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Fiscal Capacity, Equalization and Public Expenditure for Education

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Concern over the equitable distribution of public expenditures for primary and secondary education has been an important theme in education finance for many decades. Early efforts to assess differences in the ability of local communities to finance public expenditures focused on estimation of "fiscal capacity." This was usually interpreted to be some weighted average of the relevant local tax bases. Studies differed in the derivation of the weights but the assessed value of real property usually played a dominant role.[1] The weight given the per capita income was usually very small because, until quite recently, it has played a very small part in the local tax base. Income is, however, a fundamental index of the "ability-to-pay" of households. (Although year-to-year fluctuations of income for an individual household suggest that a longer-term

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[1]One of the most recent and interesting studies of local fiscal capacity is "Fiscal Needs and Resources: A Report to the New York State Commission on the Quality, Cost and Financing of Elementary and Secondary Education" by Harvey Brazer, John Akin, Gerald Anten and Cynthia Cross (November 1971). This study contains a very useful summary of earlier work on fiscal capacity.

measure--an average over several years or a life-time annuity measure of income--would be preferable, a measure of average income across many households in a community is less subject to these short-term disturbances.) For statistical purposes, family income plays a variety of roles, serving not only as a budget constraint but also as an indicator of tastes and preferences. The latter role may be an argument for considering income more as a determinant of "fiscal effort" than of fiscal capacity. Nevertheless, it can be questioned whether too little attention is given to income when measures of fiscal capacity are dominated by non-income tax bases.

The Federal government "war on poverty" in the 1960's generated an alternative approach to the equity issue. The most striking example is Title I of the Elementary and Secondary Education Act which provided for Federal grants to school districts to be allocated on the basis of the number of children of impoverished families in the district. Here family income--or more specifically the percentage of families below a specified poverty line--became the relevant measure of fiscal incapacity.

The California court case, Serrano vs. Priest, marked the return to center stage of a specific measure of local, tax-based fiscal capacity --i.e. standardized property tax base per pupil in the public schools. Under the "new equal protection doctrine," it was argued that discrimination in the provision of opportunities in which citizens have a "fundamental interest" (in this case, education, for which a precedent seemed to have been set in the racial discrimination case, Brown vs. the Board of Education) on the basis of a "suspect criterion" (in this case, income or wealth) is a denial of equal protection of the law unless the state

can show a compelling interest in using the classification scheme in question. In the Serrano case, it was argued that differences in educational expenditure per pupil were strongly associated with differences in the property tax base. Weaker evidence was presented that these differences in size of the property tax base were associated with differences in median family income. A similar argument by the plaintif, in Rodriquez vs. the Independent School District of San Antonio, was denied by the United States Supreme Court partly on the grounds that the relationship between differences in the property tax base per pupil and in median income had not been clearly established.[2]

The question of the respective roles of family income and taxable property in determining existing disparities in educational expenditures is, therefore, posed both in law and in economics. If there is a clear correlation between family income and taxable property in school districts then a stronger legal case can be made for equalization programs by State and Federal governments. Furthermore, it will matter little which indicator is used in equalization formulae. One would expect such a correlation across districts where taxable property is largely residential. On the other hand, the presence of sizeable amounts of business property may destroy such a correlation. Consequently, the role of business as a potential

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[2]Although major focus was placed on the evidence presented pertaining to Texas, the Court also cited an article analyzing the relationship of family income and taxable property in Connecticut: "A Statistical Analysis of the School Finance Decisions: On Winning Battles and Losing Wars" by Peter Grossi, Jr., Michael J. Churgin, and Peter E. Ehrenberg, Yale Law Journal, Vol. 81, No. 7, June 1972, pp. 1303-1341.

contributor to local public expenditures is one important question to be considered. The problem of disentangling the closely intertwined effects of family income, family size, family educational attainment, and family preference for central city or suburban residence must also be confronted.

This study attempts to measure the roles of these various forces in determining the differences in educational expenditure per pupil across school districts in the State of Connecticut in 1970. In particular, it investigates whether the same property tax base per pupil is likely to result in the same expenditure per pupil regardless of the composition of the tax base. If the composition of the tax base, and other community characteristics associated with it, do influence educational expenditure, then property tax base per pupil may not be the optimal index of fiscal capacity for use in equalization formulae.

I. The Sample and Some Preliminaries

Connecticut provides a useful sample for a number of reasons. First, the property tax is virtually the only source of locally raised revenues. Second, Connecticut has few overlapping but non-contiguous jurisdictions so the accounting relations between tax base, revenues and expenditures are quite simple. Finally, Connecticut school districts, which are contiguous with "towns" in all cases in this sample, have a fairly wide range of characteristics; there are some cities with metropolitan characteristics, some predominately suburban towns, and some small rural towns. The basic sample consists of 130 of the 169 towns in Connecticut. Two towns are omitted because of the presence of large Federal or State institutions

which obscure the relationship between local expenditures and the local tax base. The other towns omitted are very small and participate in consolidated school districts extending beyond town boundaries.

