Teacher Location Choice and the Distribution of Quality: Evidence from New York City*

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Abstract

This paper studies the distribution of teacher quality measures across the New York City school system. Both school-based and neighborhood-based effects are measured; and both types of variables significantly affect the distribution of teacher quality. Schools that are more likely to be in need of higher quality teachers are, in fact, less likely to have them. Further, this paper finds that the location of the school in relation to the suburban borders is an important determinant of the distribution of teacher quality.

Keywords: Teacher Quality, Teacher Location Choice

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1 Introduction

This paper investigates the distribution of teacher quality across the New York City school system. Since teachers with seniority are often able to choose the location where they teach, and since salary is paid along a fixed wage schedule, I investigate the degree to which teachers improve their utility by locating to more agreeable environments.

The theory of compensating wage differentials for quality-of-life factors in location views geographic places as interrelated bundles of wages, land rents and amenities with differing bundles for different locations. If migration across regions is relatively cheap, then households, employees and firms will compete for a fixed number of sites across locations, with agents seeking to maximize their pay-offs (utility or profit) through their location choice. In equilibrium then, wages and land rents will vary across locations in order to equate household utility (Rosen, 1979; Gabriel, et. al., 2003).

If two regions, for example, have the same exact bundle of amenities, except one location has a relatively milder climate, then the theory predicts that this location would have a lower wage since, all else equal, the milder climate would 'compensate' utility in exchange for a lower wage. Studies in this vein have generally looked at urban wages across regions as a measure of the value of different locations (Roback, 1988; Bloomquist, et. al., 1988).[1]

This theory also applies to employment choice in neighborhoods within a region as well. Workers, for example, would need to be compensated to work in dangerous neighborhoods or areas without available parking or other local amenities. In a special case, where wages are held constant across a particular area, we would expect to see an uneven distribution of worker quality. In particular, school teachers in the New York City School System are paid along a fixed salary schedule based on the number of years of service in the system and the number of graduate credits. Since schools cannot offer wage differentials based on the nature of the working environment, and teachers with seniority can transfer to the districts of their choice, we can directly measure the degree to which working environment and neighborhood characteristics affect the distribution of quality across both schools and neighborhoods.[2]

The literature on the spatial distribution of employment within a metropol-

[1] Greenwood, et. al. (1991) test the assumption of regional equilibrium for compensating differentials, and do not find strong evidence of disequilibrium across regions.

[2] The New York City school system (district) is divided into 34 sub-districts, which will be simply referred to as 'districts' in this paper.

itan area has recently focused on the flight of jobs to suburban towns away from the older core (Greenwood and Stock, 1990). However, Bollinger and Ihlanfeld (2003) study the share of a city's employment within a particular metropolitan area by looking at the effect of tax incentive programs and other neighborhood amenities. They find that tax incentives, road improvements and crime reduction improve the share of employment within the city of Atlanta.

The literature on the labor market for teachers has focused on the effects of wages on attracting higher quality teachers (Hanushek, et. al. 1999). The available evidence shows that the link is mixed. Part of this is due to the methodological problems that effect the proper measurement of this relationship (Hanushek, et. al., 1999). Hanushek, et. al. (1999) find that salary is relatively unimportant determinant of teacher mobility compared to other environmental factors. Figlio (2002) finds that whether a district is unionized affects the relationship between salary and the probability of hiring better qualified teachers. Stinebrickner (2001) finds that a female teacher's decision to stop teaching is related to marital status and number of children, as well as wage.[3] To the best of my knowledge, this paper is the first to directly measure how environmental conditions affect the distribution of quality within a city, and how proximity to suburban districts affects this distribution.

In this paper, there are three measures of teacher quality: the percentage of teachers in each school with greater than five years of teaching experience, the percentage of teachers with a Master's degree, and the percentage of teachers who have been in their particular school for more than two years. Teacher experience and teacher education levels are common measures of quality (Hanushek, 1986). Further, length of school tenure is an important quality measure because the longer a teacher stays within in a school the better the teacher will have adapted to teaching to a particular student body, within a particular organizational framework and with a particular curriculum. Note that these measures of quality are not mutually exclusive.

Clearly, the issue of teacher distribution is relevant for both understanding how to attract and retain better qualified teachers, and in understanding the nature of compensating differentials. Recent court cases attest to the fact

[3]Ballou (1996) finds that the highest quality teachers are not necessarily hired due to administrators lack of interest in these candidates; thus the lack of demand for higher quality teachers may be just as important as relatively low supply.

that urban districts receive disproportionately fewer resources compared to their suburban counterparts, such as the 'Abbott' case in New Jersey and the 'CFE' case in New York (Rivkin, 2001; Toutan, 2001; Ed. Reform. 2002); and thus it is important to measure the degree to teachers with more experience and education respond to environmental conditions in order to understand how best to alleviate disparities both across school districts and within school districts themselves.

Using data provided by the New York City school system plus other New York City level data, we are able to investigate the relationship between school quality and teacher quality, and, in addition, what kinds of neighborhood environments are likely to attract or repel higher quality teachers.

First, the *school-based effects* are measured to show their relative importance in determining the proportion of teacher quality measures in each school. Next, using these results, the *neighborhood-based effects* that determine teacher quality are estimated. The findings show that experienced teachers are more likely to work in schools that are closer to the suburbs, and are less likely to travel to the urban core. For example, for school districts that are 10 miles away from the city center (i.e., the Empire State Building), all else equal, there is an approximate increase of 3 to 5 percent of teachers with more than five years of teaching experience. The effect is even greater for the percentage of teachers within each school who have been in that school for more than two years. In addition, higher quality teachers are more likely to avoid poorer neighborhoods. These results would then suggest that the lack of a 'free market' within the city school district is depriving those students most in need of higher quality teachers.

The rest of the paper is organized as follows. Section 2 discusses the relevant facts about the New York City School District and the data set employed. Section 3 discusses details about the teacher quality measures. Next section 4 presents the results of regressions that measure the school-level effects of teacher quality. Then section 5 presents the results of regressions that measure the neighborhood effects of teacher quality. Section 6 presents some concluding remarks. Finally, appendices provides information on the teachers' salary schedule and teacher transfer rules, respectively.

2 The New York City School District

The New York City School System is the largest school system in the nation. It has an enrollment of approximately 1.1 millions students, with roughly 550,000 elementary school students, and over 200,000 middle school students. There are some 80,000 teachers of which about 49,000 are employed in elementary schools. The school district encompasses the five boroughs of New York City: Brooklyn, the Bronx, Manhattan, Queens and Staten Island. In 2001 there were 34 separate school districts within the City, (3 of which were extra-regional), and a total of 949 elementary schools and middle schools (Dept. of Ed, 2004).[4] In 2001, 35.8% of the student population identified as African American, 34.0% as Hispanic, 16.6% as White, 13.3% as Asian, and less than one percent as American Indian or Alaskan Native (BOE, 2003).

