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ABSTRACT

In this paper, the author attempts to clarify several implicit hypotheses about local school finance reform, set up tests whereby hypothesis validity can be affirmed or rejected, and outline the policy implications of the results. Two mathematical models of school district behavior are examined, and their implications are tested on a sample of 150 Massachusetts school districts. The first model assumes that the district reacts to the "effective" property base, so that a change in revenue is viewed identically whether the change resulted from a change in property tax rates or in property values. The second model indicates that reactions to changes in tax rates and to property values are different. It is demonstrated that the first model, which has dominated school finance reform litigation of the past five years, is unsupportable; and that its policy recommendations are insufficiently restrictive. (Author/DN)

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WEALTH, INCOME, AND PRICE EFFECTS IN LOCAL SCHOOL FINANCE

We are now past an initial round of litigation over the financing of schools, and past the first round of legislation, that of 1972-73, which appears to have been significantly affected by the decisions in the Serrano case and some of its successors. And we are also far enough along that some of the initial successes have been reconsidered and reversed[1] and that opponents of school finance reform have begun to initiate suits of their own.[2] It might seem at this stage either unnecessary or irrelevant to analyse further the economic issues underlying efforts to equalize resources flowing to school districts.

However, the school finance reform movement of the last five years or so has not yet run its course; litigation continues in several states,[3] and perhaps more important in the long run, state commissions investigating school finance reform and legislative consideration of reform bills has not slowed down.[4] And despite the amount which has been written about school finance over the past five years, there still remain some views of local school finance, usually implicit rather than explicit and amounting

to untested hypotheses which can be demonstrated to be unsupportable. It is the purpose of this paper to clarify these implicit hypotheses, to set up tests whereby their validity can be affirmed or rejected, and to outline the policy implications of the results.

The first of three areas to be analyzed is that of the model of school district behavior which has been used by most school finance reformers; it will in particular be demonstrated that the model which has dominated the litigation of the past five years is unsupportable, and more importantly that its policy recommendations are insufficiently restrictive. The "correct" model, on the other hand, requires us to consider the price effect which school districts face, and the nature of local price effects has been differently interpreted in the past; therefore the second section of this paper will delineate the three conceptions of price and indicate the relative magnitudes of two of them. The final section will evaluate the claims that the school finance reform litigation is seriously incomplete in failing to consider district income along with wealth (property valuation), and will present evidence to evaluate the seriousness and generality of this claim.

I. The Nature of School District Behavior

We can start with a simple representation of the process which generates total school revenues or expenditures per pupil[5]:

(1) $R = f(P, Y, SES, \ldots ; S, F, \ldots)$

That is, total revenues per pupil R are a function of local property valuation P, income Y, other socio-economic variables SES, other variables unspecified by this general function, and of state aid S and

federal aid F.[6] In particular, we can recognize the distinction between matching aid, which is a fraction m of locally-raised revenue L, and non-matching aid A, which is not a function of L. Then total revenue can be expressed as

(2) $R = (1 + m) \cdot L + A$

where A includes both state and federal non-matching aid and matching aid $m \cdot L$ in this country comes from the state. Under the assumption that local revenue comes wholly from applying a tax rate T to local property valuation per pupil P, total revenue is equivalently

(3) $R = (1 + m) \cdot T \cdot P + A$

In the behavioral model which has been served as the basis for policy recommendations of most school finance reformers since 1970,[7] districts are assumed to choose a level of revenues according to the schedule of tax rates required for each particular expenditure level which they face, or (equivalently) according to the yield per mill of tax. Since an additional mill of tax yields $(1+m) \cdot P$, equation (1) becomes

(4) $R = f((1+m)P, Y, SES, \ldots; A)$

In the case where the matching rate is zero and the state distributes aid through flat grants or foundation programs, then equation (4) indicates that revenues are affected by property valuation per pupil. However, if state aid is distributed through a district power equalizing formula where $m=k/P - 1$ and the yield per mill is a constant, k, for all school districts, then property valuation P disappears from equation (4); the Serrano mandate -- that school district resources not be a function of local wealth -- is upheld. That is, this view of school district behavior

assumes that districts will react to their "effective" property base (1+m)P, so that all DPE formulas will free district revenues from local wealth because they equalize the "effective" base across districts.

