Additional Approaches to the Measurement of Equity in Illinois Public School Finance

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Background Information

The Center for the Study of Educational Finance at Illinois State University has engaged in monitoring the progress toward or away from equity in Illinois since the state finance reform in 1973. The two main areas of concern are (1) wealth neutrality, or to what extent are a district's expenditures a function of its wealth, and (2) permissible variance, or how far above or below some measure of central tendency is the expenditure level per district.

The question of wealth neutrality has traditionally been analyzed in Illinois with simple regression techniques, using wealth as the independent variable and revenue as the dependent variable. Permissible variance has been studied using a coefficient of variation, which is simply the standard deviation divided by the mean and multipled by 100.(1)

So far there have been three studies done each year. It was necessary to do separate analyses on each type of school district; unit, high school, and elementary. This is, of course, a logical approach because by law, students are weighted differently and tax rates vary.

Schminck, Halinski, Hickrod, and Hubbard did a "conditional" wealth neutrality study controlling for operating tax rate.(2) The breakdown was again by district type.

It was decided that it would be appropriate to have a single measure for the entire state rather than three separate measures. A preliminary study was done during the summer of 1980 to attempt to combine all three district types.(3)

One purpose of this paper is to further explore the possibility of combining districts for the study of wealth neutrality as well as permissible variance. There are obvious limitations to this concept for permissible variance because the present student weighting for high school students is probably inadequate. The cost of educating high school students may be higher than 1.25 times the cost of educating elementary students.

Johns and Mager have pointed out that expenditure level is a function not only of district wealth, but also of student need and geographic location.(4) In an attempt to further reduce the inequities involved and control for location, expenditure levels can be adjusted for cost of living factors.

An additional topic addressed by this paper will be the relationship between wealth and expenditures when expenditures are adjusted for cost of living. This question will be explored for each district type separately as well as for all districts combined. Coefficients of

variation as measures of permissible variance will be calculated using the adjusted figures as well.

The cost of living adjustment will be made on the expenditure variable using the McMahon-Melton cost of living indicators for Illinois.(5) The cost of living index was computed in 1977 and there are no more recent studies.

Research Questions and Methodologies

The specific research questions addressed in this study were:

1. While controlling for district type, how much of the variation in expenditures can be associated with property wealth?

2. While controlling for operating tax rate and district type, how much of the variation in expenditures can be associated with property wealth?

3. While controlling for district type, how does the single measure of permissible variance compare to the separate measures by district type?

4. How much of the variation in expenditures adjusted for cost of living can be associated with property wealth?

5. While controlling for district type, how much of the variation in expenditures adjusted for cost of living can be associated with property wealth?

6. While controlling for district type and operating tax rate, how much of the variation in expenditures adjusted for cost of living can be associated with property wealth?

7. After adjusting expenditures for cost of living, how do permissible variance measures compare with those measures using unadjusted expenditures?

For comparison with previous research done at the Center, the variables will be defined in a like manner. Wealth will be defined as assessed valuation (ASVL) of property in the district. Expenditures will be defined as estimated revenue obtained through the state aid formula and local tax levies. State and federal categorical aid will not be included. Average daily attendance will be weighted (TWADA) to include Title One weighted average daily attendance (REVTWADA) and assessed valuation per Title One weighted average daily attendance (ASVLTWA) will be used as the dependent and independent variables respectively. The controlling variables used will be operating tax rate (OTR) and district type (DISTYPE). DISTYPE will be used as a control for the purpose of gaining information concerning the state as a whole, rather than on three

separate district types. For the purpose of these analyses, district type will be broken down into two "dummy" variables defined as follows.

DISELEM = 1 if the district type is elementary
0 otherwise

DISHS = 1 if the district type is high school
0 otherwise

The excluded category will be unit districts.

Multiple regression techniques will be used to determine if the extent of variation increase when introducing the wealth variable is significant. Previous studies have shown that the variation increase when introducing those wealth variables is large enough to conclude that Illinois is moving away from the equity goals, at least since 1976. It has been alleged that adjusting the expenditure variable for cost of living will reverse that trend. This study will provide a test of that allegation.

