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# Teacher Sorting and the Plight of Urban Schools: A Descriptive Analysis

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*This paper uses rich new data on New York State teachers to: determine how much variation in the average attributes of teachers exists across schools, identify schools that have the least-qualified teachers, assess whether the distribution has changed over time, and determine how the distribution of teachers is impacted by attrition and transfer, as well as by the job matches between teachers and schools at the start of careers. Our results show striking differences in the qualifications of teachers across schools. Urban schools, in particular, have lesser-qualified teachers; and New York City stands out among urban areas. Low-income, low-achieving and non-white students, particularly those in urban areas, find themselves in classes with many of the least skilled teachers. Salary variation rarely compensates for the apparent difficulties of teaching in urban settings and, in some cases, contributes to the disparities.*

Keywords: *teacher sorting, urban schools*

At the federal level and in every state, policymakers are struggling to address the low academic achievement of many K-12 students and the gaps in achievement among income and racial-ethnic groups of students. Concern over low student performance has a long history, however, it has taken on recent urgency in an era marked by court cases that focus on adequacy, by dramatic increases in achievement information, and by widespread calls for accountability. Recent research has emphasized the link between teachers and student outcomes.[1] Yet, even with increases in spending equity within states (Evans, Murray and Schwab, 2001), substantial differences remain across schools in the qualifications of teachers (Betts, Rueben and Danenberg, 2000). Disparities in teacher quality have been documented, but we know little about the extent of teacher sorting or its correlates.

An understanding of how schools differ in the qualifications of their teachers and the mechanisms driving these differences is useful for designing effective policies that address inequities or inadequacies in instructional resources. In this paper we use New York State as a case study: to determine how much variation in the average attributes of teachers currently exists across schools, to identify which schools have the least qualified teachers, to place the current situation in context by assessing whether the distribution has gotten more or less dispersed over time, and to determine how the distribution of teachers is impacted by attrition and transfer of teachers, as well as by the job matches between teachers and

schools at the start of teaching careers. We also examine differences in teaching salaries across schools to provide evidence of how salary differentials are currently contributing to or alleviating inequities in teacher resources.

Unlike most previous studies of teacher labor markets, we focus on the distribution of teachers across schools and not solely on the average characteristics of the teacher workforce. Our data comes from administrative records in New York State that allow us to follow *all* teachers in the state over the past 15 years. The breadth of the data (all teachers in all schools) allows analytical flexibility not possible with smaller datasets. For example, we can compare the sorting of teachers that occurs overall in the state to the sorting between schools within the same district and thus separate out district sorting from school sorting. We also have a large enough sample to look only at new teachers and thus distinguish current sorting mechanisms from historical sorting. The length of the data allows us to assess whether the current inequities in teacher quality across schools is a recent phenomenon or one that has persisted. The data is richer in its descriptions of teachers than other administrative datasets used to date, including teachers' test scores and undergraduate institution. It also allows us to match teachers to characteristics of the schools in which they teach in a way that most national longitudinal surveys, such as High School and Beyond or the National Longitudinal Survey of Youth, do not.

Our results show striking differences in the qualifications of teachers across schools. Urban schools, in particular, have lesser-qualified teachers, and New York City stands out among urban areas. Low-income, low-achieving and nonwhite students, particularly those in urban areas, find themselves in classes with many of the least skilled teachers. Finally, we find that salary variation rarely compensates for the apparent difficulties of teaching in urban settings and, in some cases, contributes to the inequities in teacher resources across schools.

In what follows, we start with a discussion of potential causes of teacher sorting across schools. The third section introduces our data and methods. The fourth section describes the variation in teacher qualifications and characteristics across schools. It looks at how schools in different locations and with different student bodies differ in the characteristics of their teachers and describes how these relationships have changed over time in addition to, exploring the impact of teacher attrition and transfers on the qualifications of teachers in different schools. The fifth section describes the variation in teacher salaries across the state; and the final section concludes with a discussion of policy implications and directions for continued research.

## Background

This paper describes the sorting of teachers across schools and does not test hypotheses for why this sorting occurs. Yet, in order to place the results in context, it is worth considering why schools might differ in the characteristics of their teachers. Research in this area is very limited, but four plausible explanations emerge. First, differences may be driven simply by differences in the preferences of residents. That is, one school may strive to hire one type of teacher and another may strive to hire a different type of teacher. Even if both schools are choosing from the same pool of potential teachers, they will end up with teaching staffs that differ systematically. As an example, schools with a high percent of minority students may benefit from having teachers with similar racial and ethnic backgrounds. These teachers may have attended lower ranked undergraduate institutions and may score lower on teacher exams than other teachers of similar quality. If this were the case then we may see teachers with poorer qualifications as measured by test score and school ranking in schools with a high percent of minority students even though the teachers in these schools are not necessarily of lower quality. We know of no studies that systematically examine this issue.

A second plausible explanation for variation in average teacher qualifications across schools is that districts may differ, not in their preferences but in the efficiency of their hiring practices. Inefficiencies in hiring will lead to systematic difference in teachers across districts. Districts with effective hiring (aggressive recruiting, spring job offers, etc . . .) will end up with higher-quality teaching staffs even though they are initially faced with the same pool of potential teachers. Few studies have explored district-hiring practices, though Pflaum & Abramson (1990) and Ballou and Podgursky (1997) do provide evidence that many districts are not hiring the most qualified candidates.

Third, within districts, schools vary in the political power they exert, which may lead to differences in teacher qualifications. For example, schools with strong parental input may not accept low-quality teachers. Bridges (1996) found that when parents and students complained about poor teachers the teachers were likely to be transferred to schools with high student transfer rates, large numbers of students receiving free or reduced price lunches, and large numbers of minority students.

While efficient hiring and district assignment may contribute to the disparities observed in the data, teacher preferences are likely to be particularly influential. Teachers differ fundamentally from other school resources. Unlike textbooks, computers, and facilities, teachers have preferences about whether to teach, what to teach, and where to teach. Potential teachers prefer one type of district to another; and within districts, they prefer one school to another. There has been much discussion about the role that compensation plays in the ability of schools to attract and retain high-quality teachers. A large body of literature suggests that teachers respond to wages. As a group, these studies show that individuals are more likely to choose to teach when starting teacher wages are high relative to wages in other occupations (Baugh and Stone, 1982; Brewer, 1996; Dolton 1990, 1993; Dolton and van der Klaaw, 1999; Dolton and Makepeace, 1993; Hanushek and Pace, 1995; Manski, 1987; Mont and Rees, 1996; Murnane, Singer & Willett, 1989; Rickman and Parker, 1990; Stinebrickner, 1998, 1999, 2000; Theobald, 1990; Theobald and Gritz, 1996). Baugh and Stone (1982), for example, find that teachers are at least as responsive to wages in their decision to quit teaching, as are workers in other occupations.[2] Teachers are more likely to quit when they work in districts with lower wages.

Salaries are one element of teaching jobs that are likely to impact sorting, but nonpecuniary job characteristics appear important as well. These characteristics may include class size, preparation time, facilities, or characteristics of the student body, among other things. As an example, class size reduction in California resulted in an increase in demand for teachers across the state. Teachers in schools with low-achieving students chose to move to higher achieving schools, leaving many high-poverty districts with vacancies and unqualified instruction (Betts, Rueben & Danenberg, 2000; Bohrnstedt and Stecher, 1999). Similarly, in Texas, Hanushek, Kain and Rivkin (1999) found teachers moving to schools with high-achieving students and, in New York City, Lankford (1999) found experienced teachers moving to high socioeconomic status schools when positions became available.

Although each of these hypotheses about the sorting of teachers is plausible, in fact, we know very little about sorting or the causal relationships that lead to sorting. In this paper we provide an empirical foundation on which to build models of teacher and school district behavior.

### *Data and Methods*

New York State faces trends in teacher demand similar to those faced across the United States. About 38% of New York's current teachers will have retired or reached age 55 within the next five years. Policies of accountability and class size reduction are also increasing demand for teachers in the State. New York serves as a good example for examining the teacher workforce because of these trends and because it comprises a diverse population and a range of schools across which teachers can demonstrate their preferences.

Our database links seven administrative datasets and various other information characterizing districts, communities, and local labor markets. It includes information for every teacher and administrator employed in a New York public school at any time from 1984–85 through 1999–2000. The core data comes from the Personnel Master File (PMF), part of the Basic Education Data System of the New York State Education Department. In a typical year there are approximately 180,000 teachers identified in the PMF. We have linked these annual records through time, yielding detailed data characterizing the career history of each individual. Several other databases that contain a range of information about the qualifications of prospective and actual teachers, as well as the environments in which these individuals make career decisions, substantially enrich this core data.[3]

The heart of our analysis relies on having measures of teacher skills. Teaching is a complicated endeavor; it is difficult to assess how well individuals perform in the classroom. A few studies quantify the quality of teachers by the contributions they make to the academic gains of their students—value-added (see Rivkin, Hanushek, and Kain

(2000), Sanders and Horn (1994) and Sanders and Rivers (1996) for examples). This approach has advantages and disadvantages both conceptually and in practice.[4] Researchers more commonly employ measures of individuals' attributes as proxies for teacher quality (DeAngelis, 1999, for example). Many of these measures are quite weak: whether or not the teacher holds a master's degree, whether or not the teacher is certified, and years of teaching experience. They have not consistently been found to influence student learning (Hanushek, 1986 & 1997). However, studies with richer detail on teachers, such as teacher test scores or the quality of teachers' undergraduate institution, have often found effects on student outcomes (Ehrenberg and Brewer, 1994; Ferguson, 1991; Ferguson and Ladd, 1996). Thus, the quality of data is important. In their analysis of who chooses to teach, Hanushek and Pace (1995) employ teachers' reading, vocabulary, and mathematics test scores (administered as part of the HSB survey), arguing that it is plausible "that 'smarter' teachers with higher achievement of their own could perform better in the classroom." Ballou and Podgursky (1997) make a similar point and provide a summary of the literature that speaks to the relationship between the strength of academic background and teacher effectiveness. Their analysis of teacher pay and quality employs college selectivity, academic major, undergraduate GPA, and SAT scores as indicators of quality.

