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AUTHOR Brazer, Harvey E.; Anderson, Ann P.
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ABSTRACT

To the extent that costs do vary among school districts, neither an equal dollar distribution of funds nor an equal-yield per unit of tax effort can achieve equality of educational inputs or the capacity to acquire them. This document addresses problems relating to the development of guidelines to achieve equality in educational inputs, or resources, through provision for adjustments in State disbursements to school districts designed to take into account differences in input prices or costs. It develops a "pilot" adjustment index that measures the influence on teachers' salaries of factors that affect both the demand for teachers and their supply. The index is designed in such a fashion that, when applied to the initial amount of dollars available, the product of the index and that initial amount will be a sum sufficient to permit all districts to acquire the same quantity of teacher inputs. The approach, in effect, neutralizes differences in demand among districts and compensates for differences in supply conditions facing districts. The authors conclude that the methodology suggested in this paper is capable of providing appropriate guidelines for adjusting dollars per pupil so as to compensate for price differences in teacher salaries. (Author/DN)

ADJUSTING FOR DIFFERENCES AMONG SCHOOL DISTRICTS IN THE COSTS OF EDUCATIONAL INPUTS

A Feasibility Report to the U.S. Office of Education, under Contract #OEC-0-74-1492

by

Harvey E. Brazer
with the assistance of
Ann P. Anderson

Ann Arbor, Michigan
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INTRODUCTION

Anyone concerned with equalization of educational opportunity necessarily focuses initially on the very wide differences in the amounts spent by school districts on the elementary and secondary education of their pupils. Among Michigan districts, for example, current operating expenditures per pupil in 1972-73 ranged from $1,608 in the affluent Detroit suburb of Oak Park to $497 in the South Boardman district of northern rural Kalkaska County,[1] while the unweighted mean for all 530 districts was $865.[2] Disregarding the extremes, we still find considerable variance. Thus the Mount Pleasant district, which ranked at the bottom of the top decile in terms of current operating expenditures per pupil, spent $1,049, and the district just one decile from the bottom, rural Quincy in Branch County, near the Indiana border, spent $734.

But how much do these expenditure figures tell us? Despite the difference of more than $300 per pupil in current operating expenditures between Quincy and Mount Pleasant, we find that composite basic skills achievement scores for fourth and seventh graders are only modestly higher in Mount Pleasant than in Quincy, and the latter experiences a substantially

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*Constructive critical comment is generally a scarce commodity. But, fortunately, an earlier draft of this paper was reviewed by the Faculty Seminar and the Public Finance Seminar of the Department of Economics, The University of Michigan, as well as several other individuals. Particularly useful were the insights and suggestions offered by Alan L. Gustman, Saul H. Hymans, George E. Johnson, Robert D. Reischauer, Daniel L. Rubinfeld, Harold M. Shapiro, Frank P. Stafford, Lester D. Taylor, Esther O. Tron, Gail R. Wilensky, and two anonymous readers. W. H. Locke Anderson's contributions were exceedingly generous and indispensable. Needless to say, not all of the advice was accepted. For all of it, however, we are deeply grateful.

[1] Michigan Department of Education, Ranking of Michigan Public High School Districts by Selected Financial Data, 1972-73, Bulletin 1012 (Lansing, n.d.), pp. 19 and 27.

[2] Derived from ibid. The standard deviation was $144. Unless otherwise indicated, data for Michigan school districts may be assumed to be drawn from Bulletin 1012.

lower dropout rate.[3] Thus in terms of performance measures such as these the two school districts look more alike than their rankings with respect to expenditures would suggest. The two most striking differences are to be found in the average teachers' salary of $13,007 for Mount Pleasant and $9,806 for Quincy, and the pupil-teacher ratios of 22 and 26, respectively.[4] In combination they account for more than two-thirds of the difference between the two districts in per pupil current operating expenditures.

Enough has been said, perhaps, to illustrate the fact that observed differences among school districts in levels of expenditure per pupil may or may not be associated with similar differences in such measures of output as achievement test scores or dropout rates. But clearly they do arise as a consequence of differences in prices paid for major inputs such as teachers (salaries) and/or differences in the quantities of inputs used (pupil-teacher ratio). If prices for inputs of various qualities were the same everywhere and if educational "needs", however defined, were everywhere equal, then the obvious route to equalization of educational inputs per child would be through the assurance of equal availability of dollars per child.[5] Under these circumstances, with prices and dollars of revenue equal everywhere, quantities of inputs would also be equal.[6] But to the extent

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[3]Michigan Department of Education, Local District Results, The Fourth Report of the 1971-72 Michigan Educational Assessment Program (Lansing: Michigan Department of Education, 1972), pp. 25 and 93.

[4]Average teachers' salaries are from Bulletin 1012 and pupil-teacher ratios (reported as "State Aid members per teaching position") are from Michigan Department of Education, 1972-73 Summary of Expenditure Data for Michigan Public School, Bulletin 1013 (n.p., n.d.).

[5]"Equal availability of dollars" and equal inputs are not the same thing, even with prices and "needs" constant, for available dollars may not be spent or may be spent differently by different districts. Emphasis here is on equal opportunity to acquire equal inputs.

[6]

that prices do vary, neither an equal dollar distribution of funds among school districts nor an equal-yield per unit of tax effort can achieve equality in terms of educational inputs or the capacity to acquire them. If such approaches are to attain those objectives some means must be found for allowing appropriately for price differences among districts.

The suggestion that cost differences be taken into account in formulas used to distribute state aid to schools or in full state finance systems has been offered frequently and sometimes implemented. In New York State, for example, for purposes of state aid high school pupils are weighted 25 per cent more heavily than elementary pupils, and further adjustments are provided for "density", in the case of urban districts, and "sparsity", at the other end of the spectrum, for rural schools. Adjustments such as these are aimed rather vaguely at educational costs as a whole, rather than at prices of inputs as variable cost elements.

A recent Urban Institute study suggests "that a funding approach be based on a cost-of-education index rather than on equal dollars per pupil."[7] The authors are not very explicit about the details of the suggestion, but it is clear that they would make allowances for differences in "cost-of-living," otherwise providing for uniform salary scales throughout the state and uniform pupil-teacher ratios. Because of the belief that teacher education and experience are "not a benefit but a fixed cost," state payments would "reflect the actual teacher education-experience characteristics of a school district."[8] As a practical matter this approach would seem to depart

[7] Betsy Levin, Thomas Muller and Corazon Sandoval, The High Cost of Education in Cities (Washington, D.C.: The Urban Institute, 1973), p. 71.

[8] Ibid., p. 72.

only modestly from an equal dollar scheme, with the principal difference entering in the form of the "cost-of-living" adjustment.

Even if it were possible to define the cost-of-living, as a price-market-basket amalgam somehow allowed to vary among areas of the state, measuring it for areas as small and as diverse as typical school districts implies a prohibitively costly task.[9] Perhaps even more important, however, is the implicit assumption that were it not for regional differences in consumer prices teachers would be indifferent as to location in the absence of salary differences. This assumption simply will not stand before the fact of differences in salaries paid within states to teachers of like education and experience that amount to as much as a third or more.[10] At best "cost-of-living" can be seen as only one of several arguments we should expect to find entering the supply function for teachers as seen by individual school districts.[11]

Similar recognition of the desirability of adjusting dollars distributed to school districts for differences in prices or costs is found in the Final Report of the President's Commission on School Finance.[12] The Commission recommended full state financing coupled with equal per pupil dollar distributions, modified by application of proposed indexes of "cost-of-

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[9]For a critique of the provision for adjusting state aid in Florida for differences among school districts (counties) in "the cost-of-living", see James N. Fox, "Cost of Living Adjustments in School Finance Reform: Righteous Intent Wrong Technique" (U.S. Office of Education, processed 1974).

