, with an average interval (T) of five years. Based on the initial (V) and terminal (V') valuation, the annual growth rate was calculated as:

$$G = a^{\frac{\log_a (V'/V)}{T}},$$

and applied to V for an estimate of valuation in all years. However, a limit of 10% was placed on the annual growth rate as a protection against sharp revaluations of the equalizing authority occuring during the measurement interval.

Federal Tax Percentage

Adjusted from NEFP sources (showing total income tax per pupil and adjusted gross income per pupil for all districts) for average-family-income base.

State Tax Percentage

Obtained by year for each state through tabulation of annual state tax revenues other than from corporate income and calculation of the annual ratio of such revenues to estimated total family income. The subsequent application of this percentage to average family income in each district rests on the assumption of neutral incidence of aggregate state taxes (with respect to family income).

Table 10: Non-corporate state tax revenues as a percentage of aggregate family income, by state, by year.

	Mass.	New York	R.I.	Pa.	Vermont
1960	5.05	5.27	5.60	4.71	7.93
1961	4.95	5.20	5.75	4.99	7.64
1962	4.85	5.46	5.39	5.42	7.58
1963	4.76	5.75	5.47	4.91	7.20
1964	4.83	5.44	5.31	5.15	7.35
1965	4.81	5.23	5.67	5.33	7.61
1966	5.26	6.44	5.85	5.34	8.04
1967	6.07	7.26	5.65	5.35	8.18
1968	5.62	7.71	6.35	5.80	8.63
1969	6.44	8.59	6.92	6.33	9.32
1970	6.88	9.42	7.87	6.86	11.93

Sources   Tax revenues; excluding corporate income, by state, by year: Department of Commerce, Bureau of the Census; annual report, State Tax Collections in XXXX.

Family income by state, by year: Interpolation of 1960 and 1970 U.S. Census figures.

Consumer Price Index

Weighted average of four series, (all adjusted to 100 in 1960), as follows:

a) Average annual salary of instructional staff in regular public elementary and secondary schools, 1960-61 to 1970-71.

Source: U.S. Office of Education, National Center for Educational Statistics: Projections of Educational Statistics to 1980-81, Table 37, p.89/

Weight: 0.73

b) Consumer price index for three selected commodity groups: electricity, fuel, durable goods.

Source: (see Consumer price index above)

Weights: 0.09 for each of the three series.

Table 11: Consumer price index and School-input price index

Year	Consumer price	School-input price
1960	100.0	100.0
1961	101.0	103.7
1962	102.2	106.9
1963	103.7	111.3
1964	105.0	113.6
1965	107.3	120.9
1966	110.6	123.5
1967	114.3	131.0
1968	119.8	139.0
1969	126.9	148.6
1970	133.4	159.3

Number of resident pupils in 1968

Tabulated for 1968 or neighboring year, depending on state. The number of resident pupils in other years, entering in previous computations, was estimated on the basis of tabulations for only two years, with an average interval of five years. The procedure was as that reported for the estimation of equalized valuations.

Ratio of resident pupils in non-public schools to total resident pupils in 1968

Tabulated for 1968 or neighboring year, depending on state.

District's valuation contributed by housing

This figure was not incorporated in the district-year file but was estimated in subsequent programmed computations. It is used to adjust family income for the potential net fiscal revenue of the district from property taxes applied to industrial and commercial properties selling primarily outside the district. With $\bar{V}$ designating total equalized valuation and $\bar{H}$ the value of housing in the district, the adjustment was calculated as $m(\bar{V}-\bar{H})$, where m is an estimated net tax revenue recoverable per dollar of non-housing property. The more of the non-housing property consists of establishments selling primarily within the district, the more $(\bar{V}-\bar{H})$ overestimates the amount of "exploitable" property; however, available data prevent the proper distinction from being made.

The value of housing in each district was, again, based on the Massachusetts sample, for which ratios of housing to total valuation are available for each district in 1972. (Source: Massachusetts Bureau of Local Assessment: Equalization data sheet for 1972)

Regression of $\bar{H}$ on average family income (Y) yielded the approximate formula;

$$\bar{H} = 1214 + 1.4\,Y$$

This was applied to estimated income in each district to provide an estimate of $\bar{H}$.

Part V

Empirical Results

(1) Sample Adjustments

The samples retained for each state were eventually reduced in the light of two criteria:

(1) It was found in the comparison of (adjusted) NEFP figures and Census figures for Massachusetts that most NEFP errors occur in the form of extreme magnitudes, resulting from improper imputations of income between school districts serving a common population. There is thus a good probability that NEFP-derived family-income measures for other states are grossly in error if they fall outside the 4,000-30,000 range (1965 figures). Accordingly, districts in Vermont and New York whose family-income measure (from NEFP sources) was outside that range were discarded.

(2) It is shown in the theoretical discussion (Part I) that, where a minimum effort or expenditure floor is imposed as a condition for full payment of the equalizing flat grant, many of the districts that would spend less than the floor in the absence of that condition are induced to raise their expenditure up to it. The strength of the incentive varies with the level of equalizing aid, the height of the floor and the amount of aid that remains guaranteed irrespective of performance. In all cases, however, a substantial probability exists that a district observed to spend at or near the floor is responding to the condition for full aid and, thus, is not equating its marginal rate of substitution between education and other things with the slope of its budget line. In all three states where a minimum spending condition was in

effect (i.e. all states except Pennsylvania* and Massachusetts), all districts with an expenditure within 10% of the floor were accordingly eliminated.**

Since the expenditure minima were fairly low, the result was a loss of most districts at the bottom of the spending scale in each of the affected states. Combined with the elimination of districts with very low NEFP income measures (some of which may, in fact, have had low incomes) under the previous adjustment, this tends to starve the remaining sample of "disadvantaged" districts. However, a run of the initial regressions for New York both before and after elimination of the districts indicates that parameter estimates are not highly sensitive to the change.

Sample sizes after all eliminations were as follows:

Massachusetts	New York	Rhode Island	Pennsylvania	Vermont
314	316	36	55	88

*Pennsylvania did impose a minimum expenditure condition. However, the cut in aid for districts spending under the "foundation" amount was progressive, putting low spending districts under what amounted to a percentage equalizing formula.

**The expenditure floor in the case of Rhode Island was set well below the already-low "foundation" expenditure and was ineffective.

(2) Initial measurement of district elasticities of substitution on the assumption of fully rational decisions. (Sample of districts receiving flat grants)

The last or next-to-last available year in which flat equalizing grants were paid was selected for each state, i.e.

Massachusetts	New York	Rhode Island	Vermont
1964	1961	1959	1965

It was impossible, in the case of Pennsylvania to obtain complete information for years previous to initiation of the percentage equalizing formula (1965). Accordingly, the earliest year available under percentage equalization was used to measure the impact of flat grants, on the expectation that aid at that early stage would still be treated as exogenous by districts. Clearly, however, the results for Pennsylvania should be interpreted with caution.

The income-effect measure $\frac{Ef}{Y/K+R}$ was regressed in each of the two large-sample states (New York and Massachusetts) against different combinations of variables Y, S=K, N, P, T, V, M, L, their transforms Y^2, $\frac{1}{Y}$, $\frac{K}{Y}$, N^2, and products of Y with members of the set (N, P, T, V). Specifically, three alternative "cores" were selected: (Y, Y^2, K), $(\frac{1}{Y}, K)$, $(\frac{K}{Y}, K)$, and each was combined with the set $(N, N^2, P, T, V, M. L)$ and the products YN, YP, YT, YV. After computing all three regressions, the following "reduction" procedure was used for each:

(a) all terms with a calculated t statistic less than 0.25 were rejected

(b) all terms with a calculated t statistic consistently less than 1.5 in successive regressions involving alternative eliminations of other variables (other than those in the core) were rejected.

The last two steps of the reduction are reported below for the two cores providing the highest proportion of explained variance.

Table 12: Parameter and standard error estimates;

Regression of $\frac{Ef}{Y/K+R}$ on selected variables.