Findings

School data for 1976-77 and 1977-78 were examined. All analyses compared all districts on the stated research questions. The district itself was the unit of analysis. Table 1 gives demographic data for Illinois school districts for the two years in question.

To answer the specific research questions posed earlier, we will review each question, the considered variables, and, if necessary, the corresponding regression model separately.

For ease in comparison with other school finance research from the Center, log 10 transformations will be made on the variables. Both beta weights and R^2 changes will be used in reporting results. For ease in interpretation, the larger the beta weight or R^2 change, the larger the existing relationship.

Research Question 1: While controlling for district type, how much of the variation in expenditures can be associated with property wealth?

where: Control Variable = district type (DISELEM, DISHS)

Wealth Variable = assessed valuation per Title One weighted pupil (ASVLTWA)

Expenditure Variable = revenue per Title One weighted pupil (REVTWADA)

Regression Model 1 REVTWADA = f(DISELEM, DISHS, ASVLTWA)

This technique basically assumes that the "one slope" associated with wealth across all districts is approximately the average of three slopes associated with the wealth variable in the three different types of districts. By using another regression model with interaction variables, it can be verified that the R^2 increase when the wealth variables are introduced differ by only .05 for 1976-77 and .04 for 1977-78 from the corresponding increase using Regression Model 1. There have been no standards to date to determine if this R^2 difference is significant. The technique of combining district types will be used and the assumption that one slope for wealth is adequate when combining districts will be accepted.

We need to determine the strength of the relationship between REVTWADA and ASVLTWA while allowing district type to account for some of the variability. Table 2 examines this relationship for all Illinois school districts for the years 1976-77 and 1977-78. The beta weights associated with the wealth variable for the two years in question are .470 and .561 respectively. The ideal situation would be that the beta weights, or "slopes," would be close to zero. Since this is not the case, we can conclude that Illinois school districts are no closer to wealth neutrality for the state as a whole than they are by district type. The reader is referred to Table 3, adapted from a Center publication, Equity Goals in Illinois School Finances: 1973-1979, for comparable statistics for each district type separately.(6) The corresponding R^2 increases associated with the wealth variables are .170 and .237 respectively. This basically shows that after the effects of district type have been partialed out, approximately 30 percent of the variation in expenditure can be associated with wealth. Illinois is still a considerable distance from equity using this definition, but we have found a single measure for that goal.

Research Question 2: While controlling for operating tax rate and district type, how much of the variation in expenditures can be associated with property wealth?

where: Control Variables = district type (DISELEM, DISHS)
operating tax rate (OTR)

Wealth Variable = assessed valuation per Title One weighted pupil (ASVLTWA)

Expenditure Variable = revenue per Title One weighted pupil (REVTWADA)

Regression Model 2 REVTWADA = f (DISELEM, DISHS, ASVLTWA)

Once again we are interested in the relationship between REVTWADA and ASVLTWA. The difference here is not only district type, but also operating tax rate is allowed to account for some of the variability. The assumption again has to be made that the one slope associated with wealth across districts is approximately the average of the three slopes associated with district types separately.

Table 4 gives the relationship between the variables in question. Beta weights of .633 in 1976-77 and .681 in 1977-78 show that the "conditional" wealth neutrality goal has not been achieved in either of the two years. The R^2 increases further verify this statement. For these two years, expenditure is very definitely a function of wealth. Once again, the technique of controlling for district type has produced a single measure of conditional wealth neutrality rather than three. Although the results are not encouraging in terms of equity, the single measure of that goal is a desired result.

Research Question 3: While controlling for district type, how does the single measure of permissible variance compare to the separate measures by district type?

where: Expenditure Variable = revenue per Title One weighted pupil (REVTWADA)

No regression techniques are needed to compute the measure of permissible variance across district types. All that is needed is the mean and standard deviation of the expenditure variable.