[10]In Michigan, for example, in a probability sample of 177 districts, the range in minimum salaries paid to teachers with M.A. degrees in 1972-73 was $7,700 to $10,350, and the range for the maximum for teachers with a M.A. degree was $11,000 to $17,399. The higher figures are greater than the lower ones by 34 and 58 per cent, respectively.

[11]Since no data are available for consumer prices, let alone cost-of-living, it will not be possible to attempt to measure the importance of this factor.

[12]Schools, People, and Money: The [illegible]

education" and "educational need".[13] Specifically it called for "Definition of cost differentials of various aspects of education among districts within a State and the development of a cost-of-education index to clarify these differences among districts," noting that "Costs of educational personnel, facilities, services, and equipment vary from area to area as they do for all other public and private activities."[14] The Commission offers no further guidance for the construction of the index. It implies, however, that construction should be relatively simple, for it finds it "surprising" that such an index does not already exist, and holds that building an educational need index "is a considerably more complex process."[15]

In his plan for full state financing of elementary and secondary education in Michigan, Governor William G. Milliken called for varying per pupil dollar amounts in accord with observed regional differences in teacher salaries, taking into account education and experience. Under this proposal basic salary levels in 1971-72 would have ranged from $12,917 in Oakland County in the Detroit SMSA to a low of $8,832 in rural Lake County.[16] Implicit in this approach is the assumption that teachers' salaries in the State in 1971-72 were in equilibrium, reflecting appropriately market forces of demand and supply for teachers, and that the existing relationships should be maintained, except for changes over time in education, experience, "cost-of-living", and salaries paid in other public and private employment in the region.[17]

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[13] Ibid., pp. 35-7.

[14] Ibid., p. 35.

[15] Ibid.

[16] School Finance Reform in Michigan (Lansing, 1972), pp. 58-63.

[17] "Region" is defined as Intermediate School District, which is a county or, in the case of the less populous areas of the State, a group of two or more contiguous counties.

Governor Milliken's proposal seems especially attractive to the teachers in low-paying districts of each region or county. It ignores entirely differences in such factors as the socio-economic status of the children in school, amenities offered by the district or region, and so forth. The fact is that in 1972-3 average teacher salaries in Oakland County ranged from $16,068 in Oak Park to $9,801 in Brand and of 28 K-12 districts in the county 3 paid an average of less than $11,000, while 4 paid more than $14,000. Undoubtedly education and experience accounted for some part of the indicated variance, but so did other factors that may be deserving of at least as much claim to recognition.

One might cite a number of other illustrations of calls for the development of a workable means of achieving equality in educational inputs or resources through provision for adjustment in state disbursements to school districts designed to take into account differences in input prices or costs. In contrast, however, as the President's Commission noted, it is not possible to cite either examples of appropriate price or cost indexes or of reasoned blueprints for their construction. It is, therefore, to the problems relating to the development of guidelines for making the desired adjustments and a limited "pilot" effort to develop illustrative actual adjustment indexes that we now turn.

QUALITY, QUANTITY, COSTS AND PRICES

Differences in current operating expenditures per pupil[18] are a function of many factors. They include differences in managerial efficiency,

[18] Defined in Michigan to include the costs of instruction and administration, attendance, health, and transportation services, operation and maintenance of plant, and "fixed charges". The latter category includes principally such things as employee fringe benefits. Excluded are capital outlay, debt services, and community and student services. Bulletin 1012, p. 3.

in quality of inputs acquired, in school programs or curricula, in quantity of inputs, and in prices paid, including teachers' salaries. Our objective in attempting to develop an adjustment index is not to ensure that the use of that index will permit revenues realized by each school district to finance whatever level of expenditures it or other districts may choose. It is, rather, to develop a means of compensating for differences among districts in the prices paid for or the costs of acquiring inputs of like quality. Thus, if our objectives were fully attained all districts in a state could be provided with precisely the funds needed to finance a uniform school program of a given quality if each district performed at the same level of managerial efficiency as every other district. That is to say, essentially, that each district in the state would be enabled to acquire the same quantity of constant quality inputs per pupil. This is not to suggest that each district <u>should</u> employ the same quantity of inputs per pupil. Obviously, perceived needs, however defined, will vary among districts and these should give rise to differences in the quantity, quality, and mix of school inputs employed. The problem of how to adjust revenues for differences in needs, except insofar as needs are reflected in factors governing the prices paid for educational inputs, is outside the scope of this paper.

Of the various school inputs teachers comprise, by any criterion, the most important category. In Michigan teachers' salaries account for approximately 55 per cent of current operating expenditures. And if we can obtain measures of other relevant influences on the level of teachers' salaries, we should be able to develop an adjustment index for this crucially important input price.

If adequate data were available quite the same might be said for the salaries of other personnel, professional and non-professional. But for purposes of this initial, preliminary study, it was not possible to compile the needed data. With respect to non-personnel prices, Michigan law prohibits the charging of prices that vary among school districts and, for the most part, differences in expenditures per pupil for books, supplies, and so forth, may be expected to reflect differences in quantities purchased or quality or level of program rather than variance in prices. Thus differences in non-institutional expenditures reflect factors such as tastes or preferences, climatic or geographic circumstances, behavior of the pupils as seen in levels of vandalism, and so forth. Clearly full analysis of this wide array of sources of variance in expenditures for things other than teachers' salaries is a large task that could not be encompassed within the framework of this study. Nevertheless, it seemed unsatisfactory simply to ignore entirely some 45 per cent of current operating expenditures. We shall, therefore, examine that part of expenditures that makes up the difference between current operating expenditures and "total instruction expenditure,"[19] or non-instructional current operating expenditures. In Michigan in 1972-73 they accounted for an average of 27 per cent of current operating expenditures. Adding teachers' salaries to this category accounts for all but 18 per cent of current operating expenditures, a residual that may be described as "instructional expenditure other than teachers' salaries."

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[19] This category includes substantially more than teachers' salaries. It is defined as "The cost of activities dealing with or aiding in the teaching of students or improving the quality of teaching." Bulletin 1012, p. 3

TEACHERS' SALARIES

A Review of Related Studies

The unionization of public school teachers, contract negotiation, and frequent strikes have stimulated substantial interest during the past four or five years in quantitative analysis of teachers' salaries. The immediate objective of virtually all of the resulting literature has been to measure the influence of union organization on salary levels. For our purposes, however, it remains of interest for the insights it may provide on determinants, in general, of teachers' salaries. Thus we shall review, briefly, some of the highlights of this literature.

There are eight papers that seem relevant in this context, all of which employ the standard techniques of ordinary or two-stage least squares regression analysis.[20] The Kasper study is the least interesting for our purposes. It analyzes variance among the 50 states and the District of Columbia in average teachers' salaries and thus tells us nothing about inter-district influences on salaries. It finds that average teachers' salaries

[20] Listed in order of their appearance they are: Hirschel Kasper, "The Effects of Collective Bargaining on Public School Teachers' Salaries," Industrial and Labor Relations Review, Vol. 24, No. 1, Oct., 1970; Robert J. Thornton, "The Effects of Collective Negotiations on Teachers' Salaries," Quarterly Review of Economics and Business, Vol. 11, No. 4, Winter, 1971; John H. Landon and Robert N. Baird, "Monopsony in the Market for Public School Teachers," American Economic Review, Vol. LXI, No. 5, Dec., 1971; Robert N. Baird and John H. Landon, "The Effects of Collective Bargainin_ on Public School Teachers' Salaries: Comment," Industrial and Labor Relations Review, Vol. 25, No. 3, April 1972; W. Clayton Hall and Norman E. Carroll, "The Effects of Teachers' Organizations on Salaries and Class Size," Industrial and Labor Relations Review, Vol. 26, No. 2, Jan. 1973; David B. Lipsky and John E. Drotning, "The Influence of Collective Bargaining on Teachers' Salaries in New York State," Industrial and Labor Relations Review, Vol. 27, No. 1, Oct. 1973; Donald E. Frey, "Wage Determination in Public Schools and the Effects of Unionization," Paper presented at the Conference on Labor in Non-Profit Industry and Government, May 7-8, 1973, Industrial Relations Section, Prin[illegible] University, Princeton, New Jer[illegible]

tend to be positively associated with the level of personal income in the state, the degree of urbanization of the population, and total current educational expenditures per pupil, and negatively related to the proportion of school revenues derived from local sources.

