

FACTORS ASSOCIATED WITH VOTER RESISTANCE TO PUBLIC EDUCATIONAL EXPENDITURE¹

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Abstract. A comprehensive regression and correlation analysis was performed using two samples of Ohio school districts. The purpose was to describe measurable socio/economic factors associated with varying levels of educational effort and to pinpoint policy implications for state or local decision makers. Evidence exists that larger districts are associated with lower cost per pupil and that wealth, measured in different ways, is associated with expenditure per pupil. State programs do somewhat equalize educational efforts, but they are far from achieving equality.

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State funding programs to primary and secondary schools in Ohio have an objective of providing equal educational opportunity to the youth in the state. State policies must take into account the different levels of local effort that occur in different school districts in Ohio. The emphasis of my analysis is to identify measurable factors associated with different levels of local support for public education. The results include a statistical description of the system and policy implications for state and/or local decision makers.

The measure of support selected for this analysis is an expenditure per pupil for Ohio school districts. Expenditure per pupil serves the dual role of a quality variable and an efficiency variable. High expenditure per pupil may denote low pupil-teacher ratios, modern supplies and equipment, *etc.*, or it could denote waste and inefficiency. In addition, "costs" may differ between schools due to differences in teaching training and experience, rural-urban cost differentials, or differences in pay scales. For the purpose of this paper, I concentrate on the quality measures, although I will also attempt to control for cost differences. It must also be assumed for the purpose of this demonstration that high expen-

diture per pupil is more likely to be associated with better school programs than is lower expenditure per pupil.

It is worth noting that other researchers confirm many of the measurements indicated in this paper and offer several additional insights. Parsons (1978) found that school districts with low local per pupil operating revenues generally have larger percentages of operating funds coming from real property that includes agricultural land. These districts represent areas of Ohio that have a sparsity of population, larger agricultural areas, and that generally have property with low economic value. In addition, lower millage is found where industrial properties often provide a relatively large number of dollars per pupil. Gensemer (1978), using a Lorenz Curve Analysis, found that total revenues were distributed more in favor of high fiscal capacity districts in 1977-78 than they had been in 1974-75, indicating Ohio is moving away from fiscal neutrality over this period.

METHODS

The statistical methods used for my study were correlation analysis and linear and quadratic regression analysis. I chose a sample of 50 school districts, utilizing data from the 1973-74 school year. Ten independent socio/economic or demographic variables were used in the regression. Quadratic terms in this regression were also introduced in order to test for economies of scale. An additional sample of 146 districts was selected, and 15 independent variables

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were used to explain expenditure per pupil. Expenditure per pupil from local efforts also was used as the dependent variable.

A residual analysis was performed where the residuals were sorted by school district type and by geographical factors. The purpose of this test was to determine the possible need for dummy variables.

The following variables were initially selected for the correlation analysis and the multiple regression analysis for a sample of fifty selected districts.

\$/P. The dependent variable, *average expenditure per pupil*, consists of the following current expenses for the 1974-74 school year:

1. General control—basically includes administrative costs;
2. Instruction—includes salaries, textbooks, and other instructional materials;
3. Plant operation and maintenance—salaries, utility bills, maintenance;
4. Attendance and health;
5. Pupil transportation;
6. Fixed charges—taxes, rent, insurance, workmen's compensation, retirement systems.

ADM. Average daily membership or roughly the number of students per school district. It was thought that possibly the greater the number of students the smaller would be the expenditure per pupil.

P/T. Student to teacher ratio or the ratio of the total number of students per district to the number of full-time teachers. The logic involved was that the smaller the ratio, the greater the expenditure per pupil.

%MIN. Percent of students from minority groups including blacks, American Indians, orientals, and Spanish Americans. It was expected that the higher the percentage, the larger the amount of expenditure.

EDLEV. The average educational level of the teachers using the following rating system:
3=less than a bachelor of arts in education;
4=bachelor of arts in education;
5=some advanced work;
6=master of education;
7=more than a master of education.

Expenditure would theoretically be higher in those districts with a higher average level of education since salaries would necessarily be higher.

#SCHOOLS. Number of schools per district. Possibly fewer schools per district would lead to less expenditure per pupil.

%STATE. The ratio of per pupil state foundation program aid to total revenue per pupil. The rationale behind this variable is that the smaller the ratio, the greater the expenditure since a small ratio implies a higher income school district.

AVSIZE. ADM divided by the number of schools shows the average number of pupils

per school in the district. Data was collected from 50 randomly selected Ohio school districts although an attempt was made to obtain a wide range of ADM's to determine if economies of scale were present. Variables two, three, and six used 1972 year data, ADM is 1973-74 school year data, and %STATE is 1974-75 school year data. EXP and EDLEV used 1974 as the base year.

