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ABSTRACT

This paper develops models which link school district resources to qualifications and salaries of professional personnel. A basic model for determination of average salaries and educational qualifications is first constructed; then models which assume that salaries are a mechanism of school district competition for qualified personnel are considered. Some of the major findings are that larger and wealthier districts pay higher salaries and are able to attract personnel with more education. They also have larger proportions of personnel who have fully qualified certification. Larger districts, in addition, are more likely to have specialists and teachers with more local experience. Salaries are also affected by characteristics of the teaching force. Variations in educational and certificational composition directly affect average salaries. Education and certification also transmit indirect positive effects of size and wealth on salaries.

Educational qualifications are lowered slightly by experience, an effect probably caused by lack of turnover which prevents the hiring of younger personnel with degrees from four-year colleges. Experience indirectly increases education, however, by increasing the proportion of personnel with life certificates. The latter, besides transmitting the indirect effect of experience, also has a strong direct positive effect on the educational level, suggesting that personnel with life certificates may have acquired more education in order to qualify for permanent certification.

No effects of salary competition on the distribution of educational qualifications can be demonstrated. Problems in conceptualizing

competition and reasons for the absence of effects are discussed. Implications of the persistent effect of school district wealth on professional qualifications are also considered.

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The report on Equality of Educational Opportunity, known as the "Coleman Report," sparked considerable interest and controversy over the existence of so-called "school effects" in pupil achievement. One of Coleman's findings, which has been taken as evidence for the existence of at least some school effects, is that a link exists between certain characteristics of teachers and pupil achievement on verbal ability tests. (See Coleman, et al., 1966, pp. 316-325.) The most important of these characteristics, in terms of the amount of variance explained, were teachers' verbal skills and teachers' educational level. Coleman was later criticized by Bowles and Levin (1968, p. 10) for understating the importance of teacher characteristics and other school resources; since, as they argued, teachers' characteristics are linked to teachers' salaries, and teachers' salaries "dominate the instructional expenditures category."

This link between school resources, salaries, and teacher characteristics is unclear. The implicit but crucial assumption in Bowles and Levin's argument is that school resources affect teacher characteristics, and teacher characteristics affect pupil achievement. Using correlations from the Coleman data Bowles and Levin did a multiple regression analysis and conclude that "teachers' characteristics explain about three-quarters of the variance in teachers' salaries." They go on:

> The implication of this evidence is that higher expenditure on teachers salaries does indeed lead to higher achievement levels among students.

Note that their regression assumes that teacher characteristics affect salaries, whereas their conclusion assumes the reverse, that salaries affect teacher characteristics.

The confusion in causal assumptions may stem from the fact that both causal connections are plausible. Supply characteristics such as the experience and education of the teaching force will affect the average salary level of a school district; however demand characteristics including the size, wealth, and the salaries paid by a school district should also affect its ability to attract teachers with exceptional qualifications.[1] Salaries can be seen both as an outcome variable, affected by school district resources and teacher characteristics, and as a mechanism for the competitive attraction of more qualified teachers to districts with more resources, thus a way of perpetuating the advantages of already advantaged districts.[2] Each of these hypothesized connections will be discussed in detail, as we attempt to construct a model linking school district resources to teacher qualifications and salaries. We will first develop a basic model for the determination of average salaries and educational qualifications, then consider models which incorporate the assumption that salaries are a mechanism of school district competition for qualified teachers.

School District Size

School district size (that is, population) is, by itself, an important factor in attracting qualified teachers. Larger districts are more likely to provide opportunities for teachers to teach in the areas of specialization for which they are trained, and there are greater possibilities for developing collegial relationships with others doing similar work.[3] Furthermore, large districts tend to be located in larger communities; and larger communities are presumably more attractive to most teachers than

are isolated rural areas or small towns.

Larger districts also tend to pay higher salaries; and possibly, thereby, to attract more qualified teachers. One reason is that the cost of living is generally somewhat higher in larger communities, and salaries in general are therefore higher. Ideally, one would like to be able to adjust for differences in the cost of living in different school districts. The data I have available are collected from the population of Wisconsin high school districts which operated high schools in 1968; and I do not have a direct measure of cost of living differences for school districts. According to at least one study, done in New York state,

> Differences in the cost of living at the same standard do not vary much among localities, but local living standards vary widely. Localities with high living standards must pay higher salaries. (New York . . . , 1951, p. 35)

We cannot distinguish either cost of living or standard of living variation from other effects of size, such as the intrinsic attractiveness of larger communities. We can nevertheless distinguish between the hypothesis that larger districts have more qualified teachers because they pay better salaries, and the hypothesis that larger districts have more qualified teachers because of unalterable size-related factors. Such a distinction is useful for policy-related research, since variance in qualifications which must be directly attributed to district size is not readily accessible to policy manipulation.

There is reason to suspect that both salaries and qualifications may increase either nonlinearly or nonmonotonically at the upper end of the size range. The central city school districts of large urban areas are probably considered less attractive than either their suburbs or middle-

sized cities; and to the extent that school administrators take advantage of the reputation of their school district or their community as an attractive place to work, they should be able to pay lower salaries and attract more qualified teachers than their cost or standard of living would warrant. In other words, central cities may have to offer even higher salaries than their cost or standard of living would require, in order to compensate for their drawbacks in teaching environment, and in order to compete with their suburbs for qualified teachers. (Note that the relative importance of this presumed competition in determining salary levels should depend on the state of the labor market. At present there is an oversupply of teachers, which would lessen the need to use salary differentials to compete for qualified teachers. In 1968 this was probably more important than it is today. On the other hand, unions play a larger part in maintaining salary levels than they did in the past.[4] Without direct measures over time of the strength of unions, the intrinsic attractiveness of communities, or the supply of potential teachers, we can only note that such factors would modify over time the strength of the relationships in a model.) Thus the relative attractiveness of communities of different sizes ought to counter, to some extent, the effects of cost or standard of living differences in determining salaries. Besides allowing for nonlinearity, our preliminary models also include a dummy variable for Milwaukee suburbs on the assumption that their proximity to Milwaukee might make it easier for them to attract qualified teachers without paying the salaries that their size would lead us to expect. That is, <u>if</u> suburbs are more attractive to teachers, and if suburban school administrators take advantage of that fact, then suburban districts ought

to have slightly lower average salaries and more highly qualified teachers than their position in the size range would produce. Alternatively, suburbs may pay higher salaries because of their greater wealth and the greater willingness or ability of their population to support the costs of education.

School District Wealth

The wealth of school districts, which affects their ability to offer high salaries and to attract qualified teachers, is also confounded with size; that is, the two tend to vary directly. We can, however, include a measure of school district wealth in the models to separate the effects of size and wealth. It is more difficult to separate the effects of economic attractiveness (wealth) from the sources of intrinsic attractiveness discussed above. Wealthy communities can afford to pay higher salaries and can thereby attract more qualified teachers. One consequence of this, as Benson points out, is that

> the higher salaries reinforce other natural advantages to divert an undue proportion of highly qualified teachers to serve children of rich parents, children who enter school with environmental advantages toward learning. (Benson, 1968, p. 312)

Wealthy districts should also tend to be districts which are intrinsically more attractive to teachers, since they are likely to contain middle class families whose children are easy to teach and who will demand and can afford to maintain schools which are attractive to teach in.[5] While we would expect school district wealth to affect average salaries directly we should also expect it to affect teacher qualifications directly because of its presumed correlation with the intrinsic attractiveness of the school district, an unmeasured variable.

I have used the total amount of revenue per pupil to measure school district wealth.[6] A possible alternative indicator would have been the local property tax base per pupil. One problem with the tax base is that it is only one component of the total resources which a school district has available. Total revenue per pupil is a composite of revenues from a large number of different sources, of which property tax is the largest, but by no means the only important one. (For Wisconsin high school districts in 1968 the average proportion of revenue which came from current property taxes was .56.) For many districts, including some of those which have high revenues per pupil, state aid is a major source of revenue. In one sense these are poor districts, since state aid is designed to compensate for the absence of local property tax revenue. In terms of their ability to pay teachers, however, they are in an advantageous position relative to districts which have a larger local tax base per pupil but less total revenue. There are also a few districts which receive large amounts of revenue from such sources as taxes on public utilities located in their district; and these districts can afford luxuries (including high salaries) which less fortunately located districts cannot. Revenue per pupil reflects these advantages, whereas property tax base per pupil does not. For measuring the ability to pay for teachers, revenue per pupil thus seems the best available indicator.

