THE EFFECTS OF ALTERNATIVE STATE AID FORMULAS
ON THE DISTRIBUTION OF PUBLIC SCHOOL EXPENDITURES
IN MASSACHUSETTS

by

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ABSTRACT

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Submitted to the Department of Economics and Urban Studies
on December 21, 1971, in partial fulfillment of the require-
ments for the degree of Doctor of Philosophy in Economics
and Urban Studies.

This thesis presents the prototype of an econometric
model designed to simulate the effects of alternative aid
formulas on expenditure by local school districts. Such
a model is more useful than the purely qualitative models
of economic theory. It is also more useful than previous
econometric models, because it takes explicit account of
how local expenditures are affected by the form of inter-
governmental grants.

The Introduction explains the nature of the model in
nontechnical terms. The two essential concepts are the
opportunity frontier and the preference function. The
opportunity frontier shows how much expenditure per pupil
a school district can obtain by levying any particular
school tax rate. The frontier is determined by the amount
of local tax base per pupil and by the state and federal
aid formulas. The preference function, on the other hand,
indicates the local school board's willingness to raise
the local school tax rate for the sake of more expenditure
per pupil. The object of the econometric model is to mea-
sure how the local willingness to tax and spend depends on
the characteristics of the population in the district.
Socioeconomic status was found to be the main determinant.
This implies that, even if every district faced the same
opportunity frontier, higher-class districts would choose
to tax and spend more for schools. Accordingly, simulation
of a pure "percentage equalizing" formula in Massachusetts
indicated that wide, wealth-related disparities would persist.

The model and simulation are presented in Chapters
IV and V. Chapter I argues why reducing disparities in
expenditure per pupil is worth doing in the first place,
and Chapter II reviews the rationale of existing and proposed
state aid formulas. At the end, Chapter VI discusses how
simulation might be used in finding an optimal state aid
formula, and suggests generalizing the ideas about state
school aid to subsidy programs in general.

Thesis Supervisor: Peter Temin
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INTRODUCTION

STATEMENT OF PURPOSE

Recent court decisions in several states have elec-
trified the issue of school finance. The courts have
ruled that the present method of using the local property
tax to pay for public schools is unconstitutional because
it makes the level of spending in a school district depend
on the wealth of that district. (1) If these rulings
stand, the states will have to change their methods of financ-
ing public schools.

To satisfy the courts, the states may simply assume
the full burden of supporting local schools. (2) Or instead
they may preserve the local school district as an autonomous
fiscal unit, but find more equalizing formulas for distri-
buting state aid to the districts. Politically, the latter
solution seems more likely. If so, it would be important
to know what pattern of expenditure per pupil would result
from any particular new aid formula. Although the courts
may judge only the process of raising money for schools,
arguments over the intrinsic fairness of various formulas
are confusing to the average person. For public discussion
and legislative choice, it would therefore be useful to
predict the results of alternative formulas.

This paper presents an econometric technique for
making such a prediction. The model simulates the distri-
bution of expenditure per pupil among school districts
that would result from any given aid formula, taking into

account the change in the amount of revenue raised locally.
This prediction, while obviously not perfect, is better
than a forecast which ignores this change in expenditure
from local sources.

The simulation model employs two basic concepts:
the opportunity frontier and the preference function.
These may be explained in nontechnical terms as follows.

The opportunity frontier is a relationship between
the local tax rate and the level of expenditure per pupil
in a school district. Given the local tax base and the
amount of state and federal aid, any particular local tax
rate will determine the amount of expenditure per pupil.
The opportunity frontier thus represents the level of
expenditure the local school board would be able to get by
levying a given local tax rate.

At the same time, a school board's willingness
to incur higher tax rates for the sake of higher spending
is expressed by its preference function. Every school
board of course would wish to spend more and tax less.
But the opportunity frontier constrains the possibilities,
so that spending more entails taxing more. The preference
function identifies the most preferred combination of taxes
and expenditure out of all the possible combinations on
the opportunity frontier. At very low levels of taxes and
expenditure, most school boards would want to raise the local
tax rate in order to get more spending. At very high tax
rates, however, most school boards would be willing to

cut expenditures in order to reduce the tax rate. Somewhere
in the middle each school board finds the point on its
frontier that it likes best. At this point raising the tax
rate would not be felt to yield enough additional expenditure,
but reducing the tax rate would lose too much. Thus pre-
ferences and possibilities interact to determine the level
of expenditure and the local tax rate.

Wealthy school districts spend more money per pupil
because they have both a more favorable opportunity frontier
and a stronger preference for spending on schools. The
more favorable opportunities are simply due to a larger
local tax base, which yields more money per pupil from a
given tax rate. The stronger propensity to tax for the
sake of schools is a completely separate thing. It has to
do with the tastes of people in the school district. For
example, if two districts have equal total wealth (taxable
property), but one district is inhabited by ten elderly
households on social security plus ten working-class
families with one child each, while the second district
contains ten upper-middle-class families with one child
each, then it is likely that the second community will
spend more money per pupil than the first, even though it
must levy a higher property tax rate in order to do so.
In fact, a main finding of the empirical model is that a
strong preference for school spending is characteristic of
well-educated, professional, upper-middle-class people,
who also tend to have higher than average income and wealth.

Therefore wealth and income would still correlate with higher expenditure, even if state aid succeeded in neutralizing differences between school districts in sheer fiscal capacity.

In addition to its usefulness for analyzing school aid formulas, the kind of model developed in this paper could be applied to other types of grant or subsidy. Revenue sharing, housing allowances, health insurance, and foreign aid are all examples of programs with certain objectives such as equalization or stimulation of some activity. If these objectives could be stated with some precision, then a simulation model could be used to find the best subsidy formula. This general problem will be considered in the final chapter.

Chapter I will discuss the reasons for wanting to reduce inequality between school districts in expenditure per pupil. Chapter II describes the state aid formulas now in use, and mentions some alternatives. Chapter III reviews some of the previous literature on explaining expenditures by local school districts. Chapter IV presents the econometric model for explaining expenditure per pupil in Massachusetts. Then Chapter V shows how the model can be used to simulate the effects of alternative aid formulas, and concludes that wealthy districts on average will continue to enjoy higher expenditures per pupil under any formula which does not compensate for class-related differences in tastes.

Notes

(1) Serrano v. Priest, 96 California Reporter 601 (Supreme Court of California, In Bank, August 30, 1971), and Van Dusartz v. Hatfield, ___ Federal Supplement ___ (U.S. District Court of Minnesota, October 12, 1971).

(2) This has been the position advocated by the U.S. Advisory Commission on Intergovernmental Relations. See Who Should Pay For Public Schools? A.C.I.R. pamphlet, October 1971.

CHAPTER I

WHY REDUCE INEQUALITY IN DOLLARS PER PUPIL?

At the moment when this is being written, the court decisions cited in the Introduction have made it seem probable that the distribution of resources for public schools within states will somehow be equalized. Years from now this moment may be seen as the beginning of a major reform in school finance, or--if the U.S. Supreme Court squelches the reform--this period may be a forgotten historical aberration. Even though the final outcome is still uncertain, it is still well worth proceeding on the assumption that equalization of some kind will indeed occur.

Education and Income

Reducing inequality in the distribution of school resources would at least hold out the hope for some increase in equality of economic opportunity. However, no one should be misled: even perfect equalization of school resources would certainly not produce equality of income, and evidence has been accumulating that education alone cannot even equalize economic opportunity. In particular, racial differences are one source of income inequality that schooling alone cannot remove. Hanoch's regression analysis of Census data showed that black males earn less than whites of the same age and number of years of schooling. (1) Similarly, Johnson found that blacks receive a lower average

rate of return to their private investment in schooling,
where this investment consists mainly of the earnings
foregone while in school. (2) Again, Welch's cross-section
analysis of data from states indicates that rural blacks
earn about 35% less income than rural whites who receive
the same quality and quantity of school inputs. (3) Finally,
and most telling, Weiss found the extra income resulting
from one year's worth of actual academic achievement appears
to be less for black men than for whites of the same age. (4)
All of these studies are based on cross-sectional data,
and therefore cannot truly predict the path of future
earnings or the rate of return to schooling for people
with various levels of education, because, as Eckaus has
observed, the experience of today's newborns over the next
thirty years will not exactly recapitulate the history of
today's age-thirty cohort. (5) Nevertheless, there is
little to suggest that the discrimination which presumably
caused the observed differences between black and white
returns to education will vanish in the future.

Not only does equal educational attainment fail to
guarantee equal economic opportunity, but also equal
educational resources would fail to produce equal academic
attainment. The main finding of the Coleman report was
that the socioeconomic status of the student and his
schoolmates is itself an important determinant of scholastic
achievement. (6) Although the Coleman report has provoked
much controversy, the issue now is the exact importance

of "school inputs" apart from socioeconomic background. (7)

Few would deny that background variables strongly affect what children learn in school.

The effect of social class on academic achievement, combined with discrimination in the labor market, explain Ribich's finding that, if the objective is to equalize income, it would be accomplished more efficiently by redistributing income directly than by equalizing expenditures on education. Ribich reached this conclusion through benefit-cost analysis of various educational anti-poverty programs. (8) He measured the benefit from a given program as the present value of the anticipated stream of extra earnings attributable to the program, discounted at 5%. Benefits to the next generation were ignored because when discounted at 5% the present value is negligible. This procedure gave benefit/cost ratios in excess of 1.0 for certain job retraining programs, but less than 1.0 for the Higher Horizons compensatory education program, for a dropout prevention program in St. Louis, and for a hypothetical program of equalizing per pupil expenditures in public schools (based on data from Project Talent). Since by definition direct redistribution of income would have a benefit/cost ratio of exactly 1.0, most of the educational programs would be less efficient in equalizing income than direct redistribution of income itself would be. Therefore any equalization of educational resources resulting from the recent court decisions will not be a substitute

for adequate programs of income maintenance.

There is also a danger that the good will forestall
the best--in the present instance, that redistribution of
school resources will be thought to eliminate the need
for direct redistribution of income itself. To the extent
that redistributing educational resources does reduce
socioeconomic inequalities, or at least hampers the inheri-
tance of socioeconomic position, it may ease the pressure
for direct redistribution of income.

On the other hand, if everyone received education of
more equal quality, and if children of black or poor parents
still earned less when they graduated, then the unfairness
of this outcome would be even more obvious than it is now.
At present differences in educational attainment serve
to legitimate differences in social class, because it is
ostensibly fair for better jobs to go to people with
better academic training and credentials, even though lower-
class children actually have less opportunity to get
these credentials, and even when they have the credentials
they have less opportunity to get good jobs. (9) Equaliz-
ing educational opportunity might therefore increase rather
than decrease the demand for further improvement, in the
form of tougher laws against job discrimination, or out-
right redistribution of income.

Other Benefits from Education

Furthermore, it would be worthwhile to improve the

education of poor children even if schooling had no impact at all on income. Economists have become preoccupied with viewing education as investment in human capita: schooling as a producer's good. But education is also a consumer's good, providing benefits that are ends in themselves. Some of these benefits accrue to society at large: literate citizens are more competent. Other benefits are purely private: the satisfaction of having and acquiring knowledge. Therefore redistributing resources for education is justified as a way of preventing wide disparities in intellectual development, quite apart from any effect on the distribution of income.

On the other hand, critics may argue that existing schools destroy rather than develop children's minds, so that giving the schools more money would at best be a waste, and at worst do more harm than good. But if the schools are really that bad, the implication is only that resources should not be redistributed to the present school authorities, or that redistribution should be conditioned upon major reforms. Perhaps public schools should be abolished and replaced through instituting a system of tuition vouchers. This issue of quality and accountability will be mentioned again in Chapter VI. The point here is that to eschew any kind of redistribution would be a mistake.

Measuring Educational Inequality

Given that it is worthwhile to think about redistribu-

ting educational resources, how should inequality in education be measured? To the possible chagrin of some, the measure to be used in this paper is the amount of money spent per pupil for non-capital expenditures. The weakness of this measure is that it does not correlate perfectly with either real input or real output from the schools. It is not a perfect index of real input because there are cost differences between schools and districts, and also because a given amount of money, with given prices, could buy an infinite number of different combinations of real inputs.

Statistical findings on the relationship of money to academic output, which have been well summarized elsewhere (10), are inconclusive. The Coleman report found no relationship between the level of expenditure per pupil and scholastic achievement, but this finding has been criticized on the grounds that the Coleman data did not measure the important differences in spending between individual schools. (11) More positive evidence of a connection between dollars and achievement was found in New York State by Kiesling, though the relationship seemed to be significant only for middle-class children in large school districts. (12) A study by Hanushek using the Coleman data demonstrated an effect of certain real inputs on achievement, but failed to find a strong expenditure effect. (13)

There ·are several reasons why the findings on ex-
penditure and achievement are inconclusive. First, as
already mentioned, differences in costs mean that the same
expenditure in different places buys different amounts of
real inputs, and therefore presumably different amounts of
output.

A second reason is the difficulty of disentangling
expenditures from socioeconomic status. If expenditure
per pupil is included as an independent variable in a
regression explaining students' achievement, but the
students' socioeconomic status is left out of the equation,
then expenditure will explain much of the variance in
achievement. But much of this explanatory power is due to
.the fact that expenditure acts as a proxy for socioeconomic
status, because places with high socioeconomic status tend
to spend more on schools. If expenditure per pupil were
added to a regression in which socioeconomic status already
appeared, then the <u>incremental</u> explanatory power would be
smaller. But this increment actually understates the
true effect of expenditure, since socioeconomic status was
already acting as a proxy for expenditure. Algebraically,
expenditure and socioeconomic status have a large
"commonality" (14), which is defined as

1.1 $\qquad R^2_E - (R^2_{E+S} - R^2_S)$.

Here R^2_E is the proportion of the variance in student
achievement that is explained by expenditure per pupil

alone. This overstates the true explanatory power of expenditure. $(R^2_{E+S} - R^2_S)$ is the increment in proportion of variance explained when expenditure is added to an equation that already includes socioeconomic status. This understates the true effect of expenditure. The commonality therefore measures the explanatory power shared by the two variables together. The point is that the large commonality makes the independent effect of expenditure hard to measure.

A third reason why statistical studies have been inconclusive is that existing schools are inefficient. Schools do not spend money in a way that maximizes achievement, either because they have other objectives or because they have insufficient knowledge. They lack knowledge about how to allocate resources to meet the particular needs of individual children. For example, increasing the number of white teachers may help some white students but stifle some black students. (15) Resources would make a difference if they were allocated more efficiently to individual children. But this potential relationship between expenditures and output does not show up consistently in studies of existing schools, because existing schools waste money.

Even if the relationship between expenditure and achievement were well understood and fully documented, it is still preferable to think in terms of redistributing

cash than to try to reduce the inequality in achievement

directly, because producing high scores on academic achieve-

ment tests is not the only purpose of education. Direct

redistribution of those resources which are most strongly

related to achievement would force the schools to give

lower priority to the broader kinds of learning that achieve-

ment tests do not measure. The consumption benefits of

education might be sacrificed to the investment benefits.

Also, direct redistribution of any kind of real input,

such as teachers with high verbal skills, would inhibit

schools from seeking more efficient combinations of inputs

to produce whatever they are trying to produce. Therefore,

given the multiple purposes and uncertain technology of

education, it makes more sense to redistribute resources

in the most general form, namely money. (16)

This does not mean that schools should have a license

to waste money. To the contrary, they should be strictly

accountable to parents and children. The schools should

serve the children, and should keep the parents fully in-

formed.

Finally, the arguments for redistributing resources

in monetary form do not imply that equal dollars per pupil

would necessarily be the most equitable distribution.

Presumably, children with equal needs should receive

equal amounts of money. But Chapter II will show that

this ethical principle could imply a whole range of possible

redistributive schemes.

Conclusion

A number of reasons have been offered for wanting to
equalize the distribution of resources for education.
First of all, to some extent this will equalize income.
Though direct redistribution of income would be more efficient,
it is less feasible politically. Moreover, equalizing
income or economic opportunity is not the only reason for
redistributing school resources. Education can yield
consumption benefits, both private and social, as well as
investment benefits. Finally, because the aims of education
and the methods for accomplishing them differ between
individuals, resources for education should be redistributed
in the form of money, not in the form of real inputs.

Notes

(1) Giora Hanoch: "An Economic Analysis of Earnings and Schooling"; Journal of Human Resources 2(3):310-329, Summer 1967.

(2) Thomas Johnson: "Returns from Investment in Human Capital"; American Economic Review 60(4):546-560, September 1970.

(3) Finis Welch: "Measurement of the Quality of Schooling"; American Economic Review Papers and Proceedings, May 1966, pp. 379-392.

(4) Randall Weiss: "The Effect of Education on Earnings of Blacks and Whites"; Review of Economics and Statistics 52(2):150-159, May 1970.

(5) Richard Eckaus: "On the Estimation of the Relations between Education and Income"; mimeographed, MIT Dept. of Economics, December 1970.

(6) James S. Coleman and others: Equality of Educational Opportunity; U.S. Government Printing Office, 1966.

(7) For a good introduction to this literature, see the U.S. Office of Education's booklet, Do Teachers Make a Difference?; OE-58042, 1970. A set of readings edited by Moynihan and Mosteller is also forthcoming.

(8) Thomas I. Ribich: Education and Poverty; Brookings, 1968.

(9) See David Cohen and Marvin Lazerson: "Education and the Industrial Order"; mimeographed, Harvard Graduate School of Education, 1970.

(10) James W. Guthrie: A Survey of School Effectiveness Studies"; Chapter 2 in Do Teachers Make a Difference?, op. cit.

(11) Samuel Bowles and Henry Levin: "The Determinants of Scholastic Achievement--An Appraisal of Some Recent Evidence"; Journal of Human Resources 3:3-24, 1968.

(12) Herbert John Kiesling: Measuring a Local Government Service: A Study of the Efficiency of School Districts in New York State; Ph.D. thesis, Harvard Dept. of Economics, 1965.

(13) Eric A Hanushek: The Education of Negroes and Whites; Ph.D. thesis, MIT Dept. of Economics, 1968.

(14) Alexander M. Mood: "Do Teachers Make A Difference?";
     Chapter 1 in Do Teachers Make A Difference?, op. cit.

(15) Stephan Michelson: "The Association of Teacher
     Resourceness with Children's Characteristics";
     Chapter 6 in Do Teachers Make A Difference?, op. cit.

(16) A similar argument is made in the Introduction to
     Stephan Michelson and Norton Grubb: The Political
     Economy of School Resource Inequalities; draft, Center
     for Educational Policy Research, Harvard Graduate
     School of Education, 1971.

CHAPTER II

EXISTING AND PROPOSED STATE AID FORMULAS

This chapter describes the formulas now being used in
the various states to equalize educational resources among
local school districts. Only formulas for dispensing
general-purpose aid will be described, because these
grants are much larger than those for special purposes
like transportation. Since Benson (1) and Coons, Clune,
and Sugarman (2) have already written good histories of
how these programs evolved, the discussion here will be
purely formalistic.

Types of General-Purpose Grants

The simplest formula is the flat grant. The way a
flat grant works is pictured in Figure 2.1 as Plan 1.
On this graph and on all the others in Figure 2.1 the verti-
cal axis, labelled g, measures the total amount of money
available per pupil in a local school district. The
horizontal axis, labelled t, measures the total tax rate.
This has two components, the state tax rate t_c and the
local rate t_i. (3) The state tax is assumed to be propor-
tional to the local tax base, so that the state tax rate t_c
is the same for all districts. Plan 1 thus imposes the same
state tax rate on all districts, and in return guarantees
a certain amount of money per pupil, labelled a. Beyond
that, each district is on its own. If it levies a certain
local tax rate, it obtains whatever the local tax base yields.