We employ measures similar to those used by Hanushek and Pace and discussed by Ballou and Podgursky. We identify the institutions from which individual teachers earned their undergraduate degrees from the NYS Teacher Certification Database (TCERT) and combine it with the Barron's ranking of college selectivity to construct variables measuring the selectivity of the college from which each teacher graduated. We draw information regarding the teacher certification exam scores of individual teachers and whether they passed on their first attempts from the NYS Teacher Certification Exam History File (EHF). In order to assess the distribution of teachers across the schools, we create multiple measures of average teacher characteristics at the school level. These measures include:

- The percent of teachers with no prior teaching experience
- The percent with no more than a Bachelors degree
- The percent not certified in any current assignment
- The percent certified in all current assignments
- The percent of exam takers who failed the NTE General Knowledge Exam or the NYSTCE Liberal Arts and Science Exam on their first attempt
- The percent who attended Barron's College Guide most competitive and highly competitive schools
- And the percent who attended competitive, less competitive, or least-competitive schools

These are a subset of the measures we have available but they are illustrative of the trends we observed in all our teacher attribute measures. To simplify the discussion we also create a composite measure using principal components analysis that combines a number of these characteristics. Appendix B describes the components of this measure. It has a reliability of 0.86 and explains 52% of the variation in its component measures. The measure has a mean of zero and a standard deviation of one, indicating that a one unit change in the composite corresponds to a one standard deviation change.[5]

*The Uneven Distribution of Teachers:* To start, we examine all teachers in the New York State system in 1999–2000. We create school level averages of the teacher measures described above and examine the distribution of these measures across the schools in the state. We then look at the correlation among the various measures to see whether schools with less qualified teachers on one dimension also tend to have lesser-qualified teachers on other dimensions. Finally we decompose the variance in teacher qualifications to see how much variation exists between regions or labor markets in the state, how much between districts within regions, and how much between schools within districts.

Parsing the variation into within-district, between-district-within-labor-market, and between-labor market can be useful for assessing the likely causes for the disparities. For example, if most of the variation in teacher qualifications exists among (not within) regional labor markets, then characteristics that vary substantially across regions such as the availability of alternative occupations for teachers or the cultural attitudes of the region may be particularly important to assess. If, on the other hand, most of the variation exists

between-districts-within-labor-markets, then district policies such as hiring practices or salary schedules may play a key role, as may other district characteristics. If, thirdly, there is much variation among schools within the same district, this focuses attention on school-level differences such as the non-pecuniary attributes of schools that affect teachers' decisions about where to teach.

*Correlates with Teacher Qualifications:* While the above analysis describes the extent of sorting, it does not reveal the characteristics of schools with systematically greater-or-lesser qualified teachers. We next look across several dimensions including urbanicity, student race, student poverty, student English proficiency, and student performance on state assessment exams. In order to separate urban, suburban and rural differences from differences in student characteristics, we look at differences in teacher qualifications across schools within each of the large urban areas in New York State, as well as across the State as a whole.

*Changes in the Distribution Over Time:* So far the analysis has concentrated on a single year, 1999–2000. We next explore time trends in order to see whether this year is an anomaly, whether it is part of a long run trend of change, or whether similar variation in teacher qualifications across schools has characterized the teacher labor market over time. We look at the stock of teachers in each year as well as the characteristics of teachers entering the workforce. The full teacher sample gives a picture of the inequities across schools, while the new teacher sample shows how these inequities are impacted by changes on the margin. A single year of new teachers may not substantially impact differences across schools but can provide information on the mechanisms driving teachers' choices of schools and districts.

*The Impact of Attrition and Transfers:* Teachers make choices that impact equity, not only when they choose their first teaching job, but also, when they decide to quit or transfer. One of the most interesting aspects of our data is the ability to follow the career choices that teachers make. In this part of the analysis, we follow cohorts of teachers examining the choices these teachers make about whether to remain in teaching in New York and whether to remain in the same school or district. For those who quit or transfer, we compare their attributes to those of their colleagues who stay and we explore the educational environments they leave and move to. This analysis shows whether quit and transfer behaviors impact the distribution of teacher qualifications across schools.

*Teacher Salaries:* Ultimately we are interested in determining causes of the distribution of teachers that we see. Teacher salaries are evident policy tools for influencing this distribution. In the final part of the analysis, we look at salary differences across schools to determine whether these differences are likely to be adding to the disparities that we see or reducing additional inequities that would exist if salaries were the same across schools. We run similar analyses as those for teacher characteristics, including decompositions, correlations with school and student characteristics, and changes over time.

### *The Teacher Workforce*

*The Uneven Distribution of Teachers:* By almost any measure, the qualifications of New York's teachers are unevenly distributed across schools. This is true across a wide range of teacher quality attributes. Table 1 shows the 10th, 50th and 90th percentiles for a variety of measures of

TABLE 1
*School Quantiles for New York State Teacher Attributes, 2000*

| | Percentile | | |
|---|---|---|---|
| Teacher Quality Attribute | 10th | Median | 90th |
| Overall teacher quality factor | –2.974 | 0.469 | 2.093 |
| % With no teaching experience | 0.000 | 0.067 | 0.176 |
| % BA degree or less | 0.029 | 0.125 | 0.262 |
| % Not certified in any assignment | 0.000 | 0.038 | 0.243 |
| % Permanent certification in all assignments | 0.449 | 0.731 | 0.889 |
| % Fail General Knowledge or Liberal Arts Exam | 0.000 | 0.077 | 0.308 |
| % BA from most competitive college | 0.000 | 0.088 | 0.234 |
| % BA from least competitive college | 0.000 | 0.097 | 0.300 |

teacher qualifications across all schools in the State. The differences across schools are striking.

Many schools have no teacher who is new, is teaching out of their certification area, failed a certification exam on their first attempt, or who graduated from the least competitive undergraduate colleges (10th percentile or below). On the other hand, many other schools (90th percentile or above) have a substantial portion of teachers who are brand new teachers (18%), who are only teaching courses for which they are not certified (24%), or who failed a certification exam on their first attempt (about one third). In some schools less than half of the teachers are permanently certified in all of the courses they teach while in other schools this figure is nearly 90%. Clearly, the qualifications of teachers are not evenly distributed across schools.

*Correlations Among Multiple Measures of Teacher Quality:* Even though it is feasible that some schools have less skilled teachers as measured in one dimension while others have less skilled teachers as measured in another dimension, this is generally not the case. The school-level teacher attribute measures are highly correlated as shown in Table 2.

Schools that have low quality teachers as measured by one attribute are more likely to have low quality teachers based on all other measures. For example, schools with high proportions of teachers who failed exams are more likely to have teachers from less competitive colleges (correlations of approximately 0.45) and schools with a high proportion of teachers who are not certified to teach any of the courses that they currently teach are much more likely to have teachers who graduated from the less competitive colleges (correlation of .40). The teacher quality factor is highly correlated with all the individual teacher attributes. Thus, New York's schools are subject to substantial systematic sorting of teachers based on their qualifications. Understanding the geography over which teacher sorting takes place provides insights into the factors that contribute to sorting.

*Decomposition of the Variation:* For the purpose of this analysis we roughly characterize nine labor markets in the state consisting of six individual Metropolitan Statistical Areas (MSAs) and three remaining rural areas (Boyd, Lankford, Loeb, and Wyckoff (2001) provides support for these definitions).[6] Table 3 shows the variance decomposition for New York State.

For the composite factor we find that approximately 25% the variation is between regions in the state; 40% is between districts within regions; and 35% is among schools within districts. Although, this partition differs across some of the component measures, there is remarkable consistency in the finding that most of the variance in teacher qualifications occurs either between districts within regions or among schools within districts. This result becomes particularly striking when we control for differences between the New York City region and the rest of the state.[7] When the New York City region is removed from the analysis, in Table 4, only two percent of the variation in the composite teacher quality index lies between regions.[8]

The results in Table 4 indicate that most of the variance in the qualifications of teachers results from either differences between districts within regions or differences between schools within districts.[9] While the New York City region differs from the rest of the state in the qualifications of its teachers, there is very little difference across the other regions. The substantial sorting of teachers within districts suggests that nonpecuniary characteristics of the schools may be playing an important role in teachers' choices of where to teach. The sorting that occurs across districts within regions suggests that district policies, including hiring practices, salaries and district-wide nonpecuniary attributes of jobs may also be important. Since teacher qualifications differ widely across New York, and most of these differences exist within regions, we explore intra-region sorting in greater detail.

*Correlates with Teacher Qualifications:* In order to characterize the sorting process we look at differences in teacher measures: (a) across labor markets, (b) between urban and suburban areas within each metropolitan area, (c) across students of different race, (d) across students in different income groups, (e) across students with different English proficiency, and (f) between high-performing and low-performing schools. Again, the results are striking, if predictable. Substantially less qualified teachers teach poor, minority students in urban areas.

*Labor Markets:* As suggested by the decomposition, there are few differences across regions in the qualifications of teachers. Figure 1 shows the distribution of the composite index across the state's labor markets. The most notable excep-

TABLE 2
*Pearson Correlations Among School-Average Teacher Measures*

| Teacher Quality Attribute | Overall teacher quality factor | No teach. exp. | BA degree or less | Not certified | Perm. cert. in all subjects | % Fail Gen. Know. or Lib. Arts | % BA, most comp. college | % BA, least comp. college |
|---|---|---|---|---|---|---|---|---|
| Overall teacher quality factor | 1.00 | | | | | | | |
| % With no teaching experience | –0.55 | 1.00 | | | | | | |
| % BA degree or less | –0.64 | 0.51 | 1.00 | | | | | |
| % Not certified in any assignment | –0.67 | 0.36 | 0.40 | 1.00 | | | | |
| % Permanent certification in all | 0.81 | –0.57 | –0.61 | –0.70 | 1.00 | | | |
| % Fail Gen. Know. or Liberal Arts Exam | –0.63 | 0.12 | 0.22 | 0.50 | –.035 | 1.00 | | |
| % BA, most competitive college | 0.17 | *0.03* | *–0.03* | *0.03* | –0.06 | –.20 | 1.00 | |
| % BA, least competitive college | –0.56 | 0.13 | 0.12 | 0.40 | –0.33 | .47 | –0.24 | 1.00 |

*Note.* Correlations are significant at the $p < .0001$ level except for those in italics.