The public decision-making process differs somewhat across towns. In all cases, the school system budget is part of the total budget of the town; the school system has no independent taxing authority. In 104 of the total of 169 towns in the State, the budget is formulated by a Board of Finance. In many of these towns, the authority of the legislative body to make changes in the size and composition of the town budget is rather circumscribed. At the opposite extreme, some of the smaller towns approve their budgets in open town meetings. In the latter case, the school system budget is likely to be large relative to expenditures for other public services and the trade-off among school expenditures, other public services and private spending (or saving) is conspicuous even if the school system is legally fiscally dependent upon the town.

Local school systems receive State and Federal aid through a variety of programs. Many of these are related to construction and purchase of equipment. These will be ignored in this study which focuses on current expenditure. By far the most important source of aid for current expenditures is a flat grant from the State of $200 per pupil in "average daily membership." This ADM grant has no cost-sharing requirements. Funds are also received from the Federal government under Title I of the Elementary and Secondary Education Act (referred to above) and under a very similar program of State Aid for Disadvantaged Children (SADC). Although the amounts of these grants are small when averaged over the total number of

pupils in the school system, the fact that the grants are received for specific programs described in a grant application suggests that they are likely to constitute a net addition to school system expenditures. Other funds are received for a welter of programs--school libraries, driver training programs, vocational education, adult education, etc.--and under a wide variety of terms involving some cost-sharing in many cases. Because the amount of these funds per pupil is also fairly small, no effort is made in the following analysis to take account of the wide array of specific grant terms.

Preliminary analysis is focused on total current expenditures per pupil net of Federal and State aid. Several qualitative assumptions seem reasonable concerning determinants of variation in these outlays across school districts.

First, actual expenditures correspond in some loose way to the desires of citizens in the community. Budget constraints of households are a major determinant of the amount of goods and services they demand. Hence, variation in median income and possibly in some characteristics of the income distribution can be expected to have a major influence on variation in per-pupil expenditures. Clearly, determinants of taste, such as the educational attainment of the adult population and preferences for public, private or parochial education may also play a role. Even the most open referendum process will not yield a result that satisfies all members of a heterogeneous community. Choice of residential location, however, is likely to result in some amount of clustering of households with homogeneous tastes within communities and disparities of tastes across communities.

Second, the size of public school enrollment relative to the population may also affect school expenditures per pupil. A larger number of families with children would imply more adults who are interested consumers (at least indirectly) of this public service. On the other hand, more children per family, and in the community at large, implies a large total tax burden for each added dollar of per-pupil expenditures.

Finally, the presence of business activity complicates the modelling of the public choice process. The business sector both provides revenue, and creates demands for public services which may compete with school expenditures for the use of tax dollars. The demand of the business sector for public education is likely to depend on the preferences of its employees, particularly administrative and professional personnel, and on its perceptions of the likelihood that today's local school-aged population will become its work force in the future. Although the business sector is often thought of as expressing its demands for public expenditures solely through its locational choice, the possibility of direct political influence is real and might be greater where an appointed Board of Finance (consisting largely of local businessmen) plays a central role in the budgetary process.

For these reasons, the size of the business sector might be expected to have an effect on public expenditures for education and other services. Measurement of the size of the business sector is problematical. Total employment (measured on an establishment basis) is used in this study, because the data is available on a local basis, even though this measure fails to capture other possibly relevant dimensions of business activity.

Although many studies of the demand for education have used the total size of the local property tax base as an explanatory variable--and despite the fact that such an approach is strongly suggested by legal and institutional literature--this does not seem appropriate.[3] On a theoretical level, rational households will not view their taxable real wealth, per se, as a budget constraint. The availability of business property is, of course, a community asset. Indeed, the larger the value of business property available as a taxable resource to a residential community of a given size, the smaller the share of public expenditures which must be directly financed by residents. This implies, however, that it would be the composition of the tax base, not its total size, which would be relevant. On a statistical level, if public expenditure and taxation decisions marginally affect the locational choices of households or businesses, they will be capitalized in local property values and a simultaneous-equations bias can be introduced by using the value of taxable property directly as an explanatory variable. Median income and ratio of business employment to population should be effective instruments for residential and business property in a crude reduced-form estimating relation. This approach has the disadvantage, however, of mixing together in a single coefficient the direct effect of median income and the indirect effect of residential property. An alternative approach is suggested later in this paper.