The City of New York and the Board of Education (BOE) collectively bargain with the teacher's union, the United Federation of Teachers (UFT), over wages, benefits and work rules. In each year, teachers are paid according to a salary schedule, which is a function of the number of years of service in the system and the educational attainment, which ranges from a Bachelor's degree to a Master's degree plus 30 additional graduate school credit-hours (the current contract can be found at http://www.uft.org). See Appendix A for more details about the teachers's salary schedule.

One benefit given to teachers is the right to apply for and obtain a 'seniority transfer,' which allows the more experienced teachers to switch to a different school district. This benefit has important implications for the distribution of quality since presumably more senior teachers can move to districts that increase their over-all utility. Appendix B reprints the Seniority Transfer rules that are in the teacher's contract. In summary, regularly appointed teachers with three years of satisfactory ratings can apply for a transfer. The teacher makes a list of six preferred location choices and the transfers are granted based on seniority and availability. There are limits to the number of teachers that can transfer from any one school at a given time.

[4] As of July 2002, the New York City school system undertook a reorganization plan, whereby the controlling authority of Board of Education was dissolved and replaced by the Mayor, who chose a new chancellor as his representative. As a result, the office that administers the schools is now the Department of Education. The current Board of Education has only an advisory function. The data used for the analysis was collected before the reorganization, thus when referring to the controlling authority, we shall refer to it as the 'Board of Education' (BOE).

On average, roughly 500-800 teachers transfer under the seniority-based system (Ballou, 1999).

2.1 The Data

Variable	Description	Obs.	Mean	Std. Dev.	Min.	Max.
EPP	Expenditures per pupil	921	10,068	2,921	3,483	59,379
%2YRS	% of teachers in same school for more than 2 yrs.	949	60.77	16.90	0	100
%5YRS	% of teachers with more than 5 yrs. teaching exper.	947	51.36	13.65	6.3	88.90
%MASTERS	% of teachers with masters degree	947	71.52	14.94	0	100
%RFL	% of students receiving reduced or free lunch	949	72.64	24.17	6.3	100
TEACH	Number of teachers	942	52.25	22.90	5	146
PARA	Number of paraprofessionals	942	4.89	4.73	0	36
ΔLnTEACH	Difference in LnTEACH from 2000-01 to 2001-02	925	$-.076$	0.193	-1.43	1.20
%ATT	Average % student attendance	949	92.07	2.37	70.5	98
ENROLL	Total student enrollment	949	800.2	395.8	68	2,532
%WHITE	% white students	949	15.69	22.52	0	93.7
%BLACK	% black students	949	34.68	30.16	0	97.5
%HISP	% hispanic studetns	949	38.22	26.32	1.5	98.5
%ASIAN	% asian students	949	11.41	15.87	0	92.1
%MALE	% male students	949	50.85	3.26	27.5	73.7
%CRI	% of expenditures for classroom instruction	921	60.16	5.46	13.7	74.8
%SUPSUP	% of expenditures on supervisory support	921	8.83	2.21	1.7	29.4
%DISTSUP	% of expenditures from local district	921	0.24	0.19	0	2.9
%PTSE	% students in full time special ed.	941	6.20	5.46	0	83.8
%FTSE	% students in part time special ed.	938	5.08	4.75	0	49.1
%IMM	% of students emigrated to U.S. within last 3 yrs	949	6.57	5.43	0	89.4
%LEP	% of students with limited English profienciy	944	12.09	9.60	0.2	56.6
STR	Student teacher ratio	942	15.49	3.25	1.19	35.73
HG5	Dummy var. if highest grade is grade 5	949	0.42			
PREK	Dummy var. if school has pre-K	949	0.47			
SURR	Dummay var. if school is 'under review'	949	0.06			

Table 1: Descriptive Statistics for New York City School system, 2001-02. School-level data.

The data used in this paper is from the 2001-2002 Annual School Report Card data assembled by the BOE. It is a rich data set that captures the different facets of education, including mean standardized test scores, teacher quality and experience measures, and other school-level information. Table 1 presents the summary statistics for the relevant variables. As discussed above, there are three measures of teacher quality: the percent of teachers in each school that have more than five or years teaching experience (anywhere), the percent of teachers who hold Master's degrees, and the percent of teachers who have been in a school for more than two years. For student-related data there are variables for race, attendance, immigrant status, and English

language proficiency. For school measures, there are the student-teacher ratio, school expenditures, the number of paraprofessionals (teacher aids), enrollment and the grade levels of the school. The sample includes both elementary schools and middle schools.

3 The Distribution of Quality

Measures of teacher quality show a wide variation across schools. For example, the average school has only 51.36% of teachers with more than five years experience, with a standard deviation of 13.65%; the average value for Master's degrees is 71.52% with a standard deviation of 14.94%. Figure 1 presents a histogram of the three quality measures. The histogram shows the relative frequency of the quality measures across schools.

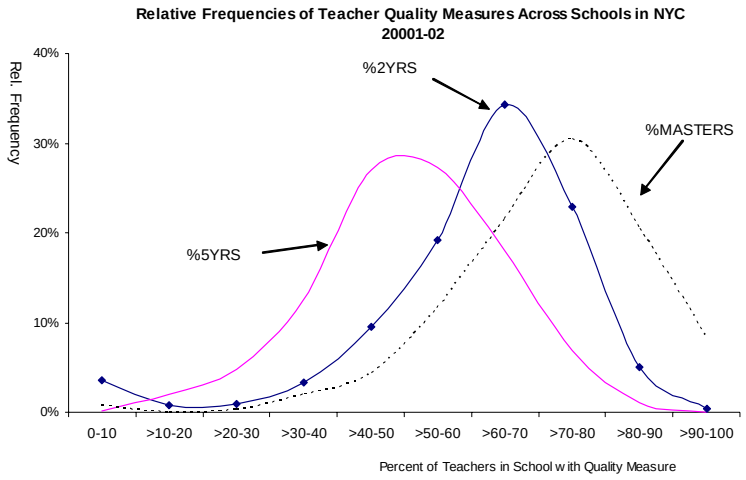


Figure 1: Histograms of teacher quality measures.