FIGURE 2.1 : ALTERNATIVE AID PLANS
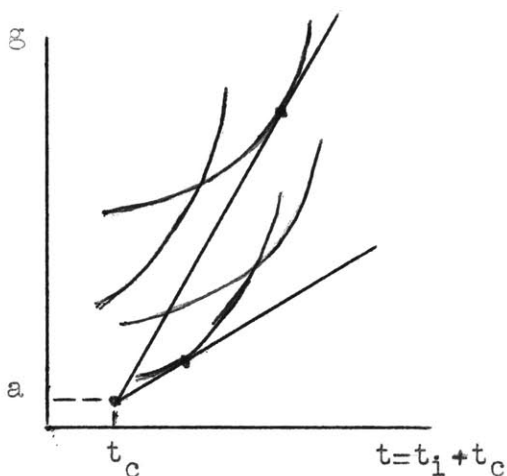
PLAN 1
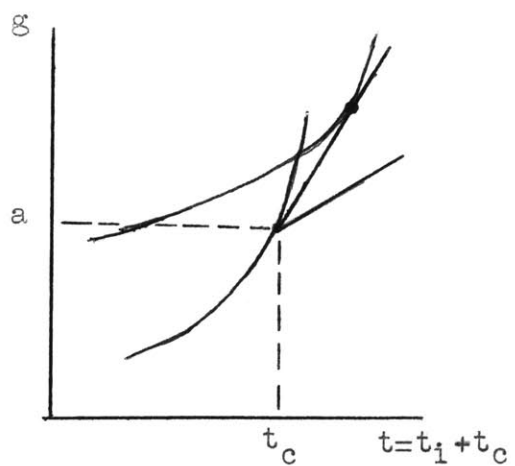
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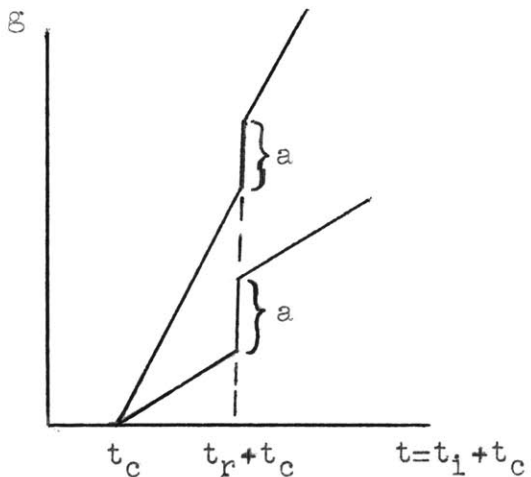
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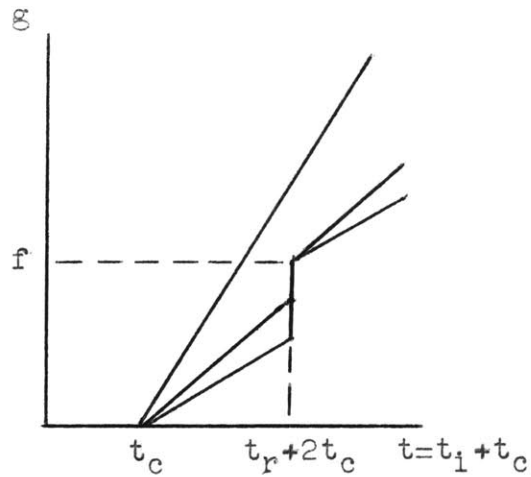
PLAN 3
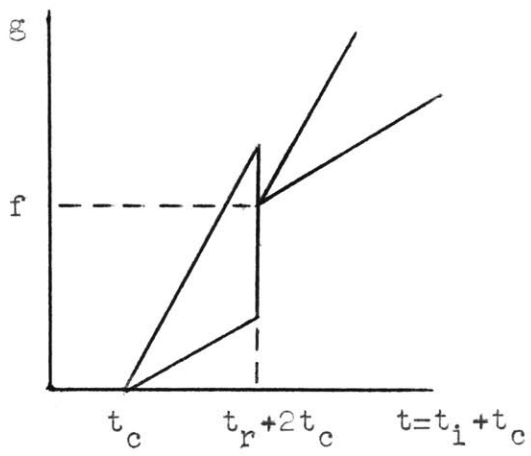
PLAN 4
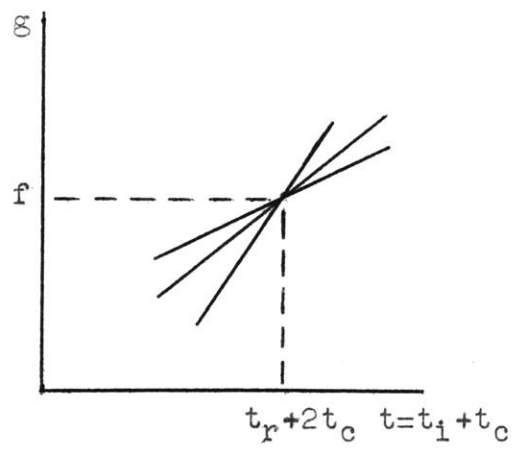
PLAN 5

FIGURE 2.1 (Continued)

PLAN 6

$t=t_i+t_c$

PLAN 7

$V_i > \overline{V}/m$

$slope = \overline{V}/m$

$2t_c$ $t=t_i+t_c$

PLAN 8

$slope = \overline{V}/m$

$2t_c$ $t=t_i+t_c$

PLAN 9

$slope = V_i$

S_i

t_c t $t=t_i+t_c$

PLAN 10

$slope = \overline{V}$

$V_i = \overline{V}$

$V_i > \overline{V}$

$2t_c$ $t=t_i+t_c$

PLAN 11

$t=t_i+t_c$
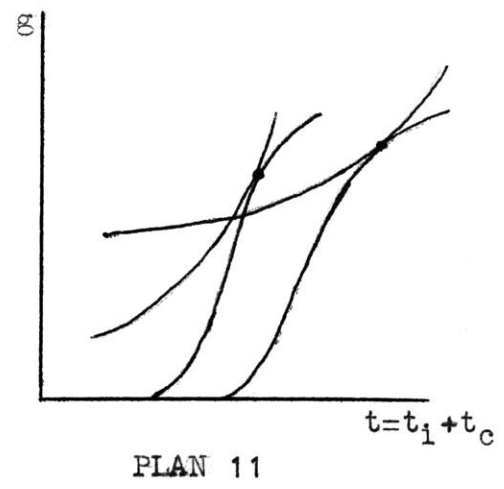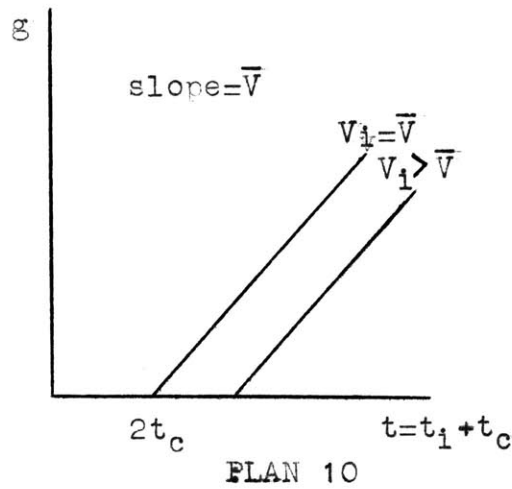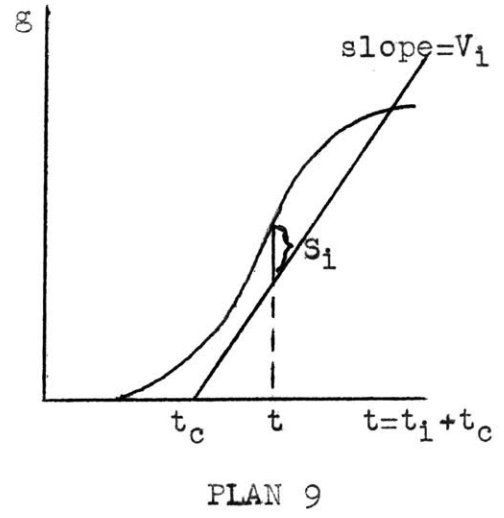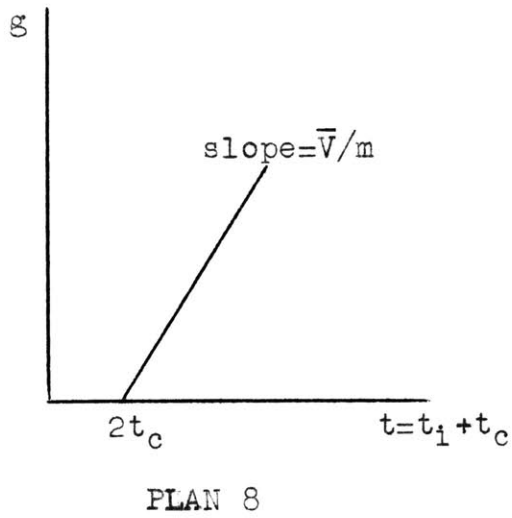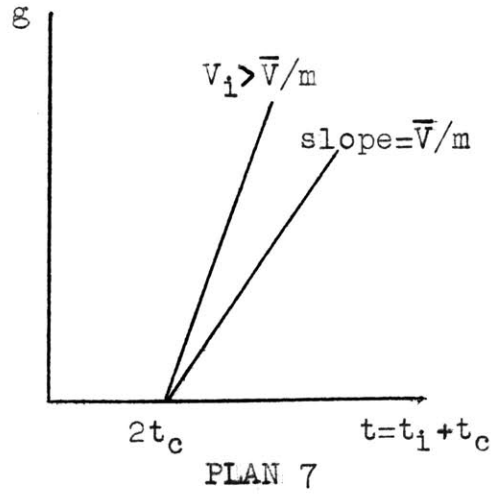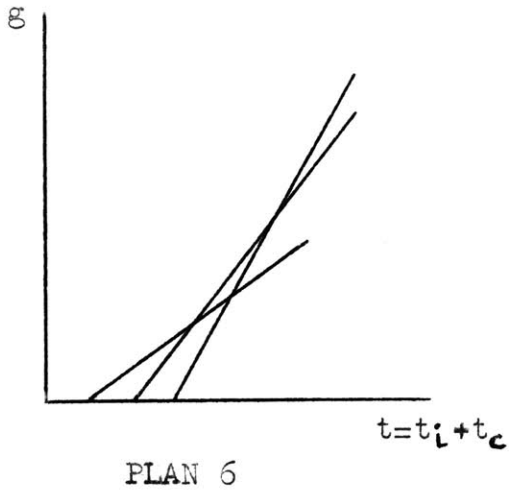
The graph of Plan 1 thus shows two rays emanating from the flat grant point. Each ray represents the opportunity frontier facing a district with a certain local tax base. The steeper ray belongs to a richer district, indicating that this district can get more resources per pupil from a given rate of local tax effort.

Flat grants in practice are not always awarded in simple proportion to the number of pupils. Sometimes the number of students in a district is weighted by sparsity (to reflect transportation costs), grade level, income, or other characteristics. Or the grant may be proportional to the number of "classroom units," which usually means the number of teachers. Each different basis for flat grants of course implies a different distribution of money among districts. But for simplicity the discussion will pretend that flat grants, as well as the other general-purpose grants to be described, are on a straight per-pupil basis.

To see why Plan 1 is not much of an equalizer, consider the two sets of hypothetical indifference curves on the graph. These represent the hypothetical preference functions of two local school boards. In the less wealthy school district, the indifference curves are steeper at any point on the graph, indicating less willingness to raise the tax rate for the sake of a given increment in per pupil expenditure. This difference in tastes is an empirical hypothesis, which will be tested later in estimating the

model. For now, consider it a working hypothesis that poorer communities are less eager, at any given level of taxes and spending, to obtain higher expenditures by raising the tax rate. Sufficient reasons would be: (a) A given property tax rate represents a greater sacrifice in a poor community because, though it takes away fewer dollars, these dollars are a larger fraction of total wealth (for homeowners) or total income (for renters) than in richer communities; (b) Poorer communities get relatively less benefit from the public schools than do upper-middle-class people.

The graph of Plan 1 shows that the combination of steeper indifference curves and a lower frontier results in lower expenditure per pupil by the poorer district. The graph also indicates that either the difference in opportunities or the difference in tastes would be sufficient to produce this result.

However, if the level of the flat grant were very high, and the corresponding state tax rate were also high, as in Plan 1A, then the outcome would be considerably more equal. The poorer district has no choice but to pay the high state tax and receive the high level of expenditure. Plan 1A is exactly what the Massachusetts Master Tax Plan Commission recently proposed. (4) They suggested giving each district

a flat grant equal to 90% of the previous year's average per pupil expenditure in the state and financing this with a statewide property tax. At the extreme, Plan 1A becomes complete state financing of public schools, as in Hawaii.

Plan 2 adds a wrinkle to Plan 1. In order to qualify for the flat grant, each district is required to levy some minimum local tax rate t_r. Unlike the state tax t_c, the proceeds from t_r are retained by the district for its own use. The result is shown in the graph of Plan 2. The opportunity frontier for each district (two are shown) is a ray beginning on the horizontal axis at t_c, but when the local tax rate reaches t_r the ray is boosted upward by the amount of the flat grant a.

Plan 3 is the famous foundation plan, the workhorse of state equalization plans. The basic idea of this plan is to guarantee to each local school district a certain minimum level of total expenditure per pupil if it taxes itself at a certain rate. Algebraically, the plan gives district i a state subsidy per pupil

2.1 $\qquad S_i = f - t_r V_i - t_c V_i$,

where f is the foundation level of per pupil expenditure, t_r is again the required local tax rate--over and above the state tax rate t_c--and V_i is the per pupil tax base in district i. Total resources per pupil in district i are therefore

2.2 $\qquad g_i = t_i V_i + S_i = (t_i - t_r - t_c)V_i + f$,

where t_i is the local component of the tax rate. Obviously, g_i will equal the constant f for all districts whenever the local tax rate $t_i = t_r + t_c$; that is, whenever the total tax rate $t = t_r + 2t_c$.

Plan 3, which is the most common version of the foundation program, contains two constraints. The first is that $S_i \geq -t_c V_i$. That is, any district in which the required local tax rate t_r raises revenue exceeding the foundation amount f does not have to forfeit or pay back the excess. So the worst a district can do is to pay the state tax and receive no offsetting subsidy. This constraint implies, from equation 2.1, that any district for which the tax base per pupil V_i is greater than f/t_r will not be affected by the program at all. These relatively wealthy districts get nothing from the foundation program, so their opportunity frontiers do not change. The graph of Plan 3 shows the opportunity locus for one such district, and also for two poorer districts for which the program does raise the opportunity frontiers. If the foundation level f is small, then fewer districts will receive subsidies, the amounts of subsidies received will be small, and the program consequently will not equalize very much. In practice, this is what usually happens. So empirical studies have found that Plan 3 does not eliminate inequalities among districts very well. (5)

The second constraint in Plan 3 is that $S_i = 0$ if t_i is less than $t_r + t_c$. That is, a district receives

no state subsidy at all if it taxes itself at less than
the required rate.

Plan 3 and Plan 1 are sometimes combined such that
the flat grant is subtracted from a district's foundation
aid, and the state subsidy is constrained to be no less
than the amount of the flat grant, a, minus the state tax.
The effect is to make the program less equalizing than
Plan 3 because foundation subsidies will be smaller and
fewer districts will receive foundation aid at all. Now
any district where V_i exceeds $(f - a)/t_r$ will have the same
opportunity locus as it would have had with the flat grant
alone. Coons, Clune, and Sugarman make much of this. (6)

Plan 4 is what would happen if the first constraint
were removed from Plan 3. A district in which the revenue
raised by the required local tax rate exceeds the foundation
level now must pay the excess to the state. All districts
are therefore affected by the program, rich districts
receiving a negative subsidy. Their larger tax base now
gives them an advantage at every tax rate except at the
single point where the local tax rate $t_i = t_r + t_c$,
or total tax rate $t = t_r + 2t_c$.

Plan 5 is the pure version of the foundation plan,
with no constraints. All opportunity frontiers cross at
the foundation point. Rich districts still have an ad-
vantage at high tax rates, but now poorer districts
actually do better at low tax rates. If the foundation
level were high enough, this advantage would matter.

But in practice the foundation tax rate $t_r + 2t_c$ is always
so small that districts wishing to obtain a decent level
of expenditure must tax themselves at higher rates, where
wealthier districts have the advantage.

Plan 6 belongs to a family of more sophisticated
grants, called percentage equalizing. The nucleus of this
family is the pair of equations

2.3 $\qquad S_i = (1 - mV_i/\bar{V})g_i - t_cV_i$; and

2.4 $\qquad g_i = t_iV_i + S_i$.

Solving gives total revenue per pupil

2.5 $\qquad g_i = (t_i - t_c)\bar{V}/m$,

where $\bar{V}$ is the statewide mean tax base per pupil and m is
some constant between zero and one. The noble purpose of
percentage equalizing is thus <u>to make the amount of re-
sources per pupil available in any district strictly
proportional to the local tax rate t_i, regardless of the
local tax base V_i</u>. Pure percentage equalizing is pictured
as Plan 8: the same linear frontier for all districts.

Plan 6, however, is not pure percentage equalizing.
It suffers from two weaknesses. The first is that the
state subsidy is proportional to local, not total, ex-
penditure per pupil:

2.6 $\qquad S_i = (1 - mV_i/\bar{V})t_iV_i - t_cV_i$.

The second weakness is the constraint that the net subsidy
S_i will be no less than the state tax $-t_cV_i$. The result
is that now total resources per pupil are given by

2.7 $g_i = (2t_i - t_c - mt_iV_i/\bar{V})V_i$ where $V_i \leqslant \bar{V}/m$;

            $(t_i - t_c)V_i$ where $V_i > \bar{V}/m$.

This rather messy outcome is shown on the graph of Plan 6, for three districts, with different amounts of local tax base. Plan 6 is approximately what prevails in Massachusetts, except that Massachusetts adds even more contorted kinks and constraints, to be unravelled in Chapter IV.

A slightly more legitimate scion of the percentage equalizing family is Plan 7, which makes the state subsidy proportional to total not local expenditure, but still constrains the net subsidy to be no more negative than the state tax. The result, drawn in the graph, is that

2.8 $g_i =$ $(t_i - t_c)\bar{V}/m$ where $V_i \leqslant \bar{V}/m$

                  $(t_i - t_c)V_i$ where $V_i > \bar{V}/m$.

Although Plans 6 and 7 may seem but base imitations of Plan 8, they are actually purer than most of the so-called percentage equalizing plans found in practice. The challenge of reconciling equalization with other objectives seems to stimulate the ingenuity of state legislatures, so that no two state plans are alike. Some states limit the amount of g_i that may be used in computing S_i, others limit the matching ratio $(1 - mV_i/\bar{V})$, some limit S_i itself, and others use arcane methods to compute m. Some of these complexities are described in Chapter 5 of Coons, Clune, and Sugarman.

Table 2.1 shows the extent to which Plans 1 through 8

are used by each state. Table 2.1 is based on descrip-
tions of the various state programs in Public School
Finance Programs, 1968-69, published by the Department of
Health, Education, and Welfare. (7) The first column of
the table tells what percentage of all state and local
expenditures for public schools were accounted for by
state grants. It is interesting that this percentage
is significantly higher in the southern states. The next
six columns correspond to six of the plans described above.
Plans 4 and 8 are not used by any state. Also, in Table 2.1
no distinction is made between Plans 1 and 1A or between
3 and 3A. The numbers in these six columns are the percent-
ages of state aid in each state that are spent on the various
plans. Adding these percentages across gives the total
percentage of state aid in each state distributed as
general-purpose grants. This is less than 100% in most
cases because states also dispense small amounts of aid
for special purposes like transportation or classes for
handicapped children. Finally, the last three columns
in Table 2.1 indicate what measures of fiscal capacity are
used for allocating aid in the various states. Assessed
value of property is the most common because the property
tax is the main source of local tax revenue.

To summarize Table 2.1: most states rely on a comb-
ination of flat grants and foundation aid, which is not very
effective in equalizing the fiscal opportunities facing local
school districts. A few states use percentage equalizing,

TABLE 2.1

CHARACTERISTICS OF GENERAL PURPOSE
SCHOOL AID PROGRAMS

STATE	STATE AID AS % OF STATE + LOCAL EXPENDITURE	% OF TOTAL STATE AID DISTRIBUTED THROUGH PLAN #						MEASURE OF WEALTH USED		
		Flat 1	Grant 2	Foundation 3	5	% Equalizing 6	7	Assessed Value	AGI	Other[1]
Alabama	75	6		89				x		
Alaska	88	32[2]		54				x		
Arizona	24[3]	44		43				x		
Arkansas	53		87					x		
California	37	45		35				x		
Colorado	29	34		54				x	x	
Connecticut	34[4]	74								
Delaware	82	82								
Florida				74						x
Georgia	67			89				x		
Hawaii	100	100[2]								
Idaho	44				100			x		

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TABLE 2.1 (Continued)

STATE	STATE AID AS % OF STATE + LOCAL EXPENDITURE	Flat Grant		Foundation		% Equalizing		Assessed VALUE	AGI	OTHER[1]
		1	2	3	5	6	7			
Illinois	27	23		62				x		
Indiana	39	18		68				x		
Iowa	14[5]					65		x	x	
Kansas	35			86				x	x	
Kentucky	58			99				x		
Louisiana	68			82				x		
Maine	30		81					x		
Maryland	40			56				x		
Massachusetts	40					67		x		
Michigan	50			94[6]				x		
Minnesota	40	7	40[7]	37[7]				x		
Mississippi	63	3		82						x
Missouri	31	66		11				x		
Montana	26	27		67				x		
Nebraska	18	52		39				x		

TABLE 2.1(Continued)

STATE	STATE AID AS % OF STATE + LOCAL EXPENDITURE	% OF TOTAL STATE AID DISTRIBUTED THROUGH PLAN #				MEASURE OF WEALTH USED		
		Flat 1	Grant 2	Foundation 3 5	% Equalizing 6 7	ASSESSED VALUE	AGI	OTHER[1]
Nevada	42			100[8]		x		
N. H.	9	11		46		x		
N. J.	29	44		30		x		
N. M.	86	72	17			x		
N. Y.	50				93[9]	x		
N. C.	76	92						
N. D.	33	11		87		x		
Ohio	33			95		x		
Oklahoma	28	4	32	60		x		
Oregon	30	58		14		x		
Pennsylvania	44	6			71[10]	x		
R. I.	38[11]				83	x		x
S. C.	66	76						
S. D.	12	17		76		x		

TABLE 2.1(Continued)

STATE	STATE AID AS % OF STATE + LOCAL EXPENDITURE	% OF TOTAL STATE AID DISTRIBUTED THROUGH PLAN #						MEASURE OF WEALTH USED		
		Flat Grant		Foundation		% Equalizing		ASSESSED VALUE	AGI	OTHER[1]
		1	2	3	5	6	7			
Tennessee	59			90						x
Texas	52	41		57				x		
Utah	59				82	6		x		
Vermont	39			82				x		
Virginia	38	21		65				x		
Washington	75			83				x		
W. Va.	60	50	47					x		
Wisconsin	28[12]	4					77	x		
Wyoming	41	17		83				x		

TABLE 2.1(Continued)

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FOOTNOTES TO TABLE 2.1

(1)   Other measures of district wealth include sales tax
      collections, employment, automobile registrations,
      vlue of farm production, median family income, and
      assessed value of public utilities.

(2)   Expenditure for state-run schools.

(3)   About 8% of Arizona's state aid goes for so-called
      "equalization," which is distributed in direct propor-
      tion to assessed valuation in the district.

(4)   About 5% of Connecticut's state aid goes for dis-
      advantaged children. This aid is distributed in propor-
      tion to the percentage of children on AFDC and the
      percentage of families with incomes under $4000.

(5)   About 22% of Iowa's state aid consists merely of
      returning 50% of the state income tax collected in
      each district.

(6)   Michigan sets a higher foundation level, but also a
      higher qualifying tax rate, for districts with less
      assessed valuation per pupil.

(7)   These are approximations; Minnesota actually spends
      77% on a program that is like a combination of
      Plans 2 and 3.

(8)   Nevada state law sets a different foundation level
      for each of the state's 17 districts.

(9)   New York also provides bonuses for very small and
      very large districts.

(10) Pennsylvania guarantees to pay at least 37.5% of each
      district's expenses, up to $400 per pupil (more in
      high density districts and districts with pupils
      from families with less than $2000 income).