TABLE 3
*Variance Decomposition*

| Teacher Quality Attribute | Between region | Between district within region | Between school within district |
|---|---|---|---|
| Overall teacher quality factor | 0.25 | 0.40 | 0.35 |
| % With no teaching experience | 0.02 | 0.25 | 0.72 |
| % BA degree or less | 0.02 | 0.35 | 0.63 |
| % Not certified in any assignment | 0.17 | 0.47 | 0.36 |
| % Permanent cert. in all assignments | 0.14 | 0.42 | 0.44 |
| % Fail General Knowledge or Liberal Arts Exam | 0.16 | 0.38 | 0.45 |
| % BA from most competitive college | 0.14 | 0.35 | 0.51 |
| % BA from least competitive college | 0.41 | 0.28 | 0.31 |

tion to this general pattern is that the New York City Region has fewer qualified teachers than the other regions in the state. This is true at the 10th, 50th, and 90th percentile. However, the differences at the 10th percentile are by far the greatest. There are a group of schools in the New York City region that have substantially less skilled teachers than those found in the rest of the state.

*Urbanicity:* For each of the urban labor markets in New York State, Table 5 shows the distribution of school-level teacher attributes for the urban and suburban schools separately. With the exception of the Utica-Rome region, urban schools have teachers with lesser qualifications. For example, in ten percent of urban schools in the Buffalo region one third of the teachers had failed the liberal arts exam, whereas in suburban schools, only one fifth failed the exam. Similar trends are evident across multiple measures and across the multiple metropolitan areas. Again, the results for the New York City region are most striking. Ten percent of New York City urban schools have an average teacher quality measure that is five standard deviations lower than the state average. The table also shows important differences in teacher qualifications within urban districts. In every urban district, the schools at the 10th percentile are qualitatively different from those at the 90th percentile.

*Student Characteristics:* As we try to better understand teacher sorting, we look at the extent to which the qualifications of teachers are sorted with respect to the racial, economic, and language attributes of students. We find that nonwhite students experience less skilled teachers than white students, poor students experience less skilled teachers than nonpoor students, and students with limited English proficiency experience less skilled teachers than non-LEP students. Table 6 summarizes the results for race and poverty status.[10] For New York State, 17% of nonwhite students have teachers who are not certified to teach any of their current teaching assignments, compared with four percent for white students. Twenty-one percent of nonwhite students' teachers have failed either the General Knowledge or Liberal Arts and Science certification exam, compared with seven percent for white students. Poor students also experience less skilled teachers. For example, on average 28% of teachers of poor students have failed the

TABLE 4
*Analysis of Variance Excluding New York City Region*

| Teacher Quality Attribute | Between region | Between district within region | Between school within district |
|---|---|---|---|
| Overall teacher quality factor | 0.02 | 0.32 | 0.66 |
| % With no teaching experience | 0.01 | 0.27 | 0.73 |
| % BA degree or less | 0.03 | 0.32 | 0.65 |
| % Not certified in any assignment | 0.03 | 0.40 | 0.57 |
| % Permanent cert. in all assignments | 0.02 | 0.32 | 0.66 |
| % Fail General Knowledge or Liberal Arts Exam | 0.01 | 0.25 | 0.75 |
| % BA from most competitive college | 0.25 | 0.30 | 0.45 |
| % BA from least competitive college | 0.11 | 0.40 | 0.49 |

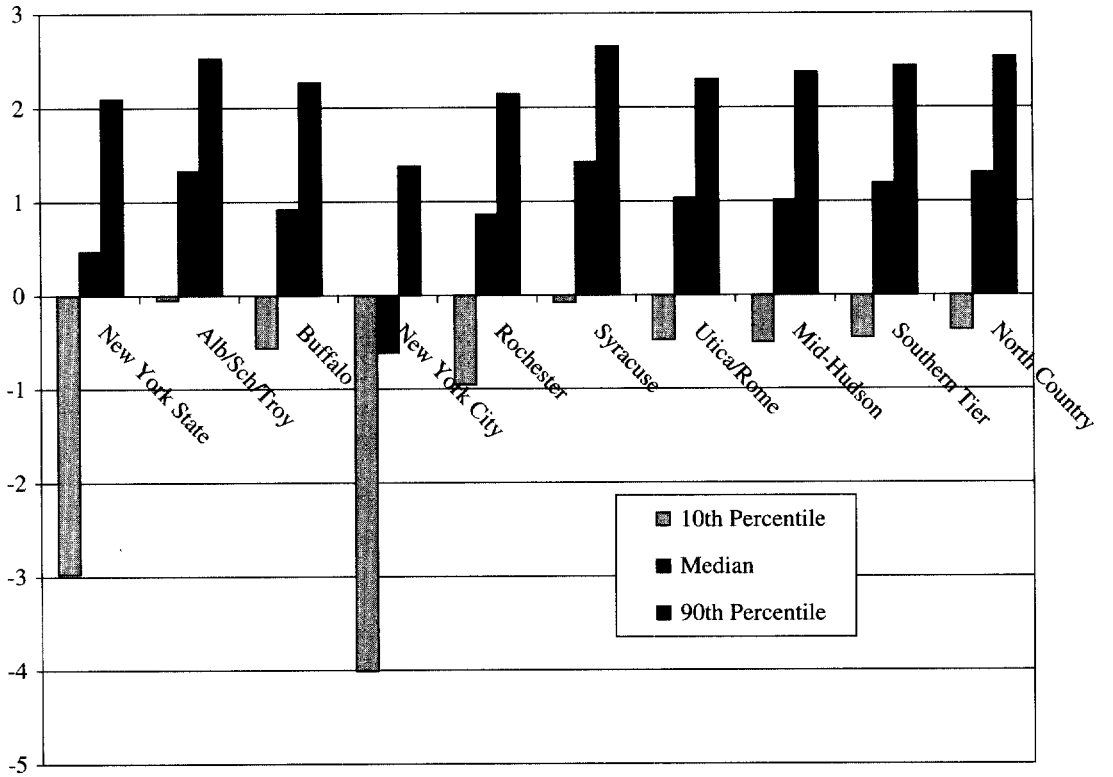


FIGURE 1. *The distribution of composite teacher quality by region.*

*Note.* Buffalo reflects the schools in the Buffalo MSA outside of the Buffalo City School District. The Buffalo City School District has a certification program that differs from that in use in the remainder of the State and therefore certification data is not comparable and the composite measure could not be computed. The standard error of the mean for the state is .034. The standard errors of the means for the regions are .065, .074, .048, .073, .064, .103, .067, .064, .066 respectively. Alb = Albany, Sch = Schenectady.

certification exams, compared with 20% for nonpoor students.[11]

Urban areas differ from rural areas and regions differ among themselves in the characteristics of their students. In order to assess whether the differences in teacher qualifications across groups of students is a result of these students living in different regions or urban areas, we look across student groups in four out of five of the state's largest urban centers.[12] Table 6 presents the results. Again, we see that nonwhite students experience teachers with lesser qualifications on a number of measures. In Yonkers, Rochester and Syracuse white students attend schools with teachers with .20 to .35 standard deviations higher in skills than nonwhite students as measured by our factor, and nonpoor students attend schools with teachers with .20 to .27 standard deviations higher in skills than poor students. The disparities within the New York City School District are substantially greater. In New York City, 21% of nonwhite students have teachers who are not certified in any subject taught, compared to 15% of white students. Twenty six percent of nonwhite students have teachers who failed either the General Knowledge or Liberal Arts and Science certification exam, compared to 16% of white students. Similarly, poor students have lower quality teachers than nonpoor students; 22% of poor students have teachers who are not certified in any subject taught, compared to 17% of nonpoor students; and 30%of poor students have teachers who failed the certification exam, compared to 21% of nonpoor students. In general the differences between the qualifications of teachers teaching LEP and non-LEP students in all urban areas is much smaller than the differences for race and income. While the intradistrict disparities are large, it is worth noting that there are differences

TABLE 5

*School Quantiles for New York State Teacher Attributes by MSA, All Teachers 2000 (All teachers FTE >.5)*

| Teacher Quality Attribute | | Alb/Sch./Troy | | Buffalo | | New York City | | Rochester | | Syracuse | | Utica/Rome | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | urban | suburban | urban | suburban | urban | suburban | urban | suburban | urban | suburban | urban | suburban |
| Teacher quality factor | 10th | –0.19 | 0.04 | na | –0.56 | –4.99 | –1.47 | –2.00 | –0.55 | –0.39 | 0.03 | –0.80 | –0.38 |
| | Median | 1.20 | 1.40 | na | 0.92 | –1.97 | 0.70 | 0.07 | 1.02 | 0.87 | 1.44 | 0.90 | 1.13 |
| | 90th | 1.75 | 2.62 | na | 2.27 | 0.15 | 1.93 | 1.45 | 2.30 | 2.10 | 2.70 | 2.93 | 2.18 |
| % With no teaching experience | 10th | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| | Median | 0.06 | 0.06 | 0.08 | 0.06 | 0.10 | 0.05 | 0.09 | 0.06 | 0.06 | 0.05 | 0.06 | 0.06 |
| | 90th | 0.17 | 0.13 | 0.22 | 0.15 | 0.24 | 0.15 | 0.18 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| % Not certified in any assignment | 10th | 0.00 | 0.00 | na | 0.00 | 0.09 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Median | 0.03 | 0.01 | na | 0.00 | 0.20 | 0.03 | 0.14 | 0.02 | 0.05 | 0.02 | 0.02 | 0.00 |
| | 90th | 0.10 | 0.06 | na | 0.06 | 0.38 | 0.10 | 0.26 | 0.08 | 0.11 | 0.09 | 0.10 | 0.06 |
| % Failed NTE Gen. Know. or NYS Lib. Arts Exam | 10th | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Median | 0.10 | 0.00 | 0.10 | 0.04 | 0.27 | 0.09 | 0.13 | 0.00 | 0.10 | 0.00 | 0.12 | 0.00 |
| | 90th | 0.20 | 0.18 | 0.33 | 0.20 | 0.53 | 0.32 | 0.25 | 0.17 | 0.24 | 0.19 | 0.29 | 0.21 |
| % BA from most competitive college | 10th | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.09 | 0.14 | 0.05 | 0.07 | 0.00 |
| | Median | 0.06 | 0.08 | 0.03 | 0.06 | 0.07 | 0.11 | 0.19 | 0.22 | 0.21 | 0.15 | 0.14 | 0.13 |
| | 90th | 0.13 | 0.17 | 0.08 | 0.13 | 0.23 | 0.24 | 0.25 | 0.36 | 0.29 | 0.29 | 0.21 | 0.23 |
| % BA from least competitive college | 10th | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Median | 0.05 | 0.03 | 0.06 | 0.03 | 0.24 | 0.15 | 0.10 | 0.03 | 0.05 | 0.03 | 0.06 | 0.03 |
| | 90th | 0.08 | 0.10 | 0.14 | 0.09 | 0.42 | 0.28 | 0.16 | 0.09 | 0.09 | 0.07 | 0.11 | 0.09 |

*Note.* Alb = Albany, Sch = Schenectady.