One might also question the use of a ratio variable to measure ability to pay. If I were to use total revenue it would be virtually collinear with size. (The correlation is .997.) Furthermore, per pupil measures of revenue and expenditures have a long history of usage in the education literature, and they are treated as substantively meaningful by school

administrators as well as researchers, whereas gross measures such as total revenue are not.[7]

Teacher Characteristics

If we consider average salaries as an outcome variable, then the average salary in a school district can be thought of as being composed of a salary schedule which sets starting salaries and provides increments in salary for increments in experience and education, and a distribution of personnel having varying combinations of these characteristics. Differences in average salaries between districts are thus a function of differences in salary schedules as well as differences in the distribution of personnel through the categories of those schedules according to education and experience. These components cannot be separated, for I do not have the salary schedules for the different districts. Since we are interested in average salaries, however, we should note that composition of the teaching force must play a major part in their determination, whereas this would not be true for variables based on salary schedules alone.

If we consider variations in salary schedules between districts, then those variations should be explained by differences in wealth and size as well as other factors which affect the demand for available teachers. If we consider differences in the distribution of people through the salary schedule according to experience, credentials and education, however, such differences should be the result of structural and historical variables such as the age of the district, the amount of turnover in the district, school district consolidation, etc. In the absence of variables to directly measure these effects, variables which measure composition also

reflect these structural and historical changes, and the latter must be taken into account in interpretation.

Variables which measure demographic composition are based on data aggregated from measurements on individual teachers within districts. The aggregated data are used to characterize districts, and the variation we observe is that between districts. If these aggregated data were used to make inferences about the relationships among characteristics of individual teachers, I would be guilty of an aggregation bias; for the effects of variables on the individual level are, as I shall point out, different from those on the district level. Since I am interested in between-district relationships, I do not intend to use the coefficients to estimate individual level effects, so aggregation bias is not a problem. What is problematic is distinguishing conceptually and interpretively between within-district and between-district effects. It is easy to make the mistake of positing effects which only make sense on the individual level; or, what is more serious, of overlooking effects which make sense on the district level but not on the individual level.[8]

Professional Qualifications

To measure qualifications, we use the average number of years of education, which is a weighted average, over all professional personnel in a district, of the following classes:

Number of Personnel with:	Weights
Less than 2 years of college	1
2-Year Diploma	2
3-Year Diploma	3
Bachelor's Degree	4

Master's Degree	5
6-Year Specialist Degree	6
Doctor's Degree	7

Personnel coded as having "Other Degree or Education" were not included in the average. The weights given here were used as an approximation in the absence of information on which to base more accurate weights.

One problem with interpreting average years of education is that of historical effects, mentioned earlier. Over time the average number of years of education of teachers has increased. One reason for this is that the requirements for teaching credentials have changed. The two-year county colleges in Wisconsin have gradually been eliminated, the last one being closed in 1971. Until 1971, teachers graduating from a two-year county college received a Two Year Teaching License. On its expiration they received a 5-Year Term Certificate, thus giving them a total of 7 years in which to become fully qualified for permanent certification. The normal procedure for teachers with a Bachelor's degree who have completed an appropriate teacher education program is to be granted an Unlimited (Life) Certificate. (For details, see Certification Standards, Wisconsin Department of Public Instruction, 1972. Bulletin No. 1809.)

The average number of years of education has thus been affected by the phasing-out of the 2-year county colleges and the consequent change in teaching credentials available. The average education of the teaching force in a district will be affected by its composition of teachers with different credentials, who arrived at their positions via different combinations of education and experience. Those school districts with higher turnover (as indicated by fewer average years of experience) will

have a greater proportion of younger, more highly educated teachers, who received their education from a four year college. On the district level then, it makes sense to think of average education as a function of the composition in terms of experience and teaching credentials because, historically, the changes in the requirements for credentials combined with different rates of turnover have created varying distributions of education in different districts.

Notice that the between-district historical effects described here are contrary to those we would hypothesize on the individual level in the short run. For individuals it does not make sense to think of credentials or experience as preceding or "causing" education.[9] Education does not "cause" credentials or experience either, however. The Three Year License does not distinguish teachers with a Bachelor's degree from those with higher degrees, so having more than a Bachelor's degree cannot improve a teacher's credential; nor can education be hypothesized as having any effect on experience.

I had initially intended to use a measure of average teaching credentials as another measure of teaching qualifications; however the categories of certification do not conform to any unidimensional ranking. The only credentials currently given to fully qualified applicants are the Three Year License as an initial credential and the Unlimited (Life) Certificate as the subsequent credential. Other credentials are granted to teachers with course work deficiencies, teachers who do not meet minimum legal teaching requirements, and teachers who are teaching in positions outside those in which they are certified. (See Certification Standards, mentioned above.) I have used the proportions of teachers with Three Year Licenses

and Life Certificates as measures of the proportion of qualified teachers in a district. However, these variables are subject to the historical changes described earlier and to different rates of turnover. Districts with high rates of turnover (fewer average years of experience) should have a smaller proportion of teachers with Life Certificates and a higher proportion of teachers with Three Year Licenses.

The average number of years of experience in a district could be considered a measure of teacher qualifications, although considered as such, its meaning is at best ambiguous. While one could argue that teachers with some experience are probably better teachers than those with no experience at all, it is not at all obvious that teaching ability improves continually with experience. In fact, the alternative argument, that younger teachers are more enthusiastic, more receptive to innovations, and therefore better teachers has at least as much common sense merit. It is also relevant to consider how school administrators regard experience -- that is, whether they are willing to pay more to obtain more experienced teachers. Considering this question brings up the problem that most salary schedules contain increments for experience -- not because teachers are presumed to improve with experience, but because the principle of seniority, rather than merit, determines salary increments. Thus, within a given school district there ought to be a positive correlation between years of experience, and inter-district variation in average salaries will reflect salary schedule variation in the increments granted for experience as well as inter-district variation in the distribution of years of experience. Since increments granted for experience within the district may differ from those for experience outside the district, both

local and nonlocal experience are included separately in the models. It is unlikely that there is any competition for more experienced teachers between districts; and I have, therefore, not assumed any effect of salaries on experience. As Benson (1968) points out, hiring is largely confined to younger teachers. For one thing, mobility is more limited in older teachers, and the reasons for moving are usually not related to salary. In addition,

> The teacher who moves cannot ordinarily expect a promotion to a higher position or rank classification. He may not even be given full credit for his previous teaching experience. If a district does offer full credit, it must defend hiring -- at substantial cost -- the experienced teacher against a number of bright young candidates who are available at lower salaries. Also, the district may resist hiring older teachers because the refusing of tenure to those of inadequate caliber is more difficult in such instances than it is in the case of young teachers. (Benson, 1968, p. 303)

In a between-district model, the average number of years of local experience must also be considered a measure of turnover. Districts with high turnover (few average years of local experience) should, over a period of time, be able to hire younger, better educated teachers with credentials requiring a four-year education. In a between-district model which takes into consideration historical changes, turnover must be seen as antecedent to teacher composition with regard to credentials and education.

Another composition variable which may affect both salaries and educational qualifications is the presence of specialized personnel, including psychologists, social workers, psychometrists, and school nurses. School districts which have such specialists may have higher average salaries and higher average years of education. The presence of specialists is, in itself, a presumed educational advantage which only larger and

wealthier districts can afford. I have therefore included a dummy variable for the presence of any of the specialists mentioned above.[10]

The Effect of District Size

All of the variables used in the following models are derived from information supplied to the Wisconsin Department of Public Instruction for the 1967-68 school year. For the analysis of the effects of district size, all 390 high school districts which operated high schools in 1967-68 were included. The remaining models omit 24 districts for which some data were incomplete.