[All quantities multiplied by 1000]

Variables:	C^{te}	$\frac{I}{Y}$ 10^3	K	V	M	P	T
New York							
$R^2 = 0.81$	-61.87	382 (14)	65.56 (12.02	0.60 (0.06)	7.96 (1.24)	-6.24 (13.05)	0.14 (0.10
$R^2 = 0.81$	-66.34	386 (12)	70.86 (4.29)	0.60 (0.06)	7.93 (1.19)		
Massachusetts							
$R^2 = 0.22$	-20.05	226 (46)	29.65 (4.61)	0.21 (0.08)	2.89 (2.05)	0.65 (10.14)	0.05 (0.14)
$R^2 = 0.22$	-17.67	229 (44)	28.23 (3.14)	0.10 (0.03)	3.69 (1.80)		

Variables:	C^{te}	$\frac{K}{Y}$ 10^3	K	V	M	P	T
New York							
$R^2 = 0.83$	-10.22	478 (16)	-1.31 (10.51)	0.60 (0.05)	7.79 (1.18)	0.79 (12.16)	0.15 (0.09)
$R^2 = 0.83$	8.18	478 (14)	-1.90* (4.58)	0.60 (0.05)	7.92 (1.13)		
Massachusetts							
$R^2 = 0.23$	6.98	207 (42)	4.29 (5.71)	0.24 (0.09)	2.42 (1.99)	3.89 (10.14)	0.09 (0.14)
$R^2 = 0.22$	12.82	205 (40)	1.51* (5.15)	0.10 (0.03)	3.55 (1.80)		

*Final elimination of K was not carried out because of program failure.

One major disappointment of the above investigation was the failure to discover any significant effect of variable T, the "municipal tax rate". This disappointment was the more severe as the gathering and checking of the necessary data required an inordinate amount of work.

The scanning of alternative structures suggests that either of the two following linear forms is appropriate for the income-effect function:

$$(19) \quad \frac{Ef}{Y/K + R} = a + b_y \frac{1}{Y} + b_s S + b_v V + b_m M + \eta \qquad (S=K)$$

$$(19) \quad \frac{Ef}{Y/K + R} = a + b_y \frac{S}{Y} \quad b_v V + b_m M + \eta' \qquad (S=K)$$

In spite of the slight excess of explained variance under (19'), expression (19) was retained in view of the linear separation of the effects of S and Y it affords.

Estimates of (19) were carried out for each state and the results are tabulated on the next page. The parameters exhibit satisfactory stability across the five states and all signs are in accordance with theoretical expectations. The relatively low magnitudes (and low overall income-effect) measured for Massachusetts are explainable in terms of the lesser bias of income-effect measures in that state as compared to the rest (see next subsection). The significant positive effect of equalized-valuation-per-family probably reflects a tendency of districts to discount somewhat the sacrifice imposed by public expenditures when the associated tax rate (expressed on a valuation basis) is low.

Table 13: Estimate of parameters and their standard errors; income-effect function (19).

[All quantities multiplied by 1000]

Parameters	a	$b_y/10^3$	b_s	b_v	b_m
New York					
$R^2 = 0.81$	-66.34	386 (12)	70.86 (4.29)	0.60 (0.06)	7.93 (1.19)
Massachusetts					
$R^2 = 0.22$	-17.67	229 (44)	28.23 (3.14)	0.10 (0.03)	3.69 (1.80)
Vermont					
$R^2 = 0.75$	-52.04	354 (22)	55.70 (11.24)	0.30 (0.12)	*
Rhode Island					
$R^2 = 0.77$	-77.06	348 (51)	74.31 (11.25)	0.30 (0.10)	0.27 (2.33)
Pennsylvania					
$R^2 = 0.87$	-58.51	424 (33)	51.60 (6.60)	0.40 (0.12)	2.57 (1.89)

*The "large-city SMSA" variable, M, is excluded in Vermont regressions as it takes value zero for all districts.

Given the possible importance of variable P (ratio of nonpublic school pupils), its significance was tested for all states in association with the retained set of variables. It was found significant only in the state of Rhode Island, suggesting the following alternate estimate.

Parameters	a	$b_y/10^3$	b_s	b_v	b_m	b_p
Rhode Island						
$R^2 = 0.84$	-24.33	369 (44)	13.35 (20.24)	0.40 (0.10)	3.34 (2.20)	-76 (22)

(3) <u>Test of rationality of districts in adjusting to flat grants and correction of elasticity estimates</u>; <u>hypothesis I (Sample of districts receiving flat grants)</u>

The test and corrected estimates are obtained through the regression previously specified (Expression (21) in III, 4.):

$$(21)\quad E_f = a(Y/K + R) + b_y\,(Y/K + R)/Y + b_s(Y/K + R)K + b_v(Y/K + R)V + b_m(Y/K + R)M + b_rR + b_qR^2 + \xi$$

The results are tabulated on the next page by state, with and without the quadratic term b_qR^2.

Looking first at the coefficients of the income-effect function, their stability across states is again satisfactory. As expected, the corrected coefficients in table 14 generate smaller income-effects than those estimated in table 13 without correction for the additional effect of R: The negative intercept, a, has lesser absolute value and the major positive contributors, b_y and b_s, are generally lower (except in Massachusetts where the very low level of R makes the corrections ineffective).

The additional effect of R varies among states, but the variation can be related systematically to the average level of aid in the state. In the attached diagrams, the estimated function $A = b_rR + b_qR^2$ is plotted as a dotted line for each state over the range of R in the state (excluding the upper and lower decile). The estimated function $\bar{A} = \bar{b}_rR$ (where $\bar{b}_r$ designates the coefficient of R when the structure excludes R^2) is also plotted as a full straight line. It is apparent that the function $\bar{A}$ has the same slope as the linear approximation of A in the aid range, but is shifted downward, the difference being picked up by other parameters of the regression. (A reverse translation occurs in the case of Massachusetts, where the A estimate is negative in the aid range).

Table 14: Estimate of parameters and their standard errors; expenditure function (21).

All quantities multiplied by 1000.

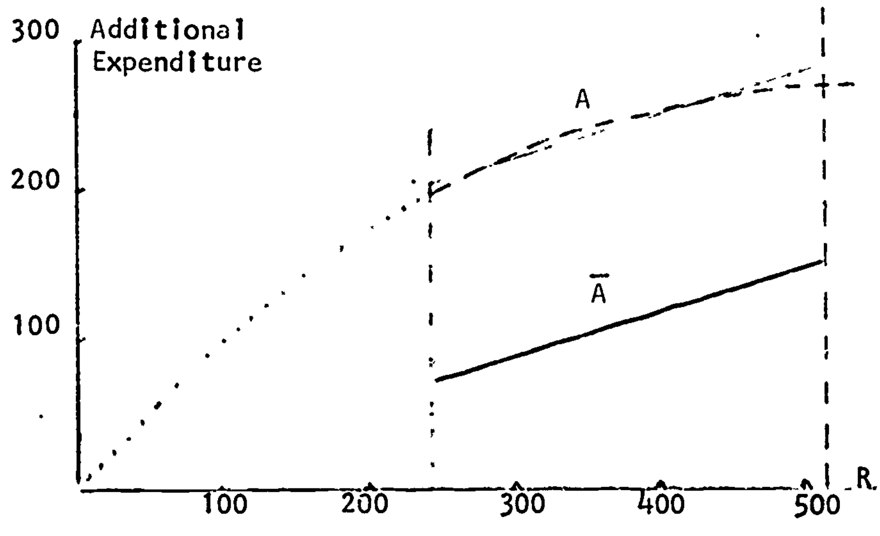
Parameters	a	$b_y/10^3$	b_s	b_v	b_m	b_r	b_q
New York	-33.91	209	27.18	0.64	8.01	1019	-0.97
$R^2 = 0.60$	(4.83)	(33)	(6.77)	(0.05)	(1.02)	(226)	(0.29)
	-44.05	294	43.11	0.60	8.24	291	
$R^2 = 0.59$	(3.82)	(21)	(4.87)	(0.05)	(1.03)	(59)	
Massachusetts	-31.81	333	42.96	0.08	4.33	-3454	28.14
$R^2 = 0.26$	(8.04)	(53)	(5.67	(0.04)	(1.51)	(1265)	(9.80)
	-19.33	233	29.83	0.10	4.54	55	
$R^2 = 0.24$	(6.84)	(40)	(3.39)	(0.04)	(1.52)	(329)	
Vermont	-37.01	237	34.65	0.29		2190	-7.21
$R^2 = 0.14$	(13.39)	(64)	(12.85)	(0.11)		(748)	(2.20)
	-59.85	410	62.53	0.11		-200	
$R^2 = 0.02$	(11.95)	(38)	(10.07)	(0.09)		(178)	
Pennsylvania	-25.36	208	10.63	0.70	2.15	2143	-4.56
$R^2 = 0.42$	(12.00)	(96)	(15.86)	(0.17)	(1.93)	(988)	(2.12)
	-45.63	389	40.15	0.45	2.06	75	
$R^2 = 0.36$	(7.72)	(48)	(8.29)	(0.14)	(2.00)	(243)	
Rhode Island	-41.87	194	45.94	0.35	1.26	1367	-3.66
$R^2 = 0.37$	(27.28)	(97)	(23.41)	(0.11)	(2.46)	(1018)	(3.34)
	-60.60	269	65.14	0.35	0.97	277	
$R^2 = 0.35$	(21.35)	(70)	(15.60)	(0.11	(2.45)	(228)	