A second view of school district behavior applies utility theory in order to formulate hypotheses about school district behavior. The approach treats a district like a utility-maximizing consumer, with utility increasing with additional resources per pupil but decreasing as the local tax rate increases.[8/] That is, each district maximizes the objective function[9/]

(5) $W = W(R,T) = W((1+m)L+A, L/P)$

In particular, under the assumption of utility-maximizing behavior, districts behave like consumers in reacting positively to increases in property valuation (analagous to income effects in the usual consumer model) and negatively to increases in the "price" of revenue per pupil, $1/(1+m)$. This expression gives the amount of local revenue required per dollar of total revenue, given a matching rate m. Thus if the state matches local revenue dollar for dollar, the matching rate is 1 and the price of each additional dollar of revenue is 1/2; every additional dollar of total revenue costs only half a dollar of local revenue. In the usual case, an increase in this price will cause a decrease in total revenues per pupil, and vice versa. Hence the state's matching rate is important not because it establishes an "effective" property base, but because it determines a price to which districts react.

The difference between these models can be state quite succinctly: the first of these models assumes that the district reacts to the

"effective" property base (1+m)P, so that a change in (1+m) and a change in P have similar effects. That is, if $E = (1+m) \cdot P$

$$(6) \qquad \frac{\partial R}{\partial m} = \frac{\partial R}{\partial E} \cdot \frac{\partial E}{\partial m} = \frac{\partial R}{\partial E} \cdot P \quad \text{and} \quad \frac{\partial R}{\partial P} = \frac{\partial R}{\partial E} \cdot \frac{\partial E}{\partial P} = \frac{\partial R}{\partial E} \cdot (1+m)$$

$$\Rightarrow \frac{\partial R}{\partial m} / P = \frac{\partial R}{\partial P} / (1+m)$$

The second model, on the other hand, indicates that reactions to changes in (1+m) (price effects) and to changes in P (analagous to income effects) are different.[10] This difference provides us with a basis for distinguishing between these two hypotheses empirically.

It proves to be rather difficult to carry out such a test. It is necessary to isolate the effects of price variation on local or total revenue, and price effects in this form exist only in states which incorporate matching rates into their state aid formulas. As of 1971-72, only seven states incorporated included matching grants for general-purposes aid; of these two (Rhode Island and Utah) had too few districts for effective statistical work, and three (New York, Pennsylvania, and Wisconsin) had rather complex district structure, including both different kinds of districts and districts non-coterminous with other political units. This leaves Massachusetts and Iowa as the only states where price effects might be readily isolated.[11] In the rest of this section I will present some results from a sample of 159 districts in Massachusetts[12] to test the implications of these two models.[13]

Two tests of the alternative models are possible. First, from equations (2) and (6), it follows that

$$(7) \qquad \frac{\partial R}{\partial m} = L + (1+m) \cdot \frac{\partial L}{\partial m}$$

(8) $$\frac{\partial R}{\partial P} = (1+m)\frac{\partial L}{\partial P} + L\frac{\partial m}{\partial P}$$

Therefore, if the first model is to hold and equation (6) is to be true, then it must be true that

(9) $$\frac{L + (1+m)\frac{\partial L}{\partial m}}{P} = \frac{(1+m)\frac{\partial L}{\partial P} + L\frac{\partial m}{\partial P}}{1+m}$$

(10) $$\Rightarrow \quad \eta_{L,(1+m)} + 1 = \eta_{L,P} + \eta_{(1+m),P}$$

where η denotes elasticities.

The validity of equation (9) is easily tested with the information from equation (2) of Table 1.[14/] Evaluating the left-hand side of equation (9) yields a value of 4.71 while the right-hand side takes a value of -5.413 at the sample mean; the difference between these two is statistically different at better than the 5% level.[15/] Hence we can reject with confidence the hypothesis of equation (6), and therefore reject the first of the two models presented here at least in the vicinity of the sample mean. Furthermore, equation (9) holds true only when the school tax rate (which is one of the arguments of $\partial L/\partial m$) takes on a value of 2.03 mills, which is far below the range of observed values. This again supports the rejection of the first model.

The test summarized by equation (9) is, however, somewhat awkward because it requires the use of specific values for L, m, $\partial m/\partial P$,[16/] and the school tax rate. A more direct test is possible, utilizing regressions for total revenue rather than local revenue and testing equation (6) directly. Equation (4) of Table 1 presents such a regression. From this it is clear that

$$\frac{\frac{\partial R}{\partial m}}{P} = \frac{-483.6 + 15.6 \cdot T}{P} = -6.64 \quad \text{at the sample mean}$$

$$\frac{\partial R}{\partial m} / (1+m) = \frac{6.583}{(1+m)} = 5.64 \quad \text{at the sample mean}$$

and $\frac{\partial R}{\partial P} / (1+m)$ and $\frac{\partial R}{\partial m} / P$ are significantly different at about the 2.5% level (the associated t - statistic is 2.21). Only where the school tax rate is in the vicinity of 41.11 mills -- which is outside the range of observed tax rates -- is the marginal impact of a change in the matching rate approximately equal to the marginal impact of a change in property valuation. Again, the second model of school district behavior is compatible with these results, while the first one is not.