The variables included in the models are:

	Size (Average Daily Attendance)
X_A	ln Size (ln Average Daily Attendance)
X_B	Milwaukee suburbs (1 = yes; 0 = no)
X_C	Wealth (Total Revenue per Pupil)
X_D	Average Years Local Experience
X_E	Average Years Nonlocal Experience
X_F	Presence of Specialists (1 = yes; 0 = no)
X_G	Percent Three Year Licenses
X_H	Percent Permanent (Life) Certificates
X_I	Average Years Education Beyond High School
X_J	Average Salary

The means, standard deviations, and a correlation matrix for variables A through J, based on N = 366, follows the size analysis.

In order to construct adequate models of the determination of salaries and qualifications it is necessary to determine an appropriate

functional form for the effects of district size on the variables in the model. Each of the endogenous variables was originally treated as a function of a third degree polynomial in district size (average daily attendance) and regressed on the first three powers of size. As discussed earlier, we would expect both qualifications and salaries to increase with size -- qualifications because of the relative attractiveness of larger districts and the greater availability of qualified personnel; and salaries because of the higher cost and/or standard of living in larger cities. I allowed for nonmonotonicity in the absence of prior knowledge of an appropriate functional form and on the assumption that very small districts might have to pay higher salaries in order to attract teachers at all; and/or larger districts (but not necessarily the largest ones) might be able to attract qualified teachers without being obliged to pay the high salaries that their cost of living alone would warrant.

Indeed there does appear to be a slight decline in average salaries for districts in the size range of approximately 14,832 to 78,470. (See Table 1 for coefficients for average salaries, X_J, and Table 2 for points of inflection.) This range includes four districts -- Green Bay, Kenosha, Racine, and Madison. Salaries increase again after this range; but the only district larger than these is Milwaukee, with 110,232 students. Thus the third power merely distinguishes Milwaukee from the middle-sized cities of Wisconsin.

If the decline in average salaries in the middle sized cities were due to their relative ease in attracting qualified teachers without paying

TABLE 1

Unstandardized Coefficients for Size Models, Including Size, $Size^2$ and $Size^3$ (N = 390)

Dependent Variable	Constant	Coefficient of Size	Coefficient of $Size^2$	Coefficient of $Size^3$
X_D	6.3135	$.26600 \times 10^{-3}$	$-.11706 \times 10^{-7}$	$.8802 \times 10^{-13}$
X_E	5.3813	$-.10541 \times 10^{-3}$	$.12645 \times 10^{-8}$	$-.50201 \times 10^{-14}$
X_G	.25557	$.11603 \times 10^{-4}$	$.96817 \times 10^{-10}$	$-.18123 \times 10^{-14}$
X_H	.50912	$.31468 \times 10^{-4}$	$-.18749 \times 10^{-8}$	$.14593 \times 10^{-13}$
X_I	3.8237	$.8243 \times 10^{-4}$	$-.32299 \times 10^{-8}$	$.23033 \times 10^{-13}$
X_J	6462.6	.28331	$-.11356 \times 10^{-4}$	$.81142 \times 10^{-10}$

Note: X_F is omitted because it is a dummy variable.

TABLE 2

Points of Inflection for Equations in Table 1

Dependent Variable	df/dX = 0 when Size =		
X_D	13381.3	or	75280.4
X_E*	76856.1	or	91068.8
X_G*	-31702.4	or	67317.2
X_H	9430.1	or	76222.8
X_I	15247.2	or	78238.9
X_J	14831.8	or	78469.7

*Neither of the higher power terms is significant at the .05 level. For X_E the linear effect of size is also not significant (p = .085).

high salaries, then we should expect to find that qualifications are higher in these cities than in either the smaller districts or Milwaukee, even though salaries are somewhat lower. Instead we find that the distribution of educational qualifications (see coefficients for X_I, number of years of education, in Table 2) is very similar to that for salaries. The size range including the same four cities shows a slight decline in qualifications; which increase again for the size range including Milwaukee. The explanation for this decline in salaries does not seem to lie in the relative attractiveness of medium-sized districts or cities. Substantively this result is of interest for it implies that the only large urban district, Milwaukee, is not at a disadvantage relative to smaller cities, at least with regard to educational qualifications of its personnel. (Of course there may still be variation between schools within Milwaukee.) Other variables which reflect composition of the teaching force show similar relationships to district size, the only exceptions being X_G, the proportion of personnel with a Three Year License, which increases steadily but not linearly until Milwaukee, although neither of the higher order powers is significant; and X_E, the average number of years of nonlocal experience, for which none of the terms is significant. Neither the experience nor the credential variables are very strongly affected by district size.

An alternative explanation of the effect of size on most of these variables is that the apparent decline in the middle-sized cities is not actually a decline but a tapering off; that is, the effect of size is monotonic (with the exception of Milwaukee) but not linear. One reason why this might be true is that the range and variance of the composition

variables are all relatively small compared to the variance in district size; and once they increase to a certain point they cannot go on increasing linearly with size. The average number of years of education, for example, after reaching a Bachelor's degree, is unlikely to continue increasing linearly with size. Translated into a functional form, this implies that educational qualifications would be a semilog function of size.[11] If it is true that both qualifications and salaries increase at a decreasing rate as size increases, then ln size ought to explain more variance than the polynomial function of size used previously; and this is in fact the case for the variables most affected by size -- namely, salaries and education (see Table 3).

While the semilog function is not an improvement over the third power function of size for the experience and certification variables, it does have the technical advantage of avoiding collinearity and the large standard errors associated with it (the correlations between the powers of size are .923, .893, and .997). Use of the semilog function also means that Milwaukee's position will not be completely accounted for by size; however, Milwaukee will not have as strong an effect on the explained variance, since it will not be such an extreme point in the size range. Both substantively and technically the semilog relationship appears to be the best approximation for the effect of district size.

TABLE 3

Comparisons of Variance Explained by Polynomial Size Function and Semilog Size Function

Independent Variables	Dependent Variable					
	X_D	X_E	X_G	X_H	X_I	X_J
Size	.040	.028	.018	.005	.064	.074
Size, $Size^2$ and $Size^3$	.049	.039	.082	.076	.191	.263
ln Size	.024	.011	.039*	.053*	.205	.372

*Based on N = 366, rather than N = 390.

Basic Model

We turn now to a basic model for the determination of qualifications and salaries. This model treats log size, revenue per pupil and Milwaukee suburbs (a dummy variable) as exogenous variables, and the composition variables -- including both experience variables and both credential variables -- as intervening variables which affect average education and average salaries. Average education is also a determinant of salaries. See complete structural equations and correlation matrix which follow.

Equations for Model 1.

1. $X_D = p_{DA}X_A + p_{DB}X_B + p_{DC}X_C + p_{DT}X_T$

2. $X_E = p_{EA}X_A + p_{EB}X_B + p_{EC}X_C + p_{EU}X_U$

3. $X_F = p_{FA}X_A + p_{FB}X_B + p_{FC}X_C + p_{FV}X_V$

4. $X_G = p_{GA}X_A + p_{GB}X_B + p_{GC}X_C + p_{GD}X_D + p_{GE}X_E + p_{GW}X_W$

5. $X_H = p_{HA}X_A + p_{HB}X_B + p_{HC}X_C + p_{HD}X_D + p_{HE}X_E + p_{HX}X_X$

6. $X_I = p_{IA}X_A + p_{IB}X_B + p_{IC}X_C + p_{ID}X_D + p_{IE}X_E + p_{IF}X_F + p_{IG}X_G + p_{IH}X_H + p_{IY}X_Y$

7. $X_J = p_{JA}X_A + p_{JB}X_B + p_{JC}X_C + p_{JD}X_D + p_{JE}X_E + p_{JF}X_F + p_{JG}X_G + p_{JH}X_H + p_{JI}X_I + p_{JZ}X_Z$

The variables X_T, X_U, X_V, X_W, X_X, X_Y, and X_Z are "disturbances," which reflect unmeasured factors affecting each of the dependent variables. Each disturbance is presumed to be uncorrelated with the predetermined variables and with other variables in the equation to which it pertains. However, disturbances may be intercorrelated with one another if the dependent variables to which they pertain are assumed to be causally unrelated to one another. In this model the nonzero correlations of disturbances are r_{TU}, r_{WX}, r_{TV}, r_{UV}, r_{VW}, and r_{VX}.[12]