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[3] Admittedly, a model of a highly centralized decision process in which the public decision maker desired to minimize the local property tax rate would result in inclusion of the property tax base as an explanatory variable.

The discussion up to this point suggests that the empirical relations to be estimated should be viewed as demand functions. Two caveats should be noted. First, the relationships between educational inputs and educational outputs is obscure. Rational residents of a community might be assumed to choose to spend more on education only if they believed that the extra dollars would purchase greater educational achievement. This presumption is not clear, however, in the absence of expert agreement on the "best educational technology." Without such knowledge, the decision of one community to spend more than another could imply any of the following: (a) the belief that more inputs will buy greater educational achievement, (b) the belief that, given the characteristics of the children enrolled, supplementary expenditures are needed to achieve the same (or some minimally satisfactory) achievement, (c) a willingness to incur the extra costs of experimenting with a new technology in the hope that it will produce greater educational achievement, or (d) the joint purchase of amenities along with educational achievement. In essence, expenditure on education is a risky purchase of a nonhomogeneous product. This does not destroy the notion of expenditure as demand determined but it does require care in the interpretation of empirical results. On the supply side, it is assumed that factor inputs are available to all schools at the same exogeneously determined price. This assumption is undoubtedly somewhat inaccurate since a premium salary may well have been required for central city teaching in the largest cities of the state. In view of the widespread belief that a low pupil-teacher ratio is likely to enhance the quality of educational achievement, it is somewhat reassuring that educational

expenditure per pupil and the pupil-teacher ratio have a negative correlation of .38 in the sample used for the estimates below. The fact that the correlation is not higher in absolute value, when teachers' salaries account for slightly more than 60 percent of current expenditures, suggests considerable variation in salary scales, in the mix of teachers of various amounts of seniority, or in the distribution of costs between teachers' salaries and other expenses. The expenditure equations to be analyzed next may be influenced by some forces other than purely demand considerations.

II. Trial Estimates

Given the assumptions mentioned above, the most simple, ad hoc regression relation attempting to explain cross-sectional variation in local educational expenditure per pupil (i.e. public expenditure net of Federal and State aid) would include as explanatory variables median family income (Med. Inc.), the ratio of employment to population (Emp. Rate), the ratio of public school enrollment to population (ADM/Pop) and, possibly, the percentage of families with incomes above $25,000 (High Inc.), the percentage of families with incomes below the Federal poverty standard (Pov't), median years of schooling of the adult population (Yrs. Ed.) and whether or not the town has a Board of Finance (Bd. Fin.). Table I provides some preliminary regressions, estimated linearly in the logarithms for the full sample of 130 towns. Regression (1') and the other regressions presented in Table I.a present regressions estimated for a sub-sample of 74 towns with populations over 10,000 for which additional Census data are available.

TABLE I

Regressions Explaining Local Educational Expenditure per Pupil
(estimated linearly in the logarithms, t-statistics appear
below coefficients)

	(1)	(1')	(2)	(3)	(4)	(5)	(6)
Med. Inc.	.407 (3.13)	.636 (4.05)	.489 (3.32)	.097 (.46)	.538 (2.65)	.408 (3.11)	.438 (3.35)
Emp. Rate	.106 (4.34)	.212 (5.59)	.108 (4.41)	.108 (4.50)	.102 (3.96)	.106 (4.32)	.126 (4.79)
ADM/Pop	-.408 (3.64)	-.403 (3.43)	-.361 (3.04)	-.272 (2.25)	-.116 (.92)	-.408 (3.63)	-.491 (4.14)
Yrs. Ed.	1.60 (4.88)	1.46 (3.54)	1.58 (4.78)	1.53 (4.74)		1.60 (4.84)	1.66 (5.05)
Pov't.			.053 (1.18)	.033 (.74)	.046 (.96)		
High Inc.				.086 (2.58)	.094 (2.63)		
Pop							-.035 (1.98)
Bd. Fin.						-.004 (.09)	-.014 (.34)
Constant	-5.760	-7.134	-6.511	-2.162	1.213	5.760	-6.05
R^2	.58	.72	.58	.61	.53	.58	.59
F	43	43	34	31	28	34	39
observations	130	74	130	130	130	130	130

TABLE I.a

	(1')	(7)	(8)
Med. Inc.	.636 (4.05)	.800 (4.37)	.756 (4.15)
Emp. Rate	.212 (5.59)	.193 (4.93)	.195 (4.97)
Bd. Fin			-.023 (.48)
ADM/Pop	-.403 (3.43)		
School Age/Pop		-.570 (3.11)	-.505 (2.75)
Pub Sch./Sch. Age		-.226 (.93)	
Pub High/High Sch			-.438 (2.08)
Pub Prim/Prim Sch			.085 (.39)
Yrs. Ed.	1.46 (3.54)	1.17 (2.69)	1.14 (2.63)
Constant	-7.134	-7.56	6.90
R^2	.72	.73	.74
F	43	36	27
observations	74	74	74