A third test is possible, based on the elasticities of equation (10) rather than on partial derivates. Equations (3) and (5) of Table 1 present log linear specifications, and the parameters are estimates of elasticities. From equation (3) of Table 1, the left-hand side of equation 10 is 1 - 1.357 + .064 or .8534 at the sample mean; the right-hand side becomes .1315. The difference is significant at better than the .1% level, since the corresponding t-statistic is 3.43. As in the previous two tests, the two sides of equation (10) can be equal only with variable values which are far outside the range of observed values. Hence the validity of the three tests of equation (6) is rather conclusive, since the results do not depend on any particular formulation. We can therefore reject the hypothesis that districts respond to their "effective property base" $(1+m) \cdot P$ and accept the hypothesis that they react "rationally" to the price effect embodied in the matching rate.

If this result had no policy implications, then it would be rather irrelevant in view of the fact that courts and legislatures are now in the midst of forming new state aid programs.

However, the first model implies, as mentioned earlier, that any district power equalizing formula will satisfy the Serrano mandate. That is, it does not matter what value k takes on, since "effective" property valuation will be $(1 + k/P - 1) \cdot P = k$ for each district, and therefore constant among districts. However, the second model implies that k must take on a precise value if the present correlation between revenues and property valuation is to be eliminated. If R is a function of P (the "income" effect) and ρ (the price $1/(1+m)$) then the following must hold:

$$(11) \quad \frac{dR}{dP} = \frac{\partial R}{\partial P} + \frac{\partial R}{\partial \rho} \cdot \frac{\partial \rho}{\partial P}$$

For the correlation between P and R to be zero, dR/dP must be zero, implying that

$$(12) \quad \frac{\partial \rho}{\partial P} = -\frac{\partial R}{\partial P} \Big/ \frac{\partial R}{\partial \rho}$$

and implying in turn that matching rate m in a DPE formula satisfying this requirement must be

$$(13) \qquad m = \frac{1}{c - \left(\frac{\partial R}{\partial p} / \frac{\partial R}{\partial \rho}\right) \cdot \rho} - 1$$

yielding, in the case where C is zero, a district power equalizing formula with

$$(14) \qquad k = - \frac{\partial R}{\partial p} / \frac{\partial R}{\partial \rho}$$

Thus, contrary to the implications of the first model, the value which k assumes is critical to the outcome. If k is lower than the value indicated in equation (14), some positive correlation between property valuation and revenue might remain; if higher than this value, a negative correlation would result.

In fact, the estimates for Massachusetts indicate that the usual DPE formulas, where k is usually at or above the state's mean property valuation per pupil, would result in a negative correlation.[17] While this result as a prediction of what would happen is not particularly believeable, it does indicate that the price effect is much stronger than is usually thought -- at least in Massachusetts -- and that a state aid formula with greater variation in matching rates than those which have existed in the past would induce radical shifts in behavior, including attempts to circumvent the state aid formula, partial abandonment of public school, and thorough changes in the behavioral patterns which underlie models such as that given in equation (1).

In Massachusetts, the magnitude of the price effect is presumably known, so that school finance policies can consider

the strength of this effect. However, the evidence presented in Section III of this paper indicates that there is little reason to believe that behavioral parameters estimated for one state can be assumed to hold for other states. Hence, because of the problems which make the estimation of price effects so difficult, few states can obtain information on the likely reation to the price effects implicit in district power equalizing formula.

One logical solution to the problem of equalizing school resources, given uncertainty about responses to price effects, is to narrow the range over which price effects are allowed to operate. This suggests that an appropriate state response to current pressure for school finance reform is to combine relatively high amounts of non-matching aid, constant among school districts except as measures of educational need vary, with smaller amounts of matching aid under a DPE formula. This approach has the advantage of limiting the possible variation in school expenditures, reducing the inequalities which have been the focus of attack both in and out of courts, without totally eliminating local choice of spending levels. But more to the point of this paper, it minimizes the uncertainty associated with the lack of information about price effects.