Further, Table 2 shows how the variables correlate. Though, as would be predicted, there are large pair-wise correlations between the three variables, they is by no means a one-to-one relationship between them

To demonstrate the importance of the distribution of quality in terms of student performance, Figures 2 and 3 show the relationship between the 'needs' of the school and teacher quality and student performance for elementary school students. The needs level is based on the New York City School

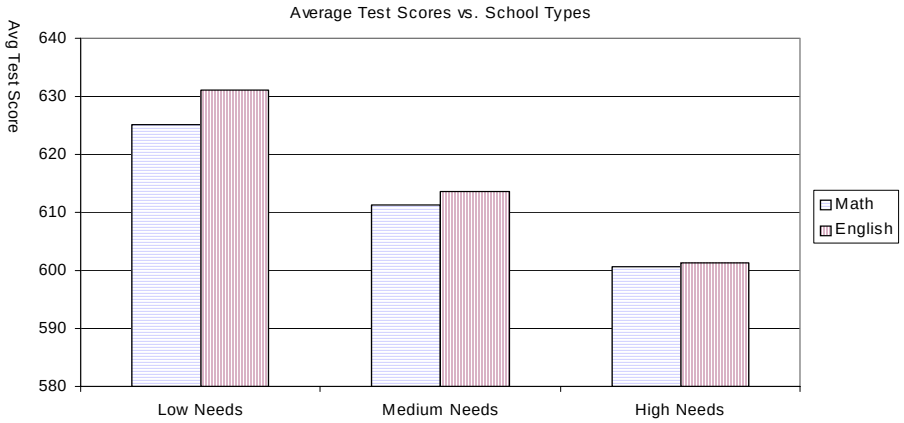


Figure 2: Average test scores for 4th grade general education math and English versus needs level of school.

Board's definition, which is determined by three variables: the percentage of students eligible for the Reduced or Free Lunch Program, the percent of students tested for special education, and the percent of students who are in the English Language Learners program (BOE, 2003). As the figures demonstrate, in general, lower needs schools perform better on standardized tests, and, in general, the distribution of teacher quality favors the lower need schools.

	%5YRS	$\%MASTERS$	%2YRS
%5YRS	1.000		
$\%MASTERS$	0.567	1.000	
%2YRS	0.598	0.458	1.000

Table 2: Pairwise Correlation Coefficients of Teacher Quality Measures

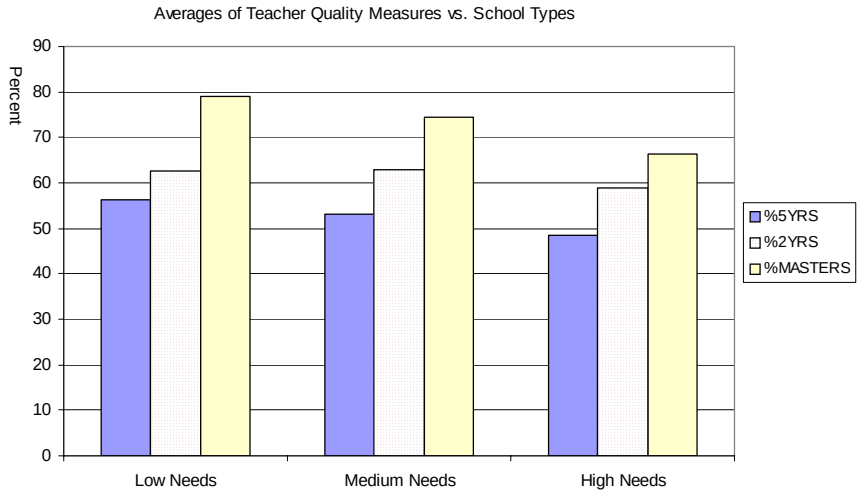


Figure 3: Average teacher quality measures versus needs level of school.

4 An Econometric Model

The wide variation in teacher quality measures leads to the questions: what determines the relative distribution of teachers in schools, and are teachers going to the schools were they are most needed, i.e., the schools that tend to do worse on student performance measures? The extent to which a school can attract and retain high quality teachers is a function of both 'push' and 'pull' factors. A positive working environment, for example, is a pulling factor, as well as commuting time from home, while difficult working conditions, for example, can push teachers out of a school. Because salary is only a function years of service and educational obtainment, schools cannot recruit based on the prospect of higher salaries.[5] Thus the nonmarket factors such as working conditions and types of positions available will determine the distribution of teachers in different schools.

To study the effects of teacher quality distribution the following two equa-

[5] One caveat to this rule is the existence of a program to offer grants to teachers who elect to teach in Schools Under Registration Review (SURR) schools, which are so designated by New York State due to exceptionally low performance. Starting in the 2001-02, grants of up to $3,400 for student loan forgiveness and tuition reimbursement. A dummy variable for SURR schools is included to control for this effect.

tion model is posited:

$$y_{ij}^q = \alpha_0^q + \mathbf{X}_{ij}\boldsymbol{\alpha}_1^q + \mathbf{Z}_{ij}\boldsymbol{\alpha}_2^q + nd_j^q + \mu_{ij}^q, \quad (1)$$

$$nd_j^q = \beta_0^q + \mathbf{W}_j\boldsymbol{\beta}_1^q + \varepsilon_j^q, \quad (2)$$

where y_{ij}^q is the value of teacher quality measure q in school i in neighborhood j. $\mathbf{X}$ is the vector of variables that measure the relative working conditions within the school itself, such as expenditures, the number of teaching assistants (paraprofessionals), etc.; $\mathbf{Z}$ is the vector of variables that measures the nature and composition of students, such as race and income, and the degree to which there are special education students. nd_j^q is the measurable neighborhood effect that and μ_{ij}^q is the purely random component of the quality measure.

Equation (2) measures the neighborhood component of the quality measures. $\mathbf{W}$ is a vector of variables that measures the neighborhood characteristics, such as crime rates, business activity and the location of the school in relation to the city center. ε_j^q is the random, unobservable part of nd_j^q. The nature of the neighborhood effects is discussed in more detail in section 5. In the vein of Card and Krueger (1992), a two equation system is specified in order to highlight the two separate types of effects on teacher quality, and in order to demonstrate the different functional forms for equation (2) that relate to the different quality measures.

4.1 Regression results

Table 3 presents the results of the OLS regressions. Each of these regressions includes dummy variables to capture the neighborhood effects, and in all cases they are jointly statistically significant.[6] For each dependent variable two equations are presented. Each equation contains measures of school characteristics, such as expenditure levels, expenditure composition, and the size and type of school; student characteristics, such as race, poverty, and special education measures. Also included is the difference in the log of the number of teachers from 2000-01 to 2001-02. The inclusion of this variable is meant to capture the effect of teacher turnover on teacher quality levels. For New York City, the higher the school turnover, the lower is the quality of

[6] For example, for $\%5YR$, equation (2), the $F-stat$ is $F(160, 617) = 1.808$, $p-value = 0.00$. For $\%MASTERS$, equation (2), $F(160, 617) = 1.841$, $p-value = 0.00$. For $\%2YR$, equation (2), $F(160, 617) = 1.64$, $p-value = 0.00$.

the workforce since, all else equal, replacements tend to be younger and less experienced. Turnover measures the degree to which teachers are leaving the schools for reasons such as taking jobs in other schools or leaving the school system all together.