Table 14: Estimate of parameters and their standard errors; expenditure function (21).

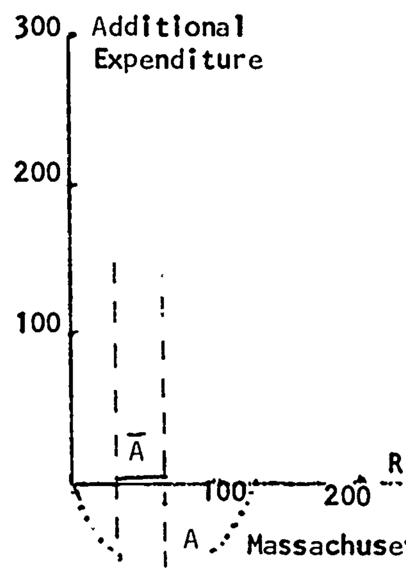
All quantities multiplied by 1000.

Parameters	a	$b_y/10^3$	b_s	b_v	b_m	b_r	b_q
New York	-33.91	209	27.18	0.64	8.01	1019	-0.97
$R^2 = 0.60$	(4.83)	(33)	(6.77)	(0.05)	(1.02)	(226)	(0.29)
	-44.05	294	43.11	0.60	8.24	291	
$R^2 = 0.59$	(3.82)	(21)	(4.87)	(0.05)	(1.03)	(59)	
Massachusetts	-31.81	333	42.96	0.08	4.33	-3454	28.14
$R^2 = 0.26$	(8.04)	(53)	(5.67	(0.04)	(1.51)	(1265)	(9.80)
	-19.33	233	29.83	0.10	4.54	55	
$R^2 = 0.24$	(6.84)	(40)	(3.39)	(0.04)	(1.52)	(329)	
Vermont	-37.01	237	34.65	0.29		2190	-7.21
$R^2 = 0.14$	(13.39)	(64)	(12.85)	(0.11)		(748)	(2.20)
	-59.85	410	62.53	0.11		-200	
$R^2 = 0.02$	(11.95)	(38)	(10.07)	(0.09)		(178)	
Pennsylvania	-25.36	208	10.63	0.70	2.15	2143	-4.56
$R^2 = 0.42$	(12.00)	(96)	(15.86)	(0.17)	(1.93)	(988)	(2.12)
	-45.63	389	40.15	0.45	2.06	75	
$R^2 = 0.36$	(7.72)	(48)	(8.29)	(0.14)	(2.00)	(243)	
Rhode Island	-41.87	194	45.94	0.35	1.26	1367	-3.66
$R^2 = 0.37$	(27.28)	(97)	(23.41)	(0.11)	(2.46)	(1018)	(3.34)
	-60.60	269	65.14	0.35	0.97	277	
$R^2 = 0.35$	(21.35)	(70)	(15.60)	(0.11	(2.45)	(228)	