TABLE 4

Correlation Matrix for Models 1, 2 and 3

	X_A	X_B	X_C	X_D	X_E	X_F	X_G	X_H	X_I	X_J
X_A	1.00									
X_B	.281	1.00								
X_C	-.195	.213	1.00							
X_D	.178	-.033	-.102	1.00						
X_E	-.120	-.125	-.181	.073	1.00					
X_F	.575	.352	.059	.095	-.093	1.00				
X_G	.198	.191	.237	-.327	-.410	.171	1.00			
X_H	.231	.041	.062	.509	.213	.186	-.356	1.00		
X_I	.472	.238	.374	.123	-.192	.379	.275	.475	1.00	
X_J	.623	.365	.262	.241	-.099	.395	.117	.473	.658	1.00
$\bar{x}$	6.990	.0437	748.61	6.639	5.178	.2377	.2787	.5450	3.940	6861.1
S_x	.9432	.2045	133.78	1.783	1.436	.4257	.1295	.1436	.2546	722.66

Adequacy of the Model

Before making substantive interpretations of the coefficients in the model we should consider its technical adequacy. The basic regression model explains almost two-thirds of the variance in educational qualifications and salaries and just over one-third of the variance in the credentials variables and in the dummy variable for the presence of specialists.[13] Very little variance in the experience variables is explained, partly because of their position in the model and partly because these variables are probably affected most strongly by the history and location of the district, which we have not been able to measure directly. The experience variables themselves reflect, and to some extent control for, historical effects which have an impact on later variables in the model, and their effects are virtually independent of those of the exogenous variables. (Indirect effects discussed later show that hardly any of the effects of the exogenous variables travel through the experience variables.)

Since none of the intervening variables is presumed to have a causal relationship to any other, I have allowed their residuals to be intercorrelated. If the model's assumptions of no causal relationships among the intervening variables is correct, we would expect the correlations among the residuals to be approximately zero. With two exceptions, they are close to zero. The exceptions are the two experience variables whose residuals are correlated at .293. The other correlations are : $r_{TV} = .020$, $r_{UV} = .024$, $r_{VW} = .015$ and $r_{VX} = .050$. The correlation among the credentials variables is inevitable, given that both are proportions of the same larger unit. That is, there is some definitional dependency inherent in them. Their residual correlation which reflects this dependency would occur in

any model which included both of them. The other minor exception, the correlation between the experience variables, may be due to the unmeasured variables discussed earlier. In this respect the model is not completely adequate, for there are exogenous variables -- particularly district age -- whose inclusion might alter some of the coefficients in the model. For the time being this is a (hopefully) minor inadequacy which we shall have to live with, in the absence of direct measurements of these variables. It may be of interest to mention here that it is very difficult, if not impossible, to determine district age with any accuracy. Information kept by the Department of Public Instruction gives conflicting data about dates of consolidation. Dates of consolidation do not always correspond to data provided in high school district annual reports. The names of school districts have changed as districts consolidated, split up, and reconsolidated. It is impossible to determine even the geographical boundaries of districts as of 15 years ago, for maps kept by the Department of Public Instruction have been altered each year to conform to newly established boundaries. Prior to 1958, not all of the area in Wisconsin was even included in high school districts, and parents not living in districts operating high schools could send their children to any of a number of different high schools. The fact that there have been major changes in school district boundaries even within the last 15 years means that a district which goes by the same name as a district of 15 years ago may have very little else in common with it. For all practical purposes, the same districts did not exist 15 years ago. The annual report forms on which most of these data are based have also been altered substantially over the same period. This discussion suggests the need for better record-

keeping for research purposes; it also indicates the difficulty of obtaining systematic comparable historical information for organizations such as school districts. The past is not so readily accessible as one might suppose.

Interpreting the Basic Model

Looking at the first three variables in the model we can ask: What is the relative importance of district size and district wealth on average salaries? Is there any evidence for the use of natural advantages by Milwaukee suburbs to attract qualified teachers without paying high salaries? The first three rows of Table 5 show the standardized regression coefficients (the same as the path coefficients in the model) for the effects of log size, revenue per pupil, and Milwaukee suburbs on the remaining variables in the model.

Size is over twice as important as ability to pay in determining average ($p_{JA} = .542$), ($p_{JC} = .263$). Both of them have strong direct effects even when all of the composition variables are included in the model. The average education of professional personnel is also higher in wealthier districts; size and wealth have similarly strong positive effects on average education ($p_{ia} = .375$), ($p_{ic} = .337$).[14]

The coefficients for Milwaukee suburbs are not what would have been expected. Rather than being able to attract more highly qualified personnel with lower salaries, it seems that, as a group, the Milwaukee suburbs pay higher salaries but receive no benefits in qualifications. The analysis

TABLE 5

Standardized Regression (Path) Coefficients for Model 1

Dependent Variable	Independent Variables									
	X_A	X_B	X_C	X_D	X_E	X_F	X_G	X_H	X_I	R^2
X_D	.190**	-.076	-.049							.041
X_E	-.148**	-.041	-.201**							.059
X_F	.554**	.168**	.131**							.386
X_G	.246**	.031	.188**	-.328**	-.318**					.337
X_H	.219**	-.017	.200**	.472**	.238**					.353
X_I	.375**	-.026	.337**	-.088*	-.093*	.015	.241**	.516**		.620
X_J	.542**	.140**	.263**	.041	.002	-.100	-.032	.210**	.213**	.664

$r_{TU} = .082$ $r_{WX} = -.293$ $r_{TV} = .020$ $r_{UV} = .024$ $r_{VW} = .015$

$r_{VX} = .050$

Note: Coefficients marked with two asterisks are those for which $p < .01$.

Coefficients marked with one asterisk are those for which $p < .05$.

thus shows no evidence for intrinsic advantages of Milwaukee suburbs being used to compensate for lower salaries.

Larger districts have, on the average, more years of local experience but fewer years of nonlocal experience. A possible explanation is that the larger districts are less likely to have undergone consolidation recently and that some of the smaller districts, being recently created out of even smaller districts, cannot have teachers with very many years of local experience.

Wealth has no significant effect on local experience, but it has a negative effect on nonlocal experience, suggesting that wealthier districts do not make any attempt to recruit more experienced teachers away from other districts.

Larger and wealthier districts have a greater proportion of teachers with three year licenses and a greater proportion of teachers with life certificates. Since these credentials distinguish fully qualified teachers from those with less than full qualifications, we can conclude that larger and wealthier districts have more qualified teachers. They are also more likely to have specialized personnel on their teaching force. Size is particularly important in influencing the likelihood of having specialists, presumably because only the largest districts operate on a scale large enough to make specialists economically feasible. Milwaukee suburbs are also somewhat more likely to have specialists, regardless of their size. If specialists and highly educated teachers with adequate qualifications improve the quality of schools, then students in small, poor and nonsuburban districts are definitely disadvantaged by the location of their families.

Before we discuss the effects of composition variables on average salaries it is useful to look at the interrelations among the composition variables themselves. I have allowed both experience variables to affect credentials and education, assuming that the experience variables reflect turnover and seniority which brings tenure, thus affecting the ability of a school district to replace personnel and thereby to alter its composition. The model shows that one effect of high average years of experience is to increase the proportion of teachers with life certificates and to prevent the hiring of new teachers with three-year licenses. (p_{HD} = .472; p_{HE} = .238; p_{GD} = -.328; p_{GE} = -.318). The latter are personnel whose initial credentials are acquired by graduating from approved teacher-education programs in four-year colleges; lack of turnover thus indirectly affects the educational level of personnel. It also has slight negative direct effects on education, indicating that there is some tradeoff between experience and education independent of the effect built into changing credentials.

Whereas experience has a negative direct effect on education, the same is not true for the proportion of teachers with life certificates. Districts which have a high proportion of teachers with life certificates have substantially higher educational levels (p_{IH} = .516). This may be due to the fact that a life certificate requires a valid credential for a teacher's subject or grade or position; and teachers holding life certificates, as opposed to teachers holding temporary credentials, are more likely to have gone back to or continued in school in order to acquire certification in a particular subject, grade or position. A high proportion of teachers with life certificates seems to be a mixed

blessing to school districts. On the one hand, it reflects a highly qualified teaching force who are trained in their specialties; on the other hand, it indicates a teaching force with a high aggregate number of years of experience, in other words, low turnover and the inability to hire young teachers with new ideas (at substantially lower salaries).