TABLE 6
*Teacher Attributes for the Average Student with Given Characteristics*

| Region | Overall teacher quality factor | No teaching experience | Not certified in any subject taught | Failed Gen Know or Liberal Arts Exam | B.A. from least competitive college |
|---|---|---|---|---|---|
| New York State | | | | | |
| Nonwhite | −1.484 | 0.099 | 0.166 | 0.212 | 0.214 |
| White | 0.847 | 0.067 | 0.040 | 0.071 | 0.102 |
| Poor | −2.393 | 0.118 | 0.207 | 0.279 | 0.250 |
| Nonpoor | −1.223 | 0.098 | 0.159 | 0.202 | 0.239 |
| New York City SD | | | | | |
| Nonwhite | −2.183 | 0.109 | 0.212 | 0.256 | 0.247 |
| White | −0.726 | 0.078 | 0.150 | 0.161 | 0.254 |
| Poor | −2.562 | 0.120 | 0.215 | 0.296 | 0.268 |
| Nonpoor | −1.341 | 0.100 | 0.167 | 0.212 | 0.258 |
| Yonkers City SD | | | | | |
| Nonwhite | −0.733 | 0.081 | 0.043 | 0.188 | 0.205 |
| White | −0.531 | 0.075 | 0.045 | 0.180 | 0.200 |
| Poor | −1.273 | 0.098 | 0.039 | 0.208 | 0.221 |
| Nonpoor | −0.995 | 0.094 | 0.031 | 0.203 | 0.211 |
| Rochester City SD | | | | | |
| Nonwhite | −0.302 | 0.105 | *0.148* | 0.107 | 0.103 |
| White | 0.051 | 0.089 | *0.147* | 0.099 | 0.107 |
| Poor | −0.418 | 0.108 | *0.173* | 0.120 | 0.097 |
| Nonpoor | −0.221 | 0.111 | *0.171* | 0.111 | 0.096 |
| Syracuse City SD | | | | | |
| Nonwhite | 1.029 | 0.080 | 0.058 | 0.100 | 0.045 |
| White | 1.254 | 0.063 | 0.054 | 0.095 | 0.043 |
| Poor | 0.970 | 0.081 | 0.056 | 0.109 | 0.046 |
| Nonpoor | 1.194 | 0.069 | 0.046 | 0.103 | 0.040 |

*Note.* All differences between Nonwhites and Whites and between Poor and Nonpoor are significant at the $p < .01$ level except for those in italics.

across the cities as well. Syracuse students, for example, are taught by more qualified teachers than those in the other urban settings to the extent that nonwhite students in Syracuse have teachers with higher average quality scores than white students in the other cities.

In summary, lesser-qualified teachers teach poor, nonwhite students. Much of these differences are due to differences in average characteristics of teachers across districts, not within urban districts; but differences among schools within urban districts are important as well. The New York City school district, in particular, exhibits large differences among student groups in the qualifications of their teachers. Note, this analysis only assess differences in the average characteristics of schools. Additional systematic sorting of teachers to students may occur within schools.

Lower performing students are also more likely to be in schools with less-skilled teachers. We do not have individual-level test scores, yet we do have test scores at the school level. We partition schools by the percent of their students that performed at the lowest level on the 4th and 8th grade English Language Arts exam.[13] The results are similar if we use mathematics exams instead (the correlations between the two scores are approximately 0.9). Table 7 shows that schools in which more than 20% of students are scoring at the lowest level have consistently less qualified teachers than the other schools. For example, 35% had failed their General Knowledge or Liberal Arts and Science exam, compared to nine percent in schools in which none of the students had scored at the lowest level on the 4th grade ELA exam. Correlations between school achievement

TABLE 7
*Average School Attributes of Teachers by Student Test Score—4th Grade ELA Level 1, 2000*

| | Percent of Students in Level 1 4th Grade ELA | | | |
|---|---|---|---|---|
| Teacher Quality Attribute | 0 | 0% to <5% | 5% to <20% | >20% |
| Overall teacher quality factor | 0.98** | 0.86** | −0.30** | −2.82 |
| % With no teaching experience | 0.06** | 0.07** | 0.09** | 0.14 |
| % Not certified in any assignment | 0.03** | 0.04** | 0.09** | 0.22 |
| % Fail NTE Gen. Know. or NYS Lib. Arts Exam | 0.09** | 0.10** | 0.19** | 0.35 |
| % BA from most competitive college | 0.11** | 0.11** | 0.09 | 0.08 |
| % BA from least competitive college | 0.10** | 0.11** | 0.16** | 0.26 |

*Note.* Statistical significance refers to differences between other student performance levels and the > 20% level for each of the mean teacher attributes: ~p < .10; *p < .05; **p < .01.

and teacher characteristics tell the same story; the proportion of a school's students who achieved at Level 1 has a 0.63 correlation with the proportion of that school's teachers who are not certified to teach any of their current courses. The correlations for the proportion failing either the NTE General Knowledge or the NYSTCE Liberal Arts and Science exam are both 0.50, and the correlation of student achievement with teacher graduation from a less competitive college is 0.41. The results of these analyses are clear. Dramatically less qualified teachers teach students in low-performing urban schools.

*Changes in the Distribution Over Time:* The variation in teacher attributes across schools appears to have remained relatively constant during the past 15 years across most of our measures, though there is weak evidence of a decrease in teacher qualifications over time. We looked at time trends in all of our teacher qualification measures for the state as a whole and then for each urban region, separating urban from suburban districts within those regions. Little consistent change is evident. For example, as shown in Figure 2, the mean proportion of teachers whose BA is from a less competitive college has remained

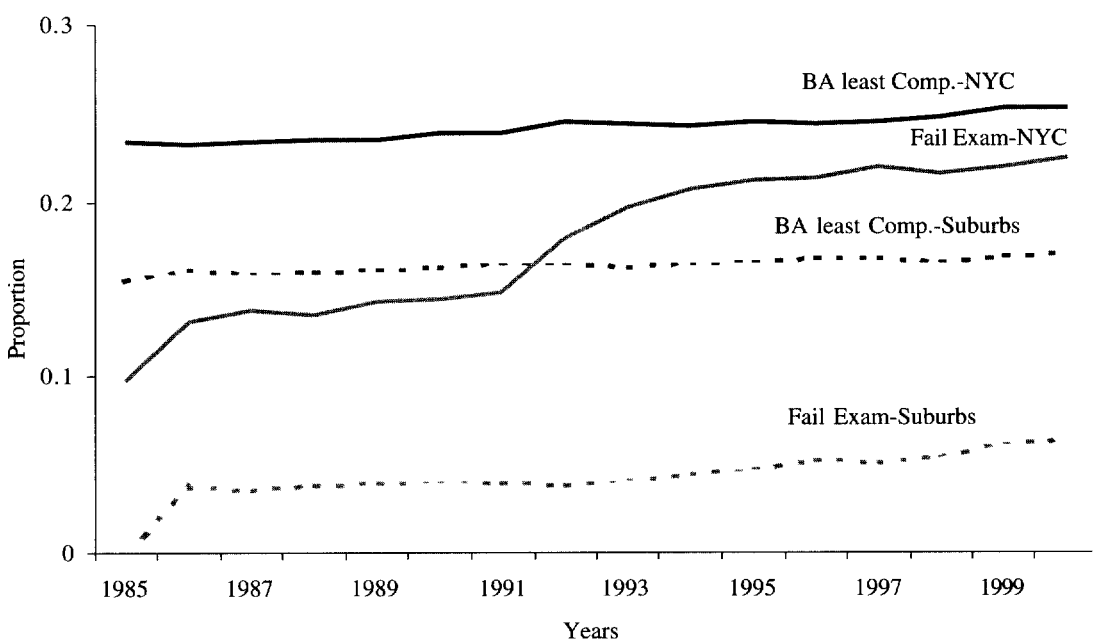


FIGURE 2. *The proportion of teachers in the New York metropolitan region who attended undergraduate colleges ranked by Barrons as least competitive and who failed either the NTE General Knowledge or the NYSTCE Liberal Arts and Science Certification Exams.*

stable in both New York City and its suburbs from 1985 through 2000. We note a slight upward trend during our time period from 23.3 percent to 25.3% in the urban districts and 15.4% to 16% in the suburban districts. This same pattern occurs in other metropolitan regions for this variable. Figure 2 does show a steady increase in the portion of teachers who failed either the NTE General Knowledge or the NYSTCE Liberal Arts and Science certification exams in New York City, though some of this change may be due to changes in the test over time. Similar analyses of the other metropolitan areas in the state suggest little or no change in the average characteristics of teachers.

The difference between suburban and urban areas has also remained relatively constant over time. Urban schools have consistently employed less qualified teachers than their suburban counterparts. We also examine changes over time for new teachers and again find little change. For example, in 1985 13.9% of new teachers had received their BA degree from a least competitive college; in 2000 this number was 13.8%. In general, the qualifications of teachers and the sorting of teachers appear stable over time.

*The Impact of Attrition and Transfers:* New teachers impact the disparities between schools by their choice of first teaching job. Transfers of teachers between schools and attrition of teachers from the New York State system may also impact equity if there are systematic patterns in the teachers who leave or transfer and in the schools they leave or move to. In this section we follow the cohort of teachers who were hired to their first teaching jobs in 1993 over the next five years of their careers.[14] Fewer than 40% of teachers with no prior teaching experience hired in 1993 remained in the same school in which they began their careers by 1998. Most of those leaving these schools left public school teaching in New York State.[15] Table 8 illustrates some differences in career paths of teachers. We look separately at differences in patterns between urban and suburban schools in New York City, urban and suburban schools in other large metropolitan areas (Buffalo, Rochester, and Syracuse), schools in other metropolitan areas, and schools in rural areas.[16]

The teacher turnover rate tends to be higher in urban schools, particularly those in the large urban areas. In urban districts in the New York City Region, for example, 38% of teachers were in the same school five years later, compared to 46% in suburban schools. In the other large metropolitan areas the corresponding numbers were 29% and 43% for urban and suburban schools respectively.