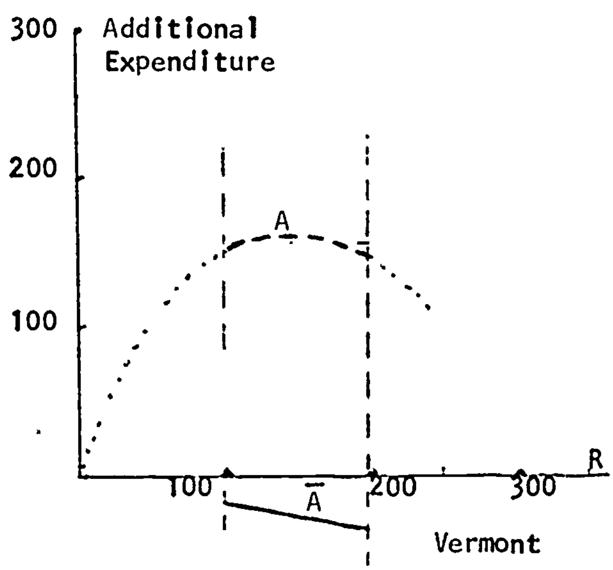
Graphs of functions A and $\bar{A}$



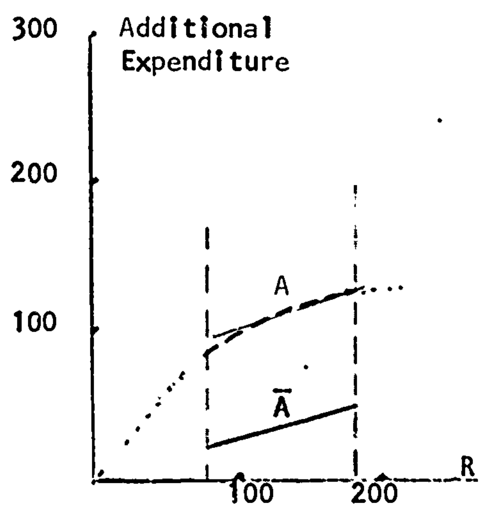
New York



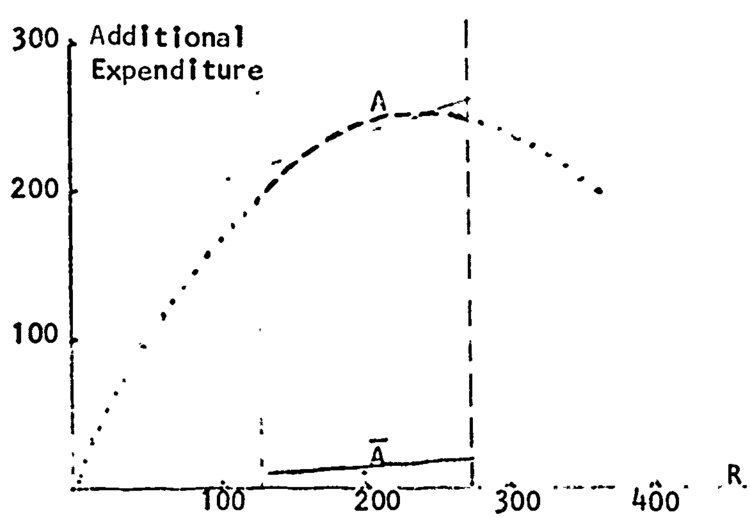
Massachusetts



Vermont

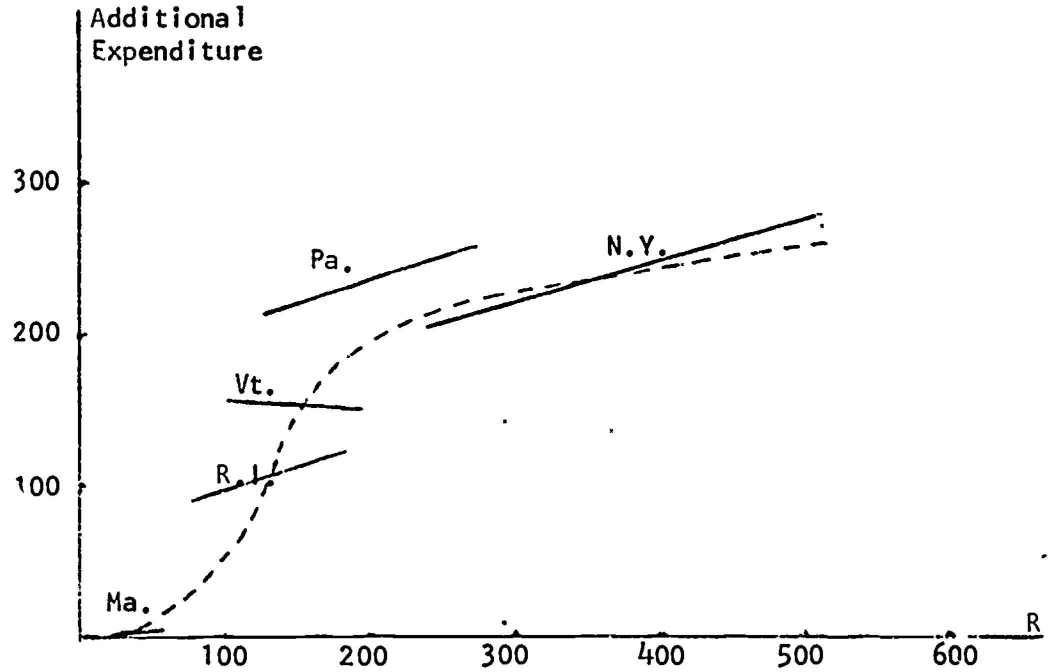


Rhode Island



Pennsylvania

For easier interpretation, the linear approximations of A in the respective ranges of state aid are plotted together in diagram (5) below. Since, in the case of Massachusetts, the negative estimate of A must be rejected on a-priori grounds, the plot is that of $\bar{A}$.



The finding is that the average level of aid in the state has a major impact on the school expenditure of all districts, but that variations in aid level among districts in any given state have a much smaller effect. The effect of differential aid among districts in the state is well measured by $\bar{b}_r$ in the regression that excludes R. Not only are $\bar{b}_r$ estimates very small in all states except New York and Rhode Island, but they are all easily acceptable as zero except in New York.

The proper specification of G(R), therefore, is

$$G(R) = H(\bar{R}_i) + h(R-\bar{R}_i),$$

where $H(\bar{R}_i)$ designates a function of average aid per pupil paid in state i and h is a parameter. Since, in further applications, it is important that the state aid of reference be independent of district behavior, the value actually selected for $\bar{R}_i$ is the aid received by a district of average ability-to-pay with (real) expenditure per pupil of $500, under the formula in effect in state i. The hand-fitted dotted line in diagram 5 suggests that $H(\bar{R}_i)$ is S-shaped, with a sharp rise in the $100-200 range of average state aid.

An estimate of all parameters under this new specification can be obtained by regression of E_f over a joint sample of districts in all five states, with the quadratic $b_r R + b_q R^2$ replaced by the sum of $h(R - \bar{R}_i)$ and a linear expression of powers of $\bar{R}_i$. Such a calculation will be carried out in the final sequence of this project. Meanwhile, we can accept individual state results as follows:

(a) <u>Estimates of parameters of the income-effect function</u>:
Accept estimates in table 14 under the quadratic specification of the additional aid effect (under the linear specification for Massachusetts).

(b) <u>Estimates of h</u>
Accept estimates of b_r $(\bar{b}_r)$ under the linear specification of the additional aid effect.

(c) <u>Estimates of $H(\bar{R}_i)$</u>
Excluding Pennsylvania (which may reflect some of the incentive effect of percentage aid), the following

points of the function are available from diagram 5 :

R_i	$H(\bar{R}_i)$
55	25
108	100
151	160
372	240

A recapitulation is offered in table 15 below. In the absence of parameter estimates of the function $H(\bar{R}_i)$, the table shows, instead, available points of the function for each state (i.e., observed $\bar{R}_i$ and approximation of $H(\bar{R}_i)$).

Table 15: Parameter estimates and points of $H(R_i)$ under re-specification of $G(R)$

All parameters multiplied by 1000

	a	b_y	b_s	b_v	b_m	h	$H(\bar{R}_i)$
New York	-33.91	209	27.18	0.64	8.01	291	240/372
Massachusetts	-19.33	233	29.83	0.10	4.54	55***	2.5 /55
Vermont	-37.01	237	34.65	0.29		-200*	160/151
Pennsylvania	-25.36	208	10.63**	0.70	2.15	75***	
Rhode Island	-41.87	194	45.94	0.35	1.26	277*	100/108

*t 1.5 **t 1 ***t 0.5

(4) Test of rationality of districts in adjusting to flat grants and estimation of modified elasticities; hypothesis II (Sample of districts receiving flat grants)

As indicated in part III, the methodologies so far utilized to estimate the standard minimum expenditure, B, and associated parameters of the income-effect under hypothesis II, have proven unsuccessful. The iterative approach based on expression (24) allows specified B and estimated B to converge in Massachusetts, but not in other states. Conversely, expression (25) allows convergence in only New York and Vermont, with a dismal coefficient of determination in the latter case. Until the behavior of the samples is better understood and estimates can be obtained consistently across all states, the results presented below must be treated as highly suspect.

Estimates of parameters and their standard errors; expenditure functions (24) or (25) with approximate convergence of specified and estimated B.

All quantities multiplied by 1000.

	a	$b_y/10^3$	b_s	b_v	b_m	$B/10^3$
New York	-42.65	252	39.86	0.48	8.47	212
$R^2 = 0.56$	(7.15)	(59)	(10.44)	(0.04)	(1.06)	(90)
Massachusetts	-12.85	181	23.24	0.10	4.51	59
$R^2 = 0.24$	(13.67)	(102)	(12.31	(0.04)	(1.51)	(99)
Vermont	-34.46	221	36.81	0.13		171
$R^2 = 0.01$	(26.78)	(188)	(26.01)	(0.09)		(202)

As could be expected, the values obtained for B_i are in the neighborhood of corresponding values of $H(\bar{R}_i)$ under hypothesis I and it is apparent that $F(\bar{R}_i)$ will be similar to $H(\bar{R}_i)$.

(5) Test of district behavior in adjustment to percentage state grants; hypothesis I
(Sample of districts receiving flat grants in initial year, percentage grants in later sequence of years).

The analysis was carried out as described in part III, section (5), based on observations of sampled districts in each of the five states over (a) the last available year under flat grants and (b) the available sequence of years under percentage-equalization. Only those districts spending under the limit of applicable expenditures in the first or second year of the percentage-equalization sequence were retained, with the result that the number of districts included in the final sample was only 556, distributed as follows by state:

New York	Massachusetts	Vermont	Pennsylvania	Rhode Island
182	239	80	19	36

Processing of the information was not carried beyond the projection of $\hat{E}_t$ and $\tilde{E}_t$, after the following pattern was discovered: Compared to actual expenditures, E_t , the projected optimum $\hat{E}_t$ shows an increasing downward bias over time, the bias being larger the greater the relative increase in average state aid; the projected "short-sighted" equilibrium $\tilde{E}_t$ fits the actual series E_t closely, but does so by being higher than $\hat{E}_t$ rather than lower as the theoretical analysis would have led one to expect. Under the circumstances, the final step of the analysis (step c) becomes irrelevant.

The obvious explanation of the downward bias of $\hat{E}_t$ projections is that hypothesis II is, in fact, the correct one, i.e., there is a minimum school expenditure base that increases with the general level of state aid, and districts seek their optimum (long or short-sighted) in terms of <u>additional</u> school expenditures and expenditures on other things, after "sinking" the base school expenditure. Under such a hypothesis, both the projections of $\hat{E}_t$ and $\tilde{E}_t$ are lifted over time by increases in the average level of state aid, with the result that $\hat{E}_t$ must exceed $\tilde{E}_t$ and, presumably, E_t as well. By contrast, projections under hypothesis I (expenditure stretch in response to <u>exogenous</u> state aid) only permit $\tilde{E}_t$ to be affected by changes in the overall level of aid.

In the absence of any rationale for the optimum to fall short of the actual expenditure, the finding that, under hypothesis I, $E_t - \hat{E}_t$ is generally positive and increases with relative changes in average state aid, effectively disproves hypothesis I.