All of the other studies employ individual school districts as their units of observation. Baird and Landon, Thornton, and Clement and Custman deal with school districts located in or comprising large cities scattered across the United States. On the other hand, Hall and Carroll (Cook County, Illinois), Lipsey and Drotning (New York State), and Frey (New Jersey) focus on districts within one state. Hence they avoid inter-state differences in legal, institutional, traditional and other influences peculiar to individual states, and also include a wide variety of sizes and kinds of communities, rather than central cities of SMSA's only.

In both of their articles Baird and Landon present results of regression analysis suggesting that teachers' salaries[21] respond positively to the level of per capita income in the community, the log of the number of school districts in the SMSA or the county, and, in some equations, the proportion of district revenues from local sources.

Thornton, using data for school districts in 83 large cities, finds that about half of the variance in teachers' salaries[22] is "explained" by a measure of union negotiating strength, the average wage rate in the city or surrounding county, and the population size of the city containing the school district. The relationship is positive in each case.

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[21] Beginning B.A. salary.

[22] Four dependent variables are analyzed: beginning and maximum B.A. and M.A. salaries.

In a rather more elaborate analysis of essentially the same sample of school districts as was used by Thornton, Clement and Gustman estimate the influence of some two dozen independent variables on average teachers' salaries. Their findings indicate a positive statistically significant relationship for a measure of opportunity cost of teaching to male and female teachers, proportion of teachers with an advanced degree, proportion of the district's population that is nonwhite, population size of the city containing the district, per capita value of taxable real property, proportion of school revenue from state sources, and whether or not the district is fiscally dependent. A negative relationship, on the other had, was found for enrollment size, proportion of teachers who are female, location of the district in the northeast or southern regions of the country, and the proportion of the SMSA population that lives in the central city. Somewhat surprisingly, perhaps, such variables as educational level of the adult population, median family income, and the proportion of public school students attending high school did not meet any reasonable test of statistical significance. In fact, quite contrary to expectations, the sign for both the income and education coefficients was negative.

Hall and Carroll direct their analysis to a sample of 118 elementary school districts in Cook County, Illinois. Their dependent variable is average teachers' salaries in the district. Median family income, percentage of the labor force engaged in white collar occupations, level of attendance in the district, proportion of teachers who are male, whether or not there is a collective bargaining agreement, and pupil-teacher ratio are all found to be positively associated with average teachers' salaries, while the association with the ratio of state aid to total expenditures is negative.

The study by Lipsky and Drotning is more closely akin to our own than any of the others reviewed thus far. The units of observation comprise 696 school districts in New York, all except the New York City district. Their analysis involves the salaries paid to teachers at three levels of education cum experience: beginning B.A.; B.A. plus 30 hours of credit and 7 years of experience; and B.A. plus 60 hours of credit and 11 years of experience. In addition, the district's mean salary is treated as a fourth dependent variable. Statistically significant in one or more of the estimating equations are pupil-teacher ratio, enrollment, percentage of teachers with advanced degrees, proportion of teachers with less than four years of service, taxable value of property per pupil, debt service per pupil, the ratio of instructional costs to taxable value, and whether or not the district is located in one of the three downstate counties, Nassau, Suffolk, or Westchester. Negative signs appear in the estimating equations only for the pupil-teacher ratio variable and even its regression coefficient is strongly positive in the case of the mean salary form of the dependent variable.

Finally, in our brief review, we have Frey's study of 298 school districts in New Jersey. Frey regresses the starting salary for beginning B.A. teachers on enrollment, median family income, taxable value of property per pupil, a measure of opportunity cost (wages paid to industrial nurses in private employment), and whether or not there is a collective bargaining agreement. All of these variables turn out to be positively related to beginning teachers' salaries, and they succeed, jointly, in "explaining" about 60 per cent of their variance, roughly the same proportion as in the case of the one clearly comparable study, that by Lipsky and Drotning.

Taken together, these studies, all but one of which was concerned primarily with measuring the impact of unionization on teachers' salaries, tend to support one's a priori views on the influence of such variables as size of the school district, median family or per capita income, size of the tax base, and education-experience of the teachers. These and other variables account for between one-half and three-quarters of variance in salary levels, the latter seen in terms either of means or at specified points on salary scales. They seem sufficiently promising to justify the view that it may be possible to employ a similar approach in the effort to devise a practical means of developing adjustment indexes designed to facilitate equalization of educational inputs among school districts.

General Methodology

Our objective is to measure the influence on teachers' salaries of factors that may be said to be operating through the demand for teachers on the one hand, and those affecting the supply function on the other. If we can successfully identify these factors, correctly specify the form of the relationships involved, and obtain estimates for the response of salaries to differences among districts in the values of the relevant factors, then we shall be able to compute the desired adjustment index. That index is to be designed in such fashion that, when applied to the initial amount of dollars available, the product of index and that initial amount will be a sum sufficient to permit all districts to acquire the same quantity of inputs -- in this specific instance, teachers.

Our approach is one which, in effect, neutralizes differences in demand among districts and compensates for differences in supply conditions

facing these districts. In simplest terms, let us suppose that we may stipulate the demand function for teachers as one in which salaries paid, S_d, are some function, d, of number of teachers employed, Q, median family income in the community, Y, and tax base per pupil, B. This may be written as:

$$S_d = d(Q, Y, B) \qquad (1)$$

Similarly, the supply of teachers, or the salaries that must be offered in order to employ various quantities of teachers of given levels of education and experience, may be a function of such things as location of the district in rural, suburban, or central city community, L, and characteristics of the pupils, perhaps as indicated by their basic achievement test scores, R. Thus we may write the supply function as:

$$S_s = s(Q, L, R) \qquad (2)$$

Assuming that the market for teachers is in equilibrium ($S_d = S_s = S$), we obtain the following reduced form equation for S:

$$S = f(Y, B, L, R) \qquad (3)$$

The parameters of equation (3) may readily be estimated using standard regression techniques. Our actual regression model assumes linearity and may be expressed as:

$$S = a + b_1Y + b_2B + b_3L + b_4R + u \,, \qquad (4)$$

where a is the intercept or constant term, the b_i's are regression coefficients, and u is an error term.

Let us suppose that the only relevant respects in which school districts differ is in terms of median family income (Y), tax base per pupil (B), location (L), and pupil achievement test scores (R), and that these four variables fully account for all variance in teachers' salaries. Now, clearly, we should not wish to reward rich districts with large tax bases, whose high demand for teachers gives rise to high salaries, in order to facilitate their paying those salaries. On the other hand, if a district, irrespective of its taxable wealth or income, pays high salaries in order to offset an undesirable location, that differential in salaries attributable to the location factor is one which we should wish to incorporate into our adjustment index. Thus, in general, our approach involves, essentially, abstracting from differences in demand factors and compensating for differences ascribable to supply factors. Once the regression equation, such as (4), has been estimated, this may be done by attributing to each district the mean value for all districts of the demand variables, and then arriving at a constructive value for teachers' salaries for each district by applying the parameters of the estimating equation to those means and the actual values of the supply variables.[23] The adjustment index for each district is, then, the ratio of this constructive estimated value for a given district, i, to the mean value for all districts of teachers' salaries. In terms of our estimating equation (4), the adjustment index for district i is:

$$\frac{\hat{S}_i = a + b_1\bar{Y} + b_2\bar{B} + b_3L_i + b_4R_i}{\bar{S} = a + b_1\bar{Y} + b_2\bar{B} + b_3\bar{L} + b_4\bar{R}}, \text{ i. e., } \frac{\hat{S}_i}{\bar{S}} \qquad (5)$$

[23] The teachers' salary level so estimated for a given district may be defined as the level that would have obtained if income (Y) and tax base (B) in the district had been equal to their averages for all districts, given the district's location (L) and pupil characteristics (R).