II. Three Conceptions of Price

It should by now be clear that lack of information on price effects make the simulation or prediction of school district behavior problemmatic except in the small handful of states where matching rates are currently in use. Some researchers have attempted to get around this problem by using another

conception of the price facing local districts as a proxy for the price induced by the state's matching rate. The second conception of price is based on the fact that local residents directly pay only that fraction of the property tax bill which falls on residential property. The tax burden on commercial and residential property may be paid indirectly by local residents as capital owners, consumers, or workers, but this may be nearly invisible to residents. More importantly, a large portion of tax on non-residential property may be exported to non-residents. Hence the fraction of each dollar of local revenue which is directly paid by local residents is given by the fraction P_r/P, where P_r is residential property value. This is, then, a kind of price: a dollar of local revenue costs residents less in a district where P_r/P is low than in one where it is high, and we can hypothesize that they will react to this price by voting for more local revenues, all other factors being equal. In fact, this hypothesis is confirmed for the Massachusetts sample, as the statistically significant negative coefficients of RES in equations 1-5 of Table 1 indicate.

However, while this response certainly follows the pattern we associate with a price effect, its use as a proxy for the effects of state matching rates is not generally valid.[18/] From equation 1, the elasticity of L with respect to price P, or $\eta_{L,P}$, is .218 at the sample mean, while $\eta_{L,RES}$ is -.134. The differences are statistically significant at better than the 1% level. The point is that, while there are at least two prices to which districts respond as we would expect, the two price effects

are not at all similar in magnitude and cannot be used as proxies for one another.

There is a third and final conception of price, one which does not enter the equations of Table 1: that of price as cost variations in the inputs (teachers, buildings, materials, etc.) to schools. School districts with higher costs, all other factors equal, should demand relatively less schooling. However, such a hypothesis requires us to isolate a measure of the "quantity" of schooling, in place of analyzing expenditures which are the product of quantity and price. Given the weaknesses of the educational production functions which have been estimated so far, our ability to isolate such quantity measures or to derive the proper weights for price indices is severely restricted, and thus cost variations typically do not enter expenditure or revenue functions such as those presented here. Nonetheless, the presence of cost variations is widely held to be an important phenomenon, especially for urban districts.[19/]

III. Wealth versus Income Effects

The original legal arguments which led to the early Serrano and which were copied in virtually every other suit focused on variation in expenditures or revenues per pupil caused by variation in property valuation -- wealth -- to the exclusion of other variables.[20/] In part this strategy was dictated by legal considerations: wealth variations were much more obviously capricious, especially when caused by non-residential property, and they were more dramatic and pervasive than variations in other variables entering into equation (1) which might offend

the court's sense of justice. Recently, however, the failure to include district income along with wealth has come under attack, especially by those who contend that poor children and/or urban districts will not benefit unless income is considered.[21/] Legally, this issue was raised because some courts have been unwilling to accept district poverty as a suspect classification, and in falling back on criteria of individual poverty focused on income inequality rather than variation in property valuation.[22/]

To the extent that there is disagreement over this issue, the debate involves the relative importance of property valuation and district income in revenue functions like equation (1). The relevant information should therefore come from estimates of revenue functions.

Equations 6-8 of Table 1 present revenue equation for South Carolina and for California, the South Carolina regressions based on all the counties in the state,[23/] and the California results estimated on data for all the unified districts in the state.[24/] Together with the Massachusetts results, these provide estimates of the relative importance of property valuation and income.

Table 2 presents two measures of relative importance for the three states: the elasticity and the beta coefficient.[25/] They indicate that the importance of district income relative to property varies among these three states. In South Carolina -- and perhaps in other states with large, relatively homogeneous districts -- income plays no significant role in explaining expenditure variations. Massachusetts represents a polar opposite, a state where a large

number of relatively small districts has led to greater inter-state variation in district income and to a greater importance of income in explaining school resources differences.[26] California represents an intermediate case. Thus corrections such as the one which Kansas uses, which weights property valuation and income equally, may well overcompensate for income variations.[27]

However, the results in Table 2 are not as precise as they might seem, and are therefore only suggestive. The reason is that the effect of income on district expenditures appears to work with a lag, so that a change in income manifests itself in a change in school resources some years later, rather than the same year. Changes in property valuation appear not to work with a lag, for the simple reason that local revenues depend directly on the property base, rather than indirectly through political mechanisms as in the case of income.[28] However, it is impossible to estimate the length of this lag with the data underlying the regressions in Table 1. Hence the precise magnitude of the income effect, as well as its pattern over time, remains somewhat imprecise.