Confirming what many observers believe, teachers beginning their careers in New York City urban schools are far more likely to leave public school teaching in New York State than are other teachers in the state. Thirty-five percent of New York City urban teachers leave the system. No other area has separations that exceed 29%. However, in contrast to what many would predict, New York City has the lowest interdistrict transfer rate of any area. This may be due to more schools per district in New York City however, when school and district transfers are combined, New York City urban schools still have the lowest transfer rate. This would suggest that while the City does lose a large number of teachers to the suburbs, in percentage terms it is not extraordinary.[17]

Given that teachers have been shown to gain substantial skills over the first few years of teaching (Rivkin, Hanushek, and Kain, 2000), high exit rates and the resulting churning of teachers on the front end of the experience distribution

TABLE 8
*Disposition of 1993 New Teachers as of 1998, by Region*

| | New York City region | | Buffalo, Rochester, Syracuse regions | | Other MSA regions | | Rural regions | New York State |
|---|---|---|---|---|---|---|---|---|
| | Urban | Suburban | Urban | Suburban | Urban | Suburban | | |
| Same school | 38.3** | 45.6 | 29.2** | 43.0 | 39.2 | 40.2 | 42.7 | 40.2 |
| Different school | 20.5** | 15.3 | 29.6** | 20.1 | 24.9** | 13.4 | 12.2 | 18.4 |
| Different district | 6.3** | 14.4 | 12.6 | 14.8 | 13.3* | 22.0 | 18.5 | 11.3 |
| Not in NYS system | 35.0** | 24.8 | 28.6* | 22.1 | 22.7 | 24.4 | 26.5 | 30.1 |

*Note.* Statistical significance refers to differences in employment status between teachers in urban and suburban schools: ~p < .10; *p < .05; **p < .01.

may impact the quality of education that students receive. Additionally, if more qualified teachers generally transfer or leave the system, leaving behind their less qualified colleagues, the negative impact of this turnover may increase. This appears to be the case. Table 9 shows that New York State teachers who began their careers in 1993 and transfer to a different district or quit teaching have stronger qualifications than those who remain in the same district. Teachers transferring to a different district are half as likely to have failed either the NTE General Knowledge or NYSTCE Liberal Arts and Science certification exam. They are 35% more likely to have received their BA from a highly or most competitive college and they are about half as likely to have received their BA from the least competitive colleges. Those who leave teaching in New York public schools altogether are somewhat less likely to have failed the certification exams, 60% more likely to have received their BA from a most or highly competitive college, and somewhat less likely to have graduated from the least competitive college. In contrast, there is little difference in the qualifications of teachers who remain in the same schools and those that transfer to other schools in the same district. This similarity may be due to district or union rules that dictate which teachers may transfer.

Comparable results for New York City teachers generally show larger differences for those transferring or quitting. Those transferring to another district have failed the certification exams half as often as those remaining in the same school. They are twice as likely to have attended a most or highly competitive college, and about half as likely to have attended the least competitive college. New York City teachers who leave teaching in New York State are also more qualified than those who remain. While the leaving behavior of teachers is consistent with the hypothesis that the opportunity cost for the best teachers is greatest, it suggests the importance of policies that seek to retain, as well as to attract, highly skilled teachers.

What is the nature of the school environments that these leavers exit and what environments are they drawn to? There are systemic patterns, particularly when teachers move across district boundaries. Table 10 illustrates this dynamic for teachers in the 1993 cohort who transfer during the next five years. Teachers generally leave schools where the proportion of poor and nonwhite students is about 75% to 100% greater than it is in the schools to which they transfer and their classes are about two students smaller. Perhaps most interestingly, their salaries are between 4 and 15% greater in their new district than they would have been had they remained in their original district.[18] We see that this systematic sorting is not as strong for transfers within districts, though still evident. Receiving schools have on average four percentage points fewer poor students and two percentage points fewer nonwhite students.

For the cohort of teachers in the New York City region (see Table 11), the differences between the teaching environments before and after transferring are even greater than for the state as a whole. Across districts, sending schools have three times higher the proportion of poor students and two times higher the proportion of nonwhite students than receiving schools. Salary differentials are particularly interesting; teachers in the New York City region who transfer to other districts receive between a 12 and 22% salary increase. Again, we see some similar trends in the intradistrict transfers but the size of the difference is much smaller. In general, the results provide evidence that moves impact the quality and composition of the teaching workforce. Teachers

TABLE 9
*Attributes of New York State Beginning Teachers in 1993 by Their 1998 Employment Status*

| Teacher Attribute | Same school | Different school | Different district | Not in NYS system |
|---|---|---|---|---|
| % Fail General Knowledge or Liberal Arts Exam | 0.142 | 0.158 | 0.072** | 0.125 |
| % BA from most competitive college | 0.116 | 0.112 | 0.157** | 0.191** |
| % BA from least competitive college | 0.157 | 0.169 | 0.087** | 0.145 |
| % With master degree when hired | 0.391 | 0.364~ | 0.382** | 0.389 |

*Note.* Statistical significance refers to differences between other employment statuses and those remaining in the same school for each of the mean teacher attributes: ~ $p < .10$; * $p < .05$; ** $p < .01$.

TABLE 10
*Attributes of Sending and Receiving Schools for 1993 Teachers in New York State Who Transferred by 1998*

| | Within District | | | Between District | | |
|---|---|---|---|---|---|---|
| School & District Attribute | Sending school | Receiving school | Difference | Sending school | Receiving school | Difference |
| Proportion students poor | 0.549 | 0.506 | −0.043~ | 0.381 | 0.192 | −0.189** |
| Proportion students LEP | 0.110 | 0.108 | −0.002 | 0.062 | 0.034 | −0.028* |
| Proportion students nonwhite | 0.639 | 0.621 | −0.018 | 0.404 | 0.231 | −0.173** |
| Class size | 24.0 | 24.2 | 0.2 | 23.5 | 21.7 | −1.8* |
| Salary schedule | na | na | na | $33,237 | $34,535 | $1,298** |
| Actual salary | na | na | na | $31,685 | $36,482 | $4,798** |

*Note.* Statistical significance refers to differences between sending and receiving schools for the mean of each teacher attribute: ~p < .10; *p < .05; **p < .01.

who transfer arguably leave those students most in need of strong teachers, compounding the inequities in teacher qualifications across schools.

### *Teacher Salaries*

Given the evidence that teachers respond to wages in their career choices, the level and structure of teacher salaries may impact the distribution of teachers across schools. Tables 10 and 11 provide preliminary evidence of this. We now look at salary differences across schools more systematically to determine whether these differences are likely to be adding to the disparities that we see or reducing additional inequities that would exist if salaries were the same across schools.

*Decomposing salary variation:* Salary schedules generally do not vary within districts. That is, most teachers who remain within the same district would receive similar salaries regardless of which school they taught in. Thus, salary differentials are unlikely to be driving the substantial intra-district disparities in teacher characteristics across schools.

While salary schedules are generally constant within districts, they do vary across regions and districts. Among districts in New York State, 68% of the variation in starting salaries for teachers with master's degrees is between regions (not between districts within regions). For teachers with 20 years of experience, 79% of the variation is between regions (again, not between districts within regions). Similar trends hold nationally.[19] This suggests that the bulk of the variation in salaries is not contributing to the sorting of teachers across districts or schools within labor markets. It may contribute to differences across region or simply reflect differences in the opportunity cost of teaching across labor markets. For example, when wages in alternative occupations are higher or when the region does not have the infrastructure to train a sufficient number of

TABLE 11
*Attributes of Sending and Receiving Schools for 1993 Teachers in the New York City Region Who Transferred by 1998*

| | Within District | | | Between District | | |
|---|---|---|---|---|---|---|
| School & District Attribute | Sending school | Receiving school | Difference | Sending school | Receiving school | Difference |
| Proportion students poor | 0.715 | 0.657 | −0.058* | 0.677 | 0.208 | −0.468** |
| Proportion students LEP | 0.163 | 0.163 | 0.000 | 0.153 | 0.062 | −0.091** |
| Proportion students nonwhite | 0.886 | 0.858 | −0.028 | 0.883 | 0.401 | −0.482** |
| Class size | 25.9 | 25.7 | 0.1 | 26.6 | 20.8 | 5.8** |
| Salary schedule | na | na | na | $33,982 | $38,256 | $4,274** |
| Actual salary | na | na | na | $32,529 | $39,835 | $7,306** |

*Note.* Statistical significance refers to differences between sending and receiving schools for the mean of each teacher attribute: *p < .05; **p < .01.

teachers, schools may need to pay more to attract and retain equally qualified teachers.

While less variation in salary exists within regions, this variation nonetheless appears to be large enough to impact teacher sorting.[20] To help assess whether these differences are likely to be contributing to teacher sorting, Figure 3 plots the 10th, 50th, and 90th percentile starting salary for each region of the state. It shows that approximately ten percent of districts have starting wages lower than $30,000, while another ten percent have starting wages higher than $41,000.[21] The New York City metropolitan area has the highest overall starting salaries. Within regions, the difference in starting salaries between districts at the 90th percentile and those at the 10th percentile ranges from $3,937 in the Rochester region to $10,687 in the New York City region. These differences are economically substantial and may be contributing to sorting among districts within a region.[22]

*Changes over time:* Salary schedules change over time. For each of the metropolitan area regions in New York State we calculated average starting salaries in each year for urban districts and for suburban districts separately using the Consumer Price Index (CPI), to normalize over time. We find that starting salaries in most New York urban and suburban districts in 2000 do not exceed and are often less than what they were in 1970 in real terms. This finding is consistent with Ehrenberg, Brewer, Gamoran, and Wilms (2001). Salaries tended to decrease in the 1970s and early 1980s, increase in the later 1980s and remain relatively constant during the 1990s.