In pursuit of this methodology our prime concern is to avoid the obvious pitfalls involved in simply adjusting the availability of funds to school districts to reflect existing differentials in prices or wages without regard to why those differentials exist. This places a heavy burden on the validity of the a priori reasoning specifying those factors that may influence demand, those influencing supply, and those that may enter on both sides of the market.[24] Despite this burden, however, the effort seems worth pursuing, partly because equal dollars simply do not produce equal inputs -- prices or costs do vary -- and any alternatives of which we are aware seem highly unpromising.

It should be entirely clear, of course, that the kind of adjustment we are concerned with can help to insure only equality of educational inputs and that differences in costs attributable to differences in identifiable educational "needs" remain unadjusted and unaccounted for, except to the extent that they are reflected in demand or supply factors. But, if one is concerned with compensating both for disparities in input prices and in needs, in order to pursue something approaching equality of educational outputs rather than merely inputs, a second index designed to measure need differentials must be estimated. Conceivably, of course, the task of estimating such an index may not be very different in terms of methodology from the one undertaken here, but it is outside the purview of this study.

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[24] Inevitably, perhaps, some normative judgments may well be involved in the specification of variables as demand or supply factors. Sensitivity of our results to such choices will be tested by the presentation of several variants of the adjustment index.

The Regression Analysis

The Sample

The school districts making up our sample are the 177 districts in Michigan which were included in the combined 1970 Census Fourth Count (Population) School District Data and the 1970 Elementary-Secondary General Information Survey Tapes, known as the "Combined SDDT-ELSEGIS III (SDEL3) Data Tapes."[25]

Salaries, the Dependent Variable

There are several possible forms that the variable "teachers' salaries" may take in the regression analysis required for construction of the adjustment index. In fact, of course, there is not, even in any given district at any one time, simply one "price", but many. Teachers' salaries vary with education, experience, and sometimes nature of responsibilities, and there is no reason to expect that these factors will give rise to the same differences in salaries in each district. It may be argued that the "key" price is the salary paid to the new, inexperienced teacher with only the baccalaureate degree. If most new teachers are hired at this salary it provides the closest reflection of current market forces. And yet it must be recognized that the beginning teacher may be as much or more influenced by prospective increments and future benefits as by those offered in the initial year of employment. Moreover, from the standpoint of the district

[25]The ELSEGIS III sample of 182 districts is a probability sample drawn from the total of 626 Michigan school districts, including the 530 K-12 that account for 99.7 per cent of enrollment and 96 elementary districts. The sampling ratios employed were 1.00 for districts with enrollment in 1969-70 of 4,000 or more, .32 for 2,500-3,999, .13 for 300 to 2,499, and .03 for under 300. In order to achieve comparability we dropped the 2 elementary districts and data do not appear on the Michigan SDEL3 tape for 3 others, leaving a sample of 177 K-12 districts.

and its taxpayers, the overall cost of maintaining a staff of teachers compatible with its educational objectives may be far more important than any particular points in the salary scale, although they are clearly related. Thus the most relevant form of the teachers' salaries variable appear to be the mean.[26] Average teachers' salaries in the district (ATS)[27] is, therefore, the dependent variable in our regression analysis.

Demand Variables

The demand variables in the reduced form equation to be estimated are those which are believed to represent, directly or indirectly, ability and willingness to pay for education and the preferences of the community. The ability to support education is represented by the state equalized value of taxable real and personal property per pupil in the district (SEVP) and by the proportion of families in the district whose 1969 income as reported in the 1970 Census was $15,000 or more (PRICH). In preliminary analysis mean family (MFY) and the proportion of families with income of less than $4,000 (PFPOV) appeared to contribute less well to the predictive power of our equations. When all three variables were included in the analysis severe problems of intercorrelation were encountered.[28]

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[26] For the sample of 177 Michigan school districts the first-order correlation coefficients between average teachers' salaries in 1972-73 and starting B.A., maximum B.A., starting M.A., and maximum M.A., are .65, .68, .66, and .74, respectively.

[27] For definitions and sources of data for ATS and all other variables used see Appendix A.

[28] The correlation matrix for PRICH, mean family income (MFY), and proportion of families with income of less than $4,000 (PFPOV) is as follows:

PRICH	1.00	
MFY	.95	1.00

Willingness to support education is indicated in our analysis by that part of the tax levy for school operations that is subject to approval by referendum at irregular intervals, known as "extra-voted" millage, as distinct from "allocated" millage. The latter is the portion of the levy, ranging among counties from about 6 to 11 mills, that is imposed without voter approval. For most districts extra-voted millage (MILLV) is at least equal to allocated millage and for many it is two to three times as high. Given the system of state aid and the value of taxable property in the district it is the level of extra-voted millage that the community approves that largely governs the amount of revenue available, for teachers' salaries as well as other objects of expenditure.

Other things equal, the larger the proportion of the local tax base that consists of residential property (RES) the higher is the "price" to individuals as taxpayer-voters of a dollar of tax revenue. This follows, of course, from the assumption that school district residents do not see themselves as "paying" taxes levied on industrial, commercial and other non-residential property. As this price rises we should expect support for schools to fall and with it the level of teachers' salaries.

We also enter as demand variables three measures expected to reflect or govern the community's preferences with respect to education. The first of these variables is the proportion that kindergarten through grade 12 public school pupils represent of the total population (PPUPOP). It combines a measure of the population age mix with reliance on the public, as opposed to private and parochial schools. Our hypothesis is that the larger the proportion of the population that is enrolled in the public schools the stronger will be the support for th -e schools, including such elements of

support as teachers' salaries. The second of this group of variables is the proportion of the population of "foreign stock" (PFOR), that is, who were not born in the United States or whose parents were not born here. Traditionally the immigrant's entry into the "mainstream" of American society, his route to social acceptance and material achievement, has been and continues to be through education, primarily public school education. We expect, therefore, that the demand for educational inputs, including teachers, is in part a positive function of the relative size of the school district's population of immigrants and children of immigrants. The third characteristic believed to be related to preferences for education, and hence to demand for teachers, is the stability of the district's population. It is measured by the proportion of the population aged 5 and older in 1970 who resided in the same house in that year as in 1965 (MOB). Our hypothesis is that long-term residents identify closely with the community and its school system, tend to feel that they have a larger stake in its quality, and thus are likely to be more supportive of local public education than people who are more mobile. The value of this variable may also reflect inversely the rate of growth of the district and, directly, its age. We believe that slower growing, older districts capture a closer sense of "community" and show a greater interest in collective enterprises, including the public schools. We expect, therefore, that districts with stable populations (high MOB) will, other things equal, exhibit high average teachers' salaries.

In summary, the demand equation suggested is the following, allowing S to represent ATS:

$$S_d = d(Q, SEVP, PRICH, MILLV, RES, PFOR, MOB, PPUPOP). \quad (6)$$

Supply Variables

We classify as supply variables those factors related to, or characteristic of, a school district that we should expect to influence the salary level at which, other things being equal, teachers are available for employment. For the most part these variables are assumed to influence teachers' perception of the school district as one that is more or less attractive as a place to teach than available alternatives. In addition, we anticipate that with increasing education and experience, teachers demand higher salaries and that average salaries reflect this.