(6) <u>Test of district behavior in adjustment to percentage grants; hypothesis II</u>
<u>(Sample of districts receiving flat grants in initial year, percentage grants in later sequence of years)</u>.

The test will be carried out as described in III, (6), after adequate estimates of $H(\bar{R}_i)$ and associated parameters of the income-effect function have been obtained.

Conclusions (Preliminary)

A. The spending behavior of school districts under flat (exogenous) grants is incompatible with ordinary assumptions concerning utility functions and/or utility maximization under budget constraints. Two alternative hypotheses appear reasonable concerning the actual decision model of districts.

Hypothesis I Districts feel compelled to spend on schools beyond their rational optimum in response to substantial levels of state aid.

Such an hypothesis is empirically validated in the context of a sample of school districts, each observed over one year under flat state grants. The specific hypothesis most congruent with the data is that the additional school expenditure in response to state aid is fairly uniform among all districts in any given state, and that it is related through a S-shaped function to the average level of state aid; the estimated effect of differential aid levels among districts in the state is easily acceptable as zero in all states except New York (where average state aid is well above that of other states in the sampled years).

Hypothesis I, however, is invalidated in the context of the historical sample, when the behavior of districts is observed over a span of years that includes one initial year under flat grants and a sequence of years under percentage grants. Irrespective of assumptions made concerning the perception of percentage-aid by districts, the utility-function parameters derived from observed behavior in the flat-grant year under hypothesis I lead to systematic underestimation of the school expenditure under percentage grants, the underestimate increasing with the ratio of average state aid in year t to average state aid in the initial year. Even though corresponding projections under hypothesis II have not yet been carried out (see below), it is apparent that utility parameters calculated under the latter will generate no such bias.

Hypothesis II   Districts "sink" a basic school expenditure related to the average level of state aid, then mazimize a utility function of "additional" school expenditures and other expenditures under a total budget that excludes the "sunk" portion.

Because of imperfect specification of the stochastic model and incomplete analysis of the sample, satisfactory tests and estimates in the context of the flat-grant sample could not be obtained. It is expected that a more systematic approach will yield acceptable results within a four-week period.

B. It is likely that, under percentage grants based on previous-year performance, school districts exhibit a "short-sighted" behavior, i.e. treat the annual aid received as exogenous. This would lead to an equilibrium school expenditure that is less than the rational (or fully-informed) optimum, the substitution-effect in favor of school expenditures having been wiped out. A secondary effect would be even greater disequalization of school expenditures among districts that can be expected in any case under "percentage equalizing" systems.

A simple procedure has been devised to test the "short-sighted" equilibrium hypothesis with reference to the historical sample. The test is based on a comparison of projected school expenditures (under short and long-sighted behavior) with actual expenditure series over the available sequence of percentage-grant years, the parameters of each district's utility function having been estimated in the initial flat-grant year. Under hypothesis I concerning district decision models, however, the series of projected optimum expenditures falls below the series of actual expenditures, indicating that hypothesis I is incorrect and making the proposed test of "short-sightedness" irrelevant. The test under hypothesis II could not yet be carried out, in view of the lack of adequate estimates of utility-function parameters under that hypothesis.

C. Based solely on factors analyzed in this report, the preferable system of general-purpose state grants to districts is the old foundation type (equalizing flat grants), with a foundation level truly reflective of contemporary standards of adequacy, an equitable measure of district ability-to-pay, and a firm obligation of districts to spend up to the foundation level as a condition for payment of any state aid.

Appendix A - Glossaries

GLOSSARY -- MASSACHUSETTS

Equalized Valuation - the equalized valuation of the aggregate taxable property in a city or town, as most recently reported.

Reimbursable Expenditures Applied - the total amount expended by a city or town during a fiscal year for the support of public schools, excluding the costs of transportation, school lunch programs, special education classes, and capital outlay. Also not included are certain receipts: tuition receipts, federal aid, proceeds of any invested funds, and grants, gifts, and receipts from any other source, to the extent that such receipts are applicable to such expenditures.

School Aid Percentage - the difference between 100% and the product, to the nearest 0.1%, of 65% times the valuation percentage for each city and town. (The maximum percentage of state support shall be 75% and the minimum shall be 15%.)

School Attending Child - any minor child in any school, kindergarten through grade twelve, resident in a city or town.

Valuation Percentage - the proportion, to the nearest 0.1%, which the equalized valuation per school attending child of a city or town bears to the average equalized valuation per school attending child for the entire state.

Net Average Membership - any minor child in any public school, kindergarten through grade twelve, resident in a city or town.

GLOSSARY -- NEW YORK

(State) Aid Ratio - ratio computed from Full Valuation, reflecting the full real property valuation behind each RWADA as compared to the State average Full Valuation per State WADA.

- used to determine State's share of district's operating expenditures, of approved Debt Service and Capital Outlay, and to compute size corrections and aid under special programs.

$$= 1.00 - \frac{\text{Full Valuation/RWADA of district}}{\text{State Avg. Full Valuation/WADA of State}} \times K^{*}$$

* K usually = .51

Approved Operating Expenses - expenditures for the regular day-to-day program. Excluded are expenditures for capital outlay and debt service, pupil transportation, services from a County Vocational & Extension Board (CVEEB) or Board of Cooperative Educational Services (BOCES), tuition payments to other districts, interfund transfers, and expenses which do not conform to law or regulations. Revenues excluded are Federal and special State aids, rentals, sales & fees, and proceeds from borrowing.

Average Daily Attendance (ADA) - the aggregate number of attendance days of pupils in a public school operated by a school district plus the total number of instruction days for pupils instructed at home by the school district (including pupils receiving instruction thru 2-way telephone communication systems) divided by the number of days of actual session.
- computed only for attendance of pupils attending district's schools; equals the measure of the number of pupils educated used in the State aid formulas; forms the basis for determining WADA and RWADA.

Weighted Average Daily Attendance (WADA) - a weighted attendance figure determined by applying the following weightings to the average daily attendance: ½-day kindergarten: .50, full-day kindergarten and grades one thru six: 1.00, and grades seven thru twelve: 1.25.

In districts with fewer than 8 teachers, the weighting for grades seven thru twelve is 1.00 rather than 1.25.

Resident Weighted Average Daily Attendance (RWADA) - equals the WADA of a district minus the WADA of nonresident pupils attending schools in the district plus the WADA of outgoing pupils and the WADA of resident pupils attending a BOCES or CVEEB school.

- used in determining State aid ratio

Base Year and Current Year - Expenditures of immediately preceding school year normally form the base for the determination of operating expenses. This school year (i.e., the preceding one) is the base year; the year in which aid is paid is the current year.

Debt Service - payments on the principal and interest charges on bonds or notes issued for building construction.

Fiscal Year - July 1 to June 30.

Full Valuation (also, Actual Valuation and True Valuation) - Total assessed valuation of property on the tax rolls within a district adjusted by the State equalization rate determined from such rolls.

General Aid - state's share of the total expenses of the school district, except for the expenses of the special programs for which aid is available.

- General aid is paid as total aid and may be used for any purpose for which a board of education may spend money.

Interfund Transfers - transfers to Capital Funds, School Lunch Fund, School Store Fund, Public Library Fund for Debt Service, Special Aid Fund.

Revenues from Federal Sources - monies received from NDEA, Title III; Federally Affected Areas: Operation; In Lieu of Taxes, and other

Revenues from Local Sources - Property & Related Taxes + Non-property taxes + Tuitions from other districts + Other revenues from local sources (e.g., interest & penalties on taxes, rentals, admissions, interest on deposits, sales & compensations for loss, contributions, etc.)

Revenues from State Sources - Gross State Aid (basic formula), State Aid-Textbooks, Educational Television, For loss of RR tax revenue & loss of public utility property, BOCES, CVEEB, Youth Recreation & other.

Special Schools - summer, evening vocational, migrant, continuing education (adult), and other schools.

Tax Levy - local revenues including property and non-property tax revenues raised by tax for school purposes. (defined by Ed. Dept.)