In every state, there is an additional barrier to the adoption of matching rates based on income as well as wealth, aside from uncertainty about the magnitude of the income effect: few states have developed current statistics on district income. While this is not particularly difficult in those states which already have state income taxes, it does indicate that another step is necessary to correct for income-based inequalities. Otherwise, the use of outmoded data will relatively penalize those districts

with slow income growth -- such as cities -- and reward those with high income growth, like many of the newer suburbs.

The results of this section do not, it seems to me, indicate that efforts to consider income variation in state aid programs should cease. They do indicate that policy analysis and recommendations must be specific to the various states. A logical alternative to income-based corrections, in the meantime, is the same as that presented in Section I: the restriction of expenditure variation by confining local choice over expenditure levels to a smaller range than has been previously permitted. If income-based resource inequities cannot be otherwise eliminated, they can at least be reduced by reducing variation itself.

IV. Conclusions

The present school finance reform movement, like most of the other reform efforts in school finance during this century, began with a description of the inequalities among districts in the allocation of school resources and the judgement that these inequalities -- or at least some of the patterns in these inequalities -- should be reduced, if not entirely eliminated. Starting from a situation of local district autonomy, the usual mechanism for achieving greater equity has been the state aid program.

The analysis of this paper should indicate that, in several ways, the use of state aid programs is a rather fragile and inexact mechanism for the alleviation of inequalities. The actual impact of state aid programs will depend ultimately on how districts respond to the price and income effects implicit in them, and such behavioral patterns need not be stable over time;

thus statements that greater equalization will prompt wealthy districts to abandon public schools or to attempt to circumvent the intent of state aid programs in various ways[29] are equivalent to assuming that changes in behavioral patterns will occur. But even when if behavioral patterns are constant, the success of a state aid formula turns critically on local price responses, which are largely unknown. In addition, inequalities are caused by a number of factors aside from property value variations, of which income is simple the most obvious and to many, the most unjustified; not only are the normative questions of the justice of such inequality unsettled, the purely descriptive issue of relative importance in explaining revenue variations is not clearly solved. A final implication of the analysis presented here is that local behavioral patterns -- the price, wealth, and income effects which districts display -- vary considerably among states, so that no general policy which depends critically on these parameters can be formulated.

I have suggested that the uncertainty which surrounds local response to state aid programs provides an additional justification for limiting the range over which district expenditures can vary; in more familiar terms, this supports moving towards full state funding mechanisms rather than adopting equalizing formulas -- like district power equalizing -- which permit unlimited variation. Having come to this conclusion, it is gratifying to see that a good deal of the legislation passed in 1972-73 has incorporated a number of restrictions. Of the nine states incorporating district power equalizing provisions into their state aid formulas,

four have provided for basic level of revenue with a required tax rate, with a restricted range above the minimum level within which the district power equalizing provision operates. In addition, all eleven states which significantly modified their state aid programs included direct restrictions on expenditure levels, either through ceilings on expenditures themselves or on the growth of expenditures.30/

The real difficulty is that of using public policy to modify the effects of locally autonomous behavior patterns, and is analagous to the difficulties of using public policies to alleviate the adverse effects of private markets without supplanting those markets entirely. In a world where parents use schools as a mechanism to ensure their children's success, local autonomy becomes a mechanism for perpetuating wealth and class based variations in school resources. Efforts by the state to impose its own program on top of systems of locally autonomous districts will ultimately come into conflict with the most basic motivation for resource disparities.31/ If this view is correct, then only direct efforts to reduce local autonomy can be successful in reducing educational inequities.

TABLE I

REVENUE FUNCTIONS FOR MASSACHUSETTS, SOUTH CAROLINA, AND CALIFORNIA

Massachusetts - 1968-69

1. $L = (5.414\ P + .0844\ Y + 634.9\ PROF - 117.10\ RES - .321A + .812\ CSA + 4.178\ T1T1 - .375\ OTHFED - .00000012\ 4 \cdot POP \cdot LNER - 75.7)/(1 + m\ (1.51 - .0667\ SCHRATE))$

SEE = 75.75 (.744) (.0146) (175) (50.9) (.120) (.615) (1.136) (.163) (.000000086) (84.6)

R^2 = .7208

2. $L = 6.953\ P - (689 + 14.38\ SCHRATE)\ (1 + m) + .0735\ Y + 429\ PROF - 133.2\ RES - 1.10A - .213\ CSA + 4.323\ T1T2 - .363\ OTHFED - .000000176\ POP \cdot LNER + 542.9$