(11) R.I. also spends about 5% of its state aid matching
      federal Title I grants.

(12) Wisconsin also guarantees that if a district's tax
      rate exceeds some maximum, despite equalizing state
      aid, then the state will reimburse all of the excess
      receipts over the prescribed maximum.

but usually a watered-down form.

Federal aid, such as grants for vocational education, is often distributed simply by proportional matching, whereby each dollar of federal aid must be matched by a dollar from the district's own resources. In allocating money among the states, the federal formula does entitle poorer states to more money per pupil,but the straight matching formula for disbursing the money to local districts does not have any equalizing effect itself. (8)

The most equalizing federal program is the controversial plan enacted as Title I of the 1965 Elementary and Secondary Education Act. This plan represents an entirely separate class of formulas, which take into account demographic variables other than those measuring fiscal capacity or effort. Title I provides block grants to local districts according to the number of children in low-income families and families receiving AFDC, plus children in institutions. (9) The amount of money per deprived child does depend on the statewide average expenditure per pupil, but this is related only weakly to the local district's own effort. In effect, Title I may be considered a version of Plan 1 in which the amount of the flat grant per pupil varies among districts, according to demographic composition.

Equity Criteria for Evaluating Grant

Formulas, and Some Proposals

In what sense are these plans supposed to equalize anything? One conceivable goal of an equalization plan would be to establish the same opportunity frontier for all districts. By this criterion, state or federal subsidies would be distributed to local districts so as to compensate exactly for differences in local fiscal capacity, thus enabling any two districts which exert the same rate of tax effort to afford the same amount of expenditure per pupil. This principle was enunciated by Coons, Clune, and Sugarman. (10) They call it the principle of "power equalizing," because it equalizes the power to purchase education. Legal briefs by Coons and others have convinced the courts in California and Minnesota to adopt this principle as an interpretation of the Fourteenth Amendment.

Coons, Clune, and Sugarman argue at some length that no existing state or federal subsidy program now achieves power equalizing. The graphs in Figure 2.1 confirm this at a glance. Of the first nine plans, only Plan 8, pure percentage equalizing, establishes the same opportunity frontier for all districts. Plan 8, however, is never used in practice. It is therefore no surprise that enormous inequalities between local districts persist under all the state plans in actual practice, even those based on percentage equalizing. (11)

Although none of the plans that are used in practice succeeds in setting the same frontier for all districts, Plan 5, the pure foundation plan, does provide that all the opportunity frontiers share one common point, at the foundation level. Plan 5 might therefore be called a "point equalizing" program. Aside from the trivial fact that several other plans establish a common point where the local tax rate t_i is zero, Plan 5 is the only point equalizing plan that is used in practice. And Plan 5 appears only in the single state of Utah.

The graphical terminology may be extended. Plan 8 is a form of "line equalizing," and Plan 9 would be "curve equalizing." This plan has been suggested by Coons, Clune, and Sugarman as the general form of power equalizing. To institute Plan 9 the state would first establish some desired relationship between fiscal effort and expenditure per pupil for all districts. An example of such a relationship is the curve shown as Plan 9. The amount of state subsidy, S_i, would then be the residual amount (positive or negative) needed to put a district on the established curve. S_i would vary with the district's fiscal capacity and effort. Plan 9 is therefore unlike the preceding plans, where the amount of state subsidy is determined by some formula, and the opportunity frontiers follow from that. In Plan 9 the legislature first designs the common frontier which then determines the subsidy scheme.

A concept of equalization that is even stronger than
equal frontiers would be that all districts should
actually get the same amount of resources per pupil.
Plan 9 or Plan 8, which do provide the same opportunity
frontier for all districts, would both fail to pass this
tougher test of equalizing actual resources, because, as
Chapter IV will show, the willingness of a school district
to pay for public schools tends to increase with district
wealth. That is, richer districts have indifference curves
that are flatter at any point, as was shown on the graph
of Plan 1. Although Plan 9 would give both the rich and
the poor district the same opportunity frontier, the rich
district is willing and able to sustain a higher fiscal
effort in order to get more resources per pupil. If
the aim of state aid is to equalize expenditure per pupil,
then this plan is inadequate.

Equalization of actual expenditures could be
accomplished in more than one way. One method would be
to require that every district make a tax rate effort
at least as great as the richest district is just
willing to make, in return for a certain level of expendi-
ture per pupil guaranteed by the state. Although any
district would still be permitted to add a local tax
above the required rate, no district would want to. This
plan would be equivalent to state assumption of the full
burden of school costs.

There is another way to equalize actual expenditures,

which would preserve more fiscal autonomy for local school districts, and would also be more favorable to poorer districts. The method would be to establish higher opportunity curves for poorer districts. This is a kind of compensatory financing, of which Title I is an example, since it is supposed to make larger flat grants to poorer districts. Plans 10 and 11 are more general cases. Plan 10 is a scheme favored by Musgrave. (12) It provides a state subsidy per pupil

$$2.9 \qquad S_i = t_i(\bar{V} - V_i) - t_c V_i,$$

so that total resources per pupil

$$2.10 \qquad g_i = t_i V_i + S_i = t_i \bar{V} - t_c V_i.$$

Every local district therefore confronts a linear opportunity frontier with the same slope, but this frontier is higher for districts where the per pupil tax base is lower.

Plan 11 is a more general form of the same thing. As with Plan 9, the state would first determine the shapes of the opportunity frontiers directly. The amounts of state subsidy would be implied by the frontiers, rather than being determined by the algebraic formula as in Plan 10. In determining the shapes and heights of the curves, the state might take into account variables which reflect educational need, such as the level of education of the adults in the district, in addition to purely fiscal variables such as tax base per pupil. The result

would be as shown in the graph of Plan 11 in Figure 2.1:
the steeper indifference curve, which belongs to a district
with smaller fiscal capacity but presumably greater need,
is tangent to a higher and steeper opportunity frontier,
so that the poorer district can choose approximately the
same level of expenditure per pupil as the richer district,
but with less fiscal effort.

Two possible criteria for equalization have now
been suggested: equal frontiers or equal expenditures.
It is clear that these imply quite different subsidy
plans. To evaluate the subsidy schemes, then, one must
evaluate the objectives they express. Such an evaluation
must involve personal beliefs and political preferences.
Normative economic theory is no help, because it says
only that if the distribution of income is optimal, then
taxation should be based on the marginal benefit from
publicly provided goods. However, since the distribution
of income is evidently suboptimal, taxation and subsidies
must be guided by other, second-best principles.

One such principle is horizontal equity, "equal treat-
ment of equals." This is a commonsense definition of fair-
ness, and something like it is expressed in the Con-
stitution's guarantee of "equal protection of the laws." (13)

In addition to its ethical appeal, the principle of
horizontal equity has been endorsed on grounds of ef-
ficiency. In a federal system, equal treatment of equals
by different jurisdictions would eliminate artificial

incentives for people to move from one place to another.

As Tiebout has argued,

> "Given the tax structures and incomes of
> various communities offering about the same
> pattern of public services, a person will
> choose the community where his tax bill
> is least. In fact, he may well choose
> a community where the pattern of services
> offered is not as nearly to his liking
> as in another community, but his tax
> bill is sufficiently lower to make this
> a more favorable location. As a result
> of unequal incomes, the resulting pattern
> of public goods will be less optimal,
> in a sense, than in the case where in-
> comes are equal." (14)

It is thus inefficient for the rich to migrate to tax
havens where they can get more for their tax rate because
their neighbors are also rich.

However, despite its appeal, the meaning of "equal
treatment of equals" is not at all precise. First of all,
what is meant by "equal" treatment? There are at least
two possibilities. (a) More equal treatment could simply
mean less variation in the kind or amount of treatment.
(b) Alternatively, only certain kinds of inequality may
be of concern. In particular, equal treatment may mean
only that no one is extremely deprived. In statistical
terms the first definition calls for minimizing the va-
riance of the distribution being considered, while the
second definition calls for minimizing the degree of
skewness to the left. Clearly, foundation plans, which
aim to guarantee some minimum level of expenditure per pupil,
are based on the second definition of "equal" treatment.

Next, what is the "treatment" that should be made equal? (a) Dollars spent per pupil is the treatment that has been considered in the plans described above. (b) Real inputs per pupil, such as teachers, textbooks, and tape recorders are a more direct measure of the kind of treatment pupils receive. (c) Even more direct would be a valid measure of the output from schooling. This could include tested academic achievement, creativity, or whatever schools are expected to produce. There is no agreement, however, on what this is. (d) Going one step further, maybe the treatment that should be equalized is the student's opportunity to earn money as an adult. (e) Even more generally, the truly relevant defnition of equal treatment may be equal preparation to achieve personal well-being. Most people would probably agree that this final definition is the proper one in the abstract, but strong disagreements would arise over the meaning of well-being, and how to prepare for it. The last definition is therefore not operational. Moreover, the last three definitions may all imply spending more real resources on poorer children, whose family environments in some sense make them more expensive to educate. The ambiguities which infest the definition of equal "treatment" thus entail important political and moral judgments.

Finally, how to define the "equals" who should receive equal treatment? (a) One possibility is simply to consider all children equal. Then all children should receive

equal treatment, no matter what race, class, or sex they may be, or in what neighborhood they may reside. (b) Alternatively, equal children may be defined as those with equal need, ability, or motivation. Such a definition would imply spending different amounts of resources on children with different social or psychological characteristics. Since some psychological characteristics in children are correlated with their parents' social class, the result might be to justify special programs for "gifted" children who happen to be mostly middle-class. On the other hand, the definition might justify special programs for "difficult" lower-class children. (c) Another classification would group together those children whose families exert the same fiscal effort for their schooling. This is the rationale of power equalizing: any two districts with the same school tax rate should be entitled to the same quality of schools. (d) Related to this last definition is the definition that considers as equals all those children whose parents pay the same amount of money for schooling. This leads to the policy proposed by Buchanan (15) of equalizing the fiscal residual for families of equal income. The fiscal residual is the amount of government services valued at cost, minus the amount of taxes paid. Since a given tax rate will yield a larger amount of money from a wealthier family, this fourth definition of "equal" pupils is more favorable to the rich than the preceding definition, which measured fiscal

effort by the rate, not the amount, of tax.

These sets of definitions could generate no fewer than forty distinct meanings of the phrase "equal treatment of equals." The principle underlying Plan 3, that every school district should be enabled to support some minimum foundation level of expenditure per pupil at some given level of fiscal effort, is a combination of definition (b) of "equal" treatment, definition (a) of "treatment," and definition (c) of "equals." Alternatively, definitions (a), (a), and (c) produce the principle that every district should face the same opportunity frontier, which underlies Plans 8 and 9. The compensatory principle of establishing higher opportunity curves for poorer districts, which is the rationale for Plans 10 and 11, can be justified by defining horizontal equity as (a), (a), and (a). And so on. Since "equal treatment of equals" could thus justify every one of the plans described above, the general principle of horizontal equity does not distinguish one best plan.

Private Schools, Taxes, and Vouchers

Several of the plans above would provide for negative subsidies to wealthy districts. The state would actually take away some of the revenues raised by local taxes. This would certainly reduce the incentive to levy local taxes in wealthy districts. Such a district might then choose to close down its public schools, and send its

children to private schools where the state would not
take a cut out of expenditures. This would be very de-
trimental to any families in the district unable to afford
private schools. Coons, Clune, and Sugarman suggest pre-
venting this by the state requiring every local district
to support its public schools at some minimum level, or
by making state aid so generous that even wealthy districts
get some subsidy, though much less than poor districts.(16)

Another way to prevent wealthy districts from abandon-
ing public schools entirely would be to use state taxes to
redistribute money between districts, instead of raking
off a portion of revenues raised by local taxes. Then
the district's payment to the state would not depend on
its own school tax effort. At the same time, the subsidy
formula could give rich as well as poor districts a
large enough increment in total resources per pupil for
every increase in the local school tax rate, to provide
a strong incentive to support local public schools. This
implies a version of Plan 11 in which the intercept, which
represents the state tax rate, is farther to the left
for wealthier districts than for poor ones, but the op-
portunity locus itself is steeper, or at least no flatter
than it would have been in the absence of state interven-
tion.

A more radical solution to the problem of private
schools would be tuition vouchers. These are tax-supported
grants to families, which may be spent on any approved

school, whether public or private. The merits and mechanics
of various voucher systems have been carefully thought
out by Jencks and his associates. (17) Coons (18) notes
that tuition grants to families are formally analogous
to state aid for local districts. The graphical analysis
in Figure 2.1, and the definitions of horizontal equity,
can be applied to families in the same way as they were
applied to school districts. Of course vouchers would
entail major changes in the structure of state and local
government. But they might also allow more consumer
sovereignty, more variety in schools, and more effective
equalization.

Summary

Among the many possible definitions of horizontal equity,
the two most relevant to existing state school aid formulas
are equalization of the opportunity frontier facing local
school districts, and equalization of actual expenditure
per pupil. Equalizing the opportunity frontier would
mean that any two districts with the same school tax
rate would get to spend the same number of dollars per
pupil. This is different from the situation that now
prevails, where a wealthier district gets more money than
a poor district with the same tax rate. Examination of
existing state aid formulas reveals that no formula in
actual use does go so far as to equalize the opportunity
frontier for all districts. Therefore no existing formula

could ever achieve the more ambitious aim of equalizing
actual expenditure per pupil in every district. However,
some of the existing plans do begin to approach frontier-
equalizing. Equalizing the opportunity frontiers for all
districts apparently represents an outer limit to the
willingness of state legislatures to equalize resources
for education. It also seems to be what the courts
will require. (19)

Notes .

(1) Charles S. Benson: The Economics of Public Education; Houghton Mifflin, 2nd edition 1968.

(2) John E. Coons, William H. Clune III, and Stephen D. Sugarman: Private Wealth and Public Education; Harvard University Press, 1970.

(3) The state tax rate t_c is included in the diagram only for completeness. As noted in Chapter IV, state and federal taxes to support local schools were found to have no measurable effect on the behavior of the local school boards. The analysis of various plans could therefore ignore t_c entirely, by shifting the origin of the graphs in Figure 2.1 to the right by the amount t_c.

(4) Tentative Proposals for a Master Tax Plan for the Commonwealth; October 1970.

(5) Coons, Clune, and Sugarman: op. cit.; Chapter 2. J. Alan Thomas: School Finance and Educational Opportunity in Michigan; Michigan Dept. of Education, 1968; Chapter 6. Edward George Boehne: Equalization in State-Local Fiscal Relations: Aid to Education in Indiana; Ph.D. thesis, University of Indiana Dept. of Economics, 1968.

(6) Coons, Clune, and Sugarman: op. cit. ; Chapter 3.

(7) Thomas L. Johns (ed.): Public School Finance Programs, 1968-69; U.S. Dept. of Health, Education, and Welfare, 1969.

(8) Joel S. Berke and other: Federal Aid to Education: Who Benefits?; U.S. Senate Select Committee on Equal Educational Opportunity, April 1971.

(9) National Association for the Advancement of Colored People: Title I of ESEA: Is It Helping Poor Children?; NAACP legal Defense and Education Fund, Inc., 2nd edition 1969.

(10) Coons, Clune, and Sugarman: op. cit.; p. 304 and Chapter 6.

(11) Steven J. Weiss: Existing Disparities in Public School Finance and Proposals for Reform; Federal Reserve Bank of Boston, Research Report No. 46, 1970. David K. Cohen and Tyll R. Van Geel: "Public Education"; in Samuel H. Beer and Ricahrd E. Barringer (eds.): The State and the Poor; Winthrop Publishers, 1970.

(12) Richard A. Musgrave: "Approaches to a Fiscal Theory of Political Federalism"; in National Bureau of Educational Research: Public Finances: Needs, Sources, and Utilization; Princeton University Press, 1961.

(13) Coons, Clune, and Sugarman: op. cit.; Part III. Arthur E. Wise: Rich Schools, Poor Schools; University of Chicago Press, 1967.

(14) Charles M. Tiebout: "An Economic Theory of Fiscal Decentralization"; in National Bureau of Economic Research: op. cit.; p. 93.

(15) See the discussion following the paper by Musgrave, loc. cit.

(16) Coons, Clune, and Sugarman: op. cit.; p. 278

(17) Center for the Study of Public Policy: Education Vouchers; Cambridge, Mass., December 1970.

(18) John E. Coons: "Recreating the Family's Role in Education"; Inequality in Education combined issue Number 3 and 4, pp. 1-4, 1970 (journal published by the Harvard Center for Law and Education).

(19) See footnote (1) to the Introduction.

CHAPTER III

PREVIOUS STUDIES OF THE FISCAL BEHAVIOR
OF SCHOOL DISTRICTS

This chapter sets the context for the econometric
model to be presented in the next chapter. The purpose of
the model is to permit simulation of how local school
districts in Massachusetts would alter their own expendi-
ture per pupil in response to hypothetical changes in the
formula for distributing general-purpose state school aid.
The present chapter describes some of the previous research
on the fiscal behavior of local school districts, especially
on the response to state aid. The intention is to identify
the various methods that have been applied to this problem,
and to summarize the major findings as well as the weak-
nesses of each approach. This chapter is by no means an
exhaustive survey of the abundant research on the fiscal
behavior of school districts. Fortunately, good surveys
have recently been published.(1)

The School District as a Collectivity

One way to analyze how money gets spent on public schools
is to view the school district as a collectivity. A
classical example of this approach is Lindahl's famous
theorem that a Pareto-optimal allocation of public costs
and benefits would equate each citizen's marginal willing-
ness to pay for the public good equals the marginal cost
of production. (2) James Buchanan has written a great

deal about how group decisions may diverge from Pareto

optimality. (3)

Buchanan's techniques have been applied specifically to

local school districts by Robin Barlow. (4) Figure 3.1

reproduces Barlow's graphical analysis of a school district's

expenditure decision. It shows the demand curves of

individuals A, B, and C for additional output, which is

FIGURE 3.1
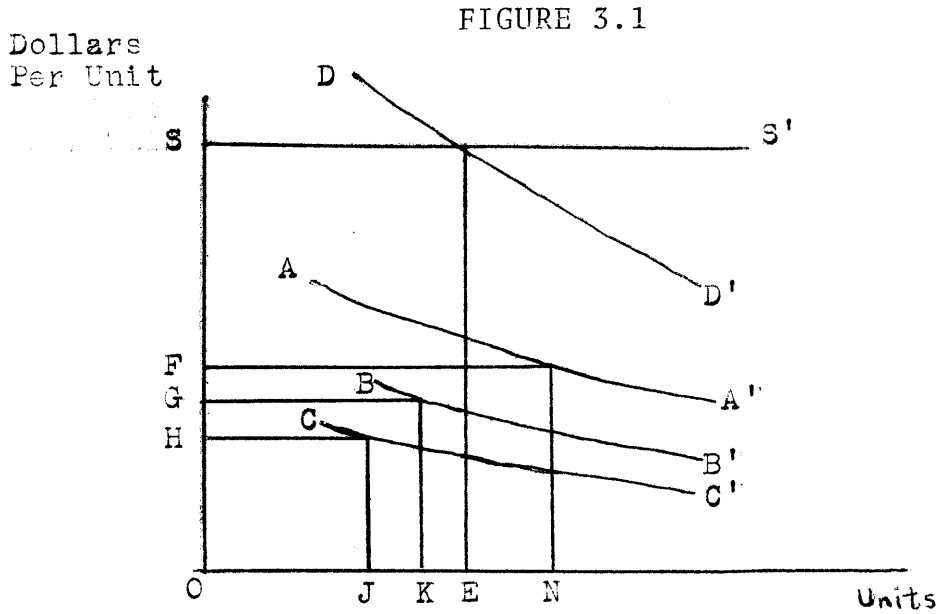
assumed to be a pure public good. DD' is the vertical sum

of the individual demands. The efficient level of output

is OE, where DD' equals the constant marginal cost of pro-

duction. The amount demanded by each individual, however,

is determined by the tax structure. If OF, OG, and OH

are the per unit tax charges to A, B, and C respectively,

then E will demand ON units of output, B will want OK, and

C will demand only OJ.

Now introduce the assumption of majority voting:
the level of output actually chosen will be the highest
level at which marginal benefit is no lower than marginal
tax cost for two of the three voters. With the tax
structure shown, the output chosen will be OK. The way
to reach the efficient output OE would be to set the
marginal tax share for B, who is the swing voter, equal
to his marginal benefit at OE. That is, under majority
rule the level of public output will be at the efficient
level if and only if the median voter's marginal tax
equals his marginal benefit at that efficient level.
Using data for Michigan, Barlow concluded that school
districts are actually spending less than they should,
because for median-income households the estimated marginal
tax under the existing tax structure exceeds what the
estimated marginal benefit from schools would be at the
efficient level of output.

A set of papers presented at the 1971 meetings of the
American Economics Association carries this approach in
other directions. (5) Bradford and Oates, like Barlow,
describe a school district as a group of individually
rational consumers. But unlike Barlow they derive the
predictive rather than the normative implications. With
majority voting, they show that a matching grant from a
higher level of government will induce more expenditure
on the public good than would a block grant of the same size.

A clear corollary of the Barlow-Bradford-Oates analysis is that not all voters will be in equilibrium under majority rule. Some will have positive and others negative excess demand for the public good. In another of the papers presented to the AEA 1971 meetings, Heins discusses the longer-run implications of these excess demands. If federal taxes are more progressive than local taxes, then federally supported grants may produce stronger demands for the subsidized service among the poor than among the well-off members of the local community. The results might include out-migration of the rich, political expression of discontent by the poor, or alterations in the local tax structure to make the poor pay a larger share.

This line of analysis has some intriguing extensions. Instead of considering educational output in the aggregate, it would be possible to deal with decisions on separate neighborhood schools. Graphically, this would imply that individuals have different demand curves for each others' schools, although their tax shares are the same for spending on every school because the schools are in the same taxing district. Suboptimality is virtually guaranteed in this system, because even if the tax structure happened to produce the efficient level of spending on one school, it would be unlikely to have this result for the other schools, assuming some symmetry in the demand curves.