{Table 3 here}

Equation (1) uses actual values for expenditure per pupil (EPP) and the percent of school expenditures on classroom instruction (%CRI). The problem, however, with these variables is that they are, in part, determined by the composition of the teacher workforce in each school. For example, if there are many senior teachers in a school then EPP and %CRI will be relatively large, merely due to salary expenditures.

Because of the lack of suitable instruments for EPP and %CRI, proxy variables are used, by removing that part of each variable that is due to salary expenditures. To do this, following regressions were ran:

$$EPP = \alpha_0 + \alpha_1 (\%5YRS) + \alpha_2 (\%MASTERS) + \alpha_3 (\%2YRS) + \alpha_4 (\%LIC) + \varepsilon_{EPP},$$
$$\%CRI = \alpha_0 + \alpha_1 (\%5YRS) + \alpha_2 (\%MASTERS) + \alpha_3 (\%2YRS) + \alpha_4 (\%LIC) + \varepsilon_{\%CRI}.$$

$\%LIC$ is the percentage of teachers in each school that have full New York State teaching licenses. The residuals, $\widehat{EPP} = \hat{\varepsilon}_{EPP}$ and $\widehat{\%CRI} = \hat{\varepsilon}_{\%CRI}$, are used to measure that part of these variables that remain after taking into account the salary effect.[7]

%5YRS In general, the variables in the regressions have the expected signs. Just to review a few, we see that expenditures per pupil and percent attendance have positive effects. Further, we see that lower grade schools tend to have more teachers with experience, because of the relative better

[7] The OLS equations are:

$$\widehat{EPP} = \underset{(.05)}{.97} + \underset{(.002)}{.001} (\%5YRS) - \underset{(.006)}{.012} (\%MASTERS) - \underset{(.001)}{.004} (\%2YRS) + \underset{(.004)}{.01} (\%LIC),$$

$R^2 = 0.10, nobs = 920.$

$$\widehat{\%CRI} = \underset{(1.2)}{56} + \underset{(.03)}{.02} (\%5YRS) + \underset{(.06)}{.009} (\%MASTERS) + \underset{(.016)}{.04} (\%2YRS) + \underset{(.04)}{.00} (\%LIC),$$

$R^2 = 0.03, nobs = 920.$ Standard errors below estimates.

working environment. Interestingly, the percent male and percent supervisory support have negative effects, as well as the proportion of students who are not proficient in English. The number of paraprofessionals, and the size of the student body in part-time special education do not appear to have effects on the experience level. In the model we include the student teacher ratio along with log of enrollment and the log of the number of teachers to control for both ratio effects as well as size effects. We find that the student-teacher ratio has a negative effect. Finally the number of paraprofessionals and the designation of a school as SURR do not seem to effect the experience level of the school.

%MASTERS Looking at the percentage of teachers with Master's degrees shows some similarities as the experience equation. Expenditures per pupil and attendance are both positive. But in this equation we also see a significant and positive effect for classroom expenditures, and schools with Pre-K programs. On the other hand, increase in limited English proficiency students shows a reduction in Master's teachers, similarly for the amount spent on supervisory support. Master's teachers are more likely to be in SURR schools. Interestingly, the Master's and teacher tenure equations have a higher effect for attendance than for experience. Also, the student teacher ratio is negative and significant.

%2YRS For %2YRS, highlighting a few results shows that attendance rates and being a lower-grade school increase the tenure rate of the school, which we see a negative relationship with the student teacher ratio. Poverty, as measured by the reduce and free lunch rate does appears to be a small and positive determinant of teacher tenure, while there is no apparent effect on Master's and experience. Overall, the effect of immigrant students on teacher quality is mixed, with experienced and Masters teachers positively effected, and no apparent affect on tenure. Tenure rates seem lower in schools with large full-time special education populations.

5 Neighborhood Effects

In this section, we turn to the measurement of neighborhood effects. In each of the regressions presented in Table 3 dummy variables for each of the zip-codes were included to control for the neighborhood factors that effect the

distribution of teacher quality. Here these effects are studied in more detail to see how they influence this distribution. If teachers have a choice of where to locate, and they are not compensated for working in worse neighborhoods, then we are likely to see higher quality teachers working in better neighborhoods, all else equal.

Tables 4 and 5 give the information and summary statistics for the neighborhood variables. For each of the three dependent variables, $nd_j^q, q = \{$%5YRS, %MASTERS, %2YRS$\}$, the estimates from the second equation for each variable from Table 3 are used.

The measure the degree of poverty of the neighborhood is the number of AFDC recipients per 10,000 residents. The next is the location of the school relative to the center of the city, i.e., the Empire State Building (ESB). This measure of distance is an important variable due to the fact that of the over 80,000 teachers in the New York City school system roughly 24,000, approximately 30%, reside outside of the borders of the City of New York (HRDOE, 2004). The distance of neighborhood (zipcode) j is calculated using the Euclidean distance formula,

$$d_j = \sqrt{(lat_j - lat_{ESB})^2 + (long_j - long_{ESB})^2},$$

where lat_j is the degrees latitude of neighborhood j, and $long_j$ is the degrees longitude. Note that the Empire State building has its own zipcode, 10118. Given the location of New York City on the planet, 1^o is roughly 60 miles.

Next, business density (the number of business per square feet) is included to measure the economic activity of a neighborhood. Also included is the number of violent crimes committed per $10,000$ youths between the ages of 10 and 20. Finally, the racial make up of residents within each zipcode is also included. Tables 6 to 8 present the regression results.

{Tables 4-5 here}

{Tables 6-8 here}

5.1 Discussion of Results

%5YRSND For %5YRSND we have four regression models. Equation (1) looks at the neighborhood effects without controlling for the borough. Here we see a negative and significant coefficient on business density,

and a positive interaction effect between our poverty measure and business density. Interestingly, though, only for low values of $AFDCPERCAP$ is $\partial \%5 YRSND/\partial BIZ$ negative. For example, using equation (3), for all values of $AFDCPERCAP$ greater than 396.31, the effect of business density on experience is positive. This would indicated that perhaps the wealthiest districts have traffic congestion problems that offset the benefits of having stores and restaurants close to work.