The hypothesis that as the size of the school district increases salaries must rise to compensate teachers for the increasing subjective costs of working in an environment bounded by rising levels of bureaucratic red tape and frustration imposed by additional layers of supervision and regulation finds considerable support in the literature.[29] Nevertheless, having deleted "Q" or quantity in order to arrive at the reduced form equation, it is clearly wrong to re-insert it for purposes of estimating that equation. And there does not appear to be any way to include a measure of district size in the estimating without confronting that obstacle.[30]

Like everyone else, teachers are presumed to have preferences regarding the kinds of communities in which they wish to live and work. Thus we classified school districts according to the nature of the predominant community in which they are located, as central city of a SMSA, suburb of a central city, "independent" city, and "rural". A district is classified as being in an independent city if it is located in or contains a city that

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[29] See, for example, Lipsky and Drotning, op. cit., Hall and Carroll, op. cit., Thornton, op. cit., and Frey, op. cit.

[30] The appropriate solution to the problem lies in estimating the

is not within the boundaries of a SMSA but has a population of 4,000 or more.[31] This classification gives us three "dummy" or dichotomous variables. A district is assigned a value of 1 if located in a central city (CE), 0 otherwise; 1 if rural (RUR), 0 otherwise;and 1 if suburban (SUB), 0 otherwise. The independent city class acts as the "control" group.

Our hypothesis is that, other things being equal, teachers require extra compensation to accept and keep employment in a central city school district. This hypothesis stems in part from observation of the exodus of non-teaching employment opportunities from the central city which, coupled with the large proportion of teachers who are second earners in the family, makes a position in the central city less attractive. Central city school buildings tend to be older and offer less attractive teaching environments, anticipated slower growth may offer fewer opportunities for "advancement" to supervisory and administrative jobs, and so forth.

By the same token the suburbs would appear to be relatively attractive, but in general not, perhaps, as appealing as modest sized independent cities. The more attractive suburbs may be viewed as relatively costly places to live. In addition, both suburbs in SMSA's and central cities are likely to have stronger, more firmly entrenched unions than places outside the metropolitan areas, thus again suggesting higher salaries.[32] The reasoning

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[31] By Census definition a central city must have a population of 50,000 or more. The classification "independent city" is limited to cities that do not qualify as suburbs and whose populations range between 4,000 and 49,999.

[32] We have not taken unionization of teachers into account in this study because all Michigan K-12 districts are now organized and their teachers are working under negotiated contracts. Moreover, outside of Wayne County, where the American Federation of Teachers is strong, virtually all districts are organized by the Michigan Education Association. Given more time and resources, it might have been possible to derive a variable or variables reflecting such things as union militancy, aggressiveness, and other attributes which, one easily supposes, could be important as arguments in the supply function for

leading to the expectation of higher salaries in suburbs and central cities implies, at the same time, lower salaries in rural and smaller city districts.

Teachers tend to be predominantly middle class, and, having gotten through high school and college, presumably average or better academic achievers. We assume that they are most comfortable teaching children who may be similarly characterized. Thus it is our hypothesis that teachers' salaries are negatively related to the socio-economic status of the pupils in the district (SESP) and to their achievement levels as measured by the district's fourth grade "Basic Skills Composite Achievement" scores (SKCP). That is, the higher the socio-economic status and achievement scores of the pupils, the lower will be the salary required to bring forth the desired number of teachers of a given education-experience level.[33]

Similar reasoning suggests that teachers view non-white pupils and parents with less favor than they do whites. Hence we expect that the level of teachers' salaries rises with the proportion of the community's population that is non-white (PNW).[34]

Furthermore, we expect that the drop out rate for pupils in grades 9 through 12 (DROP) is an additional indicator of the attractiveness of a school district as an employer of teachers. It is our hypothesis that as

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[33]Throughout this paper we avoid the attempt to define teacher "quality", for we have no means of measuring it. Education and experience are generally built into salary scales and by interence may be assumed to say something about "quality". But it is, perhaps, equally plausible to believe that higher salaries for teachers with more formal higher education credit hours or degrees and more years of teaching experience may merely reflect school boards' and administrators' -- indeed even almost everyone's -- views with respect to "fairness" in the salary structure.

[34]PNW is actually the proportion of the school district's population that is black and Spanish surname. Data by school district on other Census-recognized minorities are not available.

this rate increases, higher salaries may be expected as compensation for this "disamenity".[35]

Next we consider as arguments in our supply function two teacher characteristics that universally tend to be associated with higher salaries. They are proportion of teachers in the district who hold master's or other advanced degrees (PTECM), and the mean number of years of teaching experience (AYTE). Once inexperienced teachers with B.A. degrees have been hired and granted tenure, if we assume the salary scale to be given in terms of rewards for longevity and further degrees or degree-credits, district officials cannot control the movement of these teachers along that salary scale.[36] But they can control or at least negotiate about the structure of the scale. And it is this fact that makes us somewhat uneasy about counting PTECM and AYTE as supply variables the parameters of which are to be allowed to enter into our adjustment index. Having failed to find an acceptable means of resolving the issue, we shall present alternative estimates of the adjustment index, in one of which these variables are treated as supply factors, while in the other, their mean values are assigned to all districts, thus enabling us to "control for" these measures of teacher quality.

Thus we count nine variables in our supply equation. It may be expressed as follows:

$$S_s = s(Q, CE, SUB, RUR, SESP, SKCF, PNW, DROP, PTECM, AYTE) \quad (7)$$

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[35] In an earlier draft we included the pupil-teacher ratio as a supply variable. It seems clear, however, that this ratio is likely itself to be a function of the same factors that enter into the determination of teachers' salaries. Thus, we encounter problems of simultaneity that introduce bias into our estimates and require that this variable be dropped.

[36] For discussion of this point, see Levin et al, op. cit., pp. 22 and 72.

Intuitive logic, coupled with our review of the literature, suggests other variables that might have been added to our demand or supply functions. One of these, clearly, is a measure of district monopsony power. Following the suggestion of Landon and Baird,[37] we considered the use of this variable in the form of the logarithm of the number of school districts in the county. We decided after some preliminary analysis, however, that as the value of this variable increases so does the likelihood that we are dealing with suburban districts. It is only in SMSA counties in Michigan that the number of districts tends to exceed five or six, while it reaches a peak of 36 in Wayne County (Detroit). Thus it is difficult to interpret any relationship that may be estimated. Other variables, such as proportion of teachers who are female and a measure of the opportunity cost of teaching, in the form of salaries or wages paid in competing occupations, are not immediately available. Among those which were considered and then dropped after some analysis, either because they presented problems of multi-collinearity with other variables or because they proved to be unrelated to teachers' salaries in terms of average or beginning or maximum salaries for B.A.'s and M.A.'s, are proportion of revenue from local sources,[38] mean family income, proportion of the population of school age, proportion of the population aged 25 and over who have attended college for at least one year, and the percentage of employed persons aged 16 and over who are employed in managerial, professional and technical occupations.

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[37] Op. cit.

[38] Which, as expected, is highly correlated with State equalized value of taxable property per pupil. Appendix B presents a correlation matrix for the variables considered in our analysis.

Regression Results

Putting together equations (6) and (7) gives us the reduced form equation to be estimated directly by means of ordinary least squares for average teachers' salaries (ATS). The form of the regression equation is assumed to be linear.[39] Its estimated parameters are presented in Table 1, along with other relevant statistics.

We have 15 demand and supply variables that account together for 72 per cent of the variance among school districts in average teachers' salaries. As expected, AYTE, PTECM, DROP, CE AND RUR enter as major influences from the supply side. The regression coefficients for SKCF, SUB, and PNW have the expected signs, but they are not statistically significant.[40] SEVP, PRICH, PPUPOP, PFOR, MOB, as demand factors contribute significantly to explaining variance in average teachers' salaries. The one variable in the equation for which the regression coefficient does not take on the expected sign is the proportion of the tax base that is in the form of residential property (RES). Our hypothesis suggestd a negative influence on salary levels, whereas the estimated coefficient is positive, although not statiscally significant.[41]

The interpretation of the regression equation is fairly straightforward. Thus, for example, each additional mill of extra-voted millage (MILLV) adds $31.86 to average teachers' salaries of the district (ATS), while each

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[39] The regression equation was also estimated in a log-linear form, with no substantial difference in results.