These results have implications for average salaries. Composition effects on salaries can be divided into two categories: those which affect salaries by increasing average seniority, and those which affect salaries by improving educational qualifications. Looking first at direct effects we see that both the average educational level and the presence of a large proportion of teachers with life certificates have substantial positive effects on average salaries ($p_{JI} = .213$; $p_{JH} = .210$). Since these are net effects, the direct effect of life certificates must be attributed to seniority rather than education. Experience per se has no direct effect on salaries ($p_{JD} = .042$; $p_{JE} = .002$), which suggests that turnover or seniority only affects salaries by affecting the composition with regard to credentials and education. This does not mean it has no effect on salaries -- only that its effects are indirect. The fact that there is no interdistrict effect of experience on salaries indicates that salary schedule increments for experience within districts do not explain between-district variance in average salaries. The proportion of teachers with three year licenses also has no direct effect on salaries ($p_{JG} = -.032$), no doubt because the three year license is an initial credential; and districts which have a high proportion of teachers with three year licenses have salaries concentrated at the lower end of their salary scale.

It is surprising that the presence of specialists has a slight negative effect on average salaries. A possible explanation is that districts which must pay for their own specialists do so, to some extent, at the expense of higher salaries for other personnel; and that the net result is to lower average salaries.[15]

How important are the indirect effects in this model? Because of the way the model is constructed, variables which occur earlier in the model can have more indirect effects than those which occur later. The latter, on the other hand, can be the transmitters of more effects. Thus we cannot directly compare the overall relative importance of variables at different stages in the model since this is a consequence of our assumptions in constructing the model rather than an empirical discovery. If we look at particular intervening variables or mechanisms we can see which are the more important of the indirect effects and how they compare in magnitude to a variable's direct effects.

Size has a moderate indirect effect on salaries by increasing educational qualifications. (See Table 6.) Such an effect may be due to the attractiveness of larger districts, as distinct from the cost factor present in size. This effect is quite small compared to the direct effect of size (it is less than one-fifth the size of the direct effect). Wealth also has a moderate indirect effect on salaries -- an effect which also operates by improving qualifications. The presence of specialists has a similar indirect effect which counteracts its direct negative effect on salaries. If there is a tendency to pay lower salaries to ordinary teachers

TABLE 6

Indirect Effects on Average Salaries (X_J)

Predetermined Variables	Total Effect	Indirect Effects Via: X_D	X_E	X_F	X_G	X_H	X_I	Direct Effect
X_A	.635	.007	-.000	-.057	-.006	.049	.100	.542
X_B	.158	-.001	-.000	-.035	-.006	.009	.051	.140
X_C	.338	-.004	-.000	-.006	-.008	.013	.080	.263
X_D	.184				.010	.107	.026	.041
X_E	.019				.013	.045	-.041	.002
X_F	.013				-.006	.039	.080	-.100
X_G	.026						.058	-.032
X_H	.311						.101	.210
X_I	.213							.213

in districts where specialists are present (a "contextual" effect) the effect of this tendency on salaries is offset by the raising of the educational level which will increase salaries; a reminder of the mixed blessings of the division of labor.

A large proportion of teachers with life certificates has an indirect effect on salaries via educational qualifications -- an effect about half the size of its direct effect. Thus the total effect of a large proportion of life certificates is considerably stronger than its direct effect alone indicates. It is also a mechanism for the transmission of effects of lack of turnover (local experience) on salaries, since local experience increases the proportion of teachers with life certificates; and the latter increases salaries.

The indirect effects of other variables on educational qualifications are also of substantive interest. Since educational qualifications have been shown to affect (or to be a proxy for something which affects) pupil achievement it would be useful to find out whether, given the assumptions of this model, there are mechanisms by which they can be improved.

Table 7 shows the indirect effects of all prior variables in the model on educational qualifications. Several variables have strong effects via the proportion of personnel with life certificates. In particular, local experience has an indirect effect much stronger and in the opposite direction than its direct effect. To venture an interpretation: while lack of turnover depresses the educational level very slightly -- presumably by preventing the hiring of younger teachers, more of whom will

TABLE 7

Indirect Effects on Educational Qualifications (X_I)

Predetermined Variables	Total Effect	Indirect Effects Via: X_D	X_E	X_F	X_G	X_H	Direct Effect
X_A	.545	-.016	.011	.008	.048	.119	.375
X_B	.061	.003	.012	.005	.046	.021	-.026
X_C	.453	.009	.017	.001	.057	.032	.337
X_D	.095				-.079	.262	-.088
X_E	.082				-.099	.110	-.093
X_F	.152				.041	.096	.015
X_G	.241						.241
X_H	.516						.516

have gone to four-year colleges -- it also increases the likelihood that teachers will go back to school for more education in order to qualify for a permanent certificate in their specialty. Possibly a few years of teaching experience allows teachers the time to develop more specific ideas about their teaching career and to determine what further education would be useful for their area of specialization. If this is true, it suggests that a teacher's career is one in which continued education is built into the process of occupational advancement, at least until the acquisition of a permanent certificate. Insofar as teaching experience allows a teacher the time to acquire more education and possibly better ideas about what specialty to make a career in, it serves a useful purpose, both to the school district and to the individual teacher. Experience in a particular school district may also allow a teacher to suit his/her talents to the needs of that district by first finding out what those needs are and then acquiring the necessary further education to qualify for the desired position or subject. This also means that teaching experience, up to a point, is an indirect mechanism for maintaining the flexibility of school districts and for overcoming both time lags and imperfections in the information system in colleges and universities by which potential teachers choose their areas of specialization.

These results suggest a way that organizations faced by the problems of low turnover and tenure granted by seniority have of maintaining some adaptability to a changing environment -- namely, by retraining their employees and/or by providing opportunities and incentives (higher salaries) for employees to acquire further training on their own. To the extent that incentives for retraining are built into salary schedules,

the negative aspects of experience can be offset by its benefits in allowing school districts and teachers to adapt to one another's needs and abilities.[16]

Incentives for further education and/or retraining after a certain number of years of experience would also be a more enlightened way of dealing with the organizational problems created by changing knowledge than getting rid of older personnel and replacing them with younger cheaper ones. Since the latter is usually not a feasible alternative anyway because of unions, retraining is a possible alternative solution. It is of interest that in this respect schools are less old-fashioned and rigid than organizations which do not have such alternatives. Note that we do not assume that all or even many school districts do systematically encourage or provide incentives for further education, nor that the indirect effects of experience explain much variance. The fact that such a mechanism exists at all is what is important, for it allows us to see the existence of a structural feature which can be expanded and improved upon.

There are other indirect effects on qualifications which also operate via the proportion of personnel with life certificates. Larger districts have more people with permanent certificates and therefore more education; nonlocal experience has effects similar to local experience; and the presence of specialists also has sizeable indirect effects. Both local and nonlocal experience have negative indirect effects on the educational level via their effect on the percentage of personnel with three year licenses; that is, lack of turnover prevents the hiring of new teachers. As we have seen, however, these effects are compensated

for by their effects on the percentage of personnel with life certificates.

Summary

According to the basic regression model, we have found that larger and wealthier districts pay higher salaries and are able to attract personnel with more education (not necessarily because of their higher salaries). They also have larger proportions of personnel who have fully qualified certification. Larger districts, in addition, are more likely to have specialists and teachers with more local experience. Whether the latter is an advantage is ambiguous.

Salaries are also affected by characteristics of the teaching force. Variations in composition due to education and certification directly affect average salaries (the latter presumably through seniority). Education and certification also transmit indirect positive effects of size and wealth on salaries.

Educational qualifications are lowered slightly by experience, an effect probably caused by lack of turnover which prevents the hiring of younger personnel with degrees from four-year colleges. Experience indirectly increases education, however, by increasing the proportion of personnel with life certificates. The latter, besides transmitting the indirect effect of experience, also has a strong direct positive effect on the educational level suggesting that personnel with life certificates may have acquired more education in order to qualify for permanent certification. Thus the implications of a highly experienced labor force are mixed; it makes it more difficult to hire younger teachers with higher educational qualifications, but it also allows the existing teaching force to acquire more education in order to qualify for permanent certification.