*Urban-Suburban differences:* In 1970 in every major metropolitan region, salaries paid to urban teachers either matched or exceeded those paid to suburban teachers. In most of these regions, this pattern continued through 2000. In Buffalo and Syracuse, for example, there has been little difference over time between suburban and urban

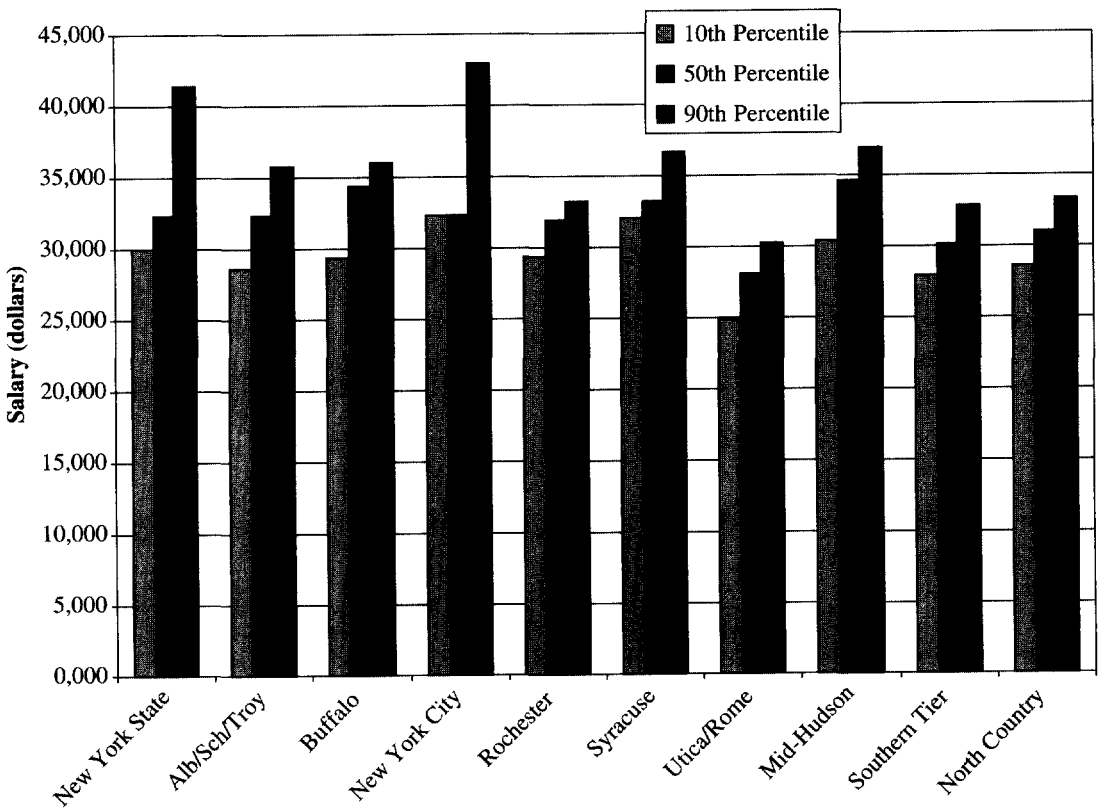


FIGURE 3. *The distribution of starting salary overall and within regions of New York State.*

*Note.* The standard error of the mean is 73 for the state and 181, 160, 107, 112, 155, 215, 197, 119, 136 for the regions respectively.

salaries either for starting teachers or more experienced teachers. They remain almost identical today. In Rochester urban salaries have been higher on average than suburban salaries though this difference has diminished in recent years, especially for new teachers. In 2000 in Rochester, there was essentially no difference in average starting salaries between urban and suburban districts. Teachers with 20 years of experience earned, on average, approximately $5,000 more in urban schools than in suburban schools. This difference may or may not be enough to compensate for difficulties of teaching in urban schools. The pattern in the New York City region is quite different. Over the 1970–2000 period, New York City urban salaries at both the entry level and the veteran level fell substantially behind their suburban counterparts (see Figure 4a).[23] In 2000, starting salaries for novice New York City school district teachers with a master's degree were about 15% lower than those for comparable suburban teachers; those for veteran teachers were more than 25% less than their suburban counterparts.

*Wages and Student Characteristics:* Similar to teacher qualifications, salaries are not randomly distributed across districts. Table 12 shows how salaries differ for teachers of students with different demographic characteristics across our metropolitan regions. In most instances, teachers of nonwhite, poor, or low-achieving students receive roughly the same starting salaries, as do teachers of white, nonpoor, and non-low-achieving students. The New York City region is an interesting exception. Starting teachers of nonwhite and poor students in this region receive about $2,800 less than starting teachers for white and nonpoor students receive. Starting teachers of low-performing students typically earn about $1,700 less than teachers of non-low-performing students. Other exceptions include the Syracuse and Utica-Rome regions where poor and nonwhite students have teachers with lower starting salaries. In general, it appears that wage differentials do not compensate for the potential nonpecuniary effects of teaching poor, nonwhite, or low-achieving students and in some instances salary differences further exasperate this situation.

### *Discussion and Conclusions*

We draw the following primary conclusions from our analysis:

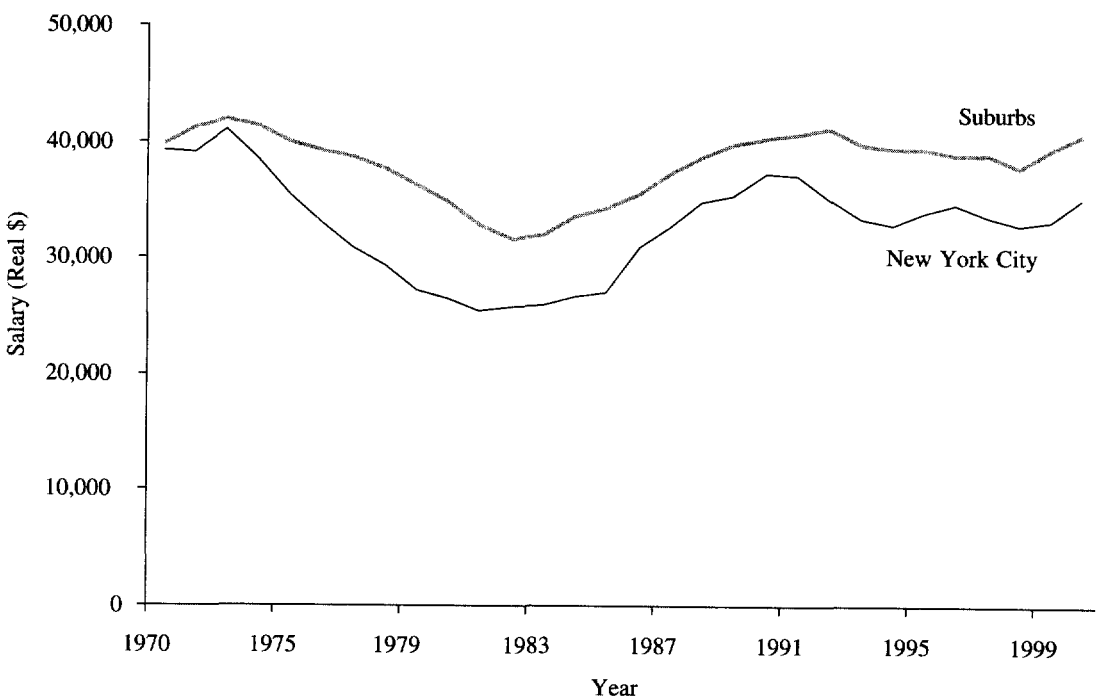


FIGURE 4a. *Estimated real salaries for teachers with MA and no experience, New York City Metropolitan Area, 1970–2000.*

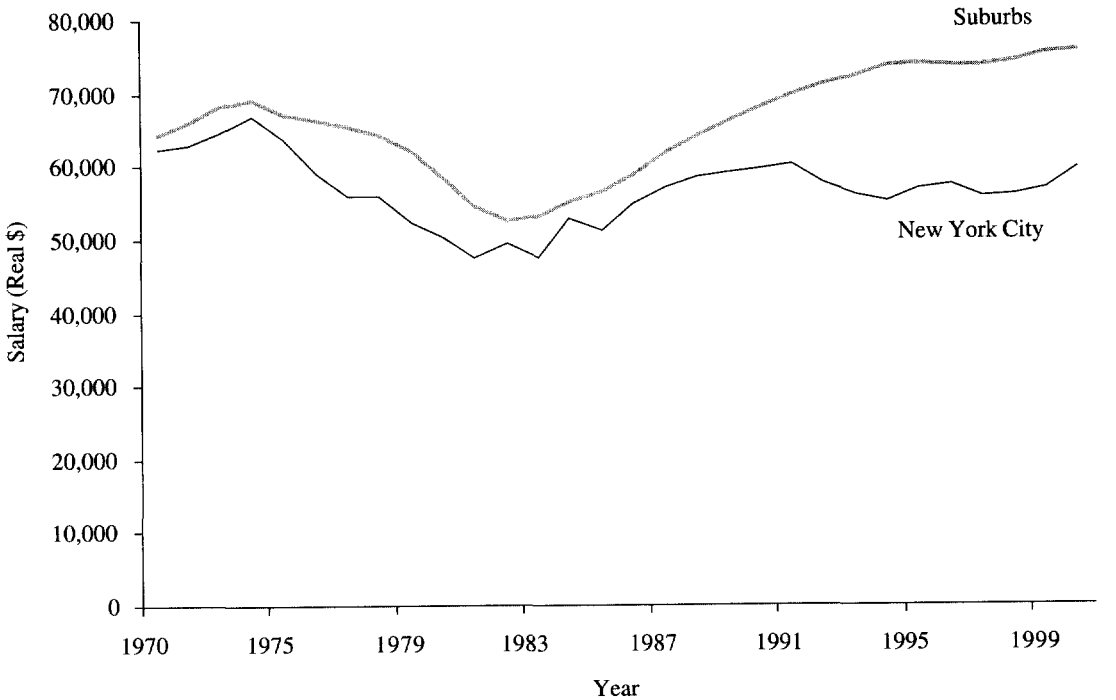


FIGURE 4b. *Estimated real salaries for teachers with MA and 20 years experience, New York City Metropolitan Area, 1970–2000.*

- Teachers are systematically sorted across schools and districts such that some schools employ substantially more qualified teachers than others do.
- Differences in the qualifications of teachers in New York State occurs primarily between schools within districts and between districts within regions, not across regions.
- The exception to the result that there is little difference in average teacher characteristics across regions is for the New York City region, which on average employs substantially less qualified teachers.
- Nonwhite, poor, and low performing students, particularly those in urban areas, attend schools with less qualified teachers.