Equations (2) through (4) include dummy variables for the boroughs (with the Bronx as the base group). Equation (4) includes measures of the population density of the neighborhoods. The reason this is included is to test whether the distance variable is really a proxy for population density, since density tends to diminish further away from the city center. Looking at all four equations, we see that the distance measure is statistically significant and positive, indicating that teachers with greater experience prefer to work closer to the suburbs all else equal.

Including population density reduces the effect of distance to 19.00; meaning an 1 degree increase from the city center is associated with an 19.00% increase in the percentage of teachers with more than five years. Since 1 degree is roughly 60 miles, that means for a 10 mile increase in distance from the city center is associated with roughly a 3.2% increase in teacher experience. As a frame of reference, the Eastern most point of the city in Queens from the Empire State Building is roughly 20 miles. Equation (3) also includes the $LATITUDE$ variable as a test for functional form. Both $LATITUDE$ and $DISTANCE$ are positive and statistically significant. Measures for crime and race do not appear to be significant determinants of neighborhood choice.[8]

%MASTERSND For $\%MASTERSND$ there are three regression models. Over-all, $\%MASTERSND$ shows the least responsiveness to neighborhood characteristics as compared to two other dependent variables. Interaction effects are not significant (and not included) and distance does not appear to be a factor in school choice. Business density coefficients, while negative, are not statistically significant. The results of this equation probably reflect the fact that teachers with Master's degrees will often specialize in a subfield, such as reading, bilingual education, or special education, and

[8]Note that the raw correlation coefficient between $PCRIME$ and $AFDCPERCAP$ is 0.375, which would suggest there is not a multicollinearity problem between the two.

will be more likely to go to those districts with these needs. In general only the dummy variables for the boroughs show any effect, with $Staten\,Island$ and $Queens$ being positive and significant.

%2YRSND For %2$YRSND$ there are four regression equations. Generally these equations show similar results at the %5$YRSND$ variable. The distance variable is even larger than in the %5$YRSND$ equation. Using equation (4) we would predict that an increase in 10 miles away from the city center is associated with an increase of almost 6% of teachers who have been in the same school for more than 2 years. Population density, while negative, does not appear to be significant, nor does it materially reduce the effect of distance. Race and crime also do not appear to matter.

6 Conclusion

This paper has presented a regression analysis of the distribution of teacher quality measures in the New York City school system. I estimate the effects of teacher quality using a two-stage procedure. First I estimate the school-based effects of teacher quality, holding constant the neighborhood effects. Next, I use the measured neighborhood effects as a dependent variable to measure those factors at the zipcode level that effect teacher quality measures.

The results show that both school and neighborhood characteristics are significant determinants of the level of teacher quality in a school. In particular, higher quality teachers are attracted to schools with higher attendance, higher expenditures, and schools that are purely elementary schools (grade 5 and lower). On the other hand, higher quality teachers avoid schools that have relatively high expenditures on supervisory support, and have large black populations. There is some evidence that higher quality teachers avoid schools with large male populations and with larger student teacher ratios. In terms of neighborhood characteristics, there is evidence that business density, poverty and distance from the center of the city are important determinants of teacher tenure and experience levels. Neighborhood variables appear to have the least influence on the percent of teachers in each school with a Master's degrees.

When given the choice to relocate, many teachers move to districts that present better working environments, better neighborhoods and lower commute times. This would suggest that the fixed salary schedule does not

present the correct incentives to teachers. If the goal of the system is to re-allocate teacher quality such that the worse schools, all else equal, have at least the same proportion of higher quality teachers as compared to the better schools, then a new compensation system must be put in place.

For example, different schools can pay 'location differentials,' which would pay a higher salary to teachers willing to work in worse schools or neighborhoods. Another reward system, although less efficient but perhaps easier to implement, would be to raise the requirements for transfers to preferred districts. For example, transfers would be allowed only for teachers who have remained in a particular school for more than seven years and have more than say fifteen years of experience. The effect of this policy, though, may inadvertently make recruitment and retention harder.

This paper, however, has only addressed the issue of the distribution of quality within New York City and not within the New York City metropolitan area. This is an important issue since New York City teachers frequently leave the system for suburban school districts, which tend to have better student performance. The determinants of the relative quality distribution of teachers within schools across the region is left for future study.

A Teacher Salary Schedule Analysis

The salary schedule for teachers pays a wage for various levels of service and educational attainment. For example, Table 9 gives the salary schedule that was in effect from 12/16/99.to 11/15/00. The service level is given in half-year increments. Starting after 10 years of service teacher receive longevity increments.

{Table 9 here}

To measure the effects of years of service and education level we on have the following regression function:

$$\ln(SAL) = \beta_0 + \beta_1 SERV + \beta_2 SERV^2 + \beta_3 ED + \beta_4 ED^2 + \beta_5 SERV \times ED + \mu$$

where $SERV$ is years of service and ED is the educational level. It is assumed that the schedule extends up to 25 years of service.

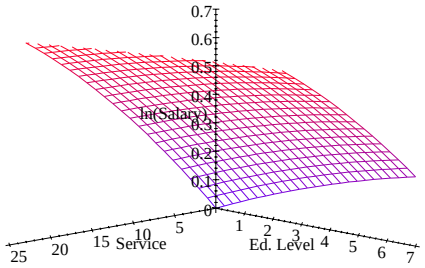
The regressions, however, serves as only one measure of the effects of experience and education of salary since a teacher remaining in the school system would also receive regular wage increases from collective bargaining. Collective bargaining is likely to change the relative distribution of salaries within the schedule overtime as the UFT and the City agree to give greater raises for some categories more than other.[9] For the sake of brevity, the effects of these agreements on the salary over time are not explored. The regression yields

$$\widehat{\ln(SAL)} = \underset{(0.01)}{10.3} + \underset{(0.00)}{0.04} SERV - \underset{(0.00)}{0.0004} SERV^2 + \underset{(0.01)}{0.047} - ED \underset{(0.00)}{0.002} ED^2 - \underset{(0.00)}{0.001} SERV \times ED,$$

with $R^2 = 0.962$, and 357 observations. Standard errors are below the estimates.

The figure below presents graph of the relative effects of education and years of service on salary. Generally, years of service is rewarded more than education.

[9] For example, a collective bargaining agreement may give greater pay raises to starting teachers versus experienced teachers if the bargaining parties believe recruitment to be an issue.



Log of salary as a function of educational obtainment and years of service.