Tax Rate - tax levy divided by th4 full valuation of real property, expressed as a rate per $1,000.00 of full valuation.

Total General Fund Expenses - sum of expenditures for Board of Education, Central Administration, Instruction (Regular Day School and Special Schools), Community Services, Transportation, Operation & Maintenance of Plant, Non-budgetary expenses (rare), Undistributed Expenses, Debt Service, and Interfund Transfers.

Total State Aid - sum total of all State aid paid pursuant to provisions of sections 3602, 3602a, 1104, 909, and 1958 of the education law.

TERMS USED PRIOR TO ENACTMENT OF FORMULA

Net Current Expenditures - excludes tuition paid to other districts, instructional services for special schools, transportation insurance, debt service, and capital expenditures.

Total Expenditures - sum of expenses for General Control, Instructional Services (Regular Day and Special Schools), Operation & Maintenance of Plant, Auxiliary Agencies, Fixed Charges, Debt Services, and Capital Outlay.

General Fund eceipts - All State Aid + Local Tax + Tuition + All Other Sources .includes Federal aid, interest earned on deposits, refunds to di-.ricts, proceeds from sales of property, and other sources).

GLOSSARY -- PENNSYLVANIA

Act 511 (Local Enabling Act) Taxes - Taxes collected for Public School purposes on Wages & Income, Per Capita, Real Estate Transfer, Occupation, Amusement, Mercantile, Trailer, Mechanical Devices, & Others (collected from 1966/67 on).

Act 481 Taxes - predecessor of Act 511 Taxes (until 1966/67).

Actual Instruction Expense - Reimbursable current expenditures; - General Fund expenses minus expenditures for: health services, transportation, debt services, capital outlay, homebound instruction, and outgoing transfers to community colleges; minus monies received for special funds (driver's education, special classes, vocational curriculum, incoming tuition, and State & Federal aid).

Aid Ratio - Commonwealth's share of reimbursable cost;

$$1.00 - \left[\frac{\text{District Market Value/District WADM}}{\text{State Market Value/State WADM}} \times \text{District's share of total cost}\right]$$

Basic Account Standard Reimbursement - formula previous to 1966.

Basic Instruction - formula aid.

Census Number of Pupils 1969/70 - Total number of Children (Public, Non-Sectarian, Sectarian, and All Other) from Birth through Age 17 minus Pre-School Children.

Current Expenditures - sum of costs for Administration, Instruction, Pupil Personnel Services, Health Services, Transportation; Operation & Maintenance of Plant, Fixed Charges, Food Services, Student Activities, & Community Services.

General Fund Receipts - Sum of monies from Federal Cources, State Appropriations, Local Sources, & Refunds.

Local Sources - Taxes (Real Estate, Per Capita Code, Act 511, In Lieu, Delinquent) & Other Revenues.

Minimum Subsidy - a guarantee to each school district that it will receive at least 10% of actual cost of instruction or 10% of Maximum Amount, whichever is less.

State Appropriation - Aid for Elementary and Secondary Education paid to a district by the Commonwealth for: Rentals, Transportation Regular, Transportation Excess Costs, Special Classes, Blind-Deaf-Cerebral Palsied, Homebound Instruction, Distressed Districts, Orphans & Court-Placed Children, Lieu of Taxes, Migrant Summer Schools, Education of Disadvantages, Basic Instruction, Basic Instruction-Poverty, Basic Instruction-D4nsity & Sparsity, Vocational Education Field Payments, Vocational Education Cost Differential, Driver Education, & Other Grants.

GLOSSARY -- PENNSYLVANIA (cont'd)

Total Expenditures - Current Expenditures + Debt Service + Capital Outlay.

Total Reimbursable Cost - the lesser of:

a. Actual instruction expense per WADM;

or

b. Maximum amount to be fixed by the General Assembly from time to time representing the estimated average actual instruction expense per WADM.

Total Taxes Raised - Sum of: Real Estate, Per Capita (School Code), in Lieu, Act 511, and Delinquent Taxes.

Weighted Pupil - a value placed upon district pupils in average daily memberskip such that:

K = 0.5 if half-day
  = 1.0 if full-day

Elem. = 1.0
Sec. = 1.36

GLOSSARY -- RHODE ISLAND

Average Daily Membership - aggregate attendance plus aggregate absence divided by number of days schools were actually in session; count of pupils enrolled whether they attend or not, includes pupils the district educates in its schools, including tuition pupils.

Basic Program - cost of education of resident pupils in grades Kindergarten through 12 in Average Daily Membership for the reference year as determined by the Mandated Minimum Program Level plus all transportation costs.

Federal Aid - aid paid for National Defense Education Act, Vocational Education programs (Smith-Hughes Act, George-Barden Act), Public Law 874, Vocational Education Act of 1963, and others.

Form 31 - report completed annually by each city, town, and regular school district listing its expenditures on current operation of public schools, basis for determining school expenditures in which State will share.

Mandated Minimum Program Level - amount which shall be spent by a community for every pupil in average daily membership.

Net Current Expenditures - Total Current Expenditures of Day Schools (Line 86, Form 31) plus unstarred items of Capital Outlay (Line 89, Form 31) minus tuitions received (Line 21, Form 31); sum of monies expended on pupils for whom district is financially responsible for General Control, Instruction, Operation and Maintenance of Plant, Fixed Charges, Auxiliary Agencies (i.e., Health Services, Transportation, Lunches, Community Service, and Tuition Payments), and unstarred items of Capital Outlay minus Tuition Receipts.

Reference Year - school year immediately preceding that in which aid is to be paid.

Resident Average Daily Membership - pupils for whom a district is financially responsible no matter where they are educated; count used in determining State Share Ratio.

State Share - aid paid by State to school districts. Until 1967, it was synonymous with Chapter 27 aid, but at that time program monies for disadvantaged and handicapped children were included.

State Share for Foundation Enhancement Program - incentive formula aid provided by Chapter 27, about 90% of State Share.

State Share Ratio - equals

$$\frac{\text{Equalized Weighted Assessed Valuation/Resident Average Daily Membership}}{\text{State Average Equalized Weighted Assessed Valuation/State Resident Average Daily}}$$

Unstarred Items of Capital Outlay (Line 89, Form 31) - expenditures considered to be operational expenses consisting of capital outlay of a replacement nature not listed under Maintenance of Plant.

GLOSSARY -- VERMONT

Aid Ratio - $\left[1.00 - \left(\frac{EGL}{ADM} \div \frac{SEGL}{SADM}\right) K\right]$ Current Expenditures

Auxiliary Services - Sum of expenditures for Attendance Services (Series 300), Health Services (400), Transportation (500), Food Service (900), and Student Activities (1000).

Average Daily Membership - the average enrollment for the first 30 days of all pupils residing within a given school district attending approved schools.

- obtained by dividing the aggregate number of days of membership of all pupils in a district during the first 30 days by 30.

N.B. "For the purpose of aid granted under section 3470 . . . the average daily membership calculated above shall be increased by a percentage equal to the percentage of the current expenditures of the school district expended for aid to schools other than public schools as defined in subdivision (2) of this section." (16VSA, S. 3441 (1) as amended)

Basic Need - figure used in pre-conversion years similar to Current Expenditures.
- lesser of Foundation Program or Total Resident Current Expense.

Foundation Program	Total Resident Current Expense
Elem. ADM x State avg. elem. cost/ADM	Total current expense (elem + sec)
+ Sec. ADM x State avg. sec. cost /ADM	- Incoming Transfer Accts. (elem + sec)
Total Foundation Program	Total Resident Current Expense

Current Expenditure - all current school expenditures for resident pupils less the sum of the following: capital outlay and debt service, incoming tuition & funds to the extent that those items are included in the expenditures, and all other federal and state funds received during the preceding year except for funds received under Public Law 81-874 (aid to impacted areas) and under sections 3471 and sections 3448(b) and 3472 of title 16 VSA (formula aid law).

= Total Expenditures minus Expenditure Deduct

Equalized Grand List - 1% of the fair market value of all taxable property in a school district as established by the tax commissioner biennially plus the taxable polls. (For 1971 state aid computations, the latest equalized grand list figures certified by the tax commissioner on Jan. 1, 1970 were used.)

