Chapter 18

The Effect of School Neighborhoods on Teachers' Career Decisions

Don Boyd, Hamp Lankford, Susanna Loeb,
Matthew Ronfeldt, and Jim Wyckoff

Recent research has confirmed a widely held belief that teachers matter for students' educational outcomes. Students consistently learn more during the course of a school year with some teachers than they do with other teachers. Yet not all students have access to teachers of the same quality. Schools with low salaries and poor working conditions, particularly poor support from school leadership, face a weaker supply of teachers, on average. A substantial body of research also shows that schools with large populations of poor, nonwhite, and low-achieving students, on average, have more difficulty attracting and retaining teachers. This difficulty in recruiting teachers to schools with high concentrations of low-income students likely reduces the educational opportunities of students in areas of concentrated poverty. As income segregation grows (see chapter 16 in this volume), the impact on students of inequalities in the teacher workforce likely also grows.

The neighborhoods in which schools are located may also affect the supply of teachers, but little research has assessed the extent to which differences in neighborhoods either affect teacher recruitment and retention or explain the observed relationship between school characteristics and teachers' career choices. This chapter uses newly compiled data on the neighborhoods of all schools in New York City, linked to a unique data set on teachers' applications to transfer, to assess the effects of neighborhoods on teachers' career decisions.

To make this assessment, the study uses indicators of the fifty-nine community districts in New York City as well as additional information on the characteristics of neighborhoods surrounding each school. The study distinguishes neighborhoods by community districts because these districts are responsible for reviewing and monitoring quality-of-life issues for New York City neighborhoods and because the community districts were designed to align with historical neighborhood boundaries. The study also includes measures of the characteristics of the neighborhoods surrounding each school such as median family income, population density, racial composition, percentage of households that are married with children, percentage of vacant lots, whether the neighborhood experiences a lot of violent crime, the distance to a subway station, and retail amenities such as grocery stores, restaurants, movie theaters, parks, libraries, bookstores, drugstores, hardware stores, and clothing stores. The study examines both the probability that a teacher will seek to transfer *to* a given school and

the probability that a teacher will seek to transfer *away from* a given school as a function of that school's neighborhood.

The analyses show that neighborhoods affect teachers' choices. First, neighborhoods add substantial predictive power to models that include relatively rich measures of school characteristics. Second, neighborhood characteristics predict teachers' choices. The effects of neighborhood characteristics differ between urban areas with relatively low and high population densities. Not surprisingly, neighborhood characteristics are more important to teachers in high-density areas. In lower-density areas, it is likely easier for teachers to travel, and so the immediate surroundings of the school are less important. In applying to schools, teachers tend to favor neighborhoods with higher median family income and less violent crime. In higher-density areas, teachers also favor neighborhoods with greater local amenities, particularly for practical (grocery stores, hardware stores, drugstores) and leisure (bars, fitness centers, coffee shops, movie theaters) purposes. When teachers apply for new jobs, they are also less likely to try to leave schools in neighborhoods with high median family income, and in high-population-density areas, they are less likely to try to leave schools near local amenities.

Overall, this study finds that although neighborhood characteristics matter somewhat to teachers when they choose where to work, their influence is modest relative to teachers' preferences to teach in schools serving relatively low proportions of African American students and low-achieving students. The effects of neighborhoods may compound the effects of school characteristics in that schools in low-income neighborhoods tend to lose teachers more rapidly than schools in higher-income neighborhoods and have fewer applicants for teaching positions. It is likely more difficult for schools in these neighborhoods to create strong, stable teaching staffs. Whether the effects operate through schools, neighborhoods, or a combination of both, to the extent that students with fewer supports for education are increasingly concentrated in a subset of schools (see chapter 16 in this volume) and are more dependent on schools for their educational opportunities (see chapter 9 in this volume), the lower supply of teachers to these schools as well as the higher teacher turnover rates can have increasingly detrimental effects on achievement and attainment.