TABLE 12
*Average Salaries for Teachers with MA and No Experience Teaching Students with Various Attributes by Region, 2000*

| Metropolitan Region | Nonwhite students | White students | Poor students | Nonpoor students | Low achieving | Non-low achieving |
|---|---|---|---|---|---|---|
| Albany (Sch./Troy) | $33,071 | $32,358 | $32,300 | $32,642 | *$32,625* | *$32,535* |
| Buffalo | $32,492 | $32,260 | $32,602 | $32,226 | *$32,193* | *$32,207* |
| New York City | $35,953 | $38,816 | $35,570 | $38,502 | $35,575 | $37,311 |
| Rochester | $32,037 | $31,727 | $31,680 | $31,946 | $31,755 | $31,923 |
| Syracuse | $33,372 | $34,535 | $33,800 | $34,662 | $33,795 | $34,608 |
| Utica/Rome | $26,528 | $28,347 | $27,458 | $28,349 | $27,698 | $28,200 |
| Mid-Hudson | $35,856 | $35,093 | $35,078 | $35,610 | *$35,359* | *$35,544* |
| Southern Tier | $30,063 | $30,193 | $30,164 | $30,294 | *$30,482* | *$30,358* |
| North Country | $31,903 | $31,315 | *$31,372* | *$31,393* | *$31,351* | *$31,470* |
| New York State | $35,564 | $34,785 | $34,774 | $35,676 | $34,960 | $35,343 |

*Note.* All differences between Nonwhite and White, between Poor and Nonpoor, and between Low achieving and Non-low achieving are significant at the $p < .01$ level except for those in italics. Alb = Albany, Sch = Schenectady.

- Although there may have been some increase in disparities in average teacher qualifications in recent years, similar differences have existed for at least the last 15 years.
- Transfer and quit behavior of teachers is consistent with the hypothesis that more qualified teachers seize opportunities to leave difficult working conditions and move to more appealing environments. Teachers are more likely to leave poor, urban schools and those who leave are likely to have greater skills than those who stay.
- The current salary structure for teachers likely does not alleviate the inequitable distribution of teachers and may well make it worse.

From a policy perspective, urban schools confront an enormous challenge. As the analysis above has shown, urban schools systematically receive less qualified teachers than their suburban counterparts and many of the dynamics work to the disadvantage urban students. Not coincidentally, these schools are most in need of teachers who are able to increase the performance of students achieving at the lowest levels. In New York State, urban students are four times more likely than their suburban peers to perform below basic proficiency.[24] Throughout the United States, nonurban students are 50% more likely to perform at a basic proficiency level than their urban peers. In high poverty settings, urban students reach basic proficiency half as often as their nonurban peers.[25]

Recruitment and retention of high-quality teachers have become a popular policy strategy for improving the performance of low-achieving students. Some states have now adopted incentives to attract teachers specifically to low-performing schools. For example, the states of Massachusetts and New York have adopted "signing bonus" policies. However, many policies aimed at attracting teachers do not target specific schools. For example, California recently enacted a tax credit of up to 50% of the tax that would otherwise be imposed on a teacher's salary and Oklahoma recently boosted its teacher salaries by $3,000 across the board. These nontargeted policies are unlikely to impact the dramatic disparities in teacher qualifications across schools.

Moreover, this is a difficult time to hire more high quality teachers. The baby boom generation of teachers is reaching retirement age and the baby boom "echo", the children of baby boomers, is working its way through the school system. Additionally, policies such as increased educational standards, accountability, and class size reduction increase the demand for highly skilled teachers. All of these trends may well have the adverse effect of reducing the qualifications of teachers available to low-performing urban schools as the higher skilled teachers move to openings in lower poverty, suburban districts.

Policies that aim to improve the achievement of low-performing students but ignore teacher labor market dynamics are unlikely to impact the sorting of teachers that appears to strongly disadvantage poor, urban students. This analysis provides a foundation for further work by documenting the extent and nature of teacher sorting. However, there is much to learn about the behavior of individuals interested in teaching and the schools that employ them. What factors are most important as individuals choose to become teachers and decide in which school to teach? Can changes in the structure of salaries alter the current sorting of teachers? Universally, what policies can be employed to attract and retain high-quality teachers in low-performing schools? Effective policy proposals may well depend on research to provide the answers to these questions.

## Notes

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[1] Rivkin, Hanushek, and Kain (2000) attribute at least seven percent of the total variance in test-score gains to differences in teachers and they argue that this is a lower bound. Sanders and Rivers (1996) find that the difference between attending classes taught by high-quality teachers (highest quartile grouping) and attending classes taught low-quality teachers (lowest quartile grouping) for three years in a row is huge, approximately 50 percentile points in the distribution of

student achievement. They also find residual effects of teachers in latter years. That is, having a high quality teacher in grade three increases learning not only in grade three but also in grades four and five.

[2] These findings may appear to be contradictory to qualitative studies (such as Berliner, 1987; Feistritzer, 1992; Murphy, 1987; and Wise, Darling-Hammond and Praskac, 1987) which tend to find that ideology and the value individuals place on education for society are important in decisions about whether and where to teach. However, because individuals' answers to questions may not reflect their actions, factors less emphasized by respondents, such as wages and job stability, may still be relatively important to teachers.

[3] See Appendix A for a description of the administrative datasets that we have linked together for this analysis.

[4] Value-added measures have the benefit that, ultimately, we care about how education affects student learning. They are direct measures of student learning. If we can design tests that measure the learning we care about, then we can define teacher quality in terms of this learning. However, very few school systems have the type of data that would support the implementation of a value-added assessment system. Moreover, because teacher assignments to students are not random, we may confound assignment with teacher quality. Value-added quality also cannot be measured for potential teachers or for first-year teachers since individuals must teach for several years before value-added can be estimated, and these measures are likely to be volatile for novice teachers because practice and effectiveness typically change substantially over the first few years of teaching (Rivkin, Hanushek, and Kain, 2000). More fundamentally, value-added teacher quality measures place a heavy burden on tests to capture the contributions of teaching that we care about, not only overall, but at each level of academic achievement.

[5] Our measures of teacher qualifications reflect the performance of individual teachers and the attributes of the colleges and universities they attended. In addition to the measures presented, we also know: individual teacher certification exam scores and whether the individual passed each of three component tests in the general battery as well as scores on the content specialty tests; whether the individual is certified to teach each of the courses they teach; their tenure status; their education level; and their experience teaching. For each of the higher educational institutions they attended we know: the identity of the college, the distribution of its math and verbal SAT scores, its ranking in the Barron's College Guide, and its admissions and attendance rate. There is remarkable consistency among most of the measures. Tables C1 and C2 in Appendix C provide a sense of this. The factor that we use is just one of many possible composite measures. We created numerous other factors in order to test the robustness of our results and found that the choice of factor made little difference.

[6] The MSAs are defined by the Office of Budget and Management and used by the US Census Bureau. The urban regions are Albany-Schenectady-Troy (including Albany, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie), Buffalo-Niagara Falls (including Erie and Niagra counties), New York City (including Putnam, Rockland, Westchester Nassau, and Suffolk counties), Rochester (including Genesee, Livingston, Monroe, Ontario, Orleans, Wayne counties), Syracuse (including Cayuga, Madison, Onondaga, Oswego), and Utica-Rome (including Herkimer and Oneida counties). The rural regions are Mid-Hudson (including Columbia, Delaware, Dutchess, Greene, Orange, Otsego, Sullivan, and Ulster counties), North Country (including Clinton, Essex, Franklin, Fulton, Hamilton, Jefferson, Lewis, St. Lawrence, Warren, Washington counties) and the Southern Tier (including Allegany, Broome, Cattaraugus, Chautauqua, Chemung, Chenango, Schuyler, Seneca, Tioga, Tompkins, Steuben, Wyoming, Yates counties).

[7] Note that we calculated these figures with each sub-district of New York City counted as a separate district. If these were combined into a single district then the percent of variation within districts would be greater.

[8] We ran the decomposition for elementary schools alone in addition to running it for all schools and found little difference in the variance decomposition. Results available.

[9] The proportion of the variance that is within versus between districts differs across regions. In the Albany region, 74 percent is within districts; in the Buffalo region, 73 percent; in the New York City region, 42 percent; in the Nassau-Suffolk region, 56 percent; in the Rochester region, 76 percent; in the Syracuse region, 66 percent; in the Utica-Rome region, 71 percent; in the Hudson region, 61 percent; in the Southern Tier region, 68 percent; and in the Northern Country region, 54 percent.

[10] Poverty status is more accurately reported for students in kindergarten through sixth grade. Because of this, we only include schools that have some these grades in the poor-nonpoor comparison. The race comparisons are estimated over the full set of schools.

[11] LEP students also receive less qualified teachers when compared to non-LEP students, although the differences are not as great as those comparing non-whites to whites and poor to non-poor. These results are not included in the tables.

[12] Buffalo is omitted from this table, as there is not comparable information about certification and as a result non-comparable information for the overall teacher quality factor. For the other teacher qualifi-

cations, Buffalo has differences similar to those of Rochester.

[13] New York's student achievement data for 4th and 8th grade English Language Arts and Math place each student's test results in one of four performance levels. The school data indicate the number of students in each level. To examine low-performing students we employed the portion of the students tested whose results place them in the lowest performance group, Level 1. Level 1 for 4th grade ELA is described by the New York State Education Department as, "These students have serious academic deficiencies. They show no evidence of any proficiency in one or more of the elementary standards and incomplete proficiency in all three standards."

[14] We have performed this analysis with cohorts starting in different years and over different durations. The results show the same patterns and generally differ in predictable ways. For example, when a longer period is employed we find increases in transfers and resignations.

[15] A teacher is determined to be outside the New York system when they are not observed in the data for two consecutive years. Our analysis ends in 1998 in order to follow teachers until 2000.

[16] When viewed from the perspective of predominant teaching assignment, there appears to be remarkable consistency in the career paths of teachers during the early part of their careers. Elementary teachers are less likely to transfer to a different district or leave the system than their peers teaching middle and high school subjects. Among middle and high school teachers, transfer and exit behavior is very similar.

[17] We are unable to determine how many of what appear to be teachers leaving the system are in fact transfers to schools in other states, (e.g., suburban locations in New Jersey and Connecticut).

[18] We have estimated salary differences in two ways that likely provide upper and lower bounds on these differences. In the first method we employ estimates of the salary schedules in both districts and use the individual's actual education and experience to determine what they made in their new district and what they would have made in their old district. The calculation in the new district assumes district experience is one, regardless of how much experience they had in their prior district(s). In many cases this will be an underestimate as teachers are frequently given experience credit when they enter a district. The alternative method examines the difference in what they were actually paid in their new district and what they received in the prior year in their previous district. This is likely an overestimate because teachers may have received a raise if they had remained in their old district.