Expenditure Deduct - Items not eligible for reimbursement under formula aid law.
- Series 1100 (Community Service), 1200 (Capital Outlay), 1300 (Debt Service); Tuition Receipts; some Federal and State Funds; State Vocation Ed. Program, Driver Ed., State Funds for Special Construction, Special Ed., Federal Vocational Ed., and NDEA, Titles III and V-A.

GLOSSARY -- VERMONT (p.2)

Federal Sources - funds received from Federal Government under P.L. 81-874 (aid to impacted areas), and other funds received directly from Federal Government.

Grand List - 1% of the total evaluation of Real & Personal Estate plus Poll Tax.

Incoming Transfer Accounts - amounts received from other school districts, both within and without the State, for Elem. and Sec. Tuition, Transportation, and Miscellaneous plus payments from other intra-state districts for Union School Assessments.

Other State Revenue - Revenues received from State for purposes such as: Driver Ed.; State Funds for Construction under Section 3448, Title 16, VSA; Special Funds for Special Education; Indebtedness on School Instruction; and Miscellaneous Revenue and Federal funds distributed by State for Vocation Education; and NDEA Titles III and V-A.

Outgoing Transfer Expense - Series 1400

-Expenditures to In-state School Districts (Tuition, Transportation, Misc.) plus Expenditures to Out-of-State School Districts (Tuition, Transportation; Miscellaneous) plus Tuition to Non-Public Schools (Approved Tuition, non-Approved Tuition, Transportation, Miscellaneous) plus Expenditures to Special Education (& Union District Membership).

Total Current Aid - a computation consisting of adding General State Aid; Other State Aid, and Revenue from Federal Sources.

Total Expenditures - expenditures for Series 100 through 1400 (Administration, Instruction, Attendance Services, Health Services, Transportation, Operation & Maintenance of Plant, Fixed Charges, Food Service, Student Activities, Community Services, Capital Outlay, Debt Service, Outgoing Transfer Expense).

Total Operating Expense - Costs for Administration (Series 100), Instruction (200), Plant Operation andMaintenance (600 and 700), Fixed Charges (800) and Auxiliary Services (300 + 400 + 500 + 900 + 1000)

-"Cost of running a school regardless of who is paying for it." A.J.McCann

Total Expenditure minus (Capital Outlay + Debt Service) = Total Operating Expense + Outgoing Transfer Expense

District Multiplier - the fraction or ratio that is obtained by dividing the district EGL/Pupil by the State EGL/Pupil (ADM). It is multiplied by a constant (State Multiplier) determined yearly, and the product is subtracted from 1.00 to determine the State Aid Ratio.

Local Capacity - 1% Fair Market Value of Taxable Property + Taxable Polls + 50% Forest Receipts + Federal Funds P.L. 874 (a pre-conversion term).

GLOSSARY -- VERMONT (p.3)

Low Limit District - a district given an adjustment period immediately following enactment of Miller Formula.
If the amount of state aid money for 70/71 is less than the amount received in 63, the district was given the greater of: a) 50% of 1963 aid, or b) 1970 computed figure, provided the ADM of 69/70 was equal to or greater than 63 ADM

Minimum or Floor District - district that receives no state aid on the Miller Formula. Its aid payment is calculated as follows:

$$30 \text{ ADM} \times \frac{\text{Total School Tax Receipts}}{\text{EGL}}$$

Reduced Low Limit District - a district whose 1970 aid figure was determined to be less than that amount of aid received in 1963 and whose 69/70 ADM was also less than its 63 ADM.
In such a case, a district is given the greater of:

a) $\frac{\text{1969 ADM}}{\text{1963 ADM}}$ (50% of 1963 State Aid)

b) 1970 figure for aid.

State Multiplier - a constant annually computed which, when multiplied by the District Multiplier and subtracted from 1.00, yields the State Share (Aid) Ratio.

Year	Constant	Computes aid for:
68/69	64.315631	69/70 (E.Jones)
69/70	68.415342	70/71
70/71	66.194781	71/72

Title 16, VSA

3471 - General State Aid (Miller Formula Aid)

3448(b) - School Construction Aid: 30% reimbursement for any construction and 20% reimbursement for bond indebtedness.

NOTE

Due to a change in statutes, the current expenditure and equalized grand list used in 1970 computations will again be used in the 1971 distribution of aid. ADM used in 1971 computation will be based upon 70/71's first 30 days.

APPENDIX - B

Comparative Nomenclature

	Massachusetts	New York	Pennsylvania	Rhode Island	Vermont
1. Average Daily Membership (P_t)	Net Average Membership	Average Daily Attendance (Grades K - 12)	Total Average Daily Membership	Resident Average Membership	Average Daily Membership
2. Current Expenditures (E_t)	Total Public School Funds	Total General Fund Expenses minus (Interfund Transfers plus Debt Service plus Community Services)	Current Expenditures	Net Current Expenditure	Total Operating Expense minus Outgoing Transfer Expense minus Pupil Transportation plus Incoming Transfer Accounts
3. Federal Aid (R_t component)	Federal Aid	Revenues Federal Sources	Federal Sources	Federal Aid	Revenues from Federal Sources
3a. State Aid (R_t component)	Revenues from the Commonwealth	Revenues from State Sources	State Appropriation	State Share	General State Aid + Other State Revenue
4. Incentive Formula Aid (C_t)	State Aid Fund, Chapter 70	Operating Expenses Aid	Basic Instruction	State Share for Foundation Enhancement Program	General State Aid
5. Reimbursable Expenditure (Q_t)	Reimbursement Expenditure Applied	Approved Operating Expenses	Actual Instruction Expense equal E_t minus Health Service minus Pupil Transportation	Expenditure from Local Sources	Current Expenditure or Basic Need
6. Aid Ratio (c_t)	School Aid Percentage	Not given	Aid Ratio	(State) Share	Not given

APPENDIX - B

Comparative Nomenclature

	Massachusetts	New York	Pennsylvania	Rhode Island	Vermont
7. Assessed Valuation (A)	Assessed Valuation	Assessed Valuation	Assessed Valuation	Assessed Valuation	Grand List (1% of market value)
8. Equalized Valuation (W)	Equalized Valuation	Full Valuation	Market Value	Full Value	Equalized Grand List
9. Tax Rate or Receipts (Municipal or Total) (M)	General Tax Rate (Total)	City/Inside Town/Village Tax Levy (Municipal -- receipts)	Municipal Tax Rate (Municipal)	Actual Rate (Municipal)	Rate (Total)
10. School Tax Rate or Receipts (S)	School Tax Rate (Actual)	Property Tax (School tax levy receipts)	School or Union Tax Rate (Actual)	Equalized Tax Rate for Schools (Equalized)	Equalized School Tax Rate (Equalized)
11. Census of all Pupils (G)	School Attending Child	Computed: Total No. Children minus Preschool Minors	Computed: Census Enumeration minus Preschool Children	Computed: A.D.M. plus enrollments in non-public schools	Computed

APPENDIX - C

Data Sets By Source

(Codes used are those listed in "Code Index" at end of appendix D)

	Massachusetts	New York	Pennsylvania	Rhode Island	Vermont
1. Average Daily Membership (P_t)	PFD	AES	SR (7D/71-OST)	ST	V052
2. Current Expenditures (E_t)	PFD	AES	SR (70/71-OST)	ST	V052
3. Federal Aid (R_t component)	PFD	AES	SA-P67, 68, 69, 70 (66/67 un-available)	ST	V052
3a. State Aid (R_t component)	PFD	AES	SR (70/71 photo-copy)	ST	V052
4. Incentive Formula Aid (C_t)	PFD	SA-NY	SA-P66, 67, 68, 69, 70	ST	V052
5. Reimbursable Expenditure (Q_t)	PFD	AES	SR (70/71-DST)	ST	V052
6. Aid Ratio (C_t)	PFD	Computed	SA-P67, 68, 69, 70	CRIE	Computed
7. Assessed Valuation (A)	PFD	AES	STEB	TAX	BRT
8. Equalized Valuation (W)	PFD	AES	STEB	TAX	V052
9. Tax Rate or Receipts (Municipal or Total) (M)	PFD	T	PTAX	TAX	BRT
10. School Tax Rate or Receipts (S)	PFD	AES	PTAX	TAX	V052
11. Census of all Pupils (G)	PFD	CE (computed)	SCE	ST (computed)	V052, SE-V (computed)
12. SMSA Classification	SMSA	SMSA	SMSA	SMSA	SMSA