Regressions (1) and (1') confirm the hypotheses that educational expenditures would be positively related to median family income, years of education of the adult population and negatively related to the ratio of public school enrollment to population (probably best interpreted as a price effect although it could also be an indication of economies of scale). The positive coefficient of the ratio of employment to population indicates that the business sector does provide a supplement to the tax base. Regressions (2), (3) and (4) suggest that the income distribution may also affect expenditures but the positive correlations among median income, the proportion of families with income above $25,000 and educational attainment and the negative correlations of these variables with poverty make it impossible reliably to distinguish separate effects. The suggestion of a positive effect of poverty on local expenditures, net of Federal and State grants, might imply either some local effort at compensatory educational or other services (school lunches, medical services or intra-district bussing) or that higher expenditures were thought to be necessary to compensate for the effects of socio-economic heterogeneity in the schools. The possibility that budget setting by a Board of Finance might curb school expenditures is not borne out, as shown in Regressions (5) and (6).

For the smaller sample, it was possible to separate the effects of the number of school aged children in the population and the proportion of those attending public elementary or high school. The former effect is clearly negative and most likely to be a price effect. The latter effect is insignificant for primary school but also negative for high school pupils suggesting some economies of scale at that level.

A number of questions are left unanswered by these estimates. First, what is the effect of grants? Since it seemed unlikely that grants would be logarithmically related to expenditures in the absence of sizeable and strict cost-sharing requirements, total educational expenditures per pupil were related linearly to the first four explanatory variables used in Table I and to total Federal grants, State aid for disadvantaged children (SADC) and other State grants excluding the flat per-pupil grant. The results, shown in Regression (9) which was estimated with 130 observations,

$$(9) \quad Y = -235 + \underset{(4.22)}{.020}\ \text{Med Inc} + \underset{(4.60)}{228}\ \text{Emp Rate} - \underset{(3.74)}{951}\ \text{ADM/Pop} + \underset{(4.95)}{7.40}\ \text{Yrs. Ed.}$$

$$- \underset{(.09)}{.050}\ \text{Fed Grants} + \underset{(2.13)}{3.29}\ \text{SADC} + \underset{(.02)}{.009}\ \text{Other grants}$$

$$R^2 = .65\ , \quad F = 32$$

indicate that only SADC grants make a net positive contribution to total expenditures per pupil.

A second question concerns the statistical properties of the estimates. Concentration of negative residuals among observations in one of the eight counties implies heteroscedasticity in Regression (1). A Box and Cox transformation[4] of both the left hand side and right hand side

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[4] Let the regression relation be $y = \beta x + \mu$ (μ distributed normal 0, σ^2). The transformation is $(y^{\lambda}-1)/\lambda$ allowing λ to vary between zero (implying a logarithmic regression) and 1 (implying a linear regression). The expression $-\frac{T}{2} \ln \hat{\sigma}^2 + (\tilde{\lambda}-1)\Sigma \ln y$ is proportional to the likelihood function. For discussion and examples see A. Zellner, An Introduction to Bayesian Inference in Econometrics, pp. 162-167.

variables in Regression (2), was used to test the appropriateness of the logarithmic specification. The likelihood function proved to be very flat; the logarithmic form could not be rejected.

The possibility that a logarithmic form was indeed correct but that other aspects of the specification could be improved called for a theoretically tighter specification.

III. Theoretical Guides to Specification and Some Quantitative Results

Assume a decision making process which maximizes the utility of the representative (median) voter subject to a budget constraint and further assume that that voter has a Cobb-Douglas utility function of the following form:

$$\mu = X^{\alpha}\left(Y - t\,\frac{R}{m}\right)^{\beta} Z^{\gamma}$$

where X is total educational expenditure per pupil,

Y is family income,

Z is expenditure per household on other public services (not pure public goods),

t is the local property tax rate,

R is the value of total residential property in the community,

m is the number of households (if there is 100% forward shifting of residential property tax there is no distinction between property owners and renters).

The budget constraint is:

$$t = \frac{nX - G + mZ}{R + B}$$

where n is the number of children in the public schools,

G is the amount of grant funds received (treated as lump sum),

B is the total value of business property (the fact that B enters the constraint but does not directly enter the calculation of after-tax income implies that the incidence of the business property tax is external to the community).