[40] That is, the probability is higher than .10 that their true values are equal to zero.

[41] This result may be due to the multicollinearity between RES and such other variables as PRICH and SUB. See Appendix B.

Table 1. Regression Results, Average Teachers' Salaries (ATS) in 177 Michigan K-12 School Districts, 1972-73

Independent Variables	Regression Coefficient	Mean (Unweighted)
Demand Variables	ATS = $11,811	
MILLV	31.86*	16.36
	(1.821)	
SEVP	.0243**	20,150
	(2.157)	
RES	3.531	49.2
	(.5918)	
P FOR	27.35**	17.7
	(2.506)	
MOB	17.86**	55.9
	(1.984)	
PRICH	26.99***	26.7
	(2.972)	
PPUPOP	62.50***	25.>
	(2.679)	
Supply Variables		
AYTE	155.3***	8.8
	(3.900)	
PTECM	37.24***	29.6
	(4.316)	
DROP	42.98*	5.2
	(1.692)	
SKCF	-58.22	51.1
	(-1.490)	
CE	752.7**	---
	(2.287)	
RUR	-429.3*	---
	(-1.774)	
SUB	136.4	---
	(.5918)	
PNW	7.729	4.6
	(.8457)	
Constant Term	7004	
R^2	.72	
S.E.	818.4	σ = 1476.7

't' statistics are in parentheses
*** significant at p < .01
** significant at p < .05
* significant at p < .10
N = 177

additional dollar of state equalized value of taxable property per pupil (SEVP), is associated with an addition of $.024 to ATS. In the case of the "dummy" variables such as CE and RUR, we find that the district being located in a central city rather than in an independent smaller city adds $753 to average salaries, while location in a rural area subtracts $429.

Salary Adjustment Indexes

Following the methodology outlined above,[42] and using the estimated coefficients presented in Table 1, we have constructed adjustment indexes for a selected group of Michigan school districts for average teachers' salaries. These indexes are reproduced in Table 2.

The first column of Table 2 presents the observed average teachers' salaries for each of 35 districts selected from our sample expressed as a ratio to the mean value of average teachers' salaries for all districts in the sample. The selected districts include the six largest central cities, two or more residential and industrial suburbs of each of them, a group of four independent cities, and six rural districts. The ratio of ATS in the district to the mean ATS for the sample may be viewed as one possible adjustment index. It would be the appropriate one if our objective were to compensate school districts directly and proportionately with variation in the level of salaries actually paid. Since our objective is, rather, to compensate for those differences attributable only to variance in supply factors in teacher labor markets as opposed to differences in demand factors, clearly a ratio that reflects both demand and supply influences is not appropriate. Nevertheless, it is useful as an indicator of the extent to

[42] See pp. 13-16.

Table 2. Illustrative Salary Adjustment Indexes, Selected Michigan School Districts

District	Adjustment Index for Average Teachers' Salaries (ATS)				
	$\frac{ATS_i}{ATS}$	Variant I[a]	Variant II[b]	Variant III[c]	Variant IV[d]
Detroit (CE)	1.086	1.194	1.151	1.145	1.102
Birmingham (SUB)	1.209	1.061	0.966	1.061	0.966
Dearborn (SUB)	1.220	1.171	0.982	1.085	0.897
Ecorse (SUB)	1.306	1.214	1.059	1.305	1.150
Highland Park (SUB)	1.041	1.072	1.078	1.118	1.125
Livonia (SUB)	1.232	1.006	0.994	1.157	1.145
Oak Park (SUB)	1.360	1.087	0.976	1.183	1.072
Walled Lake (SUB)	1.059	1.003	1.007	1.017	1.021
Flint (CE)	1.114	1.132	1.099	1.140	1.108
Beecher (SUB)	1.009	1.039	1.053	1.037	1.051
Lake Fenton (SUB)	0.854	0.914	0.994	0.825	0.905
Swartz Creek (SUB)	0.989	0.945	0.990	0.987	1.032
Grand Rapids (CE)	1.079	1.066	1.088	1.115	1.137
Forest Hills (SUB)	0.933	0.964	0.980	0.905	0.910
Kentwood (SUB)	0.904	0.933	0.988	0.918	0.972
Wyoming (SUB)	0.960	0.994	1.009	0.967	0.982
Ann Arbor (CE)	1.324	1.168	1.049	1.325	1.206
Willow Run (SUB)	0.908	1.032	1.033	0.919	0.920
Ypsilanti (SUB)	1.082	1.127	1.056	1.171	1.110
Lansing (CE)	1.141	1.158	1.090	1.173	1.106
E. Lansing (SUB)	0.908	1.132	0.988	0.983	0.839
Waverly (SUB)	0.913	1.029	0.982	0.878	0.831
Saginaw (CE)	1.118	1.153	1.113	1.147	1.107
Bridgeport (SUB)	0.882	0.969	1.015	0.903	0.949
Swan Valley (SUB)	0.825	0.891	0.988	0.857	0.954
Adrian (INDC)	0.990	1.015	0.991	1.045	0.975
Iron Mountain (INDC)	1.016	1.034	0.946	1.032	0.944
Marquette (INDC)	0.939	1.014	0.984	0.984	0.954
Midland (INDC)	1.093	1.027	0.968	1.062	1.003
Au Gres-Sims (RUR)	0.721	0.873	0.942	0.782	0.851
Deckerville (RUR)	0.845	0.964	0.964	0.901	0.901
Forest Park (RUR)	0.921	1.039	0.924	0.878	0.763
Harbor Springs (RUR)	0.948	0.959	0.947	1.005	0.993
Litchfield (RUR)	0.822	0.890	0.963	0.891	0.964
Rapid River (RUR)	0.815	0.901	0.959	0.873	0.931

[a] Based on estimating equation assuming AYTE and PCTEM are supply factors.

[b] Based on estimating equation assuming AYTE and PTCTEM are demand variables.

[c] Based on observed value of ATS corrected for differences from means of observed values of demand variables.

[d] Variant III amended to incl[illegible]

which our methodology leads to results that depart from compensation according to actual divergence of district salaries from the mean for all districts.

In column 2, labeled "Variant I," we have the salary adjustment indexes calculated from the regression coefficients shown in Table 1, the mean values of the demand variables, and the observed values of the supply variables, in accordance with the methodology described earlier. The values of the index range from 1.194 for Detroit and 1.214 for Ecorse, one of its industrial suburbs, to .873 and .890 for the rural districts of Au Gres-Sims and Litchfield. All of the central cities except Grand Rapids have indexes well above 1.1, while the rural districts and some suburbs, those that are primarily residential in function, outside the Detroit SMSA, tend to have low indexes.

The interpretation of the index values and their suggested application are simple and straightforward. If school districts in Michigan are to be compensated for differences in supply factors affecting their teachers' average salaries, then the base amount made available to each district would be multiplied by the district's index value. Suppose, for example, that the State undertakes to provide to each district in support of teachers' salaries an amount equal to $600 per pupil, adjusted for cost differences attributable to differences in supply factors. Then the actual amount for Detroit would be $716.40 ($600 x 1.194), for Flint, $679.20, Grand Rapids, $639.60, Livonia, $603.60, Au Gres-Sims, $523.80, and so forth. Thus, rather than each district receiving a uniform $600 per pupil, for the selected group of 35 districts, the amount distributed would range from $728.40 for Ecorse to $523.90 for Au Gres-Sims, a difference of $204.50. Assuming a pupil-teacher ratio of 24, this would amount to a difference of $4,908 per teaching position.