B UFT Rules for Seniority Transfers

For the contract that runs from 11/16/00 to In regards to transfers, Article 18, section A.1- A.9 of the UFT teacher contract states:

> A. Transfers for Elementary, Junior High, and High School Teachers
>
> 1. Regularly appointed teachers who have not been rated unsatisfactory in the three most recent years of active service (including the year during which they apply to transfer) shall be eligible to transfer to another school in accordance with their seniority. For this purpose, seniority shall be determined by layoff seniority. Teachers on waiver in a junior high school shall be deemed to be regularly appointed teachers in the school for purpose of transfer under this plan to another junior high school. Except for those serving in agreed-upon shortage areas, pedagogues may apply for positions posted on the transfer plan for their current license and/or one other license provided that their most recent three years of active service in the former license were satisfactory and they are eligible to revert to that license pursuant to Article 5G. A pedagogue whose transfer to a position in a former license is effectuated hereunder will revert to the license pursuant to which he/she is transferred.
>
> 2. Each year, the number of teachers who will be permitted to transfer out of a school hereunder shall be equal to five percent of the teaching faculty of the school on regular appointment; provided, however, that in the junior high schools and the high schools no more than 25 percent of the regularly appointed teachers in the school holding a particular license will be permitted to transfer. When the teaching faculty of the school on regular appointment numbers less than 20, one transfer shall be permitted, and when it numbers 21 to 39, two transfers shall be permitted. Where 25 percent of the regularly appointed teachers in a particular license would be less than one, then one teacher will be permitted to transfer.
>
> 3. Lists of vacancies existing as of May 1 shall be prepared and made available as soon as possible to teachers by the Division of Human Resources. Transfers shall be made effective as of the opening of school in September.
>
> For purposes of transfer hereunder, vacancies are:

(a) Unencumbered vacancies;

(b) Positions filled by substitutes except where (1) the substitute is replacing a teacher on sabbatical or other paid leave, or (2) the substitute is replacing a teacher on leave without pay and the teacher returns to the school no later than the first day of school in September following the beginning of the leave. This exception may not be extended or renewed by extending or renewing the leave or by obtaining a new leave.

(c) Positions of new appointees not previously advertised for transfer, except for positions held by appointees who were licensed under special legislation and who were appointed prior to May 1, 1988.

A vacancy not previously available for transfer which is filled by an administrative transfer shall be listed for transfer on the May 1 following the administrative transfer and if the vacancy is then filled by a teacher the administrative transferee shall be excessed from that school regardless of seniority. The above shall not apply to the following administrative transfers:

(1) A transfer following a U rating of the teacher made with his/her consent.

(2) A transfer to staff a new school within the number of administrative transfers allowable under existing regulations.

4. Eligible teachers who wish to transfer shall be asked to indicate up to six choices of schools in order of preference. Vacancies shall be filled from such preference sheets before any appointments are made from existing eligible lists.

5. In a high school organized on a semi-annual basis a teacher whose September transfer was rescinded will be permitted to transfer effective as of the beginning of the February term should the vacancy recur.

6. After providing for compliance with present Board integration guidelines, half the remaining vacancies in each school, as defined in paragraph 3 above, shall be available for transfer hereunder.

7. A teacher who rejects a transfer to any school he/she has indicated as one of his/her choices will not be permitted in the following year to

apply again for transfer hereunder unless the teacher has transferred pursuant to Section C, D, E, or F of this article.

8. In the case of teachers indicating the same choice of school, preference shall be given to the teacher with the greatest seniority.

A teacher serving on June 30, 1987 in a Title 1 school shall be deemed, only for purpose of transfer out of that school to have accrued double layoff seniority as of June 30, 1987. On and after September 9, 1987 such teacher shall accrue seniority as provided in paragraph 1 above. In determining seniority for transfer out of the school such teachers seniority shall be determined in accordance with such accruals. Upon accepting a transfer to a non- Title 1 school pursuant to this paragraph 9, the teachers seniority for subsequent transfer will be determined as though he/she had not received any additional accrual by reason of serving in a Title 1 school.

9. Administrative procedures for the effectuation of these provisions are to be formulated by the Board in consultation with the Union.

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	%5YRS		%MASTERS		%2YRS	
	(1)	(2)	(1)	(2)	(1)	(2)
EPP ($000)	17.60 (3.82)***		22.92 (3.21)***		11.91 (4.47)***	
$\widetilde{EPP}$ ($000)		13.40 (3.34)***		35.69 (2.52)***		11.07 (3.85)***
%RFL	0.004 (0.036)	0.009 (0.037)	−0.051 (0.030)*	−0.033 (0.028)		0.096 (0.042)**
%ATT	0.790 (0.311)**	0.744 (0.317)**	1.38 (0.261)***	1.44 (0.239)***	1.65 (0.365)***	1.57 (0.365)***
%BLACK	−0.155 (0.039)***	−0.150 (0.039)***	−0.109 (0.032)***	−0.093 (0.029)***	−0.155 (0.045)***	−0.143 (0.045)***
%HISP	−0.092 (0.046)**	−0.094 (0.047)**	−0.043 (0.039)	−0.038 (0.035)	−0.131 (0.054)**	−0.130 (0.054)**
%ASIAN	−0.012 (0.058)	−0.025 (0.059)	0.032 (0.049)	0.029 (0.044)	−0.055 (0.068)	−0.056 (0.067)
%MALE	−0.453 (0.166)***	−0.447 (0.168)***	−0.361 (0.139)***	−0.374 (0.127)***	−0.085 (0.194)	−0.097 (0.194)
%CRI	0.571 (0.114)***		0.557 (0.10)***		0.377 (0.133)***	
$\widetilde{\%CRI}$		0.158 (0.116)		0.429 (0.087)***		−0.173 (0.133)
%SUPSUP	−0.661 (0.267)**	−0.775 (0.270)***	−0.658 (0.224)***	−0.638 (0.204)***	−0.599 (0.313)*	−0.693 (0.311)**
%DISTSUP	−2.021 (2.16)	−1.13 (2.20)	−0.886 (1.82)	0.433 (1.66)	−3.67 (2.54)	−2.47 (2.54)
%IMM	0.273 (0.150)*	0.295 (0.152)*	0.414 (0.126)***	0.425 (0.115)***	0.046 (0.176)	0.077 (0.176)
%PTSE	0.103 (0.217)	0.043 (0.220)	−0.092 (0.182)	−0.164 (0.166)	0.073 (0.250)	−0.001 (0.245)
%FTSE	0.242 (0.138)*	0.027 (0.140)*	−0.126 (0.116)	−0.397 (0.106)***	−0.197 (0.161)	−0.514 (0.161)***
%LEP	−0.224 (0.092)**	−0.186 (0.093)**	−0.302 (0.077)***	−0.321 (0.070)***	−0.146 (0.107)	−0.105 (0.107)
lnENROLL	36.29 (15.10)**	26.63 (15.00)*	44.36 (12.68)***	49.64 (11.43)***	16.18 (17.7)	9.90 (17.3)
lnTEACH	−32.64 (15.22)**	−22.26 (15.17)	−43.49 (12.78)***	−46.76 (12.78)***	−7.81 (17.83)***	−0.125 (17.83)
SURR	−0.179 (1.69)	1.26 (1.70)	4.02 (1.42)***	5.74 (1.28)***	−3.65 (1.28)***	−2.51 (1.96)
STR	−1.86 (0.996)*	−1.45 (1.01)*	−2.79 (0.837)***	−2.53 (0.761)***	−1.47 (1.17)	−1.10 (1.16)
HG5	3.11 (0.943)***	3.00 (0.959)***	3.64 (0.793)***	3.88 (0.725)***	3.14 (1.11)***	2.97 (1.11)***
PREK	−0.395 (1.01)	−0.654 (1.02)	1.56 (0.847)*	1.31 (0.773)*	2.29 (1.18)*	1.86 (1.18)
lnPARA	−0.249 (0.653)	−0.479 (0.655)	−0.491 (0.548)	−0.919 (0.495)*	−0.826 (0.77)*	−1.38 (0.75)*
ΔlnTEACH	−7.24 (3.11)**	−8.03 (3.15)**	−6.85 (2.61)***	−3.38 (2.61)	−30.65 (3.65)***	−30.20 (3.63)***
CONSTANT	−121.07 (45.64)***	−46.46 (42.91)	−159.25 (38.34)***	−143.06 (32.44)***	−164.57 (32.44)***	−113.88 (49.49)**
R^2	0.528	0.513	0.688	0.740	0.511	0.512
Adj R^2	0.388	0.369	0.596	0.663	0.367	0.368
Obs.	800	800	800	800	800	800