Substituting the budget constraint into the utility function, maximizing with respect to X and Z and simplifying gives the following demand function if Y, R and B are assumed fixed:

$$X = \frac{\alpha}{\alpha+\beta+\gamma} \cdot \frac{m}{n} \cdot \frac{R+B}{R} \cdot \left(Y + \frac{G}{m} \cdot \frac{R}{R+B}\right).$$

For the purpose of statistical estimation, one would not wish to impose the strict assumption that the income and price elasticities are equal. Relaxing this assumption permits several estimating relations:

$$(10) \quad \ln X = \text{constant} + \delta \ln\left(\frac{n}{m} \cdot \frac{R}{R+B}\right) + \epsilon \ln\left(Y + \frac{G}{m} \cdot \frac{R}{R+B}\right)$$

[Tax] [Adj. Inc.]

$$(11) \quad \ln X = \text{constant} + \delta \ln \frac{n}{m} + \gamma \ln \frac{R}{R+B} + \epsilon \ln\left(Y + \frac{G}{m} \cdot \frac{R}{R+B}\right)$$

[ADM/Pop] [Price] [Adj. Inc.]

$$(12) \quad \ln\left(X - \eta \frac{G}{n}\right) = \text{constant} + \delta \ln \frac{n}{m} + \gamma \ln \frac{R}{R+B} + \epsilon Y$$

[Net X] [ADM/Pop] [Price] [Med. Inc.]

Regression estimates of equations (10), (11) and (12) are presented in Table II. In these estimates, population was substituted for number of households. The "Price" and "Tax" variables are calculated in a first stage by regression the log of residential property value per pupil and the log of total property value less residential (per pupil) each on the log of median income, the log of the employment ratio, the log of the ratio of public school enrollment to population and the years since property values were last reassessed,[5] and then computing the "Tax" and "Price" variables from these estimates values. This two stage procedure was used to avoid simultaneous equations bias in the event that (a) the level of public expenditures influences property values (the Tiebout hypothesis) or (b) that omitted socio-economic characteristics influence both educational expenditures and property values leading to a correlation of errors across the estimated regressions. Π is estimated iteratively minimizing the sum of the squared errors.

Comparison of Regressions (10-1) and (11-1) suggests that estimation of separate coefficients for ADM/Pop and Price uses degrees of freedom unnecessarily. Indeed the coefficients of these terms are not significantly different from each other or from the coefficient of the Tax term. Quite clearly, price effects are significant. Comparison of

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[5]Towns in Connecticut vary in the ratio of assessed to market value of taxable property. The dependent variables were adjusted to 100% of market value. Towns also differ in the timing and frequency of re-assessment which required the semi-log adjustment to allow for growth of property values through time.

TABLE II

Regressions Explaining Educational Expenditure per Pupil
(estimated in logarithms, t-statistics appear below coefficients)

	(10-1)	(10-1')	(10-2)	(10-3)	(11-1)	(11-2)	(12-1)	(12-2)	(12-3)	(12-4)	(12-1')	(12-1")
Dependent Variable	X	X	X	X	X	X	NetX=X	NetX	NetX	X	X	X
Independent Variables							η=0	η=.1	η=1			
Tax	-.368	-.462	-.346	-.316								
	(9.46)	(9.50)	(8.51)	(7.52)								
Adj. Inc.	.398	.608	.471	.218	.415	.501						
	(4.56)	(5.59)	(4.86)	(1.54)	(4.67)	(5.03)						
Yrs. Ed.	1.158	1.047	1.134	1.112	1.143	1.112	1.150	1.182	1.659	1.118	1.055	.808
	(5.29)	(3.66)	(5.20)	(5.20)	(5.20)	(5.10)	(5.24)	(5.24)	(5.08)	(5.12)	(3.70)	(2.75)
Pov't.			.049	.035		.055				.055		
			(1.68)	(1.22)		(1.85)				(1.85)		
High Inc.				.053								
				(2.43)								
ADM/Pop					-.299	-.256	-.301	-.304	-.338	-.258	-.382	
					(3.80)	(3.15)	(3.81)	(3.74)	(2.88)	(3.16)	(4.75)	
Price					-.454	-.453	-.448	-.461	-.648	-.446	-.563	-.542
					(4.84)	(4.88)	(4.79)	(4.80)	(4.66)	(4.82)	(5.77)	(5.51)
Med. Inc.							.406	.421	.621	.492	.614	.678
							(4.63)	(4.67)	(4.76)	(4.99)	(5.67)	(5.72)
School Age/Pop												-.400
												(3.22)
Pub.Prim/All Prim												.018
												(.12)
Pub. High/All High												-.392
												(2.70)
Constant	-3.379	-5.041	-4.091	-1.344	-3.409	-4.211	-3.354	-3.704	-8.410	-4.147	-5.062	-4.537
R^2	.591	.710	.600	.618	.594	.604	.593	.595	.588	.604	.714	.740
F	60	57	46	40	45	38	46	46	45	38	43	32
No. of Obs.	130	74	130	130	130	130	130	130	130	130	74	74
St.Dev. of Residuals							.104	.107	.154			

Regressions (12-1), (12-2) and (12-3) shows that the effect of external grants on total expenditures is negligible. This is also suggested by the similarity of Regressions (11-1) and (12-1). As in the previous regressions, it is impossible to distinguish separate effects of median income and high income. There is a suggestion of a very small positive effect of poverty. The ratio of school aged children to the population has a significantly negative effect as does the ratio of high school children in public schools. Casual examination of the residuals revealed no peculiarities that would suggest misspecification.