SEE = 73.45 (1.45) (201) (4.40) (.0146) (175) (50.3) (.359) (.709) T1T1 (.167) (.000000091) 12939

R^2 = .7555

3. $L = P^{.400}(1+m)^{(-1.351 + .064\ SCHRATE)}\ Y^{.823}\ PROF^{.894}\ RES^{-.069}\ A^{-.012}\ CSA^{.092}\ T1T1^{.052}\ OTHFED^{-.010}\ e^{-2.27}$

SEE=73.45 (.074) (.778) (.643) (.174) (.042) (.063) (.018) (.043) (.017) (.015) (1.57)

R^2=.7103

4. L= 6.583 P - (483.6 - 15.6 SCHRATE) (1+m) + .068 Y + 428 PROF - 123 RES

SEE=77.40 (1.529) (211.8) (4.64) (.154) (185) (53)

R^2=.0971 -.533 A + .733 CSA + 5.934 T1T1 + .526 OTHFED - .000000175 POP·LNLR

(.378) (748) (1.183) (.176) (.000000096)

+395

(252)

5. L= $P^{.210}_{(1+m)}(-1.224 + .0665\ SCHRATE)Y^{.475}_{PROF}{}^{.073}_{RES}{}^{-.056}_{A}{}^{.0027}_{CSA}{}^{.089}_{T1T1}{}^{.0446}_{OTHFED}{}^{.0394}e^{1.45}$

SEE=1.525 (.055) (.577) (.0219) (.129) (.031) (.046) (.013) (.032) (.013) (.011) (1.16)

R^2=.6348

South Carolina - 1968-69

6. L= .0374 P + 99.79 % WHITE - 43.14 % MAN + .377 A + .037 T1T1 - .407 OTHRED -84

SEE=24.54 (10.853) (33.69) (20.97) (.293) (.195) (.135) (62)

R^2=.554 .554

California - 1971-72

7. L= .0192 P + .0085 Y + 4.31 PROF - 4.74 % YOUNG - 8.82 % OLD + 9.72 % PRI

SEE=108 (.0009) (.0036) 1.60 (2.92) (2.77) (3.36)

R^2=.8826 .8826

-13.6 %UE + 4.06 % POV + 3.45 % BLACK + .857 % CHICANO + 8.33 % ORIENTAL

(6.41) (2.11) (1.00) (.599) (5.12)

-.658 A + 1.64 SE - .825 COMP + 1.01 OTH - .263 CO + 44.95 T1T1

(.137) (.434) (1.73) (.423) (.635) (133)

-.543 OTHFED + 428

(.089)

8. R= .0124 P + .0132Y - 14.93 % YOUNG - 8.21 % OLD - 4.93 % PAROCH

SEE=119 (.0010) (.0029) (3.12) (2.42) (2.59)

R^2=.7476 .7476

-15.90 % UE + 4.86% BLACK + 1.35 % CHICANO + .46 A

(6.78) (1.04) (.59) (.15)

+3.11 SE - 3.78 COMP + 2.23 OTH + 1.65 CO + 1.24 FED

(.47) 1.89 (.46) (.66) (.094)

TABLE 2

Relative Importance of Property Value and Income

Equation and Dependent variable		Elasticities Property	Income	Beta Weight Property	Income
MASSACHUSETTS					
2	L	.3122	.7093	.579	.363
3	L	.400	.823	---	---
4	R	.225	.499	.579	.354
5	R	.210	.475	---	---
SOUTH CAROLINA					
6	L	.6065	0	.5428	0
CALIFORNIA					
7	L	.532	.153	.778	.096
8	R	.230	.159	.662	.196

L = local revenue per pupil; R = total revenue per pupil in Massachusetts and South Carolina, current expenditures per pupil in California; P = equalized property valuation per pupil; Y = mean family income; POP = population; SCHRATE = school tax rate; LNER = local non-education revenue; PROF = percent of males employed as professional and technical workers; RES = percent of property value which is residential; % WHITE = percent of pupils who are white; % MAN = percent of property value which is manufacturing property; % YOUNG = percent of residents aged 5-18; % OLD = percent of residents over 65; % PRI = percent of pupils in private schools; % PAROCH = percent of pupils in parochial schools; % UE = Unemployment rate; % POV = percent of families with incomes below $4,000; % BLACK, % CHICANO, and % ORIENTAL = percent of public school pupils who are black, chicano, or oriental; A = general purpose state aid; CSA = categorical state aid; SE = special education aid; COMP = compensatory education aid; OTH = other categorical state aid; CO = county aid; T1T1 = Title I and ; OTHFED = non-Title I federal aid; FED = total federal aid. SES variables are from the 1960 census for Massachusetts and South Carolina, from the 1970 census for California.