MFI. Median family income, 1968 census estimate.

WAGES. Average weekly wages, 1976, county of classification of the school district.

In addition, a sample of 146 stratified samples of districts were selected from a data base that is on tape and available for analysis. Only the following variables were accessible at this time with respect to this larger sample:

S/P, MFI, WAGES, ADM, EXP, and EDLEV as previously defined. Also:

LOCAL S/P. S/P minus state funds per pupil.

SEC ADM. Average daily membership of the schools in the district classified as secondary schools.

PUP TRANS. Number of pupils transported.
DENSITY. Number of pupils per square mile.

%ADC. Percent of ADM which are classified as pupils of aid to dependent children recipients.

VOC/T. Number of vocational units per thousand pupils.

DBECN/T. Number of DBECN units per thousand pupils.

EMR/T. Number of EMR units per thousand pupils.

SALARIES. Average teacher salaries in the district.

ST ADI/P. Dollars of state aid per pupil.

RESULTS

The residual analysis showed no significant differences between school districts when grouped by type of district or by geography. Thus, no dummy variables were needed in the regressions.

Using the sample of 50, the correlation matrix indicated that none of the independent variables was highly correlated except number of schools and ADM. In fact, this relationship proved to be so strong that one of the two variables was dropped from the regression. It seems logical that districts with larger ADM's have a larger number of buildings than districts with smaller ADM's. We also note that %STATE was highly negatively correlated with expenditure per pupil as was pupils per teacher (the more pupils per teacher, the lower expendi-

ture per pupil). The education level of the teacher was positively correlated with expenditure per pupil (greater costs of higher trained personnel). To a much less degree, greater percentages of minorities was associated with higher costs and larger ADM was associated with higher per pupil costs. Interestingly, the average size of the schools (AVSIZE) was unrelated to expenditure per pupil.

In the regression analysis, several interesting models are shown. In each case we are explaining expenditure per pupil. The parameter estimates and t values for the model 1 are shown in table 1. A different

TABLE 1

Parameter estimates and t values for model 1. (The dependent variable is average expenditure per pupil).

| Parameter | Coefficient Estimate | t for H_0 : Parameter=0 |
|-----------|----------------------|---------------------------|
| Intercept | 297 | .71 |
| P.T. | -9.03 | -2.03 |
| %MIN | 530. | 1.79 |
| EXP | 3.8 | .38 |
| EDLEV | 213.7 | 2.75 |
| ADM* | .0011 | .23 |
| #SCHOOLS* | 4.6 | 1.21 |
| %STATE | -4.32 | -3.50 |

*High correlation between ADM and #SCHOOLS. $R^2 = .653$.

measure of scale would be the average size of the districts's schools. This variable was also tried in the regression. ADM was dropped since ADM and #SCHOOLS approximate each other and ADM always enters the regression after #SCHOOLS (in this sample #SCHOOLS was statistically more important).

If economies of scale exist, the resultant residual plots may appear as some sort of U-shaped curve when one or more of the scale variables #SCHOOLS or ADM or average size of schools (AVSIZE) becomes the X-axis. In my analysis, the residual plots in each case for these 3 variables showed residuals scattered fairly evenly above and below the zero line. The inclusion of AVSIZE found that it has an insignificant coefficient and that the R^2 is virtually unchanged, as shown in model 2 (table 2).

In model 3 the variable STATESQ, equal

TABLE 2

Parameter estimates and t values for model 2.

| Parameter* | Estimate | T Value |
|------------|----------|---------|
| Intercept | 310. | .73 |
| P/T | -9.03 | -2.05 |
| %MIN | 545. | 1.84 |
| EXP | 2.78 | .27 |
| EDLEV | 211. | 2.77 |
| #SCHOOLS | 5.41 | 2.07 |
| AVSIZE | .01 | .49 |
| %STATE | -4.32 | -3.51 |

*No correlation between independent variables. $R^2 = .654$.

to %STATE squared, was added in an attempt to ascertain if a quadratic term was needed (table 3). Surprising results occurred. Adding STATESQ increased the significance of all of the variables, increased the R^2 to .800, and was highly significant itself. Surprisingly, the inclusion of estimates of median family income (school district, 1969 estimates) and average weekly wages (1976, county of classification of school district) did not alter previous conclusions significantly.