Referring back to Table 1, we find that high index values are ascribable to high drop-out rates, low achievement scores (SKCF), high proportion of non-whites in the population, location in a central city as opposed to a rural area or independent city, and high values for average years of teacher experience (AYTE) and percentage of teachers having degrees beyond the baccalaureate (PTECM). Contrary to the view cited earlier, however, it may be argued that school districts can, and do, exert substantial control over AYTE and PTCEM. To the extent that this is so, the Variant I adjustment index unjustifiably (in terms of our objectives) rewards districts like Adrian and Ann Arbor, where the AYTE's are, respectively, 11.1 and 9.9 years, compared to an average for the sample, of 8.8, and Ann Arbor does well with respect to PCTEM, with a value of 62.6 per cent, relative to the sample mean of 29.6 per cent.

In response to this argument we have constructed the Variant II adjustment index. It differs from Variant I in that the mean values of AYTE and PTCEM are assigned to each district rather than the observed values. The effect is to "control for" these characteristics of teachers, characteristics which some would label "quality" indicators. The general effect is, of course, to narrow the range and variance in the adjustment index. But the general pattern of differences tends to remain basically unchanged. The principal "losers" are relatively high income suburban districts such as Birmingham, Dearborn, and Oak Park, the independent cities, and Ann Arbor among the central cities.

Thus far, in the construction of our cost adjustment indexes we have ignored the fact that our regression equation fails to explain some 28 per cent of variance among school districts in the sample in average teachers' salaries. Our [illegible]

value of ATS for each district as a ratio to its mean value for all districts (equation (5)). This procedure may be said to sweep under the rug the existence of substantial residuals, that is, differences between the observed values of ATS and the values given by the regression equation of Table 1. An alternative approach that permits these residuals to be reflected in the adjustment indexes involves adjusting the actual observed values of ATS for the differences between the observed and the mean values of the demand variables. The effect is to obtain an index value that reflects both the measured influence of supply variables and the influence of variables omitted from our estimating equation. In terms of the variables actually employed in computing the Variant III index values, the adjustment index for district i is:

$$ATS_i - b_1(MILLV_i - \overline{MILLV}) - b_2(SEVP_i - \overline{SEVP}) - b_3(RES_i - \overline{RES}) - b_4(PROR_i - \overline{PFOR}) - b_5(MOB_i - \overline{MOB}) - b_6(PRICH_i - \overline{PRICH}) - b_7(PPUOPOP_i - \overline{PPUPOP})$$

divided by $\overline{ATS}$. (8)

Again, Variant III, like Variant I, permits teachers' experience and advanced degrees to influence the adjustment index. Variant IV adds to the variables in expression (8) AYTE and PCTEM and, like Variant II, it holds these factors constant. The choice between Variant II and IV is not self-evident. Clearly the preferred course to follow is one that, by including the presently omitted variables in the analysis, would bring Variants I and III and II and IV into equality or near-equality. As the proportion of explained variance approaches 1, obviously, the size and, therefore, the relevance, of the residuals diminishes.

Thus the results presented in Table 2 and their basis in the regression equations of Table 1 obviously could profit from further efforts to refine them. They are presented here not as finished products but, rather, as means of illustrating with some precision the way in which the methodology suggested in this paper could be applied in the effort to attain equality of educational inputs. Thus further experimentation with several dimensions of the empirical portions of the paper seem warranted. As already indicated, several additional or alternative variables might be obtained and employed in the analysis; alternative specifications of the demand and supply equations might be developed; and it is likely that some problems encountered through the use of ordinary least squares to estimate a reduced form of the demand and supply equations could be resolved by means of two-stage least squares estimation of the structural equations.

Against the background of the foregoing caveats, disclaimers, and suggestions, we turn now to brief treatment of non-instructional current operating expenditures (NIXCP).

NON-INSTRUCTIONAL EXPENDITURES

Teachers' salaries constitute a price or set of prices in a manner for which we have no analog with respect to non-instructional current operating expenditures (NIXCP). These expenditures averaged $278 per pupil in 1972-73 for the 177 Michigan districts in our sample, with considerable variance, as evidenced by a standard deviation of $54. They comprise a wide range of kinds of expenditure, for such things as transportation, fuel, power, repairs, to and maintenance of buildings, books, supplies and so on. Since we are

dealing with a broad composite of different kinds of input purchases it does not appear sensible to attempt to define explicit demand and supply functions. We can, however, attempt to identify factors which appear, on a priori grounds, to be related to variance in this expenditure category.

Larger school districts tend to be in urban locations where transportation costs are less because fewer pupils are transported. They may also enjoy economies of scale and may be able to obtain lower utility rates. Thus we expect that increasing size, as measured by the logarithm of the number of teaching positions (LTEAC), is accompanied by falling levels of NIXCP.

An increasingly costly element of non-instructional expenditures consists of outlays for security and repairing the damages wrought by vandals. Such costs may be associated with the proportion of the children in the district who are culturally or educationally deprived, particularly in the central cities of SMSA's. Thus our hypothesis is that NIXCP is positively associated with location of the district in a central city (CE) and with the proportion of school age children in families with 1969 income of less than $3,000 (PCHPOV). We expect, on the other hand, a negative association with composite basic skills achievement scores (SKCF). By the same token, we anticipate that the more stable the residents of the district, measured by the proportion of people aged 5 and over who lived in the same house in 1970 as in 1965 (MOB), and the larger the proportion of families without children (PFNCH), the smaller will NIXCP be.

Finally, we have the indicators of willingness and ability to support school expenditures, in the form of MILLV and SEVP, respectively, and MILLD,

debt-service millage, as a measure of activity in the acquisition of new buildings and land. We expect that all three of these variables exert an upward influence on NIXCP.

The estimated regression equation is as follows (with 't' statistics in parentheses):

$$\begin{aligned} NIXCP = 302.6 &- \underset{(2.52)}{20.99}\ LTEAC + \underset{(2.67)}{31.33}\ CE + \underset{(2.61)}{2.755}\ PCHPOV \\ &- \underset{(2.70)}{3.072}\ SKCF + \underset{(1.72)}{8.748}\ PFNCH - \underset{(3.31)}{.9792}\ MOB + \underset{(11.72)}{.0037}\ SEVP \\ &+ \underset{(9.57)}{5.452}\ MILLV + \underset{(4.04)}{4.870}\ MILLD \qquad (R^2 = .67;\ S.E. = \$31.90) \end{aligned}$$

Thus, in the case of all variables except PFNCH, for which the sign of the regression coefficient is positive rather than negative,[43] our hypotheses find support. As in the case of teachers' salaries, in seeking an adjustment index for NIXCP, one which is far less unambiguously a "price" adjustment, we assign to each district the mean values of MILLV, MILLD and SEVP. The index for each district is then obtained in the manner described for the index for salaries, the numerator in this instance being the constructive estimate for the i^{th} district, while the denominator is the mean vlaue of NIXCP for the sample of districts as a whole.

For some of the districts listed in Table 2, the following adjustment

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[43] This is the only regression coefficient that is not significant at the $p < .05$ level or better. Other variables tested in preliminary analysis but which added nothing to explained variance are PUPT, AYTE, PTECH, RESP, DROP, RUR, SUB, RES, PCM, PFOR, PPP, PRICE, PPUPOP and POP.

indexes for NIXCP were computed:

Detroit, 1.15

Dearborn, 0.89

Oak Park, 0.95

Flint, 1.12

Ann Arbor, 1.13

Adrian, 1.01

Au Gres-Sims, 1.19

Marquette, 1.03

This index is relatively high for central cities such as Detroit and Flint and also for the rural districts of Harbor Springs and Au Gres-Sims. The values for Detroit suburbs are low, while smaller city district indexes are close to 1. The index appears to reflect need for inputs such as those used in transportation in the case of the rural districts, and perhaps security and maintenance and repairs of older building subject to heavy vandalism in the larger central cities. In any event, its use cannot be seen in the same light as the indexes for teachers' salaries. At best, it may combine the impacts of differences in prices or costs and differences in needs as given by the circumstances, societal and geographic, surrounding the school district.