Table 3: Zipcode dummies included. Standard errors below estimates. *Sig. at 90% level; **Sig. at 95% level. ***Sig. at 99% level.

Variable	Description	Source
%5YRSND (viz a viz 10001)	Neighborhood effect	Section 3
%2YRSND (viz a vis 10001)	Neighborhood effect	Section 3
%MASTERSND (viz a vis 10001)	Neighborhood effect	Section 3
PCRIMES	Violent crimes per 10,000 youths ages 10-20, 1998	NY Ofc. Alc. & Subs. Abuse Srvcs.
DISTANCE	Distance in degrees from Empire State Bldg.	http://www.citidex.com/
LATITUDE	Degrees Latitude	http://www.citidex.com/
LONGITUDE	Degrees Longitude	http://www.citidex.com/
AFDCPERCAP	AFDC recipients per 10,000 residents, 1997	NY Ofc. Alc. & Subs. Abuse Srvcs.
AREA	Square Feet	U.S. Census Bureau
POPULATION	# of residents	U.S. Census Bureau
POPDENSE	# people per square foot, 2000	U.S. Census Bureau
BIZDENS	# of businesses per square foot, 1997	U.S. Census Bureau
%WHITE	% of residents that are White, 2000	U.S. Census Bureau
%BLACK	% of residents that are Black, 2000	U.S. Census Bureau
%ASIAN	% of residents from Asia, 2000	U.S. Census Bureau
%NATAM	% of Native American resiients, 2000	U.S. Census Bureau
%HISP	% of Hispanic residents, 2000	U.S. Census Bureau
BRONX	Dummy var. for the Bronx	
BROOKLYN	Dummy var. for Brooklyn	
MANHATTAN	Dummy var. for Manhattan	
QUEENS	Dummy var. for Queens	
STATEN ISLAND	Dummy var. for Staten Island	

Table 4: Neighborhood Data by zipcode for New York City.

Var	Obs	Mean	St. Dev.	Min.	Max.
%5YRSND	160	7.96	8.16	-23.48	24.04
%2YRSND	160	24.45	8.75	-15.29	50.85
%MASTERSND	160	2.08	5.88	-14.93	18.85
PCRIME	156	11.19	8.52	0	40.65
DISTANCE	159	0.143	0.072	0.008	0.342
POPULATION	158	48,590	25,418	1,574	106,154
POPDENSE	158	0.0148	0.01	0.0005	0.050
LATITUDE	159	40.72	0.086	40.5092	40.9007
LONGITUDE	159	-73.91	0.102	-74.24	-73.70
AFDCPERCAP	155	741.51	674.90	8.52	2582.91
AREA	158	4,740,321	4,364,128	144,111	33,418,779
BIZDENSE	158	0.00020	0.00037	0.0000	0.0024
%WHITE	158	46.49	27.57	1.74	95.32
%BLACK	158	26.14	28.16	0.257	93.45
%ASIAN	158	9.59	10.22	0.395	53.93
%NATAM	158	0.497	0.370	0.015	1.74
%HISP	158	17.28	13.61	1.80	56.27
BRONX	24	0.150			
BROOKLYN	36	0.225			
MANHATTAN	31	0.194			
QUEENS	57	0.356			
STATEN ISLAND	12	0.075			

Table 5: Descriptive statistics for zipcode data.

Dep. Var.: %5YRSND

	(1)	(2)	(3)	(4)
AFDCPERCAP	−.0032	−0.0029	−0.0018	−0.003
	(.002)**	(0.0016)*	(0.0016)	(0.0016)*
BIZDENSE	−7682.4	−9201.8	−7105.8	−20,340
	(2125.5)***	(2276.20)***	(2331.3)***	(4796)***
AFDCPERCAP×BIZDENSE	20.45	19.40	17.93	27.44
	(7.16)***	(7.01)***	(6.84)***	(7.54)***
POPDENSE				−172.35
				(104.2)*
POPDENSE×BIZDENSE				442,713
				(168,608)***
LATITUDE			40.98	
			(14.06)***	
DISTANCE	22.93	25.57	37.58	19.00
	(9.66)**	(11.81)**	(12.227)***	(12.51)
PCRIME	−.026	−0.026	0.004	−0.031
	(.076)	(0.077)	(0.075)	(0.076)
%BLACK	.033	0.046	0.026	0.061
	(.029)	(0.031)	(0.031)	(0.032)*
%ASIAN	.087	0.136	0.126	0.181
	(.061)	(0.066)**	(0.064)**	(0.068)***
%HISP	−.103	−0.060	−0.156	−0.056
	(.113)	(0.114)	(0.116)	(0.112)
%NATAM	2.58	1.70	3.61	2.06
	(3.77)	(3.67)	(3.63)	(3.61)
BROOKLYN		1.20	9.64	1.21
		(1.86)	(3.42)**	(1.83)
MANHATTAN		5.13	8.20	5.06
		(2.21)**	(2.40)***	(2.28)**
QUEENS		1.10	6.411	0.708
		(1.90)	(2.60)**	(1.89)
STATEN ISLAND		5.95	15.701	5.54
		(2.565)**	(4.17)***	(2.56)**
CONSTANT	6.45	3.05	−1673.0	5.35
	(2.31)***	(3.11)	(575.2)**	(3.49)*
R^2	0.236	0.299	0.340	0.333
Adj. R^2	0.188	0.234	0.273	0.260
Obs	154	154	154	154

Table 6: Estimates obtained using weighted least squares; weights were the inverse of the square of the standard errors of the dependent variable coefficients. *Sig. at 90% level. **Sig. at 95% level. ***Sig. at 99% level.