It would be interesting to see if this framework could reveal the political rationality of lower expenditure

per pupil in poor neighborhoods (6) and the regressive
property tax. To some extent it would be in the interest
of the poor in central cities to offer the rich some
concessions, as Buchanan has argued, so that the rich will
not take their greater taxpaying ability to the suburbs.
The key question is whether the amount of these concessions
to the rich in reality already exceeds the fiscal benefit
to the poor.

The theoretical power of treating the school district
as a collectivity is also its empirical weakness: every-
thing depends on knowing the demand curves. In practice,
these are extremely difficult to measure, especially for
small groups. Barlow's household demand curves were
actually estimated from cross-section data on school
districts. This data may not give a bad approximation to
the demand curves of different income classes, but it
would be of no use in trying to measure the demands of
black families, childless households, or families with
children in private schools.

On the other hand, the analytical framework might
suggest qualitative hypotheses that can be tested with
aggregate data on school districts. For example, the
model presented in Chapter IV includes the hypothesis
that districts with a larger proportion of homeowners
will tend to spend less on schools (other things like income
assumed equal), because homeowners, who face the loss of
equity in their property, are more threatened than tenants

by the local property tax. In terms of Figure 3.1, this
hypothesis means that a homeowner will perceive his mar-
ginal tax cost to be higher even if his actual tax payment
in dollars is the same as a tenant's.

Ultimately, any statement about the relationship
between population characteristics and the aggregate level
of spending in a school district must make some assumption
about political interaction among individuals with different
demand and marginal tax curves. But analyzing the school
district as a collectivity is probably more useful in
explaining variation within school districts than between
them.

The School District as a Bureaucracy

A related approach views the determination of school
budgets as a problem in organizational decision-making.
A good example is Donald Gerwin's study of the budgeting
process in the Pittsburgh school system. (7) Gerwin
boiled down his observations to a set of rules, which he
then used to simulate the course of expenditures over a
period of years. Examples of these rules are:

Approve all departmental requests which do not exceed last
year's amount;

Grant a general salary increase when no comparable school
districts have lower B.A. starting salaries for teachers;

Float new bonds if the amount of cash in the working capital
account falls below a critical level.

This kind of analysis aims to explain variation in one
district over time, but it can yield hypotheses for ex-

plaining differences in the level of expenditure between
school districts at one point in time. For example, the
cross-section econometric study by James, Kelly, and
Garms used dummy variables to reflect whether the board
of education was elected or appointed, whether the busi-
ness manager reported to the board of education or the
superintendent, whether boards were selected at large or
by ward, whether the assessor was elected or appointed,
and whether any other governmental agency had authority
to reduce the budget passed by the board of education. (8)
The only effect of these variables that turned out to be
significant was that, in a subsample of 48 large southern
districts, school boards selected by wards tended to spend
more per pupil. This probably indicates some log-rolling.

In the model presented in Chapter IV, one of the
determinants of local expenditure per pupil is the total
population of the district. Some of the influence of this
variable has to do with the budgeting process, because
school committees in larger districts are confronted by
better organized and more powerful unions of teachers and
other employees, who are constantly pressing for higher
salaries. School boards in smaller districts, in contrast,
would be relatively more susceptible to pressure from
local taxpayers, who resist higher spending in general.
So the process of bureaucratic budgeting apparently can
explain some of the variation in spending among school
districts.

An approach more orthodox than the political one has
been to apply the economic theory of the consumer to the
behavior of local governments such as school districts.
A clear exposition of this approach is in Williams' text-
book on public finance. (9) In a diagram like Figure 3.2,
Williams depicts the choices made by a local government
concerning the level of expenditure on two different services.
The local government is assumed to receive a grant which

FIGURE 3.2
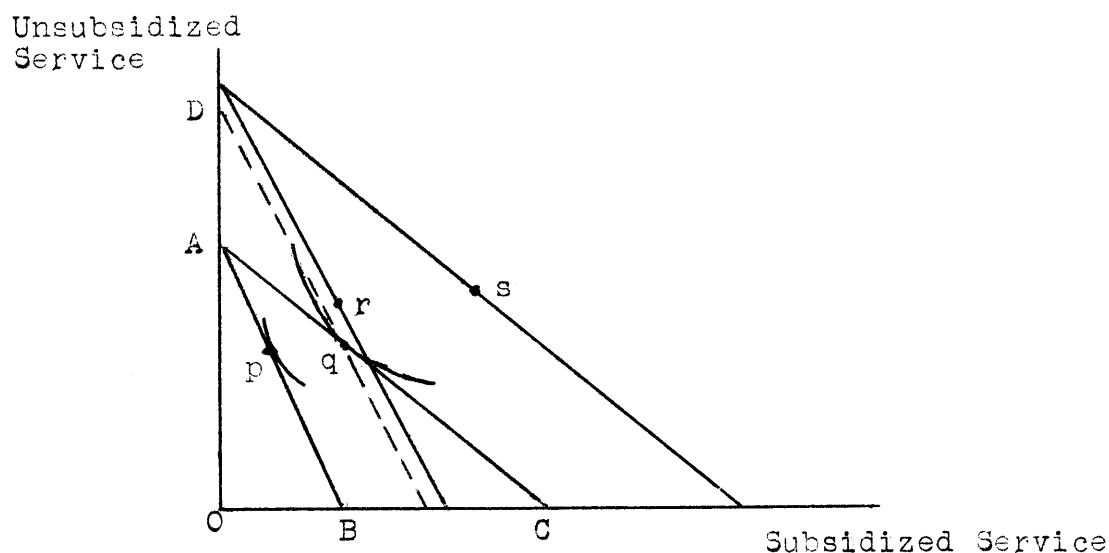
varies "in proportion to the number of units of the grant-
aided service that is provided by the receiving government."
The two steeper solid lines in Figure 3.2 show the possibi-
lities for providing various combinations of services if
the grant were not available; the higher curve corresponds
to a higher level of total public spending. The flatter

two lines show the possibilities with the proportional
matching grant. At the level of total expenditure corre-
sponding to the line AB, the effect of the matching grant,
given the preferences expressed by the indifference curves
in the picture, would be to shift the composition of services
from point p to point q.

Figure 3.2, however, does not reveal how the local
government decides on a certain level of total spending.
This decision is illustrated in Figure 3.3. The opportunity
frontier in Figure 3.3 is derived from Figure 3.2. Using
the unsubsidized service as the unit of measurement,
point q corresponds to expenditure from local revenues
equal to OA for both services, but to a total budget of OD.
The matching grant is AD. In Figure 3.3 the amounts OA
and OD determine the point q'. Similarly, point s in

FIGURE 3.3

Total
Expenditure

Expenditure from Local Sources
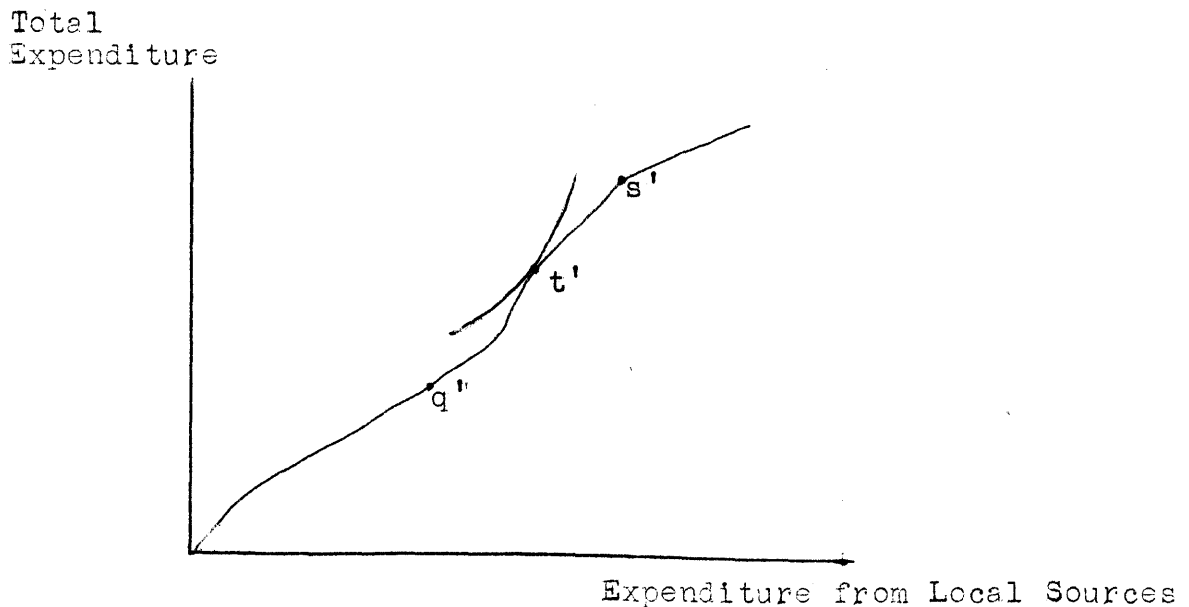
Figure 3.2 corresponds to s' in Figure 3.3. The shape of the resulting opportunity frontier thus depends on the preferences between the two services, expressed by indifference curves in Figure 3.2. But there are also indifference curves in Figure 3.3, showing the local government's willingness to raise local expenditures (i.e., local taxes) in order to increase total public consumption. These preferences correspond to preferences between public and private consumption in the local community, where public and private goods are considered as two composite commodities. Given these preferences, some point t is determined to be the best, and this in turn determines a point in Figure 3.2. That is, each level of total expenditure would imply a best combination of services, so choosing the best level of total spending implies a best of all best combinations.

Using this framework, Williams demonstrates that a matching grant induces a higher level of spending on the subsidized service, and a higher level of total expenditure as well, than would a block grant of the same size. He also demonstrates that requiring the local government to undertake a certain minimum level of expenditure before it may receive any assistance at all could induce more local spending on the subsidized service per dollar of subsidy than would a matching grant with no such requirement.

Employing the same kind of analysis, Wilde has shown that a block grant earmarked for a particular local service has no more stimulating effect on that service than a

block grant with no earmarking, unless the amount of the grant exceeds the total amount that the local government would have spent on the subsidized service in the absence of any grant. (10) Among Wilde's other conclusions is the finding that a matching grant with a ceiling on the total amount is exactly equivalent to a simple block grant if the local government is spending at a high enough level so that it receives the maximum amount of subsidy allowed.

Implicit in the analysis by Williams and Wilde is the assumption of separability in the preference function of the local government. This has been made explicit in a paper by Robert Inman, who treated the problem algebraically as well as graphically, to derive conclusions like those of Williams and Wilde. (11) "Weak separability," according to Inman, means that the government's preference function is such that the marginal rate of substitution among various services is independent of the levels of the various taxes, and the marginal rate of substitution among different local taxes does not depend on the levels of services. In other words, the government can first decide how much of the community's income to allocate between public and private consumption; then it makes separate decisions about how to raise and how to spend the indicated amount of public revenue. Inman does not discuss the robustness of his conclusions with respect to this assumption.

The question of separability in the utility function can be avoided if a school district is assumed to have only one tax and one public good. This approach has been taken by Barro(12), who assumes that the school district maximizes a preference function of the form

3.1 $U = U(e,x)$

subject to the budget constraint

3.2 $p_e ae + p_x x = y$,

"where e is the 'amount' of education provided per student and x is the aggregate amount of other goods consumed per capita by residents of the community," p_e and p_x are the prices of the two goods, y is per capita personal income in the community, and a is the ratio of average daily attendance to population in the district. The first order conditions for maximization give

3.3 $m(e,x) = pa$,

where $m(e,x) \equiv \dfrac{\partial U/\partial e}{\partial U/\partial x}$ is the marginal rate of substitution of x for e, and $p = p_e/p_x$. Barro assumes that $\partial m/\partial e < 0$ and $\partial m/\partial x > 0$; so neither good can be inferior. He therefore finds that the income derivative is always positive:

3.4 $\dfrac{de}{dy} = \dfrac{1}{p_x} \dfrac{\partial m}{\partial x} / (pa \dfrac{\partial m}{\partial x} - \dfrac{\partial m}{\partial e})$.

Also, the price derivative is always negative:

3.5 $\dfrac{de}{dp_e} = -\dfrac{a}{p_x} (1 = e\dfrac{\partial m}{\partial x}) / (pa \dfrac{\partial m}{\partial x} - \dfrac{\partial m}{\partial e})$.

An interesting result falls out at this point. Since p and a enter symmetrically in the budget equation 3.2,

de/da may be computed simply by replacing a by p_e and vice versa in equation 3.5. Then the elasticity of educational output with respect to the proportion of students to population is identical with the price elasticity. This may provide an indirect way of measuring the price elasticity empirically. Barro notes that this result depends on assuming $m(e,x)$ independent of a.

State aid in the form of a flat grant of s dollars per pupil would change the budget constraint to

3.6 $\qquad p_e ae + p_x x = y + as.$

Then $de/ds = a(de/dy)$, which is positive, so that increasing the flat grant will always augment total expenditure. However, "an increase in lump-sum aid always brings about a reduction in local educational outlay." Locally-funded expenditure per pupil is $L = p_e e - s$. Therefore $dL/ds = p_e(de/ds) - 1 = p_e a(de/dy) - 1$, so

3.7 $\qquad \dfrac{dL}{ds} = \dfrac{\partial m}{\partial e} \Big/ \Big(pa\dfrac{\partial m}{\partial x} - \dfrac{\partial m}{\partial e} \Big) ,$

which is always negative.

If state aid were provided on a matching basis, so that the local district were required to pay only some fraction r of its total educational expenditure, then the new budget constraint would be

3.8 $\qquad rp_e ae + p_x x = y.$

This is just like the original budget equation 3.2, except that r multiplies a. Therefore the new price derivative

can be found by substituting ra for a in 3.5, giving

3.9 $\dfrac{de}{dp_e} = -\dfrac{ra}{p_x}(1 + e\dfrac{\partial m}{\partial x})/(rpa\dfrac{\partial m}{\partial x} - \dfrac{\partial m}{\partial e})$,

which is still negative, but less so than without the matching
grant. Now since p_e and r enter symmetrically in 3.8, the
derivative with respect to r can be computed simply be
interchanging r and p_e in 3.9:

3.10 $\dfrac{de}{dr} = -pa(1 + e\dfrac{\partial m}{\partial x})/(rpa\dfrac{\partial m}{\partial x} - \dfrac{\partial m}{\partial e})$.

Increasing r, a or p_e always reduces e. Raising the local
portion r will reduce the amount of locally-funded expendi-
ture per pupil, $rp_e e$, if the price elasticity of e is less
than -1.0 (the elasticities of e with respect to r, a
and p_e are identical because they all appear in the same
way in 3.8). Conversely, increasing the state matching
ratio 1-r will always raise educational output per pupil,
e, and total expenditure per pupil, $p_e e$, but it may reduce
expenditure per pupil from local sources, $rp_e e$, if the price
elasticity of e is between 0 and -1.0. Matching grants are
therefore capable of stimulating locally-funded expenditure
at least in some cases, unlike block grants which always
reduce spending from local sources.

Barro also considers the effects of equalizing state aid,
the amount of which depends on the amount of local taxable
property; and he discusses the effects of the state taxes
used to finance state aid.

By fully exploiting conventional consumption theory,

Barro succeeds in providing "a firmer theoretical basis for empirical investigation of the determinants of educational spending and the effects of intergovernmental aid." However, his analysis does not go far enough to fulfill his further aim of providing "a foundation for predictive models than can be used to evaluate proposed educational aid formulas." As it stands, the theory yields only qualitative, not quantitative predictions. To quantitative questions it provides only the economist's universal answer: it depends on the elasticity.

The model to be developed in the next chapter will depart from orthodox consumer theory by omitting the community's budget constraint as such. Instead, the local tax rate will enter the school board's preference function in a negative way. This is not equivalent to using a budget constraint, because the impact of the local property tax rate on local disposable income will vary with the proportion of community property that is owned by non-residents. Given the choice, it is better to put the tax rate in the preference function than to use a budget constraint on community income, for at least two reasons. First, it is more realistic: political decision-making focuses on the tax rate; the school board would seldom even know how much disposable income it was leaving for non-school consumption. Second, using a budget constraint builds into the model an equivalence between block grants and local income. This equivalence may not hold in

reality: at least it is not valid to assert a priori that a dollar of block grants will affect local spending exactly as much as a dollar of additional local income.

The School District as a Consumer: Empirical Findings

Many previous studies have used regression models to explain empirically what determines the level of spending by states, local governments, and school districts. These studies vary in the rigor of their theoretical derivations, in statistical sophistication, and in the extent to which they focus on behavior in response to intergovernmental grants. Moreover, none of the models I have seen is specified so as to permit simulation of hypothetical grant formulas, because they all combine different matching and block grants into one single quantity. Nevertheless, it is useful to examine some of the better studies, to learn what empirical relationships they have discovered.

Table 3.1 summarizes the results of some of the relevant studies of school spending. All of them found some positive association between expenditure and local wealth, measured by average income, value of property, proportion of population in high income brackets or high occupational strata. Wealthier, higher-class districts spend more on schools both because the residents may have a better appreciation of how education can help their children (and in such districts the schools probably do improve the children's life chances), and also because they simply have more ability to pay.

TABLE 3.1   DETERMINANTS OF EXPENDITURE PER PUPIL

Author	Sample	Dependent Variable	Income	District Size	State or Federal Aid	% of Pop. Under Age 18	SES: Occup. or Educ. Level	Home Owner-ship	% of Pupils in Second-ary Grades	% of Child-ren Not in Public Schools	District in SMSA; or Non-Rural	Equaliza-tion Grants as % of State Aid	Pop. Density	Proper-ty Value
		Single Equation Models												
Brazer 1959 (13)	40 large city school districts	total current expenditure per capita	+	+	+									
Miner 1963 (14)	1700 dis-tricts in 23 states	total current expenditure per capita	+		+	+			+	-	+	-		
	1700 dis-tricts in 23 states	current expendi-ture per pupil from local sources	+		-				+	+			+	
	80 dis-tricts in Mass. (random sample)	current expendi-ture per pupil from local sources	+		-				+					
James, Thomas and Dyck 1963 (15)	589 dis-in 10 states	total current expenditure per pupil	+						-		+			+
Bishop 1964 (16)	341 dis-in Mass.	total current expenditure per pupil		+	+									+
Davis 1964 (17)	134 dis-tricts in Pa.	instructional expenditure per pupil						-		+				+
James, Kelly, and Garms 1966 (18)	107 large city school distircts	total current expenditure per pupil	+				+	-		+				+
Hickrod and Sabulao 1969 (19)	72 dis-tricts in in Boston metropo-litan area	total expendi-ture per pupil					+							+

Author   Sample   Dependent Variable   Exogenous   Variables

TABLE 3.1 (Continued)

Author	Sample	Dependent Variable	Income	District Size	State or Federal Aid	% of Pop. Under Age 18	SES: Occup. or Educ. Level	Home Owner-ship	% of Pupils in Second-ary Grades	% of Children Not in Public Schools	District in SMSA: or Non-Rural	Equalization Grants as % of State Aid	Pop. Density	Property Value
								Exogenous | Variables						

Single Equation Models

Author	Sample	Dependent Variable	Income	District Size	State or Federal Aid	% of Pop. Under Age 18	SES	Home Owner-ship	% of Pupils in Second-ary Grades	% of Children Not in Public Schools	District in SMSA or Non-Rural	Equalization Grants as % of State Aid	Pop. Density	Property Value
McMahon 1970 (20)	50 states	total current expenditure as fraction of personal disposable income				+				-		-		

Multi-Equation Models

Author	Sample	Dependent Variable	Income	District Size	State or Federal Aid	% of Pop. Under Age 18	SES	Home Owner-ship	% of Pupils in Second-ary Grades	% of Children Not in Public Schools	District in SMSA or Non-Rural	Equalization Grants as % of State Aid	Pop. Density	Property Value
Struyk 1970 (21)	140 large districts in New Jersey	total expenditure per pupil		-										
Michelson and Grubb (in progress, 1971) (22)	160 districts in Mass.	local school revenue per pupil	+	-	+ (Title I)		+	-						+
	93 districts in S. Carolina	local school revenue per pupil					+ (% white)							

As for negative factors, several studies found that a high proportion of homeowners tends to depress the level of spending. The probable cause is that raising property taxes reduces the value of a house, and may even force people to sell at a loss. Even though tenants pay property taxes in their rents, they do not face this danger of capital loss, so they offer less resistance to the tax.

The proportion of children not in public schools sometimes has a positive effect on public school spending, and sometimes a negative effect. This contradicts Barro's conclusion, which followed from his use of a community budget constraint. But, as James, Kelly and Garms have explained, this variable can work both ways because, on the one hand, fewer children in public schools means a given amount of fiscal resources is spread over a smaller number of pupils; on the other hand, it also means more voters will oppose taxes to support the public schools. Aside from this theoretical ambiguity, the proportion of children in public schools or the complementary variable, proportion in non-public schools, are bad variables to use because correlation with the denominator of the dependent variable (expenditure per pupil) may produce a spurious negative coefficient for the percentage in public school, or a spruious positive coefficient for the percentage not in public school.

In addition to the foregoing exogenous variables, some of the studies use endogenous variables such as the

local school tax rate, the pupil/teacher ratio, or the
number of auxiliary staff. These variables are not deter-
mined prior to the level of spending--they are determined
simultaneously. Therefore if such variables are included
the model should be explicitly specified in more than
one equation, and appropriate econometric procedures
should be used. The studies by Struyk and by Michelson
and Grubb are examples of the correct approach.

State and federal grants themselves are not exogenous
if they require local matching. The correct procedure
would be to treat block grants as exogenous, and to use
the known matching formulas to substitute out matching
grants entirely. The studies by Struyk and by Michelson
and Grubb, while superior to the single-equation models
in their handling of other endogenous variables, still
fail to capture the exact relationship between local spend-
ing and matching grants. This misspecification produces
some anomolous results, such as a negative coefficient on
local spending in the equation for state matching aid.
The model presented in the next chapter goes to great
lengths to represent more accurately the relationship
between local spending and state matching.