Public schools are the most extensive public intervention in the lives of children and youth, and teachers and peers are the most immediate factors influencing school experiences for students. Thus, understanding differences in teacher quality across schools can give insight into the equity and effectiveness of public interventions. Teachers affect students' educational achievement, and differences in effectiveness across teachers can be substantial (Rockoff 2004; Rivkin, Hanushek, and Kain 2005). There is also clear evidence that the characteristics of teachers vary across schools, with poor students, black students, and low-achieving students consistently in classrooms with teachers who are less experienced and less academically able, as measured by their own test performance (Lankford, Loeb, and Wyckoff 2002; Clotfelter, Ladd, and Vigdor 2005). However, qualifications and quality are not the same. There is far less evidence on the distribution of teacher quality across schools, largely because it is difficult to compare teacher quality across different contexts. Even so, researchers can observe the career choices of teachers and use this information to better understand the distribution of quality teachers across schools. To the extent that teachers' choices of whether to teach in a particular school signal differences in the supply of teachers, they

also reflect the potential for schools to select and retain effective teachers and provide high-quality educational opportunities for students.

Teacher attrition is not substantially greater than attrition in other occupations (Harris and Adams 2007); however, some schools have substantially more difficulty retaining teachers than do other schools. As an example, 27 percent of first-year teachers in New York City's lower-performing schools do not return the following year, compared to 15 percent in the quartile of schools having the relatively highest student achievement (Boyd et al. 2005).[1] Nearly 44 percent of elementary teachers and 55 percent of middle-school teachers in the lowest-performing schools in the city left within two years (Boyd et al. 2011).

Teacher attrition is not always bad. Recent research shows that more effective teachers, on average, stay in teaching and remain in their school more than do less effective teachers (Boyd, Grossman, et al. forthcoming; Boyd, Lankford et al. forthcoming; Goldhaber, Gross, and Player 2007; Hanushek et al. 2005). However, the differential attrition of more and less effective teachers appears to be similar across school types, and average attrition differences across schools are largely the result of differences in the appeal of teaching in those schools (Boyd, Lankford, et al. forthcoming). Teachers are more likely to leave schools with high proportions of low-income, black, and low-achieving students, as well as schools with less supportive leadership and lower salaries (Ingersoll and Smith 2003; Hanushek, Kain, and Rivkin 2004; Boyd et al. 2005). This greater attrition disadvantages schools because of the cost of recruiting and hiring, the greater instability of instructional programs, and the greater probability of hiring first-year teachers who have been shown to be less effective, on average (see, for example, Rockoff 2004). In addition, it likely signals a less desirable pool of teachers interested in filling vacancies.

Not only are schools with concentrations of low-income, non-white, and low-achieving schools disadvantaged in the teacher labor market, the effect of this disadvantage is likely to be more pronounced for these students because of fewer resources in the home to support their education (Kaushal, Magnuson, and Waldfogel, chapter 9 in this volume; Phillips, chapter 10 in this volume). While higher-income families can buffer their children from the effects of poorer educational opportunities at schools, lower-income families, on average, have less ability to do so. In addition, lower-income students tend to enter school with greater needs, as reflected by lower scores on measures of school readiness (Duncan and Magnuson, chapter 3 in this volume). Without effective teachers, these students are likely to continue to trail their higher-income peers.

While it is clear that school characteristics affect teachers' career choices, no research that we know of has identified the effects of neighborhood characteristics on teachers' decisions. There is, however, substantial research on the relationship between neighborhood characteristics and student outcomes. The evidence is mixed. Lisa Sanbonmatsu et al. (2006) analyze a sample of more than five thousand students from the Moving to Opportunity (MTO) program in Boston, Baltimore, Chicago, Los Angeles, and New York whose families were randomly assigned to vouchers for housing in higher-income communities. They find no effect of voucher receipt on student test scores four to seven years after random assignment, even though the characteristics of neighborhoods were strongly affected by the treatment. The findings of this aggregate study are in keeping with some earlier work that also found little effect of neighborhood change on students' later achievement (Leventhal and Brooks-Gunn 2004; Jacob 2004), and they are also in keeping with some careful correlational studies of neighborhood effects (such as Solon, Page, and Duncan 2000). However, other smaller experimental studies such as Chicago's Gautreaux program (Rosenbaum 1995) and the initial analyses of the Baltimore MTO program (Ludwig, Ladd, and Duncan 2001) do show positive effects of neighborhood transitions. Substantial research also demonstrates correlations between neighborhood characteristics and child and youth outcomes (for example, Chase-Lansdale and Gordon 1996). However, it is difficult to separate potentially

omitted family characteristics that lead families to locate in a given neighborhood from the effect of the neighborhood itself.