FOOTNOTES

1. The obvious example is the reversal of the Rodriguez decision by the Supreme Court (U.S. (1973)), but in addition the early Michigan decision, Milliken v. Green, (203 N.W. 2d. 457, Sup. Ct. 1972) was reversed last December (No. 53809, Mich. Sup. Ct., Dec. 7, 1973) on reconsideration by the state's Supreme Court with two supporters of the earlier decision replaced.

2. Legislative reforms in Montana, Florida, and Wisconsin have been challenged by wealthy districts who will be relatively worse off than before.

3. A recent district court decision in Idaho (Thompson v. Engel King, No. 47055, Dist. Ct. Ada County, decided Nov. 16, 1973) ruled that state's system of school finance financing unconstitutional; the decision is being appealed. The Serrano trial in California is still at the district court level, and may not reach the state's Supreme Court for another year or two.

4. For recent legislative action, see "From the State Capitals", a newsletter published by Bethune-Jones, 321 Sunset Avenue, Asbury Park, N.J.

5. In this paper the distinction between total revenues and current expenditures per pupil will sometimes be ignored. It should be kept in mind that the necessary correction for capital expenditures is not constant among districts, and contributes a small part of resource variation.

6. Revenues are expressed in dollars per pupil, property valuation in thousands of dollars per pupil, and the tax rate in mills.

7. The obligatory cite is John Coons, William Clune, and Stephen Sugarman , Private Wealth and Public Education (Cambridge, Harvard University Press, 1974).

8. For a typical exposition of this model, see Richard Musgrave and Peggy Musgrave , Public Finance In Theory and Practice (New York: McGraw-Hill, 1973), pp 614-620.

9. Slightly different models, in which the tax per capita or tax as a percent of income rather than the tax rate is an argument of the utility function, yield slightly different results. However, I have argued that these variants are both theoretically and operationally inferior; see "Intergovernmental Aid and Resource Disparities: School Finance in Massachusetts" (unplublished, August 1973), ch. 2.

10. Formally, total differentiation of the first-order conditions from equation (5) yields the following different expressions:

$$\frac{\frac{\partial R}{\partial m}}{\rho} = \frac{(1+m)}{\rho}\frac{\partial L}{\partial m} + \frac{L}{\rho} = \left(\frac{W_{22}\,L}{(1+m)P^3} - \frac{W_1}{\rho}\right)\Big/\left(W_{11}(1+m) + \frac{W_{22}}{(1+m)P^2}\right)$$

$$\frac{\frac{\partial R}{\partial P}}{(1+m)} = \frac{\partial L}{\partial P} + \frac{L}{(1+m)}\frac{\partial m}{\partial P} = \left(\frac{W_{22}\,L}{(1+m)^2P^3}\right)\Big/\left(W_{11}(1+m) + \frac{W_{22}}{(1+m)P^2}\right) + \frac{L}{(1+m)}\frac{\partial m}{\partial P}$$

11. While seven additional states included matching grants in legislation passed in 1972-73, the presence of save-harmless and transitional provisions will make it difficult to isolate price effects in these states for some time to come.

12. While this sample comprises less than half of the 351 districts in Massachusetts, it does include 85% of pupils in that state.

13. A second problem besides the lack of data is that the estimation of price effects is relatively complex econometric problem, involving considerations of the form of the estimating equation, identification, and simultaneity. For an exposition of these problems, see W. Norton Grubb and Stephan Michelson, States and Schools: The Political Economy of Public School Finance (Lexington, Mass.; Heath Lexington, forthcoming), ch. 7. The estimates for Massachusetts presented in Table 1 are derived by two-stage least squares, based on a system of simultaneous equations.

14. Equation (1) is the best specification for estimating local revenue, as discussed in Grubb and Michelson, op. cit., Ch. 6. However, the specifications of equations (2-5) are better suited to testing the hypotheses presented in this paper.

15. The two sides of equation (9) are statistically different from one another if the difference

$$\frac{L + (1+m)\frac{\partial L}{\partial m}}{\rho} - \frac{\partial L}{\partial P} + \frac{L}{(1+m)}\cdot\frac{\partial m}{\partial P}$$

is statistically different from zero, using a two-tailed test. Forming this expression and dividing it by its standard deviation gives a value of 2.0 indicating a statistically significant difference at better than the 5% confidence level.