CONCLUSIONS

For the more than half of school operating expenditures that is accounted for by teachers' salaries, we are confident that the methodology suggested in this paper is capable of providing appropriate guidelines for

adjusting dollars per pupil so as to compensate for price differences confronting school districts. The estimates of adjustment indexes herein presented, while offered only as first approximations, have, to us, a "reasonable" look about them, in the sense that they vary in directions and magnitudes that appear to be consonant with observed experience and circumstances in the State.

In the area of salaries we are much closer, we believe, to the objective we set out to attain than is the case with respect to non-salary expenditures. Here the available data are much less satisfactory, and it is not entirely clear that one can identify and distinguish among elements of demand and supply in a manner that permits differentiating between expenditure differences due to price variance and those due to circumstances of geography, climate, age of structures, and so forth. Perhaps, however, what is wanted is really an index that is a composite price-need index.

If school finance systems are ultimately to move toward the goal not simply of equality among districts in educational inputs, but equality in meeting educational needs, then what is wanted for all parts of school outlays are adjustment indexes that reflect both price and need differences. Much obviously remains to be done. This paper is offered as a vehicle for carrying one set of suggestions as to the direction that might be taken by larger efforts.

Appendix A

Definitions of Variables and Sources of Data

ATS — Average teachers' salaries. Michigan Department of Education, Ranking of Michigan Public High School Districts by Selected Financial Data, 1972-73, Bulletin 1012 (Lansing, n.d.). Hereinafter cited as Bulletin 1012.

NIXCP — Difference between "current operating expenditure" and "total instruction expenditure" per pupil. Bulletin 1012.

AYTE — Average years of teaching experience. Michigan Department of Education, Local District Results, The Fourth Report of the 1971-72 Michigan Educational Assessment Program (Lansing, 1972). Herinafter cited as Local District Results.

CE — Dummy variable, 1 if the district is located in the central city of a Standard Metropolitan Statistical Area, as defined by the 1970 Census of Population, and the City of Pontiac, 0 otherwise.

DROP — Drop-out rate, grades 9-12. Local District Results.

INDC — Districts other than those classified as CE, SUB, or RUR.

LTEAC — Common logarithm of the number of teaching positions in the school district. Michigan Department of Education, 1972-73 Summary of Expenditure Data for Michigan Public Schools, Bulletin 1013 (n.p., n.d.). Herinafter cited as Bulletin 1013.

MILLD — Number of mills (dollars per $1,000) levied by the school district for debt service. Bulletin 1012.

MILLV — Number of extra-voted mills approved by electorate of the school district for operations. Bulletin 1012.

MOB — Proportion of population in the school district aged 5 and over who lived in the same house in 1970 as in 1965. National Center for Educational Statistics, U.S. Office of Education, Combined SDDT-ELSEGIS III (SDEL 3) Data Tapes, Michigan Tape. Herinafter cited as SDEL3.

PCHPOV	Proportion of children aged 5-17 in families with income of less than $3,000. SDEL3.
PFNCH	Proportion of families with no children under 18. SDEL3.
PFOR	Proportion of the population not born in the United States or whose parents were not born in the United States. SDEL3.
PNW	Proportion of the population black or Negro and Spanish surname. SDEL3.
PQP	Total population. SDEL 3.
PPP	Proportion of total K-12 enrollment in private and parochial schools. SDEL3.
PPUPOP	K-12 enrollment in the public schools as a proportion of the total population. SDEL3.
PRICH	Proportion of families with income in 1969 of $15,000 and over. SDEL3.
PTECM	Proportion of teachers in the school district with M.A. degree. Local District Results.
PUPT	Number of pupils per teaching position. Bulletin 1013.
RES	Proportion of taxable value of property real residential in major municipality in the school district in 1968. The value for the county used where municipal or township data not available. A. F. Snyder and J. Zepczyk, 1968 Value of Taxable Property in Michigan (East Lansing: Institute for Community Development and Services, Michigan State University, 1969).
RUR	Dummy variable, 1 if the district is located outside of a SMSA and does not contain a city with a population of 4,000 or more, 0 otherwise.
SESP	Socio-economic status of pupils as measured by the Michigan Educational Assessment, 1971-72. Local District Results.
SKCF	Basic skills composite achievement test scores for fourth grade pupils in the district. Local District Results.

SUB	Dummy variable, 1 if the district is located outside of the central city but within the boundaries of a SMSA, 0 otherwise. (Pontiac is classified as a central city rather than a suburb of Detroit on the basis of the author's arbitrary judgment).
SEVP	State equalized value of property per pupil. This is the effective local tax base per pupil. Bulletin 1012.

APPENDIX B

CORRELATION MATRIX

Table B.1. Matrix of Correlation Coefficients, All Variables

›le	Correlation Coefficients														
	1.000														
	.026	1.000													
	-.025	.462	1.000												
	.132	-.240	.028	1.000											
	-.310	.073	.250	-.318	1.000										
	-.079	.425	.254	-.363	.586	1.000									
	-.060	.480	.628	.085	.473	.379	1.000								
	-.254	-.015	.100	.013	.369	.201	.383	1.000							
	-.120	.474	.500	-.156	.559	.458	.721	.453	1.000						
	-.143	-.046	.236	.172	.097	.174	.171	.130	.090	1.000					
	.082	.121	-.042	-.131	.201	-.056	.037	.058	.139	.480	1.000				
	-.170	.102	.435	-.034	.136	.322	.260	.217	.254	.450	-.285	1.000			
	-.118	-.471	-.581	-.040	-.115	-.155	-.501	-.078	-.412	-.087	-.056	-.138	1.000		
	.336	.377	.235	.001	.035	.008	.315	-.265	.171	-.176	.133	-.358	-.574	1.000	
	.212	.362	.163	.117	-.318	-.146	.119	-.165	.079	-.240	.281	-.135	-.228	.357	1.000
	-.169	.070	.287	-.005	.172	.328	.252	.221	.192	.417	-.608	.370	-.145	-.065	-.259	1.000

Continued

le . (Continued)

ble

Correlation Coefficients

-.337	-.162	-.232	-.168	.274	.258	-.046	.480	.133	.085	-.024	.239	.336	-.568	-.269	.159
.045	.329	.268	-.183	.305	.159	.440	.108	.422	-.244	.359	-.078	-.183	.261	.262	-.145
-.066	-.109	-.206	.079	.077	-.245	.070	.190	-.056	.079	-.040	-.246	.062	.035	-.067	-.089
-.113	.233	.334	.022	.215	.052	.369	.223	.312	-.072	.201	.156	-.390	.146	.147	-.023
.216	.520	.533	.069	.276	.212	.479	-.203	.391	-.178	.412	-.052	-.444	.587	.433	-.160
-.265	-.256	-.280	-.070	.008	.163	-.188	.149	-.190	.199	-.452	.179	.330	-.440	-.333	.447
.293	-.128	-.158	.166	-.370	-.336	-.196	-.418	-.406	-.157	-.076	-.429	.054	.362	.088	-.177
-.081	-.029	.496	.120	.064	.099	.193	.092	.156	.278	-.223	.414	-.124	-.095	-.023	.362
MILLD	MILLV	LTEAC	PUPT	SEVP	NIXCP	ATS	AYTE	PTECM	DROP	SKCF	CE	RUR	SUB	RES	PNW
1.000															
.141	1.000														
.133	.285	1.000													
-.003	.438	.260	1.000												
-.404	.439	-.209	.289	1.000											
.469	-.192	.087	-.189	-.578	1.000										
-.646	-.273	.086	-.459	.098	-.196	1.000									
.120	.104	-.050	.152	.057	.124	-.194									
PFNCH	PFOR	MOB	PPP	PRICH	PCIPOV	PPUPOP									

Note: See Appendix A for definitions of variables.