As was pointed out earlier, it is not really acceptable to put all districts together for the computation of one coefficient of variation simply because of the gross inequity in expenditures between what the student weighting in the formula accounts for and what really takes place. The coefficient will be computed for two reasons. First, we want to find a single measure of permissible variance for the state and second, we need a basis for comparison with the same measure for each district type separately. Table 5 presents both the separate and combined coefficients of variation for 1976-77 and 1977-78. As is readily visible from the table, the coefficient of variation for all districts combined is smaller than the highest single coefficient, but significantly above the average of the three.

Research Question 4: How much of the variation in expenditures adjusted for cost of living can be associated with property wealth?

where: Wealth Variable = assessed valuation per Title One weighted pupil (ASVLTWA)

Expenditure Variable = cost of living adjusted revenue per Title One weighted pupil (COSTREV)

Regression Model 3 COSTREV = f (ASVLTWA)

Separate regression equations will be formulated to accomodate the three types of districts. This will not only give a basis of comparison with the figures using unadjusted revenues, but also with the figure calculated when controlling for district type. The cost of living adjustments are made on the expenditure variable. A new revenue variable adjusted for cost of living factors (COSTREV) was found by dividing REVTWADA by the McMahon-Melton cost of living indicators for each district. Table 6 gives beta weights and R^2 increases associated with the wealth variable ASVLTWA.

A comparison with Table 3 shows that each of the individual type of districts are closer to wealth neutrality (smaller beta weights) using adjusted revenues than when using unadjusted revenues. This is true for both years in question. The differences in the beta weights are not sufficiently large to declare that a state of wealth neutrality has been reached for any of the districts. This would indicate, however, that adjusting revenue for a cost of living factor is a viable methodology in Illinois school finance research.

Research Question 5: While controlling for district type, how much of the variation in expenditures adjusted for cost of living can be associated with property wealth?

where: Control Variable = district type (DISELEM, DISHS)

Wealth Variable = assessed valuation per Title One weighted pupil (ASVLTWA)

Expenditure Variable = cost of living adjusted revenue per Title One weighted pupil (COSTREV)

Regression Model 4 COSTREV = f (DISELEM, DISHS, ASVLTWA)

A comparison should be made here with those same measures using unadjusted income. Table 7 gives the statistics associated with the wealth variable when revenues have been adjusted for cost of living. Table 2 gives the same statistics for unadjusted revenue. The cost of living adjustments move the state as a whole closer to wealth neutrality for the two years in question, but not by any significant amount. Subtraction shows the difference in beta weights to be only .043 in 1976-77 and .035 in 1977-78. The cost of living adjustments make only a small difference when considering the state as a whole. The corresponding R^2 difference is also negligible. The conclusion here again is that cost of living factors play a very small role in the wealth neutrality test.

Research Question 6: While controlling for district type and operating tax rate, how much of the variation in expenditures adjusted for cost of living can be associated with property wealth?

where:

Control Variables	= district type (DISELEM, DISHS) operating tax rate (OTR)
Wealth Variable	= assessed valuation per Title One weighted pupil (ASVLTWA)
Expenditure Variable	= cost of living adjusted revenue per Title One weighted pupil (COSTREV)
Regression Model 5 COSTREV	= f (DISELEM, DISHS, ORT, ASVLTWA)

Again, comparison with results reported earlier is in order. Table 8 gives conditional wealth results by district type. Table 9 gives beta weights and R^2 increases for the independent variables when COSTREV is used as the dependent variable. Beta weights for the wealth variable are .565 and .628 for 1976-77 and 1977-78 respectively. Comparison with Table 4, the same statistics using unadjusted revenue (REVTWADA), shows that again progress is made only in the fact that the beta weights are smaller for the adjusted figures. A difference of .068 in 1976-77 and .053 in 1977-78 can hardly suggest that "conditional" wealth neutrality is becoming a likelihood, much less a reality. The strength here again rests on the fact that we have combined all Illinois districts to obtain a single measure of conditional wealth neutrality for the state.