The Effects of Salary Competition

We have not yet discussed the hypothesis that high average salaries result in part from salary competition among school districts for the most qualified teachers. According to Benson such competition does exist with regard to salary schedules, for

> [A] salary schedule is likely to be the only important variable, given the traditionally low expenditures on recruitment in education, that school authorities in a district can manipulate in the short run to increase drawing power during the annual hiring season. (Benson, 1968, p. 297)

I cannot test this hypothesis directly, for I have no independent measures of competition other than salaries themselves. We can ask, however, whether there is any evidence that high salaries have the effect of attracting more qualified teachers; that is, if salary competition does exist and is successful, then districts with high average salaries ought to be able to attract teachers with higher educational qualifications. Such a question has policy implications also. If salaries are relatively unimportant for attracting qualified teachers, by comparison to factors such as school district size, facilities (which are presumably a function of school district wealth) and location, then a policy designed to improve teacher qualifications in poor or remote districts by offering higher salaries is not likely to be successful; and resources would more profitably be allocated to alternative mechanisms for improving learning opportunities for students.

My analysis on this question can only be suggestive, rather than conclusive. For one thing, it is not clear that average salaries are the ideal dependent variable for addressing this question. If school districts compete, they may do so by offering higher starting salaries

to attract teachers first entering the job market.[17] If so, average salaries would only reflect the results of a policy of competition which had been established for some time. If some school districts have only recently raised starting salaries, then their competitive position would not be reflected in current average salaries.

There are other more serious problems in knowing or making assumptions about how competition operates and in conceptualizing that competition in models. One possibility is that school districts compete directly by offering higher salaries. This would suggest that salaries ought to have a direct effect on the qualifications of teachers. Another possibility is that competition between school districts brings about similarity in salaries, within the limitations set by other constraints on the districts -- constraints such as size, wealth, and location. If competition produces similarity, then the variation we find in teachers' salaries and qualifications will not be attributable to competition, but to the district characteristics which set constraints.[18]

These conceptualizations are quite different. In the first case we assume we can measure the success of competition directly by the effect of salaries on qualifications. If there is no effect we would conclude that competition does not exist or is unsuccessful and that school districts cannot use it as a means of attracting qualified teachers. Under the second assumption, we have no way of testing the effects of competition, since we presume that it results in similar salary schedules for districts with similar resources and constraints. If we find that salaries have no effects on teacher qualifications, this is not grounds for rejecting the hypothesis of competition, but confirmation of the fact

that competition has produced similarity.

A consequence of the second conceptualization is that the more that school districts try to compete economically with one another, the more similar their salaries will become, and the less will teachers be able to use salaries as the basis for making a decision. As long as districts continue to vary on other characteristics, these characteristics will become more and more important as salaries become more similar. If other school district characteristics become more similar as well (for example, through consolidation), then teachers' location decisions will be dictated completely by private or personal considerations, which from the standpoint of an economic model, will appear as random error. Any policy measures based on salary competition will have the opposite effect to that intended--they will result in making teachers' decisions less subject to economic rationality.

Another possibility, which Clark (1963, p. 1) suggests is that

> raising teachers' salaries 30 percent would attract more able people into teaching. These abler people in the long run might bring about a significant increase in the quality of education. Higher salaries in a few school districts might move able teachers into these school districts. These able teachers might well produce a higher quality of education in such schools. If all schools were to raise teachers' salaries, however, this might mean that more money was being spent for the same services.

This is another instance of the problem that at any given point in time the variations that exist between districts are the result both of historical developments which have led to a particular distribution and of current or recent policies which may also affect the distribution, either now or in the future. Economic competition is one instance where the long-run effects may be the opposite of those in the short run. Notice that Benson qualifies his remarks about salary competition by

adding "in the short run". With data from one point in time, short-run effects are confounded with the effects of historical changes, and an interpretation or policy based on short-run assumptions may lead to conclusions contradictory to those which take into account long-run developments.

Another minor problem should be mentioned. We have assumed, if only tentatively, that school districts do compete for qualified applicants by offering higher salaries. As Benson points out,

> this is not an immediately obvious point. The location of a district, its reputation for excellence in program, and its working conditions might appear to account for more than salary in determining its strength in recruitment. In our decentralized school system, however, there normally are a number of districts in a given area competing for the services of qualified applicants. Several of them may seem similar with regard to quality of program and working conditions. How is the applicant to judge among them?. . . Because salary schedules are published, salaries are highly visible. Many applicants use the salary schedules as the clearest guide to discriminating among the similarly placed systems that bid for their services.

If what Benson says is true, it suggests that salary competition exists in some geographical areas where applicants have the possibility of choice between more than one district. It also presumes that applicants first choose a particular geographical area, then choose between districts within that area. This would mean that the effect of salaries as a mechanism for competing for better qualified teachers ought to differ in different areas, and that geographical area would act as a covariate for the relationship between salaries and qualifications.

I have not treated area or regions within the state as covariates. The main reason for this decision is that in the absence of administratively defined geographical areas within the state, any division of the state

into geographical regions for the sake of testing a covariance hypothesis would be somewhat arbitrary since we have no prior knowledge about whether or the extent to which potential teachers do choose one geographical region over another before making a choice between districts within an area. Another minor problem is that if salary competition only exists in certain areas, then this competition probably crosses state boundaries. If so, then the slope of the relationship between qualifications and salaries within a region of one state would be affected by districts not included in the sample at all. Lacking information about specific competition in different areas, it seems more useful to treat the state as a whole as a unit and to treat the slopes we observe as averages for the entire state.

Note that this creates a further ambiguity in interpretation. If we find no effect of salaries on education, it could either mean that school districts do not attempt to compete through salaries; that they do compete but unsuccessfully; that school districts do compete, and over time this competition produces similarity between districts of similar size and location; or that we observe no effects because competition only occurs in a few areas of the state and would be lost in a state-wide model.

Models Embodying Competition

If we allow average salaries to have an effect on educational qualifications, as our hypothesis about competition requires, we face a problem of under-identification, given all the causal paths in our original model. Both qualifications and salaries would require nine

coefficients to be estimated, and there are only eight predetermined variables in the model. (Note that education is no longer a predetermined variable for salaries; it is now a simultaneously endogenous variable.)[19] In order to achieve identification I have constructed models under different assumptions; that is, under assumptions about different causal paths in the models being zero. These assumptions are based on two different strategies. The first one (used in Model 2) is based on information gained from the regression model. Model 2 involves minimal substantive assumptions other than the ones required in the original model; the assumptions being that the presence of specialists has no direct effect on educational qualifications (in the regression model $p_{IF} = .0147$); and that the proportion of personnel with three-year licenses has no direct effect on salaries (p_{JG} in the regression model = -.0319). (It is possible that the proportion of three-year licenses has two contradictory effects which cancel one another -- a positive effect because of its reflecting a small proportion of personnel with temporary credentials who might receive lower salaries; and a negative effect because of its reflection of recent hiring of people who would be at the lower end of the salary range.) This model is just identified, since there are eight coefficients to estimate and eight predetermined variables. It can be estimated by indirect least-squares regression.

The alternative model is based on substantive assumptions which do not rely entirely on the regression results. The assumptions are that neither of the credentials variables has a direct effect on salaries, and neither of the experience variables has a direct effect on education. With regard to salaries, recall my earlier discussion of composition

effects. I noted that theoretically there are two distinct types of effects -- those which increase salaries by increasing average seniority or experience, and those which increase salaries by improving qualifications. Let us assume that average years of education is an unambiguous measure of qualifications, whereas the proportion of life certificates reflects both higher educational levels and more years of teaching experience. If this assumption is correct, we would expect to find that the direct effects of life certificates on salaries can be subsumed by experience and education, and that the percentage of life certificates is redundant, with regard to salaries. Furthermore, since salary schedules typically do not contain increments for credentials, there should be no direct effect of the credentials variables on salaries.

The assumption of no direct effect of experience on education stems from my interpretation of experience as reflecting turnover. High turnover allows the hiring of young teachers who acquired their teaching credentials by graduating from an accredited four year college. It is the changing requirements for credentials that are directly responsible for the increasing educational qualifications; and turnover -- according to this assumption -- changes the educational level by affecting the composition with regard to credentials. Lack of turnover (high average years of experience) prevents the hiring of teachers with three-year licenses and increases the likelihood of teachers' acquiring permanent certificates. Both of these variables in turn affect the educational level for reasons previously discussed. If this assumption is correct, the direct effect of experience on education can be subsumed by its indirect effect via credentials. This model (Model 3) is over-identified

and can be estimated by two-stage least-squares regression.