Dep. Var: %MASTERSND

	(1)	**(2)**	**(3)**
AFDCPERCAP	−.0038	−0.0032	−0.0032
	(.001)***	(0.001)***	(0.001)***
BIZDENSE	−1012.6	−1903.1	−1931.1
	(1415.6)	(1339.2)	(1334.0)
POPDENSE			52.39
			(55.30)
DISTANCE	15.64	−1.36	1.21
	(7.53)**	(7.97)	(8.42)
PCRIME	.0119	−0.038	−0.035
	(.058)	(0.051)	(0.051)
%BLACK	−.021	0.019	0.016
	(.022)	(0.021)	(0.021)
%ASIAN	−.041	0.018	0.010
	(.047)	(0.044)	(0.045)
%HISP	−0.003	0.062	0.054
	(.086)	(0.075)	(0.076)
%NATAM	0.813	−0.664	−0.571
	(2.93)	(2.47)	(2.48)
BROOKLYN		−0.138	−0.051
		(1.25)	(1.26)
MANHATTAN		2.58	2.16
		(1.49)*	(1.56)
QUEENS		3.035	3.23
		(1.28)**	(1.30)**
STATEN ISLAND		12.05	12.32
		(1.73)***	(1.75)***
CONSTANT	3.58	1.82	0.885
	(1.80)**	(2.09)	(2.31)
R^2	0.282	0.506	0.509
Adj. R^2	0.242	0.464	0.463
Obs	154	154	154

Table 7: Estimates obtained using weighted least squares; weights were the inverse of the square of the standard errors of the dependent variable coefficients. *Sig. at 90% level. **Sig. at 95% level. ***Sig. at 99% level.

Dep. Var: %2YRSND

	(1)	(2)	(3)	(4)
AFDCPERCAP	−0.0018	−0.0023	−0.0008	−0.0022
	(0.0016)	(0.0017)	(0.0017)	(0.0018)
BIZDENSE	−8151.5	−6705.54	−3962.2	−6661.9
	(2262.7)***	(2445.36)***	(2467.3)	(2448.0)***
AFDCxBIZDENSE	23.06	20.21	18.29	20.191
	(7.62)***	(7.53)***	(7.25)**	(7.53)***
POPDENSE				−76.50
				(88.04)
LATITUDE			53.64	
			(14.88)***	
DISTANCE	22.35	38.58	54.30	34.83
	(10.29)**	(12.68)***	(12.93)***	(13.41)***
PCRIME	−0.073	−0.093	−0.053	−0.097
	(0.08)	(0.082)	(0.080)	(0.083)
%BLACK	0.006	0.017	−0.010	0.021
	(0.031)	(0.033)	(0.033)	(0.034)
%ASIAN	0.0311	0.066	0.047	0.072
	(0.064)	(0.070)	(0.068)	(0.072)
%HISP	−0.172	−0.090	−0.22	−0.079
	(0.120)	(0.122)	(0.122)*	(0.123)
%NATAM	3.06	3.12	5.62	2.98
	(4.01)	(3.95)	(3.85)	(3.95)
BROOKLYN		4.93	15.98	4.80
		(2.00)**	(3.62)***	(1.93)**
MANHATTAN		2.48	6.49	3.10
		(2.38)	(2.54)**	(2.49)
QUEENS		−0.017	6.94	−0.299
		(2.04)	(2.74)**	(2.07)
STATEN ISLAND		2.54	15.30	2.14
		(2.754)	(4.42)***	(2.79)
CONSTANT	24.59	18.99	−2174.7	20.35
	(2.46)***	(3.34)***	(608.7)***	(3.69)***
R^2	0.198	0.251	0.315	0.272
Adj. R^2	0.148	0.183	0.246	0.199
Obs.	154	154	154	154

Table 8: Estimates obtained using weighted least squares; weights were the inverse of the square of the standard errors of the dependent variable coefficients. *Sig. at 90% level. **Sig. at 95% level. ***Sig. at 99% level.

Salary Schedule from 12/16/99 to 11/15/00

Service Level	BA	BA+30	BA+60	MA	MA+	MA+30	MA+30+
1A	31,910	33,028	35,095	36,045	38,112	37,162	40,180
1B	31,910	33,028	35,095	36,045	38,112	37,162	40,180
2A	32,549	33,667	35,734	36,684	38,751	37,801	40,819
2B	32,549	33,667	35,734	36,684	38,751	37,801	40,819
3A	33,187	34,305	36,372	37,322	39,389	38,439	41,457
3B	33,187	34,305	36,372	37,322	39,389	38,439	41,457
4A	33,825	34,943	37,010	37,960	40,027	39,077	42,095
4B	33,825	34,943	37,010	37,960	40,027	39,077	42,095
5A	34,463	35,581	37,648	38,598	40,665	39,715	42,733
5B	34,463	35,581	37,648	38,598	40,665	39,715	42,733
6A	35,101	36,219	38,286	39,236	41,303	40,353	43,371
6B	35,755	36,873	38,940	39,890	41,957	41,007	44,025
7A	36,899	38,017	40,084	41,034	43,101	42,151	45,169
7B	39,194	40,312	42,379	43,329	45,396	44,446	47,464
8A	41,490	42,608	44,675	45,625	47,692	46,742	49,760
8B	44,017	45,135	47,202	48,152	50,219	49,269	52,287
8B+L10	46,885	48,003	50,070	51,020	53,087	52,137	55,155
8B+L13	48,359	49,477	51,544	52,494	54,561	53,611	56,629
8B+L15	51,473	52,591	54,658	55,608	57,675	56,725	59,743
8B+L18	52,290	53,408	55,475	56,425	58,492	57,542	60,560
8B+L20	58,330	59,448	61,515	62,465	64,532	63,582	66,600
8B+L22	61,730	62,848	64,915	65,865	67,932	66,982	70,000

Table 9: Note: A separate column for salaries for teachers starting before 1970 is not given.