Although the results are not encouraging, the one measure can again be assumed to be valid if the assumptions mentioned above are accepted.

Research Question 7: After adjusting expenditures for cost of living, how do permissible variance measures compare with those measures using unadjusted expenditures?

where: Expenditure Variable = cost of living adjusted revenue per Title One weighted pupil (COSTREV)

Limitations to using one measure for the entire state have been discussed earlier. Table 10 gives the coefficients of variation for each type of district as well as all districts combined. As with the case of computing the coefficient with unadjusted revenues, the measure for combined districts is smaller than the highest single coefficient, but still above the average of the three for both years in question. A comparison with Table 5 (coefficient of variation using unadjusted revenues) shows that, in general, the coefficients are lower using the adjusted revenues. That is, there is less variance in expenditures when considering district type separately or combined when revenue is adjusted for cost of living factors. The one exception is with unit districts in 1977-78. This difference is not significant, and might be explained by the fact that Chicago is a unit district and cost of living factors cannot off set the tremendous weight Chicago carries when using the district as the unit of analysis.

Conclusions

1. The coefficient of variation and wealth neutrality measures reported for the state as a whole appear to be reasonable with the assumptions that have been made. The major discrepancy is in the permissible variance measure. If the weighting for high school students was raised from 1.25 to a more equitable figure, one which depicts the true level of expenditures, even this measure would be more acceptable. The assumption that the "one" slope associated with the state as a measure of wealth neutrality is the average of the three separate slopes is acceptable.

2. While the cost of living adjustments do not make a significant difference in any measure, the adjustment should be made. The adjustments do show that we are doing a better job in terms of equity than we thought. The adjustment gives a more "equalized" expenditure across the state. This is particularly important when considering the state as a whole rather than district type separately.

3. Income has traditionally been used by the Center as a second indicator of district wealth. Since the income data used have been obtained from the 1970 census, it would be useful to continue these

and other studies using the income data obtained from the 1980 census. Additional research should also go forward as the measurement of "poverty" in school districts and how "poverty" relates to measurement of "average wealth."

4. In order to truly study the effects of cost of living adjustments or combining district types on measures of wealth neutrality or permissible variance, it is necessary to use a longitudinal approach. This study should be repeated using data as early as 1972-73 and continued through to the present day. This would, of course, give a more accurate picture of the progress toward or away from equity through time.

5. Regardless of the type of fiscal equity measure used, it is clear that Illinois is moving away from the goal of wealth neutrality and that the variation in expenditure is not decreasing. The Center continues to examine the expenditure per pupil as a function of district wealth from several viewpoints. Conditional approaches controlling for operating tax rate, adjusting revenue for cost of living factors, using different measures of wealth, and combining district types are merely different ways of looking at the equity situation. The results yielded by these difference approaches are substantially the same; e.g., progress has not been made toward equity goals in Illinois in recent years, at least as far as we have been able to operationally define these goals.

It is necessary for the Illinois General Assembly to make a commitment to these equity goals and continue that commitment each and every year with appropriate legislation. If this is not done, then fiscal equity in Illinois will never be achieved.

References

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4. Johns, Thomas L. and Dexter A. Magers. "Measuring the Equity of State School Finance Programs." Journal of Education Finance, Spring, 1978, pp. 379-82.

5. McMahon, Walter W., and Carroll Melton. "A Cost of Living Index for Illinois Counties and School Districts." Perspectives on Illinois School Finance, November, 1977, p. 74.