TABLE 3

Model 3, parameter estimates and t values for a model containing a quadratic term.

| Parameter | Estimate | T Value |
|-----------|----------|---------|
| Intercept | 885. | 2.75 |
| P/T | -17.7 | -2.98 |
| %MIN | 562. | 2.53 |
| EDLEV | 186. | 3.23 |
| #SCHOOLS | 3.76 | 1.93 |
| AVSIZE | .03 | 1.20 |
| %STATE | -1740. | -5.39 |
| STATESQ | 1557. | 4.56 |

In a simple multiple regression

$$S/P = 390 + 2.50 \text{ WAGES} + .0088 \text{ MFI}$$

$$t \text{ ratio } 2.12 \quad 2.33 \quad 1.04 \quad R^2 = .23$$

Wages and income were somewhat correlated ($r = .57$), but this did not affect the low magnitude of R^2 .

All residual plots became linear or at least the residuals appeared randomly spaced above and below the residual line in the context of larger models (table 4). The models present a fairly good estimator of expenditure per pupil in 50 Ohio school districts. The measured impact of each variable was close to what was expected.

TABLE 4

Coefficient estimates and t values for the two larger models, Models 4 & 5, of educational expenditure per pupil.

| Parameter | Coefficient Estimate | t for H ₀ : Parameter=0 | Parameter | Coefficient Estimate | t for H ₀ : Parameter=0 |
|-----------|----------------------|---------------------------------------|-----------|----------------------|---------------------------------------|
| Constant | 920. | 1.96 | Constant | 1084. | 2.77 |
| P/T | -26.4 | 3.44 | P/T | -19.6 | 2.98 |
| %MIN | 5.88 | 2.10 | %MIN | 560. | 2.40 |
| EDLEV | 168. | 2.18 | EDLEV | 170. | 2.66 |
| EXP | -3.9 | .38 | EXP | -1.1 | .13 |
| #SCHOOLS | 5.4 | 2.09 | #SCHOOLS | 4.5 | 2.12 |
| %STATE | -320 | 2.54 | %STATE | -1734 | 5.05 |
| WAGES | .42 | .48 | WAGES | -.66 | .91 |
| MFI | .0072 | 1.16 | MFI | .005 | .97 |
| AVSIZE | .024 | .84 | AVSIZE | .03 | 1.30 |
| | | | %STATESQ | 1541. | 4.32 |
| | R ² = .71 | | | R ² = .81 | |

DISCUSSION

The results indicated that communities with higher levels of education among the adults better support education. Wealth, measured by either median family income or wages, seemed to have little relationship to expenditure per pupil. The relationship between percentage state support and expenditure per pupil was U-shaped with the lowest and highest percentage state supported districts having higher expenditure per pupil and the middle levels of percentage state support having lower expenditure per pupil. It can be noted that no economies of scale seemed to exist.

In terms of the sample of 146 districts, three important variables emerged. We found that expenditure per pupil was related to median family income, state aid per pupil, and percent A.D.C.:—

$$\begin{aligned}
 \$/P &= 3656 + .108 \text{ MFI} - .98 \text{ ST AID}/ \\
 P &+ 1555 \% \text{ ADC} \quad R^2 = .54
 \end{aligned}$$

A dollar increase in MFI raised expenditures by about 11 cents (assumed to be an income effect), whereas a dollar increase in state aid per pupil decreased expenditures per pupil by about one dollar (these mixed effects give a suspicious result). The higher %ADC was associated with higher expenditure per pupil. No other factors measured were significant.

With respect to rural schools alone, DBECN units per 1000 students, %ADC and pupils transported were slightly associated with expenditure per pupil. Inter-

estingly, %ADC was negatively associated, indicating that in this sample, higher ADC went along with LOWER expenditure per pupil.

The suburb-satellite group showed statistical significance. We found that:

$$\begin{aligned}
 \$/P &= 1473 + .13 \text{ MFI} - 1.5 \text{ ST AID}/ \\
 P &- .08 \text{ SEC ADM} - 95 \text{ EXP} + 1744 \\
 &\% \text{ ADC}; R^2 = .67
 \end{aligned}$$

In this case, %ADC was less than borderline significance. We also found that more teacher experience was associated with lower expenditure per pupil and more secondary ADM was associated with lower expenditure per pupil. In this case, total ADM and secondary ADM were highly correlated; either variable could have been used in the regression. The coefficient of MFI and %ADC were expected and the magnitude of the state aid coefficient was unexpected large in absolute value.

For the urban and independent schools we found a new relationship. Teacher salary emerged as the single most important variable, although MFI was a close second.

Regressions which measured significant relationships are:

$$\begin{aligned}
 \$/P &= 908 + 27 \text{ EXP} - .45 \text{ ST AID}/ \\
 P &- .026 \text{ ADM} \quad R^2 = .50
 \end{aligned}$$

$$\begin{aligned}
 \$/P &= -312 + .12 \text{ TESAL} - .03 \text{ MFI} \\
 &+ .17 \text{ DENSITY} - 55 \text{ DBECN}/T \\
 &\quad R^2 = .56
 \end{aligned}$$

$$\begin{aligned}
 \$/P &= 353 + .03 \text{ MFI} + 27 \text{ EXP} - 1.5 \\
 &\text{ WAGES} - .21 \text{ ST AID}/P \quad R^2 = .56
 \end{aligned}$$

The larger schools had somewhat lower expenditures per pupil, and state aid, again,

measured a negative relationship with expenditure. The income effect was less strong, and the negative effect of state aid was less strong than previous groups showed.