One of the most important empirical questions is the
extent to which state aid merely replaces rather than
stimulates local expenditure. Four of the studies summa-
rized in Table 3.1 throw light on the issue. Of the

single-equation studies, Miner's estimates imply that
a dollar of state aid would displace about $1.02 of local
spending. Bishop's estimate is 20¢. However, Bishop's
equation is rather sketchily specified, omitting important
variables such as income. Miner's estimate may be over-
stated because the independent variable in his equation
is the ratio of state aid to total school revenue, the
denominator of which corresponds to the dependent variable
itself, total school spending. This produces a strong
negative correlation over and above any true negative
association between the amount of state aid and the level
of total spending. Furthermore, both Bishop's and Miner's
estimates are biased because some state aid is not endogenous:
that part of state aid which is allocated on a matching
basis depends directly on the amount of local spending.
A single equation cannot separate the two directions of
causality.

The estimates from the two multi-equation models are
potentially more reliable. Struyk finds that a dollar of
aid reduces locally-funded spending by about 40¢. Michelson
and Grubb ran several equations, and their estimates
range from reductions of more than a dollar to actual
increases up to 30¢ in locally-raised revenue due to an
additional dollar of aid. None of these estimates,
however, is significantly different from zero. And, in
Massachusetts at least, the difficulty probably arises
from the failure to specify precisely the relationship

between local spending and state aid.

In addition to all these problems, none of the studies summarized in Table 3.1 could make any quantitative predictions about the effect of changing the matching _formulas_, because the parameters of the matching formula are not embodied in the estimating equations. In order to derive a behavioral equation that does embody these parameters, it is necessary to start with the school district's objective function. The exercise then becomes to estimate the coefficients in the ojbective function itself. The effect of other aid formulas on local spending can subsequently be simulated by maximizing the _estimated_ objective function subject to the new budget constraint imposed by the new aid formula.

Estimation of the objective function of local governments has been carried out by Henderson, but he did not use the estimates for simulating new aid formulas. (23) Henderson's study also has some shortcomings. His "community's ordinal welfare" function is

3.11 $\quad W = (a_0 + a_1 Y + a_2 R + a_3 P) \log G + X.$

G and X denote public and private expenditure per capita, respectively. P is population; Y and R are per capita personal income and intergovernmental grants. The obvious motive for choosing this functional form was to obtain a linear behavioral equation when W is maximized with respect to X and G. But this linearity is achieved at some cost in terms of theoretical validity. The function 3.11, for instance, implies that the level of public consumption

has no effect on the marginal utility of private consumption,
or vice versa. Also, there is no theoretical justifica-
tion for including intergovernmental grants R as a direct
determinant of the marginal utility of public consumption G.

Another shortcoming of Henderson's analysis is that it
considers only the total _amount_ of intergovernmental grants,
without allowing for variation in distribution formulas.
A superior specification in this respect was formulated by
Gramlich (24), who included the matching ratio for grants
in writing the state-local public utility function as

$$3.12 \quad U = a_1(E - kG) - \frac{a_2}{2}(E - kG)^2 + a_3kG - \frac{a_4}{2}(kG)^2$$
$$+ a_5(Y - T) - \frac{a_6}{2}(Y - T)^2 + a_7(C - B) - \frac{a_8}{2}(C - B)^2.$$

Here E = total expenditure, G = the amount of grants-in-
aid, k = the legally required matching ratio for receiving
grants, Y = total community income, T = local taxes, and
C and B denote capital outlays and borrowing respectively.
The term (E - kG) represents what the state-local govern-
ment is "willing to support unassisted by federal matching
grants," and kG is "a term with different utility parameters
which reflect the utility of grant-aided programs."

This utility function also has problems. First of all,
like Henderson's local welfare function 3.11, Gramlich's
state-local preference function 3.12 suffers from the lack
of interaction terms. For instance, the marginal utility
of public expenditure is not affected by changes in the
level of local taxes, or vice versa. Secondly, Gramlich

treats federal grants as exogenous, despite his explicit

inclusion of matching requirements. He thus errs in

deriving his regression equations by maximizing U with respect

to E, T, and B. The true control variables, in addition

to the level of borrowing B, are expenditure on the subsi-

dized service and other expenditure. If borrowing always

equals capital outlay, then taxes would be determined

automatically by the levels of subsidized and unsubsidized

expenditure.

Conclusions from Review of the Literature

Research into the behavior of local governments such

as school districts has been both theoretical and empiri-

cal. On the theoretical side, analysis of a school district

as a single consumer has produced qualitative results.

For instance, a matching grant should stimulate public

spending more than a block grant of the same amount.

However, such analysis has come under increasing attack

on the grounds that the process of collective decision-

making may yield different results altogether. Heins (25)

cites an unpublished paper by Goetz and McKnew, who

> "demonstrate that this (more stimulating
> effect of matching grants) cannot be proved
> theoretically, just as Giffin demonstrated
> that one cannot prove that individual
> demand curves must slope downward. Given
> the state of the theory, the question of the
> relative power of various grant forms to
> stiumlate public expenditures remains an
> empirical question.

The empirical studies, on the other hand, in general have tried only to identify what determines the amount of local public spending and taxation. They have not succeeded in measuring the effects of different grant formulas. To do this requires actual estimation of a preference function for local school districts. Henderson has done this for local governments in general, and Gramlich for state and local governments combined. But serious questions can be raised about the utility functions they postulate. Furthermore, both of them stop short of using the estimated utility function to make quantitative predictions about the effects of alternative grant formulas. This will be the purpose of the model described in the next chapter.

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CHAPTER IV

A PROTOTYPE MODEL FOR SIMULATING THE
RESPONSE OF MASSACHUSETTS SCHOOL DISTRICTS TO
HYPOTHETICAL CHANGES IN THE STATE AID FORMULA

This chapter presents the prototype of a model to ex-
plain expenditures by local school districts in Massachu-
setts. The formula for distributing state school aid
changed radically in 1966, with the adoption of the so-
called NESDEC formula, a diluted version of percentage
equalizing. The rationale of the NESDEC formula will be
discussed in Chapter V. The present chapter will confine
itself to describing and evaluating the simulation model
itself, which was estimated for both 1965-66 and 1968-69,
to test whether the model could explain local spending under
two very different state aid formulas.

Assumptions of the Model

1. School boards have consistent preferences regarding
taxes and spending. In order to predict their response
to changing aid formulas, it is necessary to discover some-
thing about the preferences: that is, to estimate the pre-
ference function they are assumed to maximize. This
preference function, however, does _not_ represent what
school committees _should_ maximize; it is not a social
welfare function.

2. One of the two main elements in the preference function
is the quantity of real instructional services. Opera-

tionally, this would include the amount spent for teachers'
salaries and also perhaps other current classroom costs,
deflated by a price index. This assumption means that
school boards do not know enough about the educational
production function to maximize school output directly.
Even if they knew the production function, they might not
be able to decide which outputs to maximize. So instead,
they try to maximize those real inputs which presumably
are most relevant to learning.

3. The price index for deflating instructional costs
from year to year is the same for all districts, and is
exogenous for both individual school boards and the state
as a whole. This assumption is theoretically unfortunate,
but was necessitated by lack of accessible data on teachers'
salaries by school district.

4. The second main element in the preference function is
the current school tax rate, which enters the objective
function in a negative way. The justification for using
the tax rate instead of a budget constraint was given in
the previous chapter. The school tax rate is defined
simply as current school spending divided by the equalized
assessed value of local property, since in Massachusetts
virtually all local school revenues come from the property
tax. (Although school committees in Massachusetts do not
have separate taxing authority, and their budgets must pass
through the city council or town meeting, state law re-
quires that the school operating budget be approved intact.(1)

Thus the school committees, which are separately elected, do have considerable fiscal autonomy in effect.)

5.   School boards understand state and federal grant formulas. They have a fairly accurate idea of how much aid they will get, and if there are matching grants they know how many dollars of aid they will get for every dollar they raise from local taxes. This assumption permits the quantity of matching aid to be substituted out of the behavioral equation.

6.   The problem of determining current expenditures is separable from the determination of capital investments. Furthermore, all current expenditures are supported by grants or local taxes, while all capital spending is financed by borrowing.

7.   School boards consider property values exogenous. Empirically, this is not a bad assumption, because the evidence indicates that the balanced-budget effect on property values of increasing both local school spending and local taxes by the same amount is approximately zero anyway. (2)

8.   School boards consider the number of pupils exogenous. They therefore think in terms of expenditure per pupil.

The Objective Function of Local School Committees,
and the Massachusetts Aid Formula

Under these assumptions, a school board may have a

preference function of the general form

4.1   max $f\left(\dfrac{g(L) - M}{p} ; t(L,V); Z\right)$.

         L = Local reimbursable expenditure per pupil in net average membership;

         $g(L)$ = Total amount, as perceived by the school board, of current expenditure per pupil, including grants;

         M = Current overhead costs per pupil;

         p = Price index for instructional costs;

         t = School tax rate, in dollars per thousand dollars of equalized assessed valuation;

         V = Equalized assessed property value per pupil, in thousands of dollars;

         Z = A vector of demographic variables. (3)

Current expenditure per pupil from local source, L, is the only control variable. Specifically, it is "reimbursable expenditures," as defined by Chapter 70 of the state laws (see Appendix), divided by net average membership in local elementary and secondary schools.

The function $g(L)$ is the total amount, as perceived by the school board, of current expenditure per pupil, including state and federal grants, which results from a given level of local expenditure L. For school districts in Massachusetts in both 1965-66 and 1968-69 the function could be written in the form

4.2 $g(L) = c_1 L + c_2$.

The coefficient c_1 includes matching grants, and c_2 represents block grants.

In 1965-66, $c_1 = 1$ because there were no matching grants. All state and federal non-matching, general-purpose grants are lumped together and denoted by A. This amount is multiplied by a subjective coefficient q, so that $c_2 = qA$. This coefficient q, which is to be estimated, measures the extent to which school committees perceive block grants to be substitutable for locally raised revenues (including matching grants). The coefficient would be 1.0 if block grants were perfect substitutes for revenue raised locally. A value of q between zero and 1.0 would indicate some, but less than perfect, substitution.

There could be two reasons why block grants might be less than perfect substitutes for locally raised revenue. One reason is that some block grants are categorical, to be used only for specific purposes such as purchase of audiovisual equipment. (4) Unless a district were already spending a substantial amount on audiovisual equipment, a federal grant for this purpose could not displace much local spending.

A second reason why the estimate of q might be less than 1.0 is that districts may hedge against the risk that block grants will not come through. Massachusetts towns prepare budgets on a calendar year basis (this will change in 1972). When they are preparing next year's budget, school committees seldom know exactly how much they will get in block grants, because appropriations by federal and state legislatures occur at various times

during the year. The uncertainty is presumably greater about block grants than about matching grants, which are determined by statutory formula in relation to a district's own level of spending. To be on the safe side, therefore, school committees probably estimate conservatively the amount of block grants they will receive, and to compensate they budget more of their own money than they really need. Thus, q is partly an uncertainty discount factor applied to block grants.

The model contains no coefficient like q for matching grants, because neither reason for the less than perfect substitutability of non-matching grants would seem to apply to matching grants. First, state matching grants are not categorical. Second, there would be less uncertainty about the amount of matching grants than about block grants, because the matching ratio is determined by statute, while the amount of block grants depends on each year's legislative whim. Therefore the model assumes that the perceived value of $g(L)$ will differ from the actual amount only to the extent that there are block grants.

Returning to the total resources function $g(L)$, the definitions of c_1 and c_2 become much more complicated in 1968-69 because of the new state aid formula. Total available resources per pupil as a function of local reimbursable expenditures L becomes

$$4.3 \quad g(L) = c_1 L + c_2 = [1 + (0.7)s(1 - d_1)(1 - d_2)(1 - d_3)$$
$$+ (0.525)d_3]L + q[s(1 - d_3)(361d_1 + 263d_2)$$
$$+ (1 + (0.556)d_3)AF].$$

In this expression s is the state matching percentage; AF is federal aid per pupil; and d_1, d_2, and d_3 are dummy variables. The equalizing effect of the state aid formula is embodied in the definition of the state matching percentage, which by law (see Appendix) is inversely related to the amount of equalized property value per pupil in each district:

$$4.4 \quad s = \begin{cases} 0.15 & \text{if } V \geqslant 33.55 \\ 1 - 0.65 \, V/\bar{V} & \text{if } 9.89 < V < 33.55 \\ 0.75 & \text{if } V \leqslant 9.89 \end{cases}$$

V is equalized property value per pupil in thousands of dollars, and $\bar{V}$ is the state average, which was 25.675 in 1968-69. Definition 4.4 says that the state matching ratios will be inversely related to the ratio between V in each district and the average $\bar{V}$, except that s may not be greater than 0.75 or less than 0.15. Out of the 157 sample districts in 1968-69, the floor on s was binding on 38 districts with V greater than 33.55, and the ceiling affected only one district with V less than 9.89.

The next complication is the law's stipulation that state matching funds will not apply to any local reimbursable expenditures in excess of 110% of the state average. The state average in 1968-69 was $462.50 per pupil.

Also, any district spending less than 80% of the average is nevertheless entitled to state matching as if its local reimbursable expenditures were exactly 80% of the average. These stipulations are expressed in the definitions of d_1 and d_2.

4.5
$$d_1 = \begin{cases} 1 \text{ if } L \geq 1.1(462.50), \\ 0 \text{ if otherwise}; \end{cases}$$

$$d_2 = \begin{cases} 1 \text{ if } L \leq 0.8(462.50), \\ 0 \text{ otherwise} \end{cases} .$$

Another constraint on the formula in 1968-69 is that state plus federal aid may be no more than 75% of the sum of local spending and federal aid. That is,

4.6
$$s[(1-d_1)(1-d_2)L + 1.1(462.50)d_1 + 0.8(462.50)d_2]$$
$$+ AF \leq 0.75(L + AF) .$$

Solving 4.6 for L gives the definition of d_3:

4.7
$$d_3 = \begin{cases} 1 \text{ if } L \leq \dfrac{(1.33)s[1.1(462.50)d_1 + 0.8(462.50)d_2] + (0.33)AF}{1-(1.33)s(1-d_1)(1-d_2)} , \\ 0 \text{ otherwise} . \end{cases}$$

An additional complication is that the state actually computes the amount of aid for each district in each calendar year on the basis of local reimbursable expenditure in the preceding fiscal year (school year). More precisely, the amount of aid to which a district was entitled for July through December 1968, the part of the 1968-69 school year falling in the 1968 calendar year, depended on its reimbursable expenditure in the fiscal year (school year) 1966-67.

And the amount of aid for January through June 1969 depended
on reimbursable expenditure during 1967-68.

There would have been three possible ways to handle
this time lag in the model. One would have been to set up
the whole system as an explicitly intertemporal optimiza-
tion problem. The second would have been to use data
for previous years to find the actual amount of state aid
in the current year, but still to treat the problem year by
year. The third way, and the one actually used, was to
pretend that reimbursable expenditure in all districts had
grown at the same rate as the average rate of growth for all
districts, which was known. Then the lag in state aid
could be handled simply by adjusting the state matching ratio
downward by a constant fraction for all districts. The
values of d_1, d_2, and d_3 were assumed to have been the same
in the preceding years as in 1968-69. This procedure means
that school boards act as if state aid were based on
current expenditure, but they make a downward adjustment
in the matching ratio to account for the actual dependence
of state aid on expenditure in previous years, when the
level of spending was less than the current year.

In 1968-69 it was also necessary to make an additional
downward adjustment in the matching ratio because the state
was not yet raising enough revenue to fund fully the new
aid program: districts received only 67% of the aid to
which they were entitled by the formula.

To see the overall effect of all these constraints,

consider how equation 4.3 would work for a school district which had about the average amounts of property value and local reimbursable expenditure per pupil. Then s would be about 0.35, and all the dummy variables would be zero. But because of the downward adjustments due to the lag in state aid and insufficient funding, total available resources would be only about 1.245 (rather than 1.35) times reimbursable expenditure L, plus non-matching aid discounted by the factor q.

A district with very large amounts of property value and reimbursable expenditure per pupil would have s = 0.15, and d_1 = 1, d_2 = d_3 = 0, so that total resources would simply be locally raised reimbursable expenditure L; plus the sum of block grants and 15% of $361 per pupil, discounted by q. The $361 figure is 110% of the average reimbursable expenditure of $462.50, discounted to allow for the lag in state aid and the less than full funding. This second example illustrates how any district spending more than 110% or less than 80% of the average reimbursable expenditure (d_1 = 1 or d_2 = 1) actually does not get any matching grants at all, because a marginal change in its reimbursable expenditure does not affect the amount of state aid it receives.

As a final example of how equation 4.3 works, consider any district in which federal grants plus state aid normally computed would amount to more than 75% of the sum of federal grants plus local reimbursable expenditure. This could

happen, for instance, in a "federally impacted" area. Then $d_3 = 1$, so total resources per pupil would be 1.525 times reimbursable expenditure L, plus 0.556 times q times block grants. State aid is reduced to offset "excessive" federal aid. Also, since the state matching ratio, s, no longer applies, the amount of state aid does not depend on the value of district property.

Returning to the objective function 4.1, the rest of the symbols have much simpler definitions. M represents per pupil overhead costs, which are assumed to be the same for all districts. This might mean all current expenses other than teachers, or other than all classroom costs. Since it is not self-evident what school boards really consider overhead and what they consider productive inputs, the value of M will be estimated as the consant in the regression equation.

The price index p is based on teachers' salaries for the state. In 1965-66 it was taken to be 1.0, and in 1968-69 it was 1.2, since teachers' salaries rose 20%.

The local current school tax rate is simply defined as

4.8 $t = L/V$,

the ratio of local reimbursable expenditure to equalized property value.

In a previous specification of the model the local tax rate included an index of state and federal taxes for supporting aid to local schools. These taxes were assumed to fall on each community approximately in propor-

tion to its total personal income. However, state and
federal school taxes so measured had no discernible effect
on the fiscal behavior of the local school districts.
This is not surprising after all, because the local school
board has no political responsibility for taxes imposed
by higher levels of government, even if those taxes are
eventually put at the local school boards' disposal.
In other words, it apparently makes no difference to a
local school board whether the revenues to support state
and federal aid come from its own district or from else-
where.

Finally, Z represents a vector of demographic variables
which will affect the school board's willingness to impose
higher tax rates for the sake of higher total expenditures.
4.9   Z = YM, PRO, ED, POP, HO.
The first three measure socioeconomic status: YM is mean
family income; ED is median years of schooling of the adult
population; PRO is the proportion of the labor force em-
ployed as professional, technical, or kindred workers.
These measures of social sclass should be positively associat-
ed with a desire to spend more, as in the studies reported
in Chapter III. POP is total population, which is a proxy
for the greater organization and power of teachers' unions
in large districts, relative to individual taxpayers.
Thus POP should be associated with more pressure on the
school board to spend. Finally, HO is the proportion of
homes that are owner-occupied, which, as in previous

studies, should correlate with stronger resistance to the
property tax, because a tax rise threatens homeowners but
not tenants with actual loss of capital. All this data,
unfortunately, is from the 1960 Census. (5)

Maximizing a Specific Form of the Objective Function
to Derive the Behavioral Equation

The school committee is assumed to maximize the objective
function in 4.1 with respect to the single policy variable
L. The first order condition, which determines the best L,
is

4.10 $\qquad f_1 \dfrac{dg}{dL} / p + f_2 \dfrac{dt}{dL} = 0$,

where by assumption the derivatives $f_1 > 0$, $f_2 < 0$.
This is the general form of the behavioral equation that is
to be estimated.

The presence of the price index p should not be taken
to mean that equation 4.10 is an orthodox demand function.
To the contrary, p has the same magnitude for every school
district. What will be estimated in the final version of
4.10 are the parameters of the preference function itself.

Parametrizing the preference function means postulating
a certain functional form. Under the assumption that the
level of spending chosen by the school board will maximize
the value of the preference function, some notion of
theoretically permissible forms may be obtained from the
second order condition for a maximum:

4.11 $f_{11}(\frac{dg}{dL})^2/p^2 + 2f_{12}(\frac{dg}{dL})(\frac{dt}{dL})/p + f_{22}(\frac{dt}{dL})^2 + f_1(\frac{d^2g}{dL^2})/p$

$+ f_2(\frac{d^2t}{dL^2}) < 0 .$

The following are sufficient conditions under which inequality 4.11 will hold:

4.12 $f_1(\frac{d^2g}{dL^2})/p + f_2(\frac{d^2t}{dL^2}) \leq 0 ,$ and

4.13 $f_{11}(\frac{dg}{dL})^2/p^2 + 2f_{12}(\frac{dg}{dL})(\frac{dt}{dL})/p + f_{22}(\frac{dt}{dL})^2 < 0 .$

The functions g and t are already given in equations 4.2 and 4.8. Since both are linear in L, condition 4.12 holds as an equality.

To satisfy 4.13, which is the condition for concave indifference curves, there would be several simple forms in which to write the preference function. For example

$$\max \quad m(\frac{g-M}{p}) + n \log (\frac{g-M}{p}) - ut + w \log t ;$$

$$\max \quad m(\frac{g-M}{p}) - nt (\frac{g-M}{p}) - ut;$$

$$\max \quad n \log (\frac{g-M}{p}) - ut^2 ; etc.$$

The coefficients m, n, u, and w are all assumed positive.

There is no a priori way to choose among the functional forms of 4.1 that satisfy 4.13. The way to choose among these theoretically permissible forms is to try different ones, derive and estimate the behavioral equation for each, and choose the one that produces the best fit to the data.

Accordingly, two functional forms were tried. One was

$$\max \quad n(\frac{g-M}{p}) - (\frac{g-M}{p})t - ut.$$

This form has the theoretically desirable feature that the marginal utility of real, non-overhead expenditure $(\frac{g-M}{p})$ decreases when the tax rate t increases, and the marginal disutility of the tax rate increases when the level of spending increases. Since this is only an ordinal function, it is permissible to normalize it by setting one of the coefficients equal to unity. That is why the middle term appears with no coefficient. Substituting $g = c_1 L + c_2$ and $t = L/V$, and maximizing with respect to L produced the behavioral equation

$$4.14 \qquad L = \frac{1}{2}(nV - \frac{c_2}{c_1} + \frac{M}{c_1} - \frac{pu}{c_1}).$$

Although 4.14 has a pleasing linear form, it did not give as good a fit to the data as did the behavioral equation based on the preference function

$$4.15 \qquad \max \quad n(\frac{g-M}{p}) - \frac{1}{2}(\frac{g-M}{p})^2 - \frac{1}{2}ut^2 .$$

Substituting again for t and g and differentiating gives the behavioral equation

$$4.16 \qquad L = \frac{pn - c_2 + M}{c_1 + p^2 u/c_1 V^2} .$$

This is the parametrized form of 4.10. Local spending L will depend positively on the marginal preference for real instructional inputs, measured by n; and L varies inversely with the marginal disutility of the local tax

rate, measured by u. Larger overhead M will mean larger L, more block grants in c_2 will produce smaller L, and the effect of changes in the price index p or the matching ratio c_1 are uncertain.