Omitted variables bias is a concern in correlational studies of the effects of neighborhoods on student outcomes, and it is a concern in assessing the effects of neighborhoods on teachers as well. In particular, if we see higher attrition of teachers in one neighborhood than in another, this difference could be driven by neighborhood characteristics, but it could also be driven by differences in school characteristics across neighborhoods or by differences in teacher characteristics across neighborhoods that we are not measuring. In the analyses that follow, we adjust for school and teacher characteristics that could differ across neighborhoods using an unusually rich data set on New York City schools; however, there is still some concern that neighborhood characteristics could be reflecting unobserved characteristics of schools and teachers.

In addition to the potential bias caused by omitted variables, estimates of the effects of neighborhood characteristics are complicated by the potential variation in effects across contexts. A neighborhood characteristic such as ample public transportation may have a different effect in an area where there is easy access by car and easy parking than it would in an area without this access. In this study, we use data from one large urban school district, so there is more uniformity in location than there would be in a state or national study; we do not, for example, need to worry about differential effects in urban and rural areas. Nonetheless, there is variation in density within New York City. In some of the city's outer areas, teachers drive to work, therefore amenities such as parking may be salient and the distance to a coffee shop or subway station less salient; in the most densely populated areas, driving to work is not an option and local amenities and public transportation may be particularly important. To address these differences in location, we look separately at the effects of neighborhood characteristics in high- and low-population-density locations.

The analysis of teacher career decisions also presents challenges of its own. Most studies of teachers' choices examine whether teachers are more likely to quit or to transfer to other schools when they work in one type of school relative to when they work in another type of school. Yet transferring across schools is a two-sided choice; the teacher has to be willing to transfer, and the school has to be willing to accept the teacher. Transfers reflect both teacher and school preferences. In this chapter, we are able to isolate teacher preferences by using data on applications to transfer, instead of on the actual transfer (Boyd, Lankford, et al. forthcoming). We detail these data next.

DATA

Our work is the result of the analysis of multiple sets of data, including that from the New York City Department of Education and the New York State Department of Education, the 2000 United States Census, and WalkScore.com.

Transfer Request System Data

The primary data for this chapter come from the New York City Department of Education Transfer Request System. The data include the applications for open positions for the 2006 to 2007 and 2007 to 2008 academic years. Each application identifies the teacher as well as characteristics of the open positions such as the school and the subject area. These data also indicate which applicants were hired for a given position.[2]

These data are relatively newly available and are the results of policy changes in New York City. In 2005, the Department of Education and its teachers union decided to reform prior hiring policies to move away from a system that was based on seniority and gave teachers and principals

little input in hiring decisions to a more free-market approach. Previously, teachers applied for and received transfers through the central human-resources or district offices, "a behind the scenes process that many teachers and schools found inscrutable" (Daly et al. 2008, 14). Teachers who were displaced from their jobs for any number of reasons, such as school closure or changing enrollment, were assigned to new placements by human-resources staff, often without teacher or principal input. The new policy requires that all teachers seeking transfer—both voluntary and involuntary—enter an open applications system in which hiring decisions are made mutually by both teacher and principal. Senior teachers can no longer claim the positions of novice teachers because of their seniority, a practice that previously had tied the hands of principals in the hiring process. To achieve these objectives, the district instituted a more centralized hiring system, including an online infrastructure for searching job postings and applying to them directly. The open-market system allows for transfers during a window that begins the last week in April and closes the first week in August. Transfers that occur outside of this period are not subject to the open-market process. The data for this study come from the first two years that the new applications system was in place. Across that time, about half of all transfers occurred through the open-market system and about half outside of it. Each year, approximately 8 percent of all active teachers submitted at least one application through the Transfer Request System. Of those who applied across two years, 42 percent transferred. We use information on which teachers applied to transfer and to which schools they applied.[3]