In the city group, we found that %ADC, ADM, and WAGES were all strong factors. STATE AID PER PUPIL and DENSITY also entered the picture.

$$$/P = 1273 + 2022 \text{ \%ADC} - .003$$

$$\text{ADM} - .66 \text{ ST AID/P} \quad R^2 = .49$$

$$$/P = 493 + 1836 \text{ \%ADC} - .0001$$

$$\text{ADM} + 6.80 \text{ WAGES} - .23$$

$$\text{DENSITY} - .013 \text{ \#TRANSP} + 53$$

$$\text{EMR/T} \quad R^2 = .76$$

Again, ADM had a small negative effect and %ADM was positively associated with expenditure per pupil. The positive effects of WAGES (average weekly wages) measured extremely large relative to any other subgroup.

Only a few firm conclusions can be drawn from these results. Income, either median family income or average weekly wages, had a relatively strong positive association with expenditure for all groups. STATE AID/PUPIL was strongly negative for all groups. For all groups except rural, higher ADC was associated with higher expenditure per pupil. For all but the rural groups, there is some evidence that larger districts are associated with lower expenditure per pupil.

In one additional analysis, the dependent variable was changed so that it became expenditure per pupil EXCLUDING state funds per pupil. While a portion of expenditure may have resulted from federal funds, it can be considered a measure of local effort. The regression results derived from using the entire sample of 146 appear in Model 6 (table 5).

In terms of previous research where more or different socio-economic variables were explored, my results show a positive significant correlation between local effort (per capita) and per capita income, percentage of taxable land classified as industrial, median education level, and growth rate of the population. In addition, population size

TABLE 5

Model 6, coefficient estimates and *t* values for a model of sample size of 146.

| Parameter | Estimate | <i>t</i> for H_0 : Parameter=0 |
|-----------|-------------|-------------------------------------|
| Constant | 257 | — |
| ST AID/P | -2.01 | -11.8 |
| MFI | .112 | 10.8 |
| %ADC | 234 | 5.3 |
| SEC ADM | -.014 | -2.5 |
| | $R^2 = .69$ | — |

and ADM were of borderline significance with respect to positive correlation.

My results show a significant negative correlation between local effort per capita and percentage of the population classified as poor and unemployment rate (of the previous year). Percentage of taxable land classified as agricultural was of borderline significance. The implication is that wealthy (income-wise) and/or highly educated groups are more supportive of educations, and districts with more industry are more likely to generate more local funds. Faster growing communities have more local effort than slower growing or declining communities. Areas with higher concentrations of poor and/or with higher unemployment rates have lower local efforts. This can be viewed as a wealth effect. In terms of the multiple regression analysis, only per capita income, ADM (or population size), percentage of land classified as industrial, and population growth rate had significant (all positive) coefficients at the 95% level.

In most cases, the socio-economic variables shown do not present surprising results when compared with local effort. Since no attempt is likely to be made to equalize per capita income distributions or any of the other factors associated with population characteristics, only several alternatives exist. State and/or outside funding could equalize educational dollars, industrial land could be taxed by the state rather than the locality, or maximum expenditure (per pupil) could be mandated. Unfortunately, the probable result would be equalized, but not good educational efforts. Present state funding programs show very little evidence of reducing the per

pupil gap between the higher per pupil revenue districts and low per pupil revenue districts. That is, state aid, both basic and (to a lesser degree) categorical, do act somewhat to move total state/local revenues toward an equal distribution (total funds are "more equitable" than local revenue alone), but as shown by Gensemer (1978), the total distribution is still far from equitable distributed.

With respect to other questions, mixed evidence indicates that income, either wages or median family income, is somewhat associated with expenditure per pupil. Some evidence shows that larger districts are associated with lower cost per pupil, and other evidence indicates that more state aid per pupil goes to districts with lower expenditure per pupil. Some cost factors, such as percent ADC, are associated with higher expenditure per pupil. Very little else appears in terms of consistent results.

It is also noteworthy that state aid programs do somewhat equalize educational efforts but are far from achieving an equalized state and are not particularly moving in that direction as of 1977-78. Worth consideration is how an equalization program could be achieved without turning every district into a "below average" district

in terms of any measure of educational quality. The trick is somehow to raise the efforts in our less able or less willing districts without impairing the better efforts in the more able or more willing districts.

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