Regressions (10-1) and (12-1) were re-estimated omitting towns with populations less than 10,000 in order to exclude most districts participating in consolidated high schools or other large inter-district programs. These types of consolidation create problems in the accounting and allocation of costs and therefore may introduce noise in the data. The exclusion of the smaller towns permits a better fit and substantially raises the income and price coefficients. Particularly for this sub-sample, the goodness-of-fit compares favorably with the results of other studies where R^2 varied between .6 and .86. The samples used in other studies[6] have varied, in some cases being a set of districts within a specific state, in some cases State aggregates and in some cases districts from various states. Regressions have been estimated either linearly or logarithmically.

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[6] See the empirical references on educational expenditures listed at the end of this paper.

Regressors have included median income, total taxable property value, the price variable used above, the proportion of students in private schools, the proportion of students in high school, population density or urbanization, age and race characteristics of the community, amounts of aid from various sources, the proportion of expenditures financed by the local property tax and, in a few instances, supply or cost variables such as teachers' salaries or the pupil/teacher ratio. As might be expected, the importance of fiscal variables is dependent on the nature of the sample; they are more important if the sample is drawn from a State which has large amounts of state aid, particularly if it involves a cost sharing formula, or if it includes observations from several states among which there is considerable variation in the structure of school financing. Conclusions about fiscal effects drawn from the Connecticut sample used in this study should not be generalized. In most other respects, the results of this analysis are qualitatively similar to earlier studies. This similarity, the overall goodness-of-fit achieved for the Connecticut sample, and the reasonableness of the results are grounds for some confidence in the descriptive accuracy of the models even though the amount of data-mining might raise some qualms about the forecasting characteristics.

IV. A Hypothetical Experiment

At the beginning of this paper, it was noted that if the composition of the tax base influenced expenditures for education, an equalization formula geared to the total size of the tax base per pupil would be suspect. It was further noted that the role of business activity, on the

one hand, as a contribution to the tax base and, on the other hand, as an influence on the level of taxation and the allocation of expenditures would be a major factor in the influence of the composition of the tax base. The expenditure relations presented in Section III point clearly to the significance of the composition of the tax base. They also permit the following hypothetical experiment.

Consider two towns one of which has a 10 percent higher ratio of employment to population than the second. The first town, however, has a sufficiently lower median income than the second that the two have the same total property tax base per pupil in the public schools. Table III presents regressions relating property values to income and employment. Would there be any difference in the expenditure for education between the two towns?

The evidence from the full sample of 130 towns implies that, if ADM/Pop is assumed constant, a 10 percent higher employment ratio and a 2.06 percent lower median income would be associated with constancy in the total property value per pupil. These differences in community characteristics will be associated with a 3.3 percent lower ratio of residential to total taxable property ("Price") in the community with lower median income and a 0.7 percent lower educational attainment of adults. Regressions (12-1) and (10-1) in Table II imply that the community with lower median income will spend on education between 0.1 percent and 0.4 percent less per pupil. Approximately the same results can be derived from Regressions (12-4) and (10-2). The corresponding regressions for the smaller sample (12-1' and 10-1') imply 0.2 percent to 0.6 percent less expenditures per pupil in the community with lower median income and greater business activity.

TABLE III

Regressions Explaining Property Value per Pupil in the Public Schools (estimated in logarithms, t-statistics appear below coefficients)

	Residential Property	Business Property	Residential Property	Business Property
Dependent Variable:	130 towns	130 towns	74 towns	74 towns
Independent Variables:				
Med. Inc.	1.6167 (12.81)	.6259 (3.49)	1.6012 (11.68)	.6528 (3.43)
Emp. Rate	-.0023 (.06)	.4645 (9.09)	-.0152 (.29)	.6158 (8.58)
Yrs. since assessment	-.0267 (4.96)	-.0243 (3.18)	-.0242 (3.91)	-.0297 (3.45)
ADM/Pop	-.9243 (5.88)	-1.0828 (4.85)	-.8743 (5.39)	-.7846 (3.48)
Constant	-6.460	+2.829	-6.300	+3.214
R^2	.66	.67	.74	.72