Other School and District Data

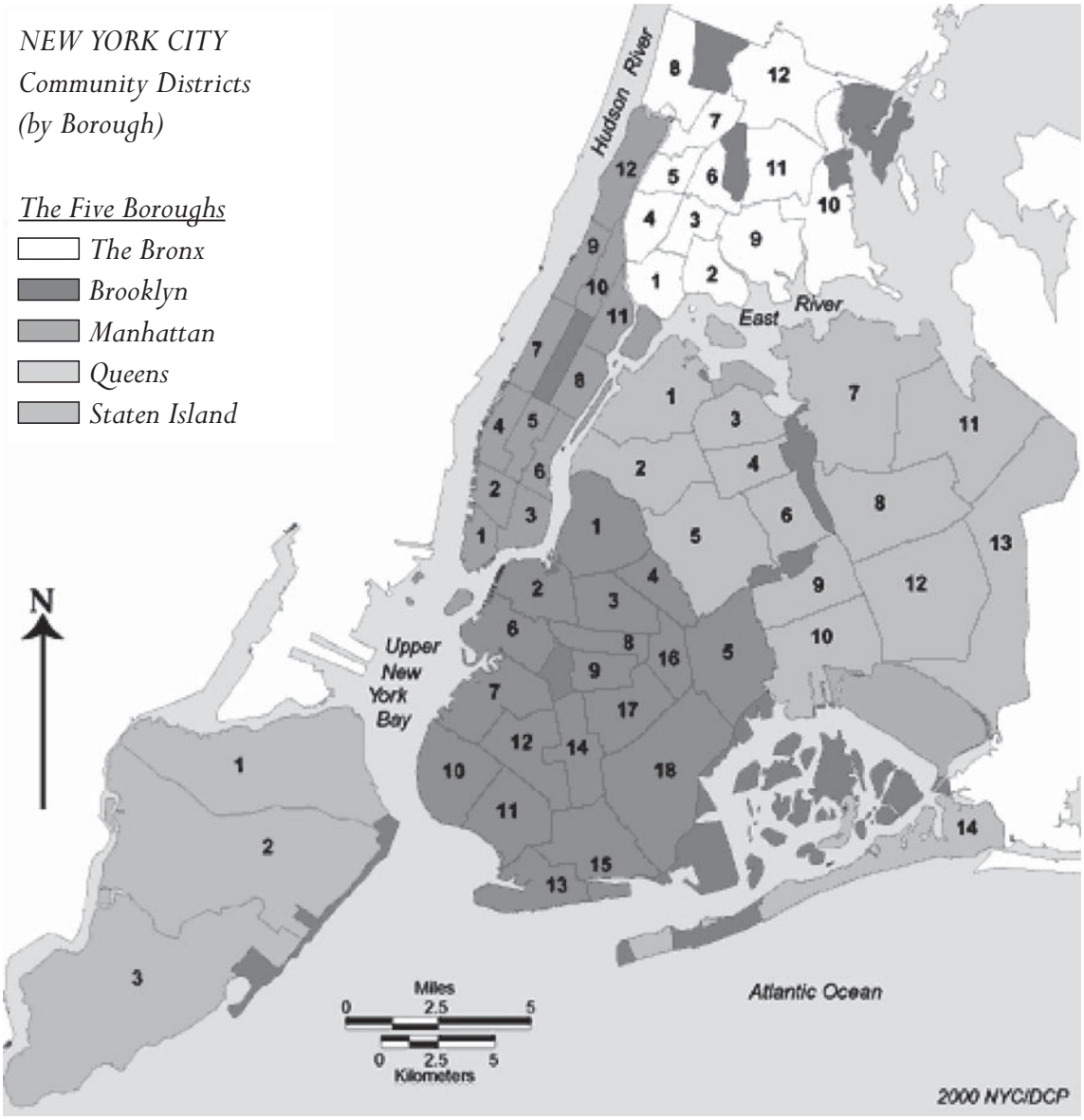
To these data, we have linked an array of additional data on teachers and schools in the New York City School District. Data on teacher characteristics include demographic information (race, gender, age), information on professional preparation pathway, years of experience, scores on the general-knowledge certification exam, and whether teachers attended a competitive undergraduate college. Data on schools include school level (elementary school, middle school, high school, or other grade combination), student race or ethnicity, student eligibility for free or reduced-price lunch, student English-learner status, when the school was established, the experience of teachers in the school, school enrollment, crime rates, and a host of other variables.[4]