16. The value of $\partial m/\partial P$ is given by the formula for general school aid in Massachusetts; it is not stochastic and is not therefore estimated. Its value is -.033 for districts other than those affected by one of the many ceiling or floors in the formula; most of these effectively receive non-matching and, so $\partial m/\partial P = 0$. (P is measured in thousands of dollars.)

17. Grubb and Michelson, op. cit., Ch. 8. For a similar result using a slightly different data base, see Martin Feldstein, "Wealth Neutrality and Local Choice in Public Education", Harvard Institute of Economic Research Discussion Paper 293, July 1973.

18. For a good example of the use of property composition as the measure of price effect, see Robin Barlow, "Efficiency Aspects of Local School Finance", Journal of Political Economy 78 (Sept. - Oct. 1970).

19. See especially John Callahan, William Willken, and Tracy Sillerman, "Urban Schools and School Finance Reform: Promise and Reality", The National Urban Coalition, Nov. 1973.

20. See Coons, Clune and Sugarman, op. cit.

21. See again Callahan, Wilken, and Sillerman, op. cit.

22. See especially the Supreme Court's decision in Rodriquez, _____ U.S. ____ , (1973). For a summary of legal arguments and previous commentary on wealth versus individual poverty see Note "A Statistical Analysis of the School Finance Decision: On Winning Battles and Losing Wars", Yale Law Journal 81 (1972); for a rebuttal of this article, see W. Norton Grubb and Stephan Michelson, "School Finance in a Post-Serrano World", Harvard Civil Rights-Civil Liberties Law Review 8, May 1973.

23. About half the counties in South Carolina contain more than one school district, and therefore the results reflect some aggregation of school districts into county units. This approach was necessitated by the lack of socio-economic data for districts. These results are, like those for Massachusetts, estimated with a simultaneous-equations model using two-stage least squares. See Grubb and Michelson, States and Schools: The Political Economy of Public School Finance (Lexington, Mass.: Heath-Lexington Books, forthcoming), Appendix to Ch. 7.

24. These results were obtained in collaboration with Jack Osman. Because of the lack of simultaneity in the most critical variables and the structure of school districts in California, these results are ordinary least squares results from single equation models.

25. The elasticity of x with respect to y is $\frac{\partial x}{\partial y} / \frac{x}{y}$, and represents a standardization for the relative magnitudes of x and y. The beta x with respect to y is $\frac{\partial x}{\partial y} / \frac{\sigma x}{\sigma y}$, where σ indicates the standard deviation; it is therefore a standardization of $\partial x/\partial y$ for the relative variation of x and y.

26. This refers to the elasticities. Beta weights, on the other hand, indicate that property value is more important determinant of local revenue. This is due to the extraordinarily large variation of property value compared to income.

27. This comment implicitly assumes that the relative weights in an index of poverty or wealth for a school aid formula should be based on the coefficients from regressions like those in Table 1. For a more thorough discussion of this concept, see John Akin, "An Improved Method for Estimating Local Fiscal Capacity", working paper 183-73, Institute for Research in Poverty, University of Wisconsin, November 1973. There is a theoretically serious drawback to using such indices in state matching rates to eliminate the positive correlation of revenues with both property valuation and income: it is easy to show that it is impossible to attain two goals with one policy instrument, the state's matching rate. Grubb, op. cit., Ch. 5. However, in reality the use of income as well as property valuation should reduce both correlations; for relevant simulations, see Grubb and Michelson, States and Schools, Ch. 8.

28. The evidence for the existence of this lag is rather indirect. In Massachusetts, including 1969 income (from the 1970 Census) in a regression for 1968-69 local revenue results in lower explanatory power than the inclusion of 1959 income. Similarly, for the California unified districts the regression of 1969-70 revenue and expenditure data on 1969 income yielded an insignificant coefficient for income, but 1969 income is clearly significant in regressions for 1971-72 revenue and expenditures. However, lagging property valuation does not increase explanatory power the way lagging income does.

29. See Charles Benson, "How to Beat Serrano: Rules for the Rich", Saturday Review of Education 35 (Jan. 1973); Grubb and Michelson, "Public School Finance in a Post-Serrano World", pp. 568-570.

30. For a description of this legislation, see W. Norton Grubb, "Public School Finance in a post-Serrano World: The First Round of Legislation", Law and Contemporary Problems, June 1974.

31. For a historical argument along these lines, see Grubb and Michelson, op. cit. Ch. 2.