The assumption of a constant ratio of public school enrollment to population is not descriptively accurate. In fact, for the entire Connecticut sample in question, a median income one percent lower is associated with an enrollment ratio that is about 0.4 percent lower. This finding does not imply that lower income families have fewer children, or fewer children in public school (although differential high school drop-out rates would tend to work in this direction). Primarily it reflects the fact that a large proportion of middle income families with children--who account

for a large proportion of the population--live in suburban towns while central cities contain not only large lower-income families but also unattached individuals, and young and older couples without children resident in the household. If the ratio of school enrollment to population is adjusted for this effect in the calculations just presented, the results drawn from the full sample imply expenditures that are 0.4 to 0.6 percent lower in the town with lower median income. Results based on the smaller sample, however, imply expenditures that are 0.4 to 0.8 percent higher in the town with lower median income. This reversal of sign illustrates the sensitivity of the results from this hypothetical experiment to the errors of estimate of an entire set of coefficients from several regression relations.

The magnitude of the variations in expenditure implied in the preceding exercise seems very small. These results should be viewed, however, in the context of Table IV which shows that the employment ratio varies by as much as a factor of 7 even among towns with quite similar property values per pupil. The table also shows substantial variation in per pupil expenditures (defined to exclude grants through the State Aid for Disadvantaged Children program which appears to be the one type of grant contributing a net addition to expenditures) among towns in the same tax base category. Row (3), the category containing the mean value of property tax base per pupil, suggests that expenditures tend to be lower in the more urbanized areas; Row (5) also tends to support this hypothesis. Rows (2) and (4), on the other hand, tend to refute this hypothesis to the extent that they display any discernable pattern at all.

TABLE IV

Cross-tabulation of School Expenditure, Median Income and Poverty

Tax Base Per Pupil		Employment Rate 1 Under .11	2 .11-.20	3 .20-.29	4 .29-.38	5 .38-.47	6 .47-.56	7 .56-.73	8 Over .73
(1) Under $24,943	a)	687	644	644	0	710	0	0	0
b') 11,294	b)	11,592	10,904	10,806	0	10,763	0	0	0
	c)	4.4	5.0	5.1	0	4.0	0	0	0
	N	11	2	4	0	1	0	0	0
(2) $24,943-$37,055	a)	700	725	704	724	608	752	0	0
b') 12,034	b)	11,882	12,880	11,751	11,660	9,978	10,957	0	0
	c)	3.7	3.6	4.1	4.2	5.8	5.1	0	0
	N	7	16	10	9	2	2	0	0
(3) $37,055-$45,130	a)	0	785	760	787	741	730	0	0
b') 12,324	b)	0	14,351	12,799	11,325	10,913	10,909	0	0
	c)	0	2.7	3.6	5.0	5.8	6.0	0	0
	N	0	4	8	2	3	4	0	0
(4) $45,130-$57,243	a)	841	801	836	837	828	764	949	880
b') 12,917	b)	20,566	13,197	14,345	12,161	12,815	11,041	11,478	10,842
(12,328)	c)	2.2	4.7	3.8	4.0	3.7	6.4	8.2	7.9
	N	2	1	3	6	8	4	2	2
(5) $57,243-$73,393	a)	0	670	1033	985	0	902	938	902
b') 15,613	b)	0	13,583	18,674	15,451	0	13,174	13,245	11,771
	c)	0	4.0	2.8	2.2	0	5.2	3.3	3.4
	N	0	2	5	1	0	2	1	1
(6) Over $73,393	a)	0	728	0	1011	1040	0	0	0
b') 14,972	b)	0	12,080	0	14,919	18,024	0	0	0
	c)	0	1.0	0	3.2	2.9	0	0	0
	N	0	1	3	1	0	0	0	0

Note: a) Educational expenditure per pupil less SADC.
b) Median income. b') Average median income for towns in row (also shown for Row 4 exc. towns in Col. 1).
c) Percent of households below the poverty line.
N Number of observations in cell.

Mean tax base (adjusted to 100% of market value and corrected for growth since assessment) per pupil is $41,093. Category 1) contains observations more than one standard deviation below the mean, Categories 2) and 4) between one-quarter and 1 standard deviation from the mean, Category 5) between 1 and 2 standard deviations above the mean and Category 6) more than two standard deviations above the mean.

Mean employment rate (ratio of employment to population) is .28. The width of Categories 2) through 6) is one-half standard deviation; the width of Category 7) is one standard deviation.