The path coefficients for both models are presented in Table 8. Neither of the models is completely satisfactory and the interpretations they permit are quite different. If we compare the salary equations, we see that Model 2, which includes X_H -- the proportion of personnel with life certificates -- shows a negligible effect for education; whereas Model 3, which excludes both credentials variables, shows a very strong effect for education. In Model 3, furthermore, the effects of size and wealth become considerably weaker than they are in the regression model or in Model 2. Life certificates and education do appear to be redundant (another equation for salaries which omits only the proportion with life certificates yields very similar results); however, the model with life certificates (Model 2) explains somewhat more variance. We can either conclude that experience and education directly affect average salaries; or that the presence of a large proportion of personnel with life certificates (who also have more education and more experience) directly affects salaries.

If we look at the education equations, it is also difficult to decide which is better. Their coefficients are, for the most part, quite similar; however, in Model 2 the coefficients are statistically significant, whereas in Model 3 their large standard errors prevent them from being significant. Model 3, on the other hand, explains very slightly more variance in education than Model 2. The most important point in terms of our hypothesis is that neither equation for education shows a signif-

TABLE 8

Path Coefficients for Model 2 and Model 3

Independent Variables	Model 2		Model 3	
	Education X_I	Salaries X_J	Education X_I	Salaries X_J
X_A	.470	.592**	.387	.384**
X_B	-.005	.137**	-.019	.146**
X_C	.388**	.307**	.360	.125*
X_D	-.085*	.030	---	.124**
X_E	-.095*	-.010	---	.079*
X_F	---	-.098*	.012	-.105*
X_G	.244**	---	.285**	---
X_H	.565**	.279**	.471	---
X_I	---	.080	---	.572**
X_J	-.152	---	-.018	---
R^2	.588	.657	.606	.604
p_{IY}	.642	---	.627	---
p_{JZ}	---	.586	---	.630
r_{YZ}	---	.270	---	-.318

Note: Coefficients marked with two asterisks are those for which $p < .01$.

Coefficients marked with one asterisk are those for which $p < .05$.

icant effect for salaries, and the effects that do exist are negative. The data thus fail to support the hypothesis of salary competition. This could be due to any of the problems we discussed earlier, or to possible inadequacies in the models. Notice that in both models there is a substantial residual correlation between salaries and education. In Model 2 this correlation is positive; in Model 3 it is negative. Given the absence of direct effects of the endogenous variables in Model 2, a positive residual correlation makes sense; perhaps if we were able to find better instrumental variables or to make other assumptions to achieve identification, this correlation might be eliminated, and the paths of one or both of the endogenous variables would increase. The negative residual correlation in Model 3 is not readily meaningful and may be a reason for eliminating this model from further consideration. There are also other features of Model 3 which make it less than completely satisfactory. Being over-identified, Model 3 contains four nonzero correlations of predetermined variables with residuals. These correlations are:

$$r_{GZ} = -.133 \qquad r_{DY} = -.084$$

$$r_{HZ} = .062 \qquad r_{EY} = -.107$$

None of these is enormous, but some of them are sizeable, and they indicate that our assumptions of the absence of direct effects of these variables are not completely justifiable. Given these defects in the model, it does not seem worthwhile to elaborate its details further unless we are very strongly committed -- on a priori grounds -- to the assumption of a direct effect for education on salaries. In that case the choice between models must be based on criteria other than those provided by the model itself.

If we are willing to abandon the competition hypothesis, then the original regression model is the best model empirically. It explains more variance than either of the others and most of its coefficients are statistically significant. The competition models are useful, however, for they contain a structural mechanism for improving the qualifications of the teaching force. The fact that this mechanism is not successful or is not used (or is too successful in the sense described earlier) is itself of substantive interest; and the existence of a coefficient which measures the existence and/or success of salary competition permits comparisons to educational systems in which such mechanisms do exist as well as assessment of changes in one system over time.

Conclusions

Although the models presented here show no direct effects of salary competition on educational qualifications, this does not mean that school districts have no differentially allocated resources with which to compete for qualified teachers. All of the models presented here show a substantial direct effect of revenue per pupil on educational qualifications -- an effect which does not change much from model to model (p_{IC} = .337 in Model 1; .388 in Model 2; and .360 in Model 3). Thus schools with more revenue per pupil have teachers with more education. Revenue per pupil is obviously a variable which can be subjected to policy manipulation. (If the basic regression model is an adequate representation of the effect of revenue per pupil on educational qualifications, then an increase of $100 per pupil, net of other variables, would raise the average educa-

tional level by .064 years, assuming that the allocation policies of school districts were to remain unchanged with additional revenues. See Appendix A for unstandardized coefficients for the three models.) Furthermore, the fact that revenue per pupil does affect the educational level of teachers indicates that returns to governmental spending for education have not been exhausted, provided we accept the relationship at face value, and provided we have confidence in the relationship between the education of teachers and pupil achievement.[20]

The caveats that must be mentioned in this discussion point out how little we actually know about the process by which increases in revenue bring about improvements in educational qualifications of the teaching force. The preceding analysis shows that the effect is not simply one of raising average salaries. It could be that high revenue districts have better facilities or programs and thereby attract more qualified teachers; alternatively, it may be that high revenue districts are districts with wealthier or more educated families, in which teachers find it more attractive to teach. The latter explanation would mean that changing the distribution of revenue per pupil would not necessarily change the distribution of educational qualifications. The limited evidence I have available suggests that the effect of revenue per pupil is altered only very slightly when we control for socioeconomic characteristics of the population. Using data from a survey of high school seniors in Wisconsin in 1968, and aggregated for high school districts, I found that when variables measuring father's mean educational level and the percentage of fathers who are executives are introduced into the education equation, father's education has a positive effect on the

educational level ($b^* = .175$), the percentage of executive fathers has no effect ($b^* = -.017$), and the effect of revenue per pupil becomes .307 (unstandardized $b = .00058$). I do not wish to rely very heavily on these background variables, since I do not have a great deal of confidence in the data on which they are based. They do suggest that the effect of revenue per pupil cannot be dismissed as a spurious correlation with population characteristics.

Another possible explanation for the effect of revenue per pupil is that additional revenue is itself an incentive to administrators to improve the quality of their educational system and to attract qualified teachers thereby; so that additional increments in revenue will have educationally beneficial consequences that go beyond the mere purchasing power of the revenue. Such an hypothesis is admittedly speculative (as are the others mentioned here), but it should not be overlooked. It is certainly a plausible alternative to the assumption that additional revenue, if obtained from increases in state aid, will cause districts to become "fiscally irresponsible;" that is, to spend frivolously without regard to the benefits received for additional expenditures.[21] These and the other hypotheses discussed here require research in order to determine the means by which wealthier school districts are able to attract more qualified teachers, as well as the effects of different revenue sources and different concrete uses of revenue on the improvement of educational quality.

APPENDIX A

	Unstandardized Coefficients			
	Model 2		Model 3	
	Education X_I	Salaries X_J	Education X_I	Salaries X_J
Constant	2.361	755.2	2.127	-2615.
X_A	.1267	453.2	.1044	294.2
X_B	-.0067	484.4	-.0237	515.2
X_C	.00074	1.660	.00068	.6733
X_D	-.0121	12.05	---	50.18
X_E	-.0169	-5.273	---	39.62
X_F	---	-165.8	.0070	-179.0
X_G	.4791	---	.5600	---
X_H	1.001	1402.	.8352	---
X_I	---	227.6	---	1624.
X_J	-.00005	---	-.000006	---

Unstandardized Regression Coefficients for Model 1

Dependent Variable	Independent Variables									
	X_A	X_B	X_C	X_D	X_E	X_F	X_G	X_H	X_I	Constant
X_D	.3596	-.6647	-.0006							4.640
X_E	-.2249	-.2860	-.0022							8.381
X_F	.2500	.3498	.0004							-1.838
X_G	.0338	.0197	.0002	-.0238	-.0287					.2126
X_H	.0334	-.0122	.0002	.0380	.0238					-.2245
X_I	.1011	-.0323	.00064	-.0126	-.0164	.0088	.4733	.9143		2.292
X_J	415.2	496.5	1.419	16.79	.9009	-169.1	-177.9	1058.	603.5	-106.3

NOTES

[1]As salary schedules are presently constituted, it is impossible for the most important teacher characteristic studied by Coleman -- verbal skills -- to be directly affected by school resources such as salaries. Salary schedules typically offer increments only for additional experience or education, so there is no way to reward teachers for exceptional verbal skills. Thus Bowles and Levin's argument applies directly only to educational qualifications. Various students of education have criticized the current system of automatic salary schedules linked only to education and experience. See Benson (1968, Chapter 10) and Wasserman (1963, pp. 36-38) for discussions of this problem.