Neighborhood Data

To assess the effects of neighborhoods, we use indicators of the fifty-nine community districts in New York City as well as additional information on the characteristics of neighborhoods surrounding each school. The community districts, shown in figure 18.1, were established in 1975 in order to help city agencies administer public services. They review and monitor quality-of-life issues for New York City neighborhoods. We choose community districts as categories of neighborhoods because of this administrative role and because the community districts were designed to align with historical neighborhood boundaries. As shown in figure 18.2, each community district is composed of multiple neighborhoods. For example, Community District 1 in the Bronx includes the neighborhoods of Mott Haven, Port Morris, and Melrose, while District 2 includes Longwood and Hunts Point.

We also collected data on the characteristics of the neighborhood surrounding each school. Because schools can be located on the boundaries of community districts and historic neighborhoods, we choose to use measures of characteristics based on geographic distance. We start with administrative data on the latitude and longitude of each school in New York City. We then link the schools to all Census tracts within one mile of the school, as measured by distance

FIGURE 18.1 *New York City Community Districts*

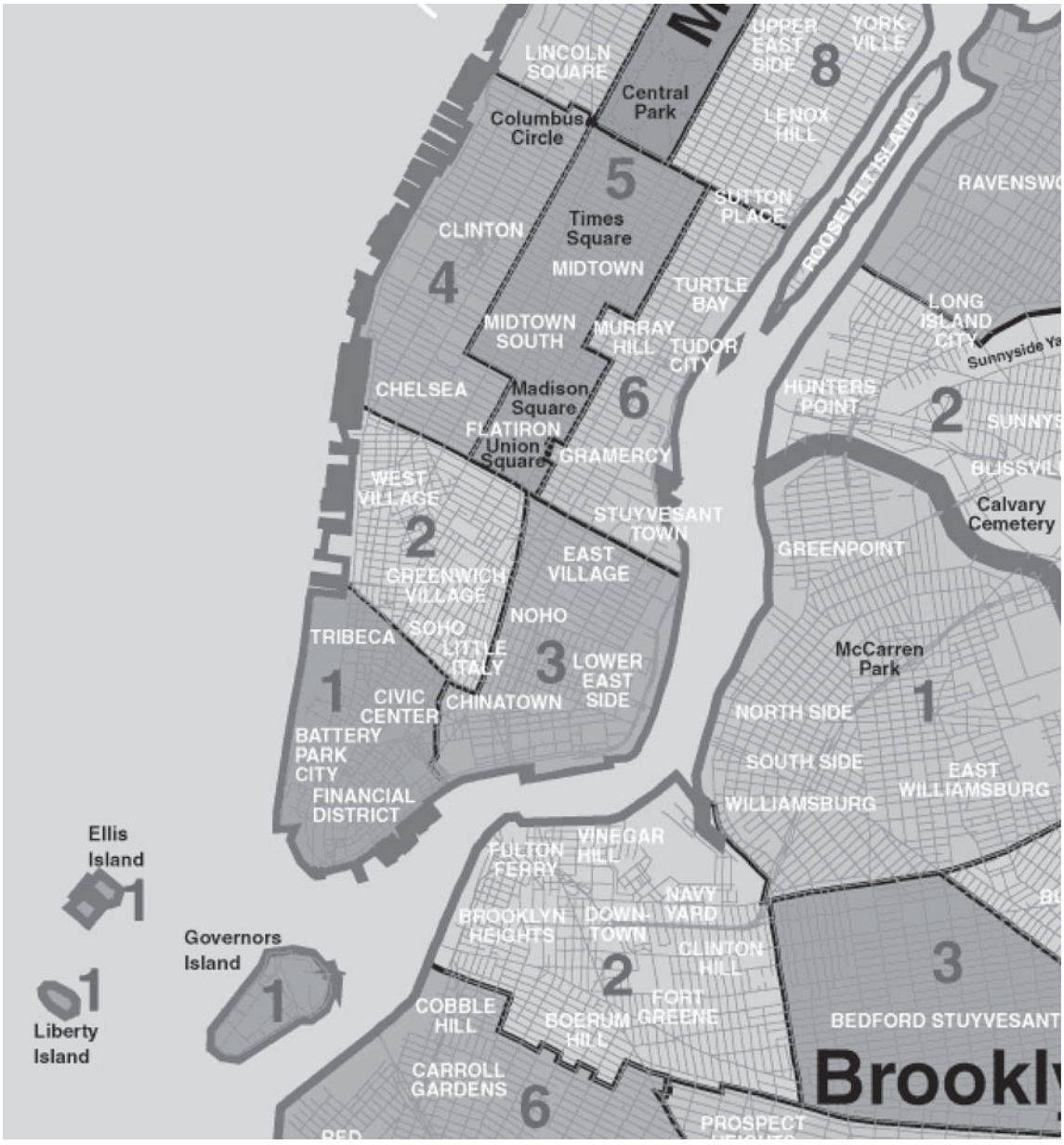


Source: New York City Department of City Planning (2008).

to the tract centroid, until the square area of the aggregated tracts is 0.64 square miles. We use this area, which is equivalent to 0.8 by 0.8 miles, because it is a reasonable walking distance for teachers in New York City. We then aggregated the values of each neighborhood's characteristics across all such nearby tracts and computed relevant variables from these aggregated tracts.