[19] We found similar results nationally using metropolitan areas in the 1993–94 Schools and Staffing Survey. Between 67 and 76% of variation in starting salaries across districts could be attributed to average differences between metro areas. Half of this across metro area variance was explained by differences in the salaries of non-teaching college graduates. Metropolitan areas with higher paying alternative opportunities for teachers pay teachers more.

[20] This is true nationally as well. Using the Schools and Staffing Surveys (1993–94) we found that although most of the variation was not between districts within the same region, the variation that did exist within regions was economically important. For example, in Pittsburgh, PA, the metro area in our sample with the largest variation across districts (only MSAs for which at least 20 districts were represented in SASS), the lowest starting salary was $18,500 while the highest was $34,554. Chicago also showed substantial differences across districts ranging from $19,891 to $31,621. The salaries for more experienced teachers showed even greater variation within regions. In Chicago there was a $36,978 difference in wages for teachers with 20 years of experience and a Masters degree between the lowest and highest paying district. Only Dallas, Huston and Tulsa showed ranges of less than $10,000 and even there the differences across districts were large enough to be economically important.

[21] These data are from the 1998–1999 academic year.

[22] As a check on the magnitude of salary differences across districts we looked at the distribution of salaries for teachers with 20 years of experience. The variation across districts is even larger for experienced teachers. Approximately ten percent of districts have salaries lower than $43,500 for these teachers, while another ten percent have starting wages higher than $74,900.

[23] We normalized all salaries over time using the Consumer Price Index for July of the relevant year. No adjustments have been made to account for differences in costs across places at a point in time.

[24] These statistics are based on results for the 1999–2000 English Language Arts exam administered to 4th graders. Similar results hold for the 4th grade math and 8th grade math and ELA exams.

[25] Education Week, *"Quality Counts '98: The Urban Challenge,"* January 8, 1998 Bethesda, MD

## Appendix A

TABLE A1
*Workforce Database*

| | Personnel data | Certification and exam data | SUNY student data | School and district data |
|---|---|---|---|---|
| *Universe:* | All public school teachers, superintendents, principals, and other staff | All individuals taking certification exams | All SUNY applicants (including non-teachers) | All public schools and districts |
| *Elements:* | –Salary<br>–Course subject and grade<br>–Class size<br>–Experience (district and other)<br>–Years of education and degree attainment<br>–Age<br>–Gender | –Scores on each taking of NTE and NYSTCE (general knowledge, pedagogy, and content specialty) exams<br>–College of undergraduate and graduate degrees<br>–Degrees earned<br>–Zip code of residence when certified<br>–Race | –High school attended<br>–High school courses<br>–High school GPA<br>–SAT exam scores<br>–College attended and dates<br>–Intended college major<br>–Actual college major<br>–College GPA<br>–Degrees earned | –Enrollment<br>–Student poverty (free and reduced lunch counts)<br>–Enrollment by race<br>–Limited English proficiency<br>–Student test results<br>–Dropout rates<br>–District wealth<br>–District salary schedule<br>–Support staff and aides |
| *Time period:* | 1969–70 to 1999–00 | 1984–85 to 1999–00 | 1989–90 to 1999–00 | 1969–70 to 1999–00 |
| *Source:* | New York State Education Department | New York State Education Department | The State University of New York | New York State Education Department |

## Appendix B

TABLE B1
*The Composite Measure of Teacher Quality*

| Component: | Scoring-Coefficient |
|---|---|
| 1. Percent of teachers with less than or equal to three years of experience | –0.36449 |
| 2. Percent of teachers with tenure | 0.36032 |
| 3. Percent of teachers with more than a BA degree | 0.31576 |
| 4. Percent of teachers certified in all courses taught | 0.39435 |
| 5. Percent of teachers from less-competitive or non-competitive colleges | –0.27578 |
| 6. Average teacher score on the NTE communication skills exam | 0.37538 |
| 7. Average teacher score on the NTE general knowledge exam | 0.34601 |
| 8. Average teacher score on the NTE professional knowledge exam | 0.38134 |

**Eigenvalue:** 4.17 (52.14% of variation)
**Cronbach's alpha (reliability):** 0.8641

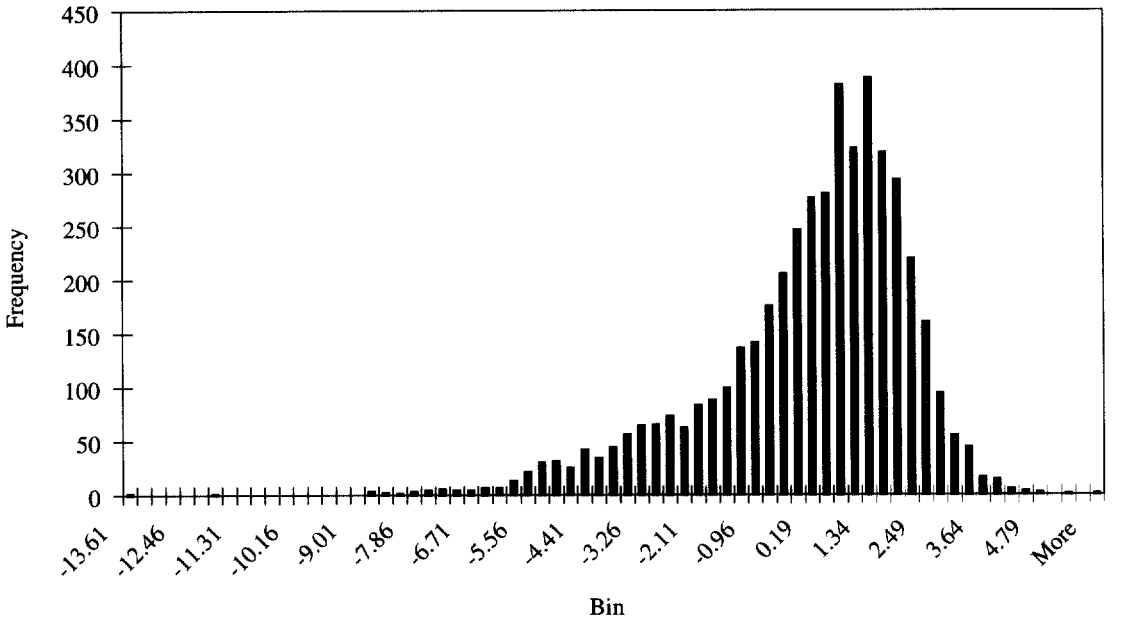


FIGURE B1. *Histogram of factor.*

## Appendix C: Use of Individual and College Level Measures Proxies for Additional Measures

TABLE C1
*Use of Teacher Failure on General Knowledge Exam as Proxy for Results of Other Teacher Exams, 1999–00*

| | Fail Either General Knowledge or LAST Exam | | | |
|---|---|---|---|---|
| Exam | Mean | Standard Deviation | No | Yes |
| Score on General Knowledge Exam | 660.1 | 11.6 | 663.4 | 641.7 |
| Score on Communication Skills Exam | 662.2 | 10.9 | 664.8 | 647.6 |
| Score on Professional Knowledge Exam | 659.9 | 10.7 | 662.3 | 646.7 |
| Score on Liberal Arts and Science Exam | 250.8 | 28.9 | 260.8 | 204.8 |
| Score on Elementary Knowledge Exam | 249.6 | 24.9 | 256.7 | 219.0 |
| Score on Secondary Knowledge Exam | 251.9 | 24.9 | 257.2 | 211.9 |
| Fail General Knowledge Exam | 0.150 | 0.357 | 0.000 | 0.987 |
| Fail Communication Skills Exam | 0.113 | 0.316 | 0.040 | 0.523 |
| Fail Professional Knowledge Exam | 0.090 | 0.286 | 0.033 | 0.407 |
| Fail Liberal Arts and Science Exam | 0.149 | 0.357 | 0.000 | 0.839 |
| Fail Elementary Knowledge Exam | 0.118 | 0.323 | 0.036 | 0.470 |
| Fail Secondary Knowledge Exam | 0.111 | 0.315 | 0.045 | 0.610 |

TABLE C2
*Use of Barron's Rankings of Undergraduate College as Proxy for Other Measures of College Quality, Weighted by Number of NYS Public School Teachers Receiving Bachelors Degrees From Each Institution, 1999–00 Teachers*

| | Colleges by Barron's Rankings | | | |
|---|---|---|---|---|
| Other Measure of College Quality | 1 | 2 | 3 | 4 |
| **SAT Scores** | | | | |
| Verbal 25th percentile | 557 | 515 | 456 | 429 |
| Verbal 75th percentile | 659 | 619 | 553 | 541 |
| Math 25th percentile | 594 | 504 | 463 | 420 |
| Math 75th percentile | 689 | 608 | 561 | 532 |
| Proportion of students with scores | 0.91 | 0.75 | 0.79 | 0.72 |
| Institution did not report scores | 0.01 | 0.05 | 0.13 | 0.4 |
| **Grade Point Average** | | | | |
| Proportion mean GPA 2.0 to 2.99 | 0.10 | 0.19 | 0.39 | 0.52 |
| Mean GPA > = 3.0 | 0.91 | 0.79 | 0.54 | 0.33 |
| **New York State Certification Exams** | | | | |
| General Exams | | | | |
| Mean Liberal Arts and Science (LAST) | 269 | 259 | 252 | 236 |
| Portion passing LAST | 0.02 | 0.07 | 0.12 | 0.3 |
| Mean elementary | 264 | 254 | 251 | 237 |
| Portion passing elementary | 0.02 | 0.07 | 0.09 | 0.25 |
| Mean secondary | 264 | 255 | 252 | 239 |
| Portion passing secondary | 0.02 | 0.06 | 0.1 | 0.24 |
| Content Specialty Exams | | | | |
| Mean elementary | 273 | 262 | 258 | 243 |
| Portion passing elementary | 0.02 | 0.04 | 0.07 | 0.2 |
| Mean English | 259 | 251 | 245 | 235 |
| Portion passing English | 0.01 | 0.06 | 0.1 | 0.27 |
| Mean math | 257 | 245 | 231 | 215 |
| Portion passing math | 0.1 | 0.2 | 0.33 | 0.45 |
| **Admission** | | | | |
| Proportion of applicants admitted | 0.6 | 0.75 | 0.71 | 0.85 |
| Proportion of admitted who attend | 0.29 | 0.38 | 0.35 | 0.41 |
| Admission information missing | 0.02 | 0.13 | 0.18 | 0.42 |
| Attendance information missing | 0.02 | 0.13 | 0.18 | 0.42 |
| Open admission policy | 0 | 0 | 0 | 0.08 |

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