[2]Cohn (1972, p. 311), who does a multiple regression analysis of median teachers' salaries in Iowa school districts, mentions that "a more meaningful analysis would involve estimation by a simultaneous-equation model." In his models, which include location variables, population composition variables, and only one supply variable (college hours per high school teaching assignment), the only statistically significant variables are district size (average daily attendance) and college hours. However, these models are based on the 81 Iowa school districts for which he had complete data, and the small sample size may have prevented the results from being statistically significant.

[3]Hooker and Mueller (1970, pp. 65ff) summarize a number of studies showing the relationship of school district size to program offerings and educational advantages.

[4]Benson (1959, p. 58) mentions teachers' organizations as a major impetus for salary change.

[5]It is also possible that, over time, the presence of exceptional teachers in a district is a factor in attracting those parents who are most able and/or willing to support expenditures for education. Unfortunately I do not have the data to test this feedback hypothesis.

[6]A recent sociological study of school organization and achievement uses the same indicator of school district resources. See Bidwell and Kasarda (1975, p. 59). One problem with this measure is that, over time, revenue per pupil must be considered to be a function of prior expenditures, and variations in expenditures per pupil reflect variations in costs as well as variations in wealth and variations in relatively fixed parameters such as the pupil/teacher ratio. The latter is itself a function of both wealth (which enables a school district to lower the pupil/teacher ratio) and costs (the more expensive it is to hire a teacher, the higher the pupil/teacher ratio will be). Since expenditures are composed very largely of salaries, over time revenue per pupil is also a function of salaries as well as a determinant of them in the short run; and salaries can be seen as a function of either costs or wealth or both. At one point in time, however, revenue per pupil is still a direct measure of resources and therefore the ability to pay salaries.

The problem of separating cost variation from wealth variation is a

version of a problem which pervades the educational finance literature -- the separation of cost from quality in expenditures. It has been variously handled -- sometimes by decomposition of expenditures, which requires prior assumptions that some expenditures reflect costs and others quality. See Mort, Reusser, and Polley (1960, pp. 79ff). Sometimes it is handled by direct assumptions that expenditures reflect one or the other. Morgan et al. (1962, pp. 301ff) use per pupil school expenditures as an indicator of benefits, for example. Coons et al. (1970, pp. 25-33) also argue that expenditures can be used as a direct measure of school quality. When discussing the problems of small school districts, on the other hand, expenditure variations are often interpreted as cost variations due to small scale and high per unit operating costs. Coons et al. (1970, p. 83) mention that apparently wealthy districts in Nevada may actually be small districts with problems of scale. Wasserman (1963) advocates the development of price indexes in education to separate out price changes from changes in quantity or quality; but at present publicly available education finance data do not permit the separation of these components. Levin (1970, p. 186) mentions this problem also.

[7]Freeman and Kronefeld (1973) raise the issue that in the relationship between size and a ratio variable based on size the magnitude and sign of the relationship may depend heavily on the variances of the components. This does not introduce errors in estimation unless the measured variables are not the ones of theoretical or substantive interest. See Schussler (1973) for discussion of this problem. In the present case the variables measured are the ones of interest, so there should be no problem in using them.

[8]I could separate the between- and within-district effects if we had included a dummy variable for every school district along with terms for co-variance effects. However, the problem of how an individual's characteristics affects her/his salary in each district is not the problem we are pursuing. In fact, the answer to that problem can be found in differences between salary schedules, since the latter generally determine salaries completely, once experience and education are known. Including dummy variables for each district would have allowed me to separate the effects of salary schedule alone from composition, at the price of making interpretation impossible. (I would have had to use 366 dummy variables for different intercepts as well as product terms for each independent variable and each district in order to allow the slopes of each variable to differ in different districts.) Such a procedure would also have told us nothing about the crucial features of different salary schedules which make their consequences differ, other than the fact that they are located in different districts.

[9]This is not a matter of aggregation bias. It is not merely that the sign of the effects is different, but that the causal or temporal direction is different.

[10]I tried originally to develop a Guttman scale for the extent of specialization; however, the categories of personnel were not found to be scaleable.

[11]Note that for the semilog function, Y = ln X, the elasticity is beta/Y; that is, the percentage change in Y for a percentage change in X is a declining function of Y.

[12]For assumptions of path analysis of fully recursive models, see Duncan (1966). A path diagram was not included here because there seemed to be no way to draw one which would clarify, rather than obfuscate, all the causal paths involved.

[13]Using a dichotomous variable as a dependent variable has the problem that the disturbance is heteroscedastic. See Goldberger (1964, pp. 248-251). Since I am primarily interested in specialists as an independent variable, rather than a dependent variable, I have not tried alternative models (e.g. probit analysis) which avoid the problem of heteroscedasticity but which would be much more complicated to work with in this case.

[14]Using a somewhat different variable to measure qualifications -- the percent of certificated staff who held at least the Master's degree -- Bidwell and Kasarda (1975) found that size and wealth had approximately equal effects on qualifications, a finding similar to mine. Although their data are based on a sample of 104 Colorado school districts, and they include other organizational and environmental variables in their equations, their regression coefficients for the effects of log size and wealth (.307 and .293, respectively) are also quite similar to mine.

[15]This explanation is highly speculative; if it is true, it suggests a possible economy of scale of which large districts can take advantage. If hiring specialists for certain tasks allows a district to take advantage of a cheaper labor force for other tasks, then the extra expenditure for specialists is an economical move. Robinson (1958, pp. 15-16) describes this advantage of the division of labor. He quotes Henry Ford who used it to advantage.

[16]To the extent that continued education is built into the teaching career, teaching would be an exception to the usual assumptions of mobility models in which education is assumed to precede and to terminate before first job.

[17]Benson (1959, p. 59) suggests that if school districts compete in recruitment then they are most likely to do so by competing over starting salaries.

[18]Hawley (1950, p. 202), in discussing competition, points out that "A second stage is one of increasing homogeneity among the competitors. The singularity of the supply and the given character of environmental factors impose standard conditions of competition which call forth more or less uniform responses from all units engaged in the relationship." It would seem that, if true, this argument would apply to school districts as well as other forms of human organization.

[19]See Duncan, Haller, and Portes (1968) and Duncan (1970) for solution routines for models similar to the ones examined in this section and for the computation of residual paths and correlations among residuals.

[20]This result provides support for some of the justifications put forth by Coons, Clune and Sugarman (1970, pp. 1-33) on behalf of redistribution to equalize financial resources of school districts, insofar as increasing the revenue of poor districts would enable them to attract better qualified teachers (but not necessarily by offering higher salaries). However, they want to treat money as an indicator of quality -- that is, to take for granted the relationship between more money and better quality, whereas it is precisely the strength of this relationship which we are trying to ascertain. (Note that both they and we are leaving aside the issue of educational outcomes; our results only pertain to what Coons et al. refer to as "objective" measures of school quality.)

[21]This possibility is raised by Benson (1961, pp. 230-231) in regard to increases in the proportion of total revenue which is derived from state aid. The same arguments would apply, however, to additional quantities of revenue as well as to proportions of total revenue. Coons et al. (1970, p. 211) bring up this argument and dismiss it, saying "Benson maintains that if more than 75% of the funds issue from the state, compensating central budgetary controls are required. This is admittedly a guess on his part; we guess the opposite, preferring to raise a presumption of equal responsibility from equal effort." No one, so far as I know, has seriously studied the role of state aid (either quantities or proportions) in affecting the behavior of school district administrators, so that all of these hypotheses remain on the level of guesswork.

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