The Census data include multiple measures of the local community, but the data do not have information on the retail amenities surrounding schools. Amenities such as shopping opportunities may matter to teachers because they provide entertainment and ease of accomplishing household chores, even though teachers spend most of their day within school build-

FIGURE 18.2 *Neighborhoods Within Community Districts*



Source: New York City Department of City Planning (2011).

ings. In order to get this information, we use the Walk Score website (www.walkscore.com). For each address, the website provides data on up to eight grocery stores, restaurants, coffee shops, bars, movie theaters, other schools, parks, libraries, bookstores, fitness facilities, drug-stores, hardware stores, clothing stores, and music stores within any given distance of the school. We use a half-mile to designate distance, and because of the high correlation across amenities, we created an aggregate measure of local amenities using factor analysis. We also collect information on the distance to the closest amenity in each group and use this measure for robustness checks.

TABLE 18.1 *Descriptive Statistics on Active Teachers*

	Full Sample		By Population Density	
	Observations	Overall	Low Population Density	High Population Density
Proportion black	75,364	0.19	0.18	0.20
Proportion Hispanic	75,364	0.13	0.09	0.16
Proportion other, nonwhite	75,364	0.06	0.05	0.07
Proportion white	75,364	0.62	0.68	0.57
Proportion female	77,751	0.76	0.76	0.75
Age	77,755	41.27	41.79	40.76
Proportion college-recommending	71,748	0.43	0.48	0.39
Proportion teaching fellows	71,748	0.12	0.09	0.14
Proportion Teach for America	71,748	0.02	0.01	0.03
Proportion temporary license	71,748	0.22	0.20	0.23
Proportion "other" path	71,748	0.21	0.21	0.22
LAST score	53,023	248.00	246.77	249.12
Years of experience	77,755	7.51	7.97	7.06
Proportion competitive college	58,991	0.33	0.31	0.36

Source: Authors' calculations based on data from New York City Department of Education (2006–2008), not publicly available.