APPENDIX - D

Data Sources

1. Massachusetts — CODE

Source	CODE
Department of Education, "Pupil Financial Data," Boston: 1972. (Print-outs for years 1966/67 - 1970/71.)	PFD
________, State Aid: Chapter 70 Distribution[1], Boston. (Published annually; available for years 1964/65 - 1970/1971.)	C70
________, Annual Report: Part II, Boston: 1965 (1964-65, 1965-66)	AR-II
________, State Reimbursements 1947-1966 (h;nd-written ledger).	MSR

[1] a compilation of pamphlets entitled individually "State Aid to Massachusetts Cities and Towns"

11. New York

Billmyer, David L. Analysis of School Finances: New York State School Districts, 1970-71, Albany: April 1972. (Also; a 1969/70 edition.) ASF*

Department of Education, Annual Educational Summary: Statistical and Financial Summary of Education in New York State for the Year Ending June 30, 19--, Albany. (Annually since 1959) AES

_________, "Annual Financial Report for Districts with Eight or More Teachers Based on Double-Entry Accounting for the Year Ending June 30, 19--," (Form ST-3), Albany AFRf*

_________, "Census Enrollment of Resident Children Under 18 Years of Age by County and School District, 1969-70," Albany: 1970, (Photocopied print-out.) CE

_________, A Guide to Programs of State Aid for Elementary and Secondary Education, Albany. (Annually since 1969) GSA*

_________, Tapes on State Aid: SA-NY

62/63: "State Aid 1962-63"
63/64: "1963 State Aid: County Breakdowns"
64/65 "County Breakdowns: 1964 State Aid"
65/66: "Formula Table 6611--Projected State Aid Payable to Major School Districts"
66/67: "Formula Table 6613--Projected State Aid Payable to Major School Districts in 1966-67"
67/68: "Table 5: 1967-68 State Aid Components"
68/69: No Title Given
69/70:

Albany: annually. (Photocopied print-outs.)

_________, Understanding Financial Support of Public Schools: 1970-71, Albany: 1971. UFS*

Department of Taxation; "County Tax Levied for Fiscal Year Ended in 1968," Albany: 1968. (Photocopied document; also a 1963 edition.)

111. Pennsylvania

General Assembly of Pennsylvania, "Senate Bill No. 792; an Act, No. 580," Harrisburg: February 1966. A580*

__________, "Senate Bill No. 284," Harrisburg: August 1971. SB284*

Lauver, Paul H., Our Schools Today: Public School Financial Statistics Report, Harrisburg: annually, since 1966/67. OST

Department of Commerce, Property Tax Rates: County, Local and School Property Tax Rates for Selected Boroughs, Cities and Townships, Harrisburg: 1969. (Also 1971 edition.) PTAX

Department of Education, "A.I.E./WADM and Aid Ratios: 1967/68 - 1970/71." (Hand-transcribed copy.) AIE

__________, "Appropriations to 1st and 2nd Class Districts Paid 1967-68." (Photocopy.) SA-P67

__________, "State Appropriations; 1st & 2nd Class Districts Paid 1968-69." (Photocopy) SA-P68

__________, "State Appropriations Paid 1969-70." (Photocopy.) SA-P69

__________, "State Appropriations Paid 1970-71." (Photocopy.) SA-P70

__________, "Statistical Report of the Secretary of Education for the Year Ending June 30, 19__," Harrisburg. (Annually since 1964/65.) SR

__________, "Subsidy Payments During 1966-67." (Photocopy.) SA-P66

__________, "Summary of Census Enumeration from Birth Through Age Seventeen, By District 1969-70." (Print-out.) SCE

__________, A Summary of Enrollments in Public Schools of Pennsylvania, Fall 1971, Harrisburg: 1972. PSE*

State Tax Equalization Board, Market Values of Taxable Real Property, Harrisburg. (1969 and 1971 certifications used.) STEB

Lauver, Paul H., Act 511 Taxes 1970-71, Harrisburg: March 1972 A511*

Stewart, Gerald, 1971-1972: A Measure of Local Effort, Harrisburg, 1972. MLE*

IV. Rhode Island

"Annual State Report on Local Government Finances and Tax Equalization," Providence. (Published annually since 1958; photocopies of selected data.) TAX

Department of Education, "Public School Finance--Form 31" and Supplements E, N, R, PS, Providence. (Annually.) F31*

_________, State Aid in Rhode Island: Title 16, Chapter 7, Providence: 1970. SA-R70*

_________, State Financial Support for Schools (Title 16) (Chapter 7), Providence: 1972. SFS*

_________, Statistical Tables, Providence. (Annually since 1956.) ST

_________, "Calculation of Rhode Island State Share Entitlement for School Operation," Providence. (Annually since 1961; photocopy.) CRIE

V. Vermont

Commissioner of Taxes, Biennial Report of the State of Vermont for the Term Ending June 30, 19--, Montpelier. (1968 and 1970 editions used.) BRT

__________, Photocopied table from the Biennial Report of the State of Vermont for the Term Ending June 30, 19--, Montpelier. (1964 and 1966 editions used.) BRT

1964: Table IX, "Schedule Showing Taxes Raised in 1963 and 1964 in the Various Towns, Cities, Villages, School and Fire Districts";

1966: Table VI, "Schedule Showing Taxes Raised in 1965 and 1966 in the Various Towns, Cities, Villages, School and Fire Districts."

Department of Education, "Alphabetical List of 248 School Districts," Montpelier: 1971. (Photocopy.) AL*

__________, "Annual Statistical Report of Schools for the School Year Ending June 30, 1972" (Form No. 5a), Montpelier: 1972. F5a*

__________, Elementary School Enrollment--Fall 1971: Vermont Public Schools, Montpelier: May 1972. SE-E

__________, Financial Statistics: Vermont School Systems (Report 052), Montpelier: (1963/64 - 71/72) V052

__________, 1971-72 Vermont School Enrollment (Report 027), Montpelier: March 1972. SE-V

__________, Secondary School Enrollment--Fall 1971: Vermont Public Schools, Montpelier: May 1972. SE-S

__________, Vermont State Aid, Montpelier: 1970 VSA70*

__________, Vermont State Aid, Montpelier: 1971. VSA71*

VI. General

Executive Office of the President, Bureau of the Budget, Standard Metropolitan Statistical Areas, Washington: 1967. SMSA

Stollar, Dewey and Gerald Boardman, Personal Income by School Districts in the United States, National Educational Finance Project, Gainesville, Florida: 1971. NEFP

* denotes a reference work.

APPENDIX - D

Code Index to Data Sources

CODE	STATE	CODE	STATE
AES	New York	T	New York
A511	Pennsylvania	TAX	Rhode Island
A580*	Pennsylvania		
AFRF*	New York	UFS*	New York
AIE	Pennsylvania		
AL*	Vermont	VSA70*	Vermont
AR-11	Massachusetts	VSA71*	Vermont
ASF*	New York	V052	Vermont
BRT	Vermont		
CE	New York		
CRIE	Rhode Island		
C70	Massachusetts		
F5a*	Vermont		
F31	Rhode Island		
GSA*	New York		
MLE*	Pennsylvania		
MSR	Massachusetts		
NEFP	General		
OST	Pennsylvania		
PFD	Massachusetts		
PSE*	Pennsylvania		
PTAX	Pennsylvania		
SA-NY	New York		
SA-P66	Pennsylvania		
SA-P67	Pennsylvania		
SA-P68	Pennsylvania		
SA-P69	Pennsylvania		
SA-P70	Pennsylvania		
SA-R70*	Rhode Island		
SB284*	Pennsylvania		
SCE	Pennsylvania		
SE-E	Vermont		
SE-S	Vermont		
SE-V	Vermont		
SFS*	Rhode Island		
SMSA	General		
SR	Pennsylvania		
ST	Rhode Island		
STEB	Pennsylvania		

* denotes reference work