Before estimating 4.16 or 4.14 it still remained to specify how n and u depend on the characteristics of local communities. After experimenting with different variables, a good specification seemed to be

4.17 $n = a_1 YM + a_2 PRO + a_3 ED + a_4 POP$.

4.18 $u = a_5 HO$.

The reasoning, to recapitulate, is that the school board's desire for more instructional inputs should be positively related to the community's socioeconomic status as measured by income, level of education, and the percentage in professional occupations (since people in these occupations would place more importance on academic training and credentials). As mentioned above, district size also correlates with the power of teachers' unions relative to individual taxpayers, so large population would mean a tendency to spend more in the classroom. On the other hand, the disutility of the property tax rate should increase with the proportion of owner-occupied homes, since a rise in the tax rate threatens homeowners but not tenants with a capital loss.

For 1965-66, therefore, equation 4.16 was finally estimated in the form

4.19 $\qquad L = \dfrac{a_1 YM + a_2 PRO + a_3 ED + a_4 POP + M - qA}{1 + a_5 HO/V^2} + \varepsilon$.

For 1968-69, the equation was

$$4.20 \quad L = \frac{p(a_1YM+a_2PRO+a_3ED+a_4POP)+M-q[s(1-d_3)(361d_1+263d_2)+(1+0.556d_3)AF]}{1+(0.7)s(1-d_1)(1-d_2)(1-d_3)+0.525d_3+\dfrac{p^2a_5HO}{V^2[1+(0.7)s(1-d_1)(1-d_2)(1-d_3)+0.525d_3]}} + \varepsilon \ .$$

Results of the Estimation

The estimation made use of a nonlinear regression
program recently developed at MIT for the TROLL system.(6)
Table 4.1 displays the results.

TABLE 4.1

Coefficient and Variable	1965-66	1968-69 (standard errors in parentheses)
a_1 income	0.027 (0.010)	0.024 (0.010)
a_2 % professionals	538 (141)	510 (161)
a_3 education of adults	9.52 (5.54)	16.86 (6.57)
a_4 population	0.000087 (0.000071)	0.000347 (0.000099)
M overhead spending	139.76 (61.93)	142.52 (82.92)
q block grant discount factor	0.680 (0.132)	0.601 (0.103)
a_5 % homes owner-occupied	64.7 (10.8)	111.8 (20.9)
$\bar{R}^2$	0.70	0.76
Sample size	157	157

The coefficients all have the predicted sign. The
values of $\bar{R}^2$ are quite satisfactory for cross-sectional
regressions, and they compare favorably with those obtained
by Michelson and Grubb, who analyzed the same sample in
1968-69 with a linear, multi-equation model. By these
measures, the model fits the data well in both years,
despite the drastic change in the state aid formula.

It is worth commenting in particular about the estimate of q. School boards receiving an additional dollar of non-matching aid will reduce their own current expenditure by the estimated value of q divided by the denominator in 4.19 or 4.20. On average, these denominators are about 1.1 to 1.3 (V is measured in thousands of dollars). So the fact that the estimate of q is between 0.5 and 0.7 means that the reduction in local current expenditure from an extra dollar of non-matching aid will be around 45 to 65 cents.

The estimate of overhead costs, M, suggests that what school committees regard as overhead is anything not spent on teachers. In 1965-66 the estimated value of M was about $140, or 33.4% of the mean value of L, which was $419. For the state as a whole, the total expenditure on teachers was 64.2% of total current expenditure, which is remarkably close to 100% minus 33.4%. For 1968-69 lack of state data prevented making a comparable calculation.

A Chow test was performed to test the significance of the difference between the two sets of coefficients in Table 4.1, and the hypothesis that the two sets are the same can be rejected at the 0.05 level. But most of these coefficients correspond to variables for which only 1960 data was available, despite the fact that the true demographic characteristics of the communities did change from 1960 to 1965-66, and from 1965-66 to 1968-69. In theory, the behavior of local school boards depends on the

current characteristics of their constituents. Since the relationship of current characteristics to the 1960 data undoubtedly changed between 1965-66 and 1968-69, the coefficients based on 1960 data should be different in the two years. If current data had been available, there would presumably have been less difference, if any, between the two sets of coefficients. Furthermore, even if there were some change over time in the coefficients based on current data, this would not imply that school boards in any given year would reveal inconsistent preferences in making decisions under different aid formulas. In short, the difference between the two sets of coefficients in Table 4.1 certainly does not invalidate the model as a basis for predicting responses bo hypothetical grant plans in a given year.

In addition to looking at the coefficients themselves, the model can be appraised in two other ways. First, the estimates imply a different preference function and set of indifference curves for each district, and examples of these can be examined. Second, some of the qualitative and quantitative implications for school district fiscal behavior can be assessed.

Measuring the Effect of SES on Willingness to Pay for Schools

The basic idea of the simulation model is to make use of an estimated preference function for each school district.

It is therefore appropriate to ask whether the preferences
implied by the estimates in Table 4.1 are reasonable.

Table 4.2 considers two districts, Milton and New Bedford.
Milton is a wealthy residential suburb of Boston; New
Bedford is a decaying port city on Massachusetts' southern
coast. They are typical rather than extreme examples.
Table 4.2 contains the 1960 demographic data for the two
districts. It also shows the computed values of n and u,
from equations 4.17 and 4.18, using the 1968-69 estimated
coefficients.

<div align="center">TABLE 4.2</div>

	New Bedford	Milton
Mean family income (YM)	4,930	7,192
Proportion employed as professionals (PRO)	0.063	0.204
Median education of adults (ED)	8.4	12.6
Population (POP)	102,477	26,375
Proportion of homes owner-occupied (HO)	0.391	0.864
$n = 0.024YM + 510PRO + 16.86ED + 0.000347POP$	328.0	498.7
$u = 111.8HO$	43.7	96.6

Figure 4.1 depicts a set of indifference curves for
each district, representing combinations of total resources
g and tax rate t which produce the same value of the
district's preference function. Except at levels of g
below $367 per pupil, the indifference curves for New
Bedford are steeper than for Milton. This means that
in this range, the New Bedford school board would require

FIGURE 4.1
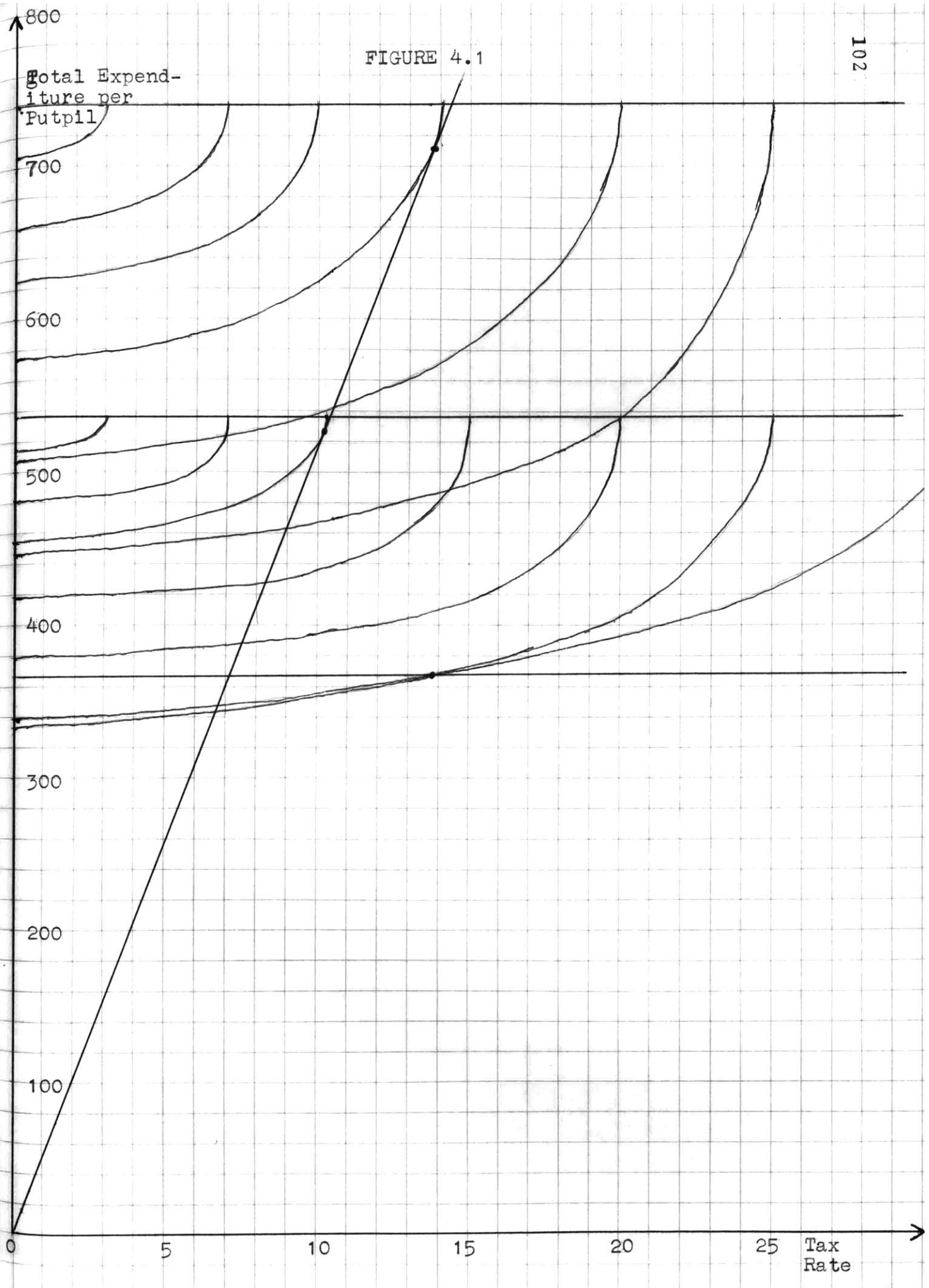
a larger increment of expenditure per pupil to induce it to raise the tax rate by a given amount. Algebraically, the slope of an indifference curve, from 4.15, is

$$\frac{dg}{dt} = \frac{put}{np - (g-M)}$$. Given the estimated values of n and

u, this quantity is greater for New Bedford than for Milton, in the relevant range of g. Thus the estimated coefficients confirm the hypothesis that the socioeconomic characteristics of the population determine the district's willingness to tax itself for the sake of more expenditure per pupil. This effect of SES on preferences is separate and distinct from the effect of wealth per se on the ability to get a certain amount of expenditure from a given tax rate.

Measuring the Different Stimulus from Matching and

Block Grants

The theoretical consensus reported in Chapter III is that increasing either block grants or matching grants will normally lead to more total expenditure on the subsidized service, but less expenditure from local sources, as grants are partially substituted for local revenues. It can be shown by differentiating equation 4.16 that the present model agrees with these theoretical conclusions.

Most previous theory also asserts that replacing a dollar of block grants with a dollar of matching money will stimulate greater local, and therefore total, expenditure on the subsidized service. However, the model as

estimated implies that this is not necessarily true. The reason is that the parameter q is estimated to be less than 1.0: because of their sometimes categorical nature and their uncertainty relative to matching grants, block grants are treated as less than perfect substitutes for revenues produced by local efforts.

To see how this works algebraically, recall that the total amount of aid received by a district is $(c_1-1)L + A$, the sum of matching grants plus block grants. Now consider what would happen to L if A were reduced and $(c_1-1)L$ increased by the same amount. That is, what would be the sign of dL if

4.21 $dA = -d[(c_1 - 1)L]$?

First of all,

4.22 $dL = \dfrac{\partial L}{\partial c_1} dc + \dfrac{\partial L}{\partial c_2} dc_2$.

But $c_2 = qA$, so

4.23 $dc_2 = qdA = -qd[(c_1 - 1)L] = -q[(c_1 - 1)dL + Ldc_1]$.

Substituting 4.23 into 4.32 and solving for dL gives

4.24 $dL = \dfrac{(\dfrac{\partial L}{\partial c_1} -qL \dfrac{\partial L}{\partial c_2})dc_1}{1 + q(c_1 - 1) \dfrac{\partial L}{\partial c_2}}$.

It can be shown that the denominator of 4.24 is always positive. Therefore dL is positive if and only if

4.25 $\dfrac{\partial L}{\partial c_1} > qL \dfrac{\partial L}{\partial c_2}$.

After substituting for L, $\dfrac{\partial L}{\partial c_1}$, and $\dfrac{\partial L}{\partial c_2}$ from 4.16, condition

4.25 becomes

4.26 $\quad p^2 u / c_1^2 V^2 > 1 - q.$

If $q = 1$, condition 4.26 would always be true, so
dL would always be positive, if matching funds were sub-
stituted for an equal amount of block grants. But with
the estimate of $q = 0.6$, it is quite conceivable that 4.26
might not hold in some districts where u were high and $c_1 V$
low enough. In point of fact, condition 4.26 probably does
hold for all districts in the sample. Nevertheless, the
difference between matching and block grants is less clear
cut in practice than in theory. The qualitative conclusions
from pure theory are attenuated, and sometimes may even
be reversed, by institutional realities.

Conclusion

In order to permit simulation of the local response
to hypothetical state aid formulas, the model presented
here has tried to do two things that previous models have
not done. First, it has parametrized the preferences of
local school boards in such a way that the parameters can
be estimated from observed data on local spending. These
preference parameters were found to depend on the socio-
economic characteristics of local communities. Upper-middle-
class districts, identified by occupation, income, and
education, are more willing to raise the local tax rate
for the sake of spending more per pupil in local schools.
This greater willingness to spend is separate and distinct

from wealthier districts' advantage in sheer ability
to pay.

To explain fully why upper-middle-class communities
are more willing to raise the tax rate for the sake of more
expenditure is beyond the scope of this paper. However,
two complementary hypotheses suggest themselves. First,
a given property tax rate represents less of a burden
in wealthier communities, where a larger proportion of
total wealth is held in the form of securities and other
assets not subject to the local property tax. The pro-
perty tax, in short, is regressive in terms of wealth,
whether or not it is regressive in terms of permanent income.
An additional reason why upper-middle-class districts have
a stronger propensity to tax themselves for schools could
well be that the schools as they now exist are best
suited for this class. Studies cited in Chapter I found
that the rate of return to education is higher for whites
than for blacks; given the correlation between race and class
in this country, it also seems likely that the rate of return
to formal schooling for the upper-middle-class would
exceed that for the lower classes. Certainly academic
credentials are more valuable in professional, technical,
and managerial careers than in blue-collar occupations,
where on-the-job training is more important. Education
is also essential in the upper-middle-class style of
life: in part, their status depends on it. Since the
schools as presently constituted serve the purposes of the

wealthier class, it is only rational for them to be more
willing to pay.

The second innovation in the model has been to incorpo-
rate the state matching formula in such a way that matching
aid is embodied in the very structure of the estimating
equation, rather than appearing as a separate variable.
This approach produced a good fit to the data in two years
when the state aid formula was very different. The explan-
atory power of the model is at least as great as a linear,
multi-equation model which used the same data. Finally,
this formulation indicated that the difference between
matching and block grants in stimulating local expenditure
may be less than qualitative theories have asserted.

Notes

(1) Stuart DeBard: Massachusetts Finance Committee
     Handbook; Association of Town Finance Committees,
     November 1970; pp. 49-50.

(2) Wallace E. Oates: "The Effects of Property Taxes
     and Local Public Spending on Property Values: An
     Empirical Study of Tax Capitalization and the Tiebout
     Hypothesis"; Journal of Political Economy 77: 957-971,
     November/December 1969.

(3) Data on the demographic variables, already punched
     on cards, was generously provided by Norton Grubb
     and Stephan Michelson of the Harvard Center for
     Educational Policy Research. The sample of 157
     districts includes all districts in Massachusetts
     except those belonging to regional high school districts
     and those too small to be tabulated separately in
     the U.S. Census. For a fuller description of the
     sample, see David K. Cohen and Tyll R. Van Geel:
     "Public Education"; in Samuel H. Beer and Richard E.
     Barringer (eds.): The State and the Poor; Winthrop
     Publishers, 1970.

     Data for 1965-66 on local reimbursable expenditures,
     state and federal aid, and equalized property value
     are from the Annual Report of the (Mass.) Department of
     Education for the Year Ending June 30, 1966, Part II.

     1966-67 data on federal aid, used instead of 1968-69
     data, were also provided by the Center for Educational
     Policy Research.

     Data for 1968-69 on state aid, local expenditure, and
     equalized property value are from mimeographed lists
     obtained from the Mass. Dept. of Education.

     The price index was computed from data on teachers'
     salaries obtained from the Massachusetts Teachers'
     Association.

(4) This is true of aid under NDEA Title III. Some federal
     programs, including this one, also require one-to-one
     local matching, which would further tend to reduce the
     estimated coefficient q. Strictly speaking, these
     matching requirements should be built into the model,
     instead of treating NDEA Title III as a block grant.
     However, these programs do not represent a major share
     of federal aid, and it would not have been worth
     making the model even more complicated than it already
     is.

(5) See footnote (3).

(6) For a description of the estimation procedure, see
     Mark Eisner and Robert S. Pindyck: "A Generalized
     Approach to Estimation for the TROLL/1 System";
     mimeographed draft, MIT Dept. of Economics, April 1971.

CHAPTER V

THE EFFECTIVENESS OF EQUALIZING FORMULAS IN
MASSACHUSETTS

This chapter reports two kinds of experiments with
state aid to public schools in Massachusetts. The first
experiment was historical: in 1966 the formula for dis-
tributing state aid to local school districts changed
fundamentally. The change in its effects on the distri-
bution of educational resources will be described. The
second kind of experiment is a simulation of a hypothetical
new formula for distributing state aid. (1)

The Situation in 1965-66

The formula for distributing general-purpose aid for
local schools in 1965-66 had been handed down in 1948,
when the Massachusetts legislature grandly announced a
program "To promote the equalization of educational opportunity
in public schools of the commonwealth and the equalization of
the burden of the cost of schools to the respective towns..."
(2) The basic formula gave each district $130 for every
child between the ages of seven and sixteen, minus 0.006
times the total equalized value of real estate in the dis-
trict. Wealthier towns would thus receive less state
aid per pupil; a district containing taxable property worth
more than $21,700 per child of school age would get nothing
under the formula--except that the act explicitly guaranteed
every district a minimum amount equal to the amount of
state aid received in 1948.

Although the 1948 Act appears to promise state grants on the order of at least $30 to $50 per pupil for the average district, by 1965-66 the program was providing on average less than $7 per pupil in regular day schools across the state. The amount of aid may have shrunk because state taxes did not pump enough money into the Massachusetts School Fund. Also, growth of locally taxable property may have choked off state aid under the formula, despite the provision in the 1948 Act that the $130 "foundation" level would grow one dollar for every hundred million increase in total statewide property value. Whatever the reason, general-purpose state aid in 1965-66 was a mere pittance.

School districts in 1965-66 did receive some other state and federal grants for general current expenses. In addition to the nearly $7 per pupil in general-purpose aid from the state, local school districts in Massachusetts received on average another $5 or so from the state for more specific purposes, plus roughly $20 per pupil from the federal government. Much of the federal aid came as block grants, either for "federally impacted areas" under P.L. 874 or for districts with concentrations of low-income students under E.S.E.A. Title I. (3) Together these various state and federal grants represented roughly 7% of the average district's current spending.

The results of this system of grants are displayed in the first column of Tables 5.1 and 5.2. The local tax

rates in these tables are local "reimbursable expenditures"
(defined in Appendix), per thousand dollars of equalized
property value. The figures on total expenditure per
pupil include local reimbursable expenditure, plus state

TABLE 5.1

	actual 1965-66	actual 1968-69	estimated 1968-69	simulated 1968-69 pure percentage equalizing	ultimate equalizing
mean total expenditure per pupil	454.54	592.52	600.18	612.57	581.76
mean local tax rate	18.07	17.79	17.46	11.94	15.01
variance of log of total expenditure per pupil	.067	.028	.020	.014	.002

and federal grants. The amounts of equalized property
value per pupil are in thousands of dollars. Finally,
the variance of the logarithm of total expenditure is used
as the measure of variation because it is not affected by
linear transformations of the data: for instance, if every
district spent twice as much because costs doubled, the
variance of the log of expenditure would not change.