6. Hickrod, Chaudhari, and Hubbard, Equity Goals in Illinois School Finance: 1973-1979.

TABLE 1

DEMOGRAPHIC DATA OF ILLINOIS SCHOOL DISTRICTS
FOR SCHOOL YEARS 1976-1977 AND 1977-1978

	Number of Districts			
School Year	Elementary	High School	Unit	Total
1976-1977	458	129	446	1033
1977-1978	458	128	448	1034

TABLE 2

RELATIONSHIP OF DISELEM, DISHS, AND ASVLTWA WITH REVTWADA
--LOG 10 TRANSFORMATIONS--ALL DISTRICTS

School Year	Statistic	DISELEM	DISHS	ASVLTWA
1976-1977	Beta	.010	.125	.470
	R^2 Increase	.109		.170
1977-1978	Beta	-.015	.105	.561
	R^2 Increase	.128		.237

TABLE 3

RELATIONSHIP OF ASVLTWA WITH REVTWADA
--LOG 10 TRANSFORMATIONS

School Year	Statistic*	Elementary	High School	Unit
1976-1977	Beta	.551	.538	.139
	R^2 Increase	.304	.289	.019
1977-1978	Beta	.631	.528	.259
	R^2 Increase	.399	.279	.067

*Statistics are associated with the wealth variable ASVLTWA

TABLE 4

RELATIONSHIP OF DISELEM, DISHS, OTR AND ASVLTWA WITH REVTWADA
--LOG 10 TRANSFORMATIONS

School Year	Statistic	DISELEM	DISHS	OTR	ASVLTWA
1976-1977	Beta	.539	.513	.840	.633
	R^2 Increase	.109		.192	.290
1977-1978	Beta	.483	.494	.775	.681
	R^2 Increase	.127		.159	.335

TABLE 5

COEFFICIENTS OF VARIATION
--REVTWADA IS THE EXPENDITURE VARIABLE

School Year	Elementary	High School	Unit	Combined
1976-1977	26.3736	18.5278	12.8929	22.0698
1977-1978	28.7523	17.6998	13.7218	23.8563

TABLE 6

RELATIONSHIP OF ASVLTWA WITH COSTREV
--LOG 10 TRANSFORMATIONS--
COST OF LIVING ADJUSTMENTS

School Year	Statistics*	Elementary	High School	Unit
1976-1977	Beta	.531	.470	.069
	R^2 Increase	.281	.221	.005
1977-1978	Beta	.617	.456	.193
	R^2 Increase	.380	.208	.037

*Statistics associated with the wealth variable ASVLTWA

TABLE 7

RELATIONSHIP OF DISELEM, DISHS AND ASVLTWA WITH COSTREV
--LOG 10 TRANSFORMATIONS--
COST OF LIVING ADJUSTMENTS

School Year	Statistic	DISELEM	DISHS	ASVLTWA
1976-1977	Beta	-.068	.117	.427
	R^2 Increase	.091		.140
	Beta	.094	-.087	.526
	R^2 Increase	.104		.209

TABLE 8

RELATIONSHIP OF OTR AND ASVLTWA WITH REVTWADA
--LOG 10 TRANSFORMATIONS

School Year	Statistic*	Elementary	High School	Unit
1976-1977	Beta	.542	.682	.377
	R^2 Increase	.436	.440	.130
1977-1978	Beta	.734	.667	.393
	R^2 Increase	.514	.422	.149

* Statistics are associated with the wealth variable ASVLTWA

TABLE 9

RELATIONSHIP OF DISELEM, DISHS, OTR AND ASVLTWA WITH COSTREV
--LOG 10 TRANSFORMATIONS--
COST OF LIVING ADJUSTMENTS

School Year	Statistic	DISELEM	DISHS	OTR	ASVLTWA
1976-1977	Beta	.380	.446	.712	.565
	R^2 Increase	.091		.133	.221
1977-1978	Beta	.334	.423	.656	.628
	R^2 Increase	.104		.108	.285

TABLE 10

COEFFICIENTS OF VARIATION
--COSTREV IN THE EXPENDITURE VARIABLE
--COST OF LIVING ADJUSTMENTS

School Year	Elementary	High School	Unit	Combined
1976-1977	24.2187	18.3203	12.7362	20.2855
1977-1978	27.1675	17.6523	13.8760	22.3626