A number of policy issues are posed by the preceding statistical analysis and by Table IV. First, there is a fairly clear association between family income and taxable property values in Connecticut but this is by no means a strong simple correlation between the total tax base per pupil and family income.[7] The pattern shown in Table III seems likely to be typical of industrialized States; the relation between family income and property value might be much weaker in States where a substantial amount of taxable property wealth results from mineral deposits. The degree of correlation necessary to satisfy the Federal courts seems unlikely to be tested in the near future in view of the rejection of the arguments of the plaintiffs in Rodriquez on other grounds as well. The possibility of legislative remedied remains, however, regardless of court action.

Second, Table IV demonstrates that redistribution formulae based on the total value of taxable property per pupil will, at the extreme, redistribute funds from upper-income, quasi-suburban towns to lower-income rural areas. Redistribution from towns in Rows (5) and (6) to towns in Row (1) is clearly progressive if the incidence of revenues used in State aid is reasonably proportional to income. With the exception of the two towns in Row (4) Column (1), however, redistribution from towns in Row (4) to towns in Row (2) reshuffles income among towns with very similar median incomes. The progressivity or regressivity of this action would

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[7] This point is already well documented in Grossi et al., op. cit., where the simple correlation between median family income and adjusted property value per pupil is shown to be .452.

depend on the extent to which State aid is raised from the business community in the towns with high employment ratios (which are also the largest towns in the State) and on the ultimate incidence of these business taxes.

Reading across the Rows in Table IV, one sees that towns with quite similar taxable property per pupil--and, hence, treated similarly under a redistribution plan based on this criterion--differ substantially in other characteristics. The differences in median income and incidence of poverty is particularly notable in Row (4). The contrast between the equalization remedies suggested by the "new equal protection doctrine" and those associated with the 1960's wars on poverty and urban blight can be illustrated by reference to Row (4). Under the former, the initial impact of redistribution will be adverse to towns in this Row, including the large and heavily urbanized towns in Columns (6), (7), and (8). Under the SADC program these urbanized towns received more SADC funds per pupil than any other towns in the State, as would be expected on the basis of their poverty statistics.

Finally, the hypothetical experiment based on the regressional analysis implies that central cities characterized by lower median incomes and larger business tax bases achieve relatively high educational expenditures per pupil not primarily through the beneficience of the business sector but at least in part by having fewer students to serve. Financing schemes adverse to these cities will tend to perpetuate the exodus of middle income families with children. For the families who remain, the fiscal benefits of a smaller ratio of school enrollment to population must be weighed against the costs--social and possibly financial--of greater economic and racial segregation.

Two of the most interesting equalization schemes focussed on maintaining local autonomy are the percentage equalization plan of Coons, Clune and Sugarman[8] and the price elasticity proposal of Feldstein.[9] Under the percentage equalization plan the State assigns a correspondence between property tax rates for education and levels of expenditure per pupil. Local districts can choose the tax rate-expenditure level they wish. All districts choosing the same tax rate are assured (by State grants and collection of surplus revenues) the same expenditure level regardless of the revenues their own tax base would yield. Feldstein shows that, if expenditures are price elastic, the effective elasticity of expenditures with respect to the property tax base can be reduced to zero by the use of cost-sharing grants where the cost-sharing requirement is also elastic with respect to the tax base.[10] These ingenious plans both suffer from the problem of treating central cities symmetrically with other areas. Either could be amended, however. Indeed, Coons et al. note that compensatory spending could be incorporated in their formula by weighting the number of pupils used in calculating the tax base per pupil; heavier weight could be given to high school pupils since this level of education may be more costly and, similarly, heavier weight could be assigned to disadvantaged

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[8] Coons, John E., William Clune and Stephen Sugarman, Private Wealth and Public Education, The Belknap Press, 1970, especially Ch. 6.

[9] Feldstein, Martin, op.cit.

[10] Feldstein notes that the Coons et al. proposal makes the elasticity of the cost-sharing requirement one and hence could over-shoot the target.

pupils. This procedure would reduce the tax base to which the chosen rate would be applied and hence increase the amount of State aid.[11] Feldstein does not consider this issue but, in principle, income elasticity could be substituted for elasticity with respect to the tax base in his formulation. He does suggest that wealth elasticity, per se, should perhaps be separated from taste for education which might be correlated with wealth. The distinction between the separate effects of income and educational attainment of adults, as done in Section III of this paper, would carry this thought through in a price elasticity approach to equalization where it was the effective income elasticity that was being reduced. These modifications of equalization programs would have substantially different distributive implications from programs based solely on total property tax base per pupil. The role of specifically compensatory educational expenditures must be decided at least partly on technological grounds: what can be accomplished, at what costs, in the education of different types of pupils? The role of fiscal incentives for, or against, segregation of the central cities ultimately cannot be evaded.

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[11] Although they note this possibility and appear to be sympathetic to the distinction between primary and secondary school, they seem to be rather indifferent toward the adjustment that would be required to solve the problem of central cities.

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