Comparing the districts with highest and lowest
levels of total expenditure clearly reveals the inadequacy
of state aid in 1965-66. While Weston and Lexington
enjoyed more than $700 per pupil, Abington and Middleborough
somehow made do with less than $200. Incredible though
they may seem, these extremely low levels of spending are

TABLE 5.2

	actual 1965-66	actual 1968-69	simulated 1968-69 pure percentage equalizing	ultimate equalizing
5 districts with highest total expenditure per pupil: total expenditure, local tax rate (in dollars per thousant), and equalized property value (in thousands).	Lexington 715.85 28.6 23.5	Brookline 1032.98 12.5 73.4	Weston 849.53 16.6 40.1	92 districts have total expenditure = $600;
	Weston 706.84 20.6 33.5	Westwood 919.43 23.7 33.0	Boston 833.47 16.2 21.4	5 districts with highest local tax rate:
	Brookline 678.85 9.7 68.4	Swampscott 871.75 20.1 38.6	Longmeadow 805.73 15.7 30.9	Newton 59.4
	Swampscott 671.09 16.5	Weston 857.59 19.9	Wellesley 802.28 15.6	Weston 42.9
	Wellesley 659.20 15.6 41.3	Wellesley 843.03 17.6 41.6	Newton 801.73 15.6 37.3	Westwood 36.0
				Boston 35.0
				Longmeadow 33.8

TABLE 5.2 (Continued)

	actual 1965-66	actual 1968-69	simulated pure percentage equalizing	1968-69 percentage equalizing
5 districts with lowest total expenditure per pupil: total expenditure, local tax rate (in dollars per thousand), and equalized property value (in thousands).	Middleborough 128.69 22.3 5.3	N. Brookfield 349.26 11.1 19.3	Blackstone 495.07 9.7 18.6	Westport 508.64 7.2 35.6
	Abington 161.30 24.9 6.0	Millville 369.67 15.6 14.5	Winchendon 499.80 9.8 13.8	Webster 514.84 6.9 37.9
	Millville 288.68 16.5 16.5	Hudson 408.36 13.6 19.2	Westport 501.18 9.8 35.6	Winchendon 517.47 5.7 13.8
	Tyngsborough 321.05 31.5 9.8	Webster 421.57 8.8 37.9	Webster 505.81 9.9 37.9	Provincetown 517.99 6.5 79.4
	Hudson 331.91 17.2 17.6	Bellingham 441.65 19.1 14.7	Provincetown 506.10 9.9 79.4	Ware 519.86 6.2 29.4

consistent with the extremely small amounts of property
value per pupil in these districts. Indeed, this is the
main problem: given the paltry amounts of state and federal
aid, local districts had to rely on their own property
tax to support the schools. Obviously, wealthy districts
could raise more money this way. The five districts
with the highest total expenditure had property value per
pupil ranging from $40,000 to $68,400, while the five
lowest ranged from $5,280 to $17,600. The clincher is that
the five highest-spending districts could raise two to
five times as many dollars per pupil as the five lowest,
but could still get away with a lower average total tax
rate: 18.2 compared with 22.5 dollars per thousand.

NESDEC in 1968-69

The obvious need for more adequate--both more sub-
stantial and more equalizing--state aid to local schools
prompted passage in 1966 of a brand-new distribution formula,
named the NESDEC formula in honor of the New England
School Development Council, which invented it. (4) The
NESDEC formula is spelled out in Chapter 70 of the state
laws, which is included as an Appendix for readers who
enjoy translating legal prose into algebra.

To recapitulate, the NESDEC formula is a variant of
"percentage equalizing," the pure form of which appeared
in Chapter II as Plan 8 in Table 2.1. Pure percentage
equalizing gives all districts the same linear opportunity

frontier, by setting

5.1 $g(L) = kL/V$,

where V is equalized value of property per pupil in the district. In terms of equation 4.2, $c_2 = 0$, and $c_1 = k/V$, where k is the same constant for all districts. The result is to make total expenditure per pupil, $g(L)$, strictly proportional to the local school tax rate L/V. Every district gets to spend exactly k times its local tax rate--no more, no less. (Equation 5.1, unlike equation 2.5, ignores state taxes paid by the district, since the school boards themselves seem to ignore them.)

For total resources to be independent of local wealth as measured by V, state aid per pupil, S, would be

5.2 $S = (1 - mV/\bar{V})g - F = (1 - mV/\bar{V})(L + S + F) - F.$

Here m is a constant between zero and 1.0 with the same value for all districts, $\bar{V}$ is property value per pupil in the average district, and F is per pupil federal aid, which is assumed to be exogenous and known. Then

5.3 $S = \dfrac{(1 - mV/\bar{V})L}{mV/\bar{V}} - F$, so that

5.4 $g(L) \equiv L + S + F = (\bar{V}/m)(L/V),$

which corresponds to equation 5.1 with $k = \bar{V}/m$. Thus the state aid formula in equation 5.3 makes total resources per pupil a function of the local tax rate alone.

However, the NESDEC formula is not percentage equalizing in this pure form. First of all, instead of formula 5.2

NESDEC has

5.5 $\qquad S = (1 - mV/\bar{V})L,$

with m = 0.65. So for the average district $(V = \bar{V})$,
state aid is 35% of <u>local</u> spending, not 35% of <u>total</u>
spending, which includes the amount of state aid itself.
Since state aid is larger in poorer districts, NESDEC
is less equalizing than pure percentage equalizing would be.

In addition, the NESDEC formula includes three
constraints, which contributed so much to the complexity
of the model in Chapter IV. (See 4.4, 4.5, 4.6.) To
repeat, the first constraint says that the state matching
percentage will be no more than 75% in any district, and
no less than 15%. This constraint is extremely important.
Without it, the matching percentage $(1 - 0.65V/\bar{V})$ would
be less than 15% for all districts with property value per
pupil more than $0.85\bar{V}/0.65$, or \$33,600 in 1968-69. In
the sample of 157 districts, 33 had at least this much
property value. The wealthiest of these, in the absence
of constraint 5.8, would actually have been due for <u>ne-</u>
<u>gative</u> subsidies according to equation 5.5. This constraint
therefore gives many of the wealthier districts more
state matching than they would get from pure percentage
equalizing.

The second constraint holds that a district which spends
more than 110% of the state average from local sources
will not receive any state matching on the excess over
110%; but if a district spends less than 80% of the state

average, it will get state matching as if it spent exactly 80%. The result is that school districts which spend more than 110% or less than 80% of the state average simply receive block grants, equal to the appropriate state matching percentage multiplied by $0.8\bar{L}$ or $1.1\bar{L}$. So for districts outside the middle range of reimbursable expenditure, NESDEC really provides not matching but block grants.

NESDEC's third constraint is that state plus federal aid may be no more than 75% of local spending plus federal aid. This constraint applies mainly to "federally impacted" districts, such as those containing military bases, where federal P.L. 874 pays the consequent local school costs.

What actually came out of all these constraints and coefficients? Refer again to Tables 5.1 and 5.2, where the second column presents data for 1968-69. One clear result is that the more generous program of state assistance did raise the average level of total expenditure per pupil. State aid, which was roughly 3% of toal current expenditure in 1965-66, shot up to about 20% in 1968-69 under NESDEC. This spurred a 30% increase in the average total expenditure per pupil, from $455 to $593. Since teacher salaries in general rose only about 20% in this period, there was an apparent increase in the amount of real instructional resources per pupil.

The increase in total expenditure, moreover, was financed mostly by state (and federal) aid. Expenditure from local sources, which averaged $418 per pupil in 1965-66,

rose only to $456 in 1968-69. So local districts contributed only $38 to the $138 rise in total expenditure per pupil; state (and federal) grants paid the remaining $100.

In fact, NESDEC was not a very potent stimulus to local tax effort. Because assessed valuation rose, the average local school tax rate in the sample actually dropped slightly, from $18.07 to $17.49 per thousand dollars of equalized assessed property value. This is good news to those people, including most local public officials, who always viewed NESDEC as a device for shifting the burden of local school costs from the local property tax to the state sales and income taxes. On the other hand, it might alarm those who deem state aid inefficient unless it stimulates local fiscal effort.

As an equalizer, the NESDEC formula produced mixed results. (5) Table 5.1 shows that the variance of the logarithm of total expenditure per pupil in the 157 sample school districts fell from 0.067 in 1965-66 to 0.028 in 1968-69. These numbers measure variation in the ratio between the sample observations and the geometric mean, so the decrease indicates that the level of expenditure in high-spending districts became a smaller multiple of expenditure in low-spending districts under NESDEC. Roughly speaking, if the logarithm of expenditure has an approximately normal distribution, then these variances imply that, while two thirds of the districts differed no more than 30% from the average expenditure per pupil in 1965-66,

NESDEC reduced the variation so that two-thirds differed
no more than 20% from the average in 1968-69. At the
extremes, the ratio of Lexington's total expenditure per
pupil to Middleborough's in 1965-66 was 5.57; in 1968-69
the ratio of Brookline's to North Brookfield's was only
2.96.

On the other hand, the absolute difference between per
pupil expenditure in Brookline and in North Brookfield
for 1968-69 was $684; in 1965-66 the difference between
Lexington and Middleborough had been only $587. So while the
spread between highest and lowest decreased in ratio terms,
it increased almost $100 in absolute amount. Furthermore,
Table 5.2 indicates that the highest-spending districts
still tended to have equalized property value per pupil
well in excess of the $25,675 state average, while the
lowest-spending districts generally had less than average
property per pupil. It is true that the highest-spending
districts taxed themselves at somewhat higher rates than
the lowest. But this merely suggests than an effective
equalizing formula must take into account the stronger
propensities of wealthier districts to spend money on schools.
It is symptomatic of NESDEC's shortcoming as an equalization
formula that Brookline, Swampscott, and Wellesley all had
higher school tax rates in 1968-69 than in 1965-66, while
Hudson and Millville actually reduced their local tax
effort in response to the new formula. Apparently NESDEC
failed to promote equality in expenditure per pupil be-

cause it offered stronger incentives to rich districts than to poor ones.

TABLE 5.3

	New Bedford	Milton	average in sample
total expenditure per pupil, 1965-66	383.03	560.71	418.58
local tax rate, 1965-66	13.75	10.42	18.07
total expenditure per pupil, 1968-69	529.77	699.14	592.52
local tax rate, 1968-69	16.50	11.23	17.49
simulated values, 1968-69:			
total expenditure per pupil, percentage equalizing	525.83	711.35	612.57
local tax rate, percentage equalizing	10.25	13.85	11.94
total expenditure per pupil ultimate equalizing	527.56	600.00	581.76
local tax rate, ultimate equalizing	9.39	27.66	15.01
property value per pupil, 1968-69 (in thousands)	20.52	56.54	25.675
Property value per pupil, 1965-66	22.02	48.30	

Figure 5.1 shows how NESDEC in fact does give stronger incentive to a wealthier district. The lines in Figure 5.1 are opportunity frontiers for two districts, Milton and New Bedford. The significance of opportunity frontiers was discussed in Chapter II. In Figure 5.1, point B1 denotes the combination of local tax rate and total expenditure per pupil chosen by New Bedford's school committee in 1965-66. The line through B1 is the opportunity fron-

FIGURE 5.1
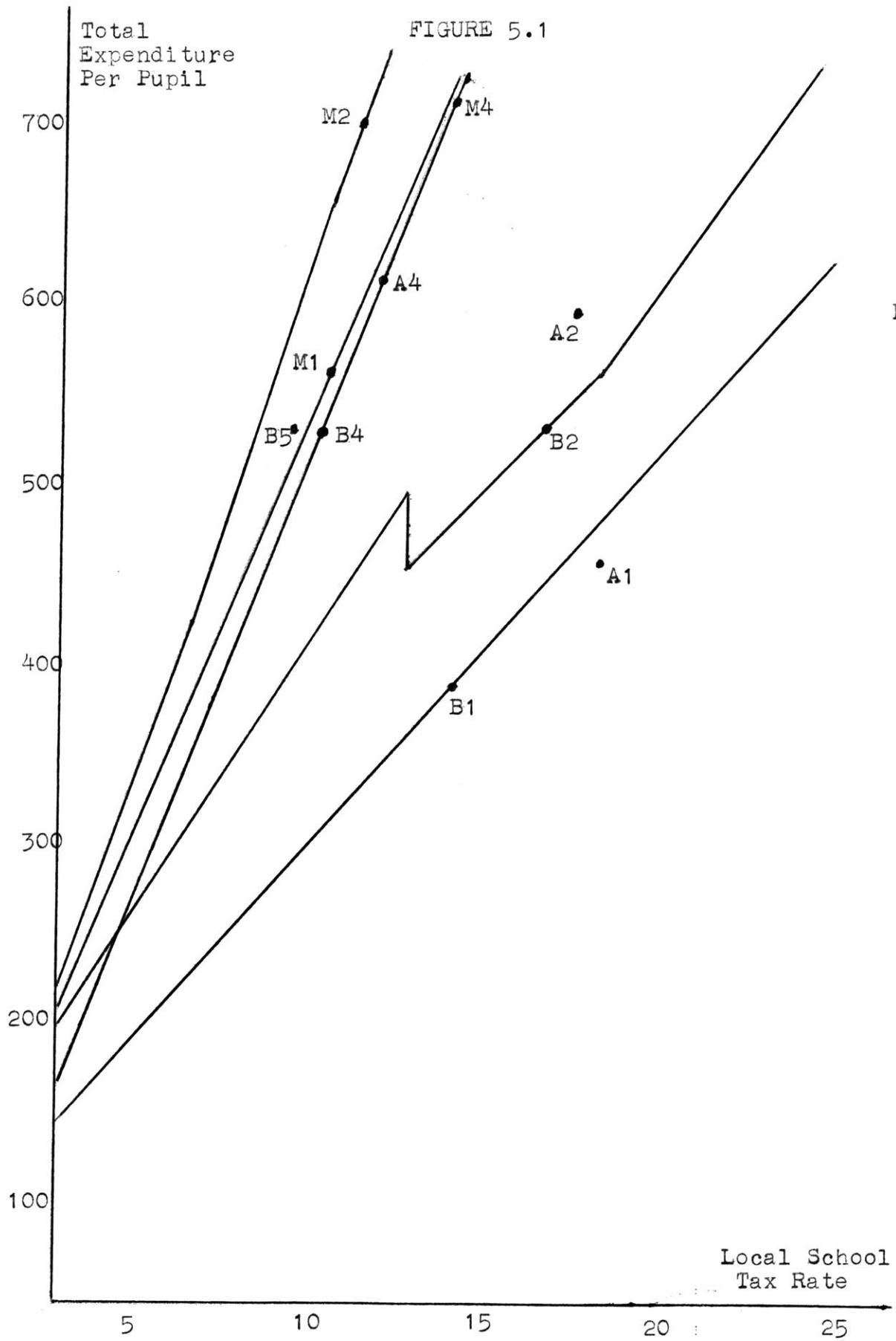
tier New Bedford faced in that year. Since there were
no matching grants in 1965-66, the slope of this line is
22.02, the amount (in thousands) of property value per
pupil. And the intercept is the amount of state and fed-
eral aid, $80 per pupil. Similarly, M1 marks Milton's
local tax rate and total per pupil expenditure in 1965-66,
and the line through M1 was Milton's opportunity frontier
in that year. Its intercept is about $23 lower than
New Bedford's, but its slope is much steeper, so at tax
rates greater than one dollar per thousand Milton's frontier
is higher than New Bedford's. That is why Milton could get
$178 per pupil more than New Bedford in 1965-66, but with
a lower tax rage (M1 is northwest of B1). For comparison,
point A1 represents the average tax rate and total expendi-
ture in 1965-66 for all 157 districts.

The more generous provision of state aid under NESDEC
pushed up the opportunity frontier for every district. B2
denotes New Bedford's tax rate and total expenditure in
1968-69, M2 is Milton's and A2 again is the average for all
districts in the sample. These three points all lie
above their corresponding points in 1965-66. Concomitantly,
the frontier through B2 lies above that through B1; the
same for M2 and M1. The kinks and jags in the new frontiers
express NESDEC's several constraints. However, the most
important feature of these frontiers is that, over the
relevant range, the NESDEC frontier lies no greater distance
above the 1965-66 frontier for New Bedford than for Milton.

For tax rates from 9 to 12, the line through M2 lies aout

$85 above the line through M1. With tax rates from 13 to

17, the line through B2 also lies only about $90 above

the frontier through B1. NESDEC therefore did not even

offset the growth in Milton's tax base relative to New

Bedford's. As a result, between 1965-66 and 1968-69

New Bedford's opportunities did not improve any more than

Milton's. This illustrates how NESDEC failed as an

equalizer.

Simulation

The remainder of this chapter will describe the simu-

lation of two hypothetical programs for distributing state

aid to local school districts. The purpose of the first

simulation is actually to predict, the effects of a pure

percentage equalizing formula. The second simulation

will demonstrate how the model can be used to find the

"best" state aid program, once the objectives are defined.

The first step in the simulation procedure is to ex-

press the new state aid formula in terms of the total

resources function, equation 4.2. In the present instance,

pure percentage equalizing means $g(L) = kL/V$, so $c_1 = k/V$,

and $c_2 = 0$. The parameter k was set at 51.3, so that the

average district, which had $V = 25.675$, would have $c_1 = 2$.

That is, the marginal matching ratio would be 100% for a

district with the average amount of assessed valuation.

This is more than the 35% provided by NESDEC. But the

increase in the average matching ratio is partially offset

by eliminating the lower limit on the matching ratio,
by which NESDEC guaranteed that no district would be
matched at less than 15%.

The next step is to substitute the hypothetical
values of c_1 and c_2 into the basic behavioral equation
4.16, along with the estimated 1968-69 coefficients from
Table 4.1 and the exogenous data for each district. This
yields the estimated amount of local expenditure per pupil
by district under the hypothetical program. Calculating
total expenditure and the local tax rate is then trivial.

Table 5.1 displays the results of this simulation in
column four. The index of variation here should be com-
pared with column three rather than with column two.
Column three is based on estimated local expenditure,
computed from the regression equation 4.20. The variation
in total expenditure based on this computation is therefore
the variation that can be explained by the model as a
result of demiographic differences between local districts.
But this explained variation is only about 75% of the total;
about 25% remains unexplained by the model. The simula-
tion results also leave out this unexplained variation,
so they understate the amount of variation that would actually
occur if the hypothetical formulas were really tried.
Therefore the variation in the simulated results must be
compared with the estimated variation in column three,
rather than with the actual variation in column two.

Pure percentage equalizing apparently would accomplish

substantial but by no means complete equalization of total expenditure per pupil. Table 5.1 shows a reduction in the index of explainable variation from 0.020 to 0.014. This means that two-thirds of the districts would spend within about 12% of the average amount per pupil compared to 15% under NESDEC (referring here to column three). However, Table 5.2 shows the range of variation in spending would still be large. Several districts spend only $500 per pupil or less, while others enjoy $800 or more. For Milton and New Bedford, the difference is $127 per pupil.

To see why such differences persist, refer back to the estimated indifference curves in Figure 4.1, Chapter IV. The straight line in this picture is the same as the percentage-equalizing frontier in Figure 5.1. (This frontier involves no block grants, so there is no difference between the actual amount of total resources and the amount perceived by the local authorities, because the block grant discount factor, q, does not apply.) Milton's indifference curves are tangent to the common frontier at a higher point, because Milton's richer, more educated, upper-middle-class voters are more willing to raise the tax rate for the sake of more expenditure per pupil. As suggested above, this probably reflects the regressivity of the property tax, as well as the greater importance of formal education in the work and life of the middle class.

Whatever the exact underlying reasons are, the simulation strongly suggests that even pure percentage equali-

zing would not erase the influence of socioeconomic status on per pupil expenditure.

To compensate for the effect of socioeconomic status on the propensity to spend, it would be possible to provide stronger incentives for poor districts than for wealthier ones. As suggested in Chapter II, the state could adjust the opportunity frontiers to be higher or steeper for poorer districts. This would induce poorer districts to spend relatively more, and would reduce the correlation between socioeconomic status and expenditure per pupil

At the extreme, it would even be possible to adjust the frontier to approach complete equality of expenditures per pupil. Some people may object to this idea on the grounds that eliminating all variation in expenditures, some of which is attributable to "legitimate" differences in tastes and not to socioeconomic status, would thus eliminate free choice; the baby would be thrown out with the bath. Moreover, as a technical matter, if the goal were complete equalization of expenditure, then it would be easier to accomplish this by complete state assumption of all school costs, rather than pretending to maintain the fiscal autonomy of local districts.

Nevertheless, it is instructive to show how the model can be used to find an optimal state aid program once the objectives have been stated. In this instance, let the objective be simply to induce all districts to choose the exact same level of total expenditure per pupil. To derive

the formula, start by setting every district's total
resources equal to some target:

5.6 $c_1 L + c_2 = T$,

where T is the target level of total expenditure for all
districts. The desired values of c_1 and c_2 for each dis-
trict are then found by simply taking the estimated equa-
tion 4.16 as an exact description of what determines local
spending, and substituting the right-hand side of 4.16
for L in 5.6. This will give one equation in two
unknowns, c_1 and c_2, meaning that there would be an infinite
number of combinations of c_1 and c_2 that could induce all
districts to choose the identical amount of total expendi-
ture T. To find a unique formula, it is necessary to
constrain either c_1 or c_2. One possibility would be to
set $c_1 = 1$, so that there would be no matching grants.
All grants would be block grants. Solving for c_2 then
gives

5.7
$$c_2 = \frac{(1+161HO/V^2)T-142.5-0.0289YM-612.2PRO-20.23ED-0.4173POP}{161HO/V^2} .$$

Since $c_2 = qA$, this determines the required amount of the
block grant, A. For wealthy districts A could be negative.
The formula therefore allows each district to spend whatever
it raises from local taxation, plus or minus the block
grant.

If formula 5.7 were ever applied in practice, local
expenditure must presumably be constrained to be non-negative.

Otherwise districts might actually take block grants in excess of T per pupil, and simply pass out the excess to local taxpayers as a negative tax. Since the aim of this program is not to subsidize local taxpayers but to equalize expenditure per pupil, the state would presumably want to set a maximum block grant equal to T, and require that any local district receiving a block grant must spend it all on schools, not pass any of it back as a tax rebate.

Another way to get perfect equality would be to use the matching parameter c_1 instead of the lump sum c_2. To find the necessary value of c_1 for each district, set $c_2 = 0$. Then substituting equation 4.16 into 5.6 and solving gives

5.8
$$c_1 = \sqrt{\frac{161(110)T}{V^2(142.5 + 0.0289YM + 612.2PRO + 20.23ED + 0.4173POP - T)}} .$$

Making this operational as a state aid formula would simply require solving

5.9 $S = T - L - F = (c_1 - 1)L - F.$

This formula would adjust the amount of state aid to equate the sum of state and federal aid with the difference between the target $T = c_1L$ and the amount L raised locally. If the amount raised locally exceeded the target, then state plus federal aid would have to be negative. But c_1 is always positive, though less than 1.0 for wealthier districts, so every district would still obtain a higher level of total expenditure by measuring its own local expenditure. State aid would never take away all of the incentive to

increase local taxation.

Simulation of formula 5.8 produces few surprises, since the derivation of c_1 in 5.8 already made use of the simulation equation 4.16. The main question for simulation is the tradeoff between equalization and the level of the target expenditure. In order to produce an average level of total spending comparable to the actual average of $593 in 1968-69, the target T for each district was set equal to the lesser of $600 per pupil, or $(142.5 + 0.0289YM + 612.2PRO + 20.23ED + 0.4173POP) - 10$. As reported in Tables 5.1 and 5.2, 92 of the 157 districts came out at the $600 level of total expenditure. In the remaining districts, the lowest total expenditure was $508.64. The overall average was $581.76, only slightly less than the actual average in 1968-69. At this level of total expenditure the index of variation could be reduced all the way to 0.002, which means that roughly two-thirds of the districts would be within 5% of the average expenditure per pupil. In Figure 5.1, points B5 and M5 mark the new positions of New Bedford and Milton. The spread in spending is sharply reduced. Clearly, formula 5.8 can produce very substantial equalization at the prevailing average level of per pupil expenditure.

Conclusion

The California court ruling in Serrano v. Priest, which has already been cited as precedent of Van Dusartz v. Hatfield and may soon become precedent in other states

as well, declares unconstitutional any system of public school finance in which the quality of a child's education, as measured by expenditure per pupil, depends on the wealth of parents and neighbors. The California court was strongly influenced by an _amicus_ _curriae_ brief filed by John Coons and Stephen Sugarman, and by the earlier book written by these two and William Clune. (6) These writers propose a remedial principle called "power equalizing", which calls for distributing state aid such that any two districts with the same tax rate are guaranteed the same amount of expenditure per pupil, regardless of differences in the local amount of taxable wealth. As explained in Chapter II, this means that all districts share the same opportunity frontier. Percentage equalizing, where the common frontier is a straight line, is one form of power equalizing.

The main finding reported in this chapter is that, because communities with higher socioeconomic status, have a stronger propensity to pay for schools, the correlation between wealth and expenditure per pupil will persist even under percentage equalizing. It is likely that the correlation would persist under any form of power equalizing, because no form of power equalizing would actually compensate for differences in tastes related to socioeconomic status.

This finding is a fact, the validity of which rests upon the accuracy of the econometric model in identifying

the determinants of local expenditure. The implications of
the finding, however, involve question of value. There is
a judicial question: if the correlation between wealth and
expenditure persists in a power-equalized system because wealth
is related to tastes, does Serrano imply the system is
therefore unconstitutional? Beyond this there is a moral
and political question: which differences in tastes
are "legitimate" expressions of free choice, and which are
responses learned in an environment of unequal opportun-
ity?

This chapter also showed that, although state aid in
Massachusetts historically has failed to accomplish its
stated purpose of equalizing educational opportunity,
this failure cannot be attributed to technical impossibility.
Technically, it would be entirely feasible, even with
autonomous school districts, to reduce inequality in
expenditure per pupil all the way to zero. Complete
state assumption of school costs would of course be an
easier way to equalize expenditure, but at the cost of
destroying local autonomy. The compensatory formulas
presented in this chapter demonstrate that local decision-
making is not incompatible with complete or nearly complete
equalization of expenditure per pupil. Indeed, districts
with lower socioeconomic status presumably could be induced
even to spend more.

If full equalization or even more is feasible, why has

it not happened? Apparently the system is expressing other

objectives in addition to equalization. The problem of

how to deal with these other objectives is the topic of

the final chapter.

Notes

(1) There have been previous attempts to simulate the
effects of different formulas for distributing state
aid. Andre Daniere's Cost Benefit Analysis of General
Purpose State School-Aid Formulas in Massachusetts
(report to the Mass. Advisory Council on Education,
1969) is a careful and revealing evaluation of the
NESDEC formula. But his simulations, unlike those to
be reported here, did not take accurate account of how
local school districts would respond. Instead, he
merely made the crude assumption that any amount of
increase or decrease in state aid under a hypothetical
formula would be divided 50-50 by the local school
board between reducing local taxes and increasing the
level of spending on schools. (p. 74)

See also Steven J. Weiss; Existing Disparities in
Public School Finance and Proposals for Reform;
Federal Reserve Bank of Boston, Research Report No.
46, Feb. 1970. This is a lucid description of the
state aid problem in the six New England states.
But the analysis of proposed formulas does not take
account of the local districts' response. (p. 45)

(2) Acts of 1948, Chapter 643.

(3) For a good summary of the federal programs, see
Charles S. Benson: The Economics of Public Education;
Houghton Mifflin, 2nd edition 1968; Chapter 7.

(4) Such things, of course, do not just happen automatically.
For an interesting chronology of the political pro-
cess, see William Harvey Hebert: The Role of the
Massachusetts Teachers' Association in Legislation
on Teachers' Salaries and State Aid to Schools in the
Commonwealth of Massachusetts; Ph.D. thesis, University
of Connecticut School of Education, 1968.

(5) For further documentation, see Weiss, op. cit. Also
David K. Cohen and Tyll R. van Geel: "Public Educa-
tion"; in Samuel H. Beer and Richard E. Barringer
(eds.): The State and the Poor; Winthrop Publishers,
1970.

(6) See John E. Coons, William H. Clune III, and Stephen
D. Sugarman: Private Wealth and Public Education;
Harvard University Press, 1970.

CHAPTER VI

TOWARD A THEORY OF SUBSIDIES

After analyzing various actual and hypothetical state
aid programs, the question naturally arises: What would
be the best state aid formula? This chapter contains
some thoughts on how the simulation model could be used to
answer this question, as part of either the political
process or a programming algorithm. Some of these ideas
would be applicable to other subsidy programs which are
formally similar to state school aid, such as revenue sharing,
income maintenance, foreign aid, or housing allowances.
Therefore some of the discussion will be in terms of sub-
sidies in general.

One way to use a simulation model to find the best
subsidy formula would be to simulate the effects of a range
of possible programs, taking into account the response of
the recipients of subsidies, and then let public discussion
and the political process choose the best formula. This
procedure could be called pragmatic, democratic, or radical.
It differs from the present method of legislatures develop-
ing subsidy programs in conjunction with experts, lobby
groups, and bureaucrats. In the present legislative process,
subsidy formulas are ostensibly judged by their intrinsic
merits. Although these judgments rely implicitly on some
notion of the expected outcome, this expectation seldom
is made explicit, and hardly ever includes systematic

prediction of how the recipients would respond to the subsidies. Therefore public discussion of distribution and taxation tends to become confusing and doctrinarie. Use of systematic simulation models to predict actual outcomes could clarify the debate by letting people know what they really stand to gain or lose.

A simulation model could also be used in searching for the optimal formula by the more elitist method of mathematical programming. This procedure requires a statement of objectives for the subsidy scheme. The following is a list of objectives for subsidy programs in general.

Stimulation

This is the raison d'etre of subsidies: to compensate for positive externalities. Education is the classic example of a good which creates benefits external to the market. (1) Public money is required to stimulate production or consumption to the point where marginal social benefit equals marginal social cost. Thus in theory the marginal subsidy at any level of output or consumption should equal the marginal benefit that accrues to society at large. (2) In the case of intergovernmental expenditure, output or consumption is usually measured by the amount of spending, and society at large means everyone outside the jurisdiction of the government getting the grant.

This theoretical solution is not completely satisfactory. One reason is that marginal benefits are notoriously difficult to measure. Another reason is that these benefits,

even if measurable, would reflect tastes which depend on
the existing distribution of resources. If redistribution
is another important objective of the subsidy program, it
would be inconsistent to make the amount of subsidy depend
on the initial distribution.

For these reasons, the best approach for the donors
of susidies may be to satisfice, by setting some target
level of overall or average consumption or production.
Then a subsidy formula could be chosen to minimize the cost
to the donor of reaching the target.

Equalization

This is another essential aim of many subsidy programs,
but Chapter II showed how difficult is to define exactly
what equalization means. It is not always a simple matter
of reducing the variance in the amount consumed or received.

Incidence over income or wealth classes may also be
important. For example, to comply with court rulings
state school aid will have to reduce the correlation be-
tween expenditure and wealth.

Equalization tends to conflict with stimulation.
In the context of income maintenance programs, this conflict
creates the well-known tradeoff between equality in the
distribution of income and the total level of income or
output, since income transfers may interfere with the
incentive to work for both donors and recipients. In housing
programs, those which subsidize producers may stimulate

more housing production, but grants to consumers in the
form of housing allowances tend to be more equalizing.
As a final example, in distributing a given amount of state
aid to local school districts, any money allotted to
stimulating expenditures in wealthy districts will only
exacerbate the inequality of expenditure between rich and
poor districts.

Substitution?

Subsidy programs are sometimes advocated as a way of
substituting the donor's resources for the recipient's.
This is especially true in intergovernmental grant pro-
grams, where state and federal tax revenues to some extent
substitute for local taxes. Thus revenue sharing and even
state aid to schools have been sold to the voters as methods
to relieve local property taxes. Indeed, one reason for
the "fiscal crisis" in local public schools may be that the
voters feel the local school boards have not been passing
enough state aid back in the form of lower taxes, but have
been using it instead to expand programs or raise salaries.

Substitution and stimulation are inevitably antithe-
tical. To the extent that grants are substituted for the
recipient's own resources, they cannot possibly stimulate
consumption of the desired good. Since stimulation is
the most important purpose of subsidies, some other me-
thod must be found to bring about substitution. For
example, since the chief purpose of state school aid is

to stimulate school spending, the goal of substituting sales and income for property tax revenues should be accomplished by some other means, such as by empowering school districts to levy local surcharges on income and sales taxes. As another example, to the extent that housing allowances augment family disposable income by substituting grants for the family's own expenditure on housing, they fail to achieve their main objective of stimulating the consumption of housing; so the substitution objective should be accomplished by some other means, such as income transfers.

Consumer Sovereignty

This is a general criterion for economic efficiency, which in the context of subsidy programs is related to accountability and responsiveness. Accountability implies, first of all, that resources should actually go to the people for whom they are ostensibly designated. This has been a real problem in administering Title I grants for compensatory education. (3) Secondly, consumer sovereignty implies that the recipients should have maximum leeway in getting what they want for their money.

The problem here is that consumer sovereignty may conflict with both equalization and stimulation. The best way to promote consumer sovereignty is to give out block grants directly to consumers. Stimulation would be better served by subsidies to producers or by giving consumers

grants only with categorical limitations, matching require-
ments, and other strings attached. And equalization implies
even more constraints, to prevent or discourage unequalizing
behavior at either end of the distribution.

Keeping Factor Costs Down

In programs which subsidize particular goods like
housing, education, or medical care, a big danger is that
the extra resources provided by grants will be siphoned
off on the supply side. Competition among producers of
course is the best preventative. But if ensuring competi-
tion requires strict regulation it may interfere with
consumer sovereignty. And in general, any subsidy program
which attempts to stimulate an industry operating near
capacity will raise the price of scarce factors.

Exactly how to work these various objectives into an
optimization problem is not self-evident. One of them
could be taken as the optimand, and the rest treated
as constraints. Or a scalar optimand could be constructed
by weighting two or more objectives.

In the specific case of state aid to local school
districts, the problem could be stated as follows: Within
the class of acceptable equalizing formulas, find the one
that minimizes the cost to the state, subject to the con-
straint that no district spends less than some minimum
amount per pupil. This statement of the problem would
seem to rule out state assumption of all school costs,

unless the class of acceptable equalizing formulas were
so small as to require virtually the same expenditure per
pupil in every district, or unless full state assumption
were required for some other reason, such as keeping factor
costs down. But suppose instead that the class of permissible
formulas were broad enough to include power equalizing,
where total expenditure per pupil $g(L)$ depends only on the
local school tax rate t:

6.1 $\qquad g(L) = h(t).$

L is current expenditure per pupil from local revenues,
and t is the local school tax rate:

6.2 $\qquad t = L/B,$

where B is a measure of the local tax base. Now suppose
that the frontier is described by the two parameters,
A and k:

6.3 $\qquad h(t) = A + kt.$

The procedure for finding the best formula now consists
in searching along the minimum-expenditure constraint for
the least costly formula. Start by setting A and k at some
reasonable level, then using an estimated behavioral
equation like 4.16, with $c_1 = k/B$ and $c_2 = qA$, to find
the resulting distribution of per pupil expenditure. Next
identify the lowest-spending district in this distribu-
tion. Then set the minimum level of total expenditure per
pupil, E, equal to the amount predicted by the behavioral
equation for the lowest-spending district for any values of
A and k:

6.4 $E = A + k(\bar{L}/\bar{B})$

$$= A + \frac{k}{\bar{B}} \left(\frac{p\bar{n} - qA + M}{k + p^2\bar{u}/k\bar{B}^2}\right) \ .$$

Here the bars over symbols denote data for the lowest-spending district. Equation 6.4, which relates the two unknowns A and k, is therefore the minimum expenditure constraint.

To find the particular combination of A and k that would minimize the cost to the state, it would be reasonable to begin with A = 0, and k determined by 6.4. The reason is that in general matching grants are more stimulating than block grants. If there were a value of k that satisfied 6.4 with A = 0, then this inself might be the optimal formula. If setting A = 0 would not be feasible, then it would be necessary to find the smallest value of A that would yield a solution to 6.4.

To check whether the combination of A and k derived in this fashion would indeed be optimal, the predicted expenditure per pupil in each district would have to be computed by means of 4.16. It is possible that after changing A and k some other district would become the least-spending district, in which case equation 6.4 would have to be rewritten using the data for this new lowest-expenditure district. Then a new combination of A and k would have to be found from the new equation 6.4.

Finally, it is of course necessary to compute explicitly the cost to the state resulting from the chosen combination

of A and k. This is simply the sum over all districts of the per pupil subsidy times the number of pupils N_i:

6.5 $\qquad \sum_i (A + kL_i/B_i - L_i)N_i$.

A coarse grid search over the range of A and k, in addition to a finer search in the neighborhood of the chosen combination, would check that this combination of A and k really did minimize the cost to the state.

To find the cost-minimizing formula among more complicated classes of equalizing grants would be more difficult, but not impossible. For example, it would be possible to consider the class of power-equalizing formulas that create a linear but kinked frontier:

6.6 $\qquad h(t) = (1 - d_1)k_1 t + d_1[k_1 t^* + k_2(t - t^*)],$

$\qquad$ where $\qquad d_1 = \begin{array}{l} 0 \text{ for } t \leq t^* \\ 1 \text{ for } t > t^* \end{array}$.

This would produce a frontier with a slope equal to k_1 up to t^*, and k_2 beyond that. Simulation of the local response to this is complicated because iteration may be required to find the correct value of d_1 in each district.

Another possible class of formulas would be like 6.3, but A and k would be functions of the tax base B_i.

Conclusions

Models which predict how subsidies will change the economic behavior of the recipients can be used to find the best subsidy formula, in two ways. One way would be to simulate the effects of alternative subsidy programs, and

introduce the results directly into public discussion.
The second appraoch would be to formulate an optimization
problem, to find the formula that could best achieve the
goals of stimulation, equalization, consumer sovereignty,
and keeping factor costs down.

Two warnings are in order here, though. First, no
subsidy formula, no matter how carefully designed and
thoroughly discussed, will be perfect. Any program will
need to adapt as experience grows and situations change.
Adaptability should therefore be built right into the
program. This could be done by writing provisions into
statutes and regulations which call for changes in the form
or parameters of the grant program in the event that the
results are unsatisfactory. Ideally, there might even be
some kind of automatic "citizen feedback," so that public
opinion would monitor the program continuously or periodi-
cally.

The second warning is that the analysis of subsidy
programs should never distract attention from the constraints
imposed by the structure of the system. An "optimal"
program is optimal only within these constraints, and some-
times the best may not be very good. For example, an
"optimal" income maintenance program that is constrained to
preserve markets in labor and the hierarchy of jobs may not
provide adequate income maintenance at all. If this is
true, our efforts may be better spent in trying to relax the
systemic constraints than in making marginal improvements.

Notes

(1) Charles S. Benson: The Economics of Public Education;
     Houghton-Mifflin, 2nd edition 1968.

(2) George F. Break: Intergovernmental Fiscal Relations
     in the United States; Brookings, 1967; p. 75.

(3) NAACP Legal Defense and Educational Fund: Title I of
     ESEA: Is It Helping Poor Children?; 1966.

section, the amount of state tax assessed to the own, under St.1921, cc. 399 and 492, was not paid within the required time, interest assessed as provided by the statute cannot be abated. 6 Op.Atty.Gen.1922, p. 389.

Cities and towns maintaining continuation schools for employed minors are

not entitled to reimbursement provided to "public day schools". 5 Op.Atty.Gen. 1920, p. 580.

Cities and towns conducting schools for American citizenship are not entitled to additional reimbursement on account of salaries paid to teachers in such schools. 5 Op.Atty.Gen.1920, p. 573.

§ 2.   Definitions

When used in this chapter the following words shall, unless the context requires otherwise, have the following meanings:—

(a)   "Equalized valuation", the equalized valuation of the aggregate property in a city or town subject to local taxation, as most recently reported by the state tax commission to the general court under the provisions of section ten C of chapter fifty-eight.

(b)   "Public school", any school or class under the control of a school committee, regional district school committee, local trustees of vocational education or district trustees of vocational education.

(c)   "Reimbursable expenditures", the total amount expended by a city or town during a fiscal year for the support of public schools during said year exclusive of expenditures for transportation, for school lunch programs, for special classes for the physically handicapped and the mentally retarded, for programs of vocational education as provided in chapter seventy-four and for capital outlays, after deducting therefrom any receipts for tuition, receipts from the federal government, the 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.   The commissioner of education may, by regulation, further define the expenditures and receipts that may be included hereunder.

(d)   "School aid percentage", for each city or town, the amount by which one hundred per cent exceeds the product, to the nearest tenth of one per cent, of sixty-five per cent times the valuation percentage; provided that, in applying the school aid formula under section four, the maximum percentage of state support shall be seventy-five per cent and the minimum shall be fifteen per cent.

(e)   "School attending child", any minor child in any school, kindergarten through grade twelve, resident in the city or town, as reported by the superintendent of schools in accordance with the requirements of section two A of chapter seventy-two.

(f)   "Valuation percentage", the proportion, to the nearest tenth of one per cent, which the equalized valuation per school attending

child of the city or town bears to the average equalized valuation per school attending child for the entire state.

Added by St.1966, c. 14,. § 40.   Amended by St.1967, c. 791, § 1.

Historical Note

St.1967, c. 791, § 1, approved Dec. 18, 1967, inserted, in the first sentence of par. (c), "for programs of vocational education as provided in chapter seventy-four."

This section contains subject matter similar to that of former sections 7 and 8 of this chapter.

Prior Laws:

St.1948, c. 643, § 1.

§ 3.   Massachusetts school fund

The present school fund of the commonwealth, known as the Massachusetts School Fund, with future additions, shall continue to constitute a permanent fund. The commissioner of education and the state treasurer shall continue to be commissioners to invest and manage said fund, and they shall report annually the condition and income thereof. All investments shall be made with the approval of the governor and council. The annual income thereof shall be credited to the Local Aid Fund and shall be paid to the several cities and towns, under the provisions of section eighteen A of chapter fifty-eight, as part of the school aid required under this chapter.

Added by St.1966, c. 14, § 40.

Historical Note

This section contains provisions similar to those of former section 2 of this chapter.

Prior Laws:

St.1948, c. 643, § 1.

Cross References

State treasurer authorized to invest and reinvest funds, see c. 10, § 16.

Notes of Decisions

I. In general

Treasurer of commonwealth is not authorized to distribute funds pursuant to this section, unless and until commissioner of education informs him, or a court of competent jurisdiction rules that reports required under c. 72 had been filed with the commissioner's office in accordance with applicable provisions. Op.Atty.Gen. April 29, 1965, p. 269.

Failure of a school committee of a town to prosecute a parent for not sending his child to school is not a failure on part of town to comply with laws relating to truancy, and commissioners of Massachusetts School Fund have no authority to withhold from the town its share of said fund on that account. 1 Op.Atty.Gen.1898, p. 517.

§ 4.   P

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Prior Laws:

St.1948, c.
St.1950, c.

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§ 4.   Payments; determination of amounts

The school aid to be paid to each city and town in any calendar year shall be the amount obtained by multiplying its reimbursable expenditures for the last preceding fiscal year by its school aid percentage for the calendar year during which such fiscal year begins; provided, that in determining the amount of such aid the school aid percentage shall not be applied to any portion of reimbursable expenditures above an amount equal to one hundred and ten per cent of the average reimbursable expenditures per child in net average membership for the state multiplied by the total number of children in net average membership in such city or town; and further provided, that in the case of any city or town whose reimbursable expenditures per child in net average membership shall fall below eighty per cent of the state average of such expenditures, the school aid percentage shall be applied to a figure which is equivalent to eighty per cent of the state average reimbursable expenditures per child in net average membership, provided, however, that the amount received by any such city or town as reimbursement on account of the provisions of this section together with any amounts received from the federal government for expenditures for reimbursable purposes during the previous fiscal year shall not exceed seventy-five per cent of the sum of its reimbursable expenditures as defined in this chapter and such amounts received from the federal government; nor shall the amount of said aid be less than one hundred and fifteen per cent of the amounts paid by the commonwealth to each city or town in nineteen hundred and sixty-five as school aid under this chapter, plus any grants and reimbursements paid in such year under provisions of chapters sixty-nine, seventy-one and seventy-four which are thereafter terminated. In determining the amounts paid by the commonwealth in nineteen hundred and sixty-five, amounts paid to regional school districts shall be deemed to have been received by each city or town in such district in the same proportion as the expenditures of such district which it is required to pay bear to the total expenditures of such district.

Added by St.1966, c. 14, § 40.

Historical Note

This section contains subject matter similar to that of former sections 3, 3B, 4, 4A, 5 and 6 of this chapter.

Prior Laws:
St.1948, c. 643, § 1.
St.1950, c. 774.

St.1951, c. 592, § 1.
St.1953, c. 547, §§ 1, 2.
St.1956, c. 453.
St.1956, c. 599, § 2.

BIOGRAPHICAL NOTE

The author graduated from Harvard College in 1966,
magna cum laude in Social Relations. His undergraduate
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special attention to Boston's South End. In 1968 he received
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the use of neighborhoods by mothers and children. Then
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