Descriptive Statistics

Table 18.1 provides the descriptive statistics for the teachers in the sample. We see that there are more than 75,000 teachers. Nineteen percent of the teachers are black, 13 percent are Hispanic, and 62 percent are white. Most teachers (76 percent) are female, and they average forty-one years of age. Less than half the teachers entered New York City schools through the traditional college-recommended route (43 percent), while another 14 percent came through the two most common early-entry or alternative routes, the New York City Teaching Fellows and Teach for America. Although 22 percent of teachers initially entered teaching with a temporary license, as of 2003 they all must have completed a recognized teacher preparation pathway and so now have a valid certification.

About 33 percent of active teachers graduated from colleges rated in the top two out of four tiers of competitiveness according to Barron's ratings. As part of their New York City certification requirements, the teachers had to take the Liberal Arts and Sciences Test (LAST), intended to measure "knowledge and skills in the liberal arts and sciences, in teaching theory and practice, and in the content area of the certificate title" (New York State Teacher Certification Examinations 2009). The exam includes a multiple-choice section covering scientific, mathematical, and technological processes; historical and social-scientific awareness; artistic expression and humanities; communication and research skills; and written analysis and expression. There is also a component requiring teachers to prepare a written response to an assigned topic. Teachers had an average score on the LAST exam of 248 (s.d. = 30), where 220 is required to pass for certification. Active teachers had an average of about seven and a half years of teaching experience. More than one-third of teachers (36 percent) had three or fewer years of experience; less than one-third (32 percent) had more than ten years of experience.

Table 18.1 also includes similar descriptive statistics for areas of the city with high and low population density, as this distinction proves important in the analyses. We define high-density areas as those with greater than fifty thousand people per square mile and low-density areas as those

TABLE 18.2 *Descriptive Statistics on Schools*

	Full Sample		By Population Density	
	Observations	Overall	Low Population Density	High Population Density
Proportion elementary schools	1,363	0.54	0.61	0.48
Proportion middle schools	1,363	0.20	0.17	0.22
Proportion high schools	1,363	0.26	0.22	0.30
Percentage black	1,357	36.25	36.98	35.62
Percentage Hispanic	1,357	40.11	31.36	47.75
Percentage Asian	1,357	10.89	13.65	8.48
Percentage English language learners (ELLs)	1,295	13.24	9.98	16.24
Percentage female	1,357	49.82	49.42	50.18
Percentage qualifying for free or reduced-price lunch	1,301	69.58	63.16	75.46
Percentage level 1 (lowest) math achievement	901	14.51	12.78	16.38
Enrollment	1,357	745.65	827.78	674.05
Attendance rate	1,301	90.38	90.87	89.93
Percentage of faculty with five-plus years' experience	1,347	47.44	51.56	43.82
Suspension and enrollment	1,347	0.05	0.04	0.06
Proportion high violent crime (top quartile)	1,236	0.25	0.22	0.28

Source: Authors' calculations based on data from New York City Department of Education (2006–2008), not publicly available.

with less than fifty thousand people per square mile. This categorization splits the sample of teachers approximately in half. On average, teachers in high-population-density areas of the city are more likely to be Hispanic and to have entered teaching through alternative pathways. They are also slightly less experienced, on average, and were more likely to attend a competitive college.

Table 18.2 provides similar descriptive statistics for the schools in New York City. Just more than half of all schools are elementary, with another 20 percent middle schools and 26 percent high schools. The average enrollment in these schools is 746 students, with approximately 70 percent of students qualifying for a free or reduced-price lunch. The attendance rate averages 90 percent, and the racial distribution of students is 40 percent Hispanic, 36 percent black, 13 percent white, and 11 percent Asian. On average, there is a somewhat greater representation of elementary schools in the low-population-density areas. In addition, the enrollments are slightly higher; the percentage of students eligible for subsidized lunch, lower; the percentage of Hispanic students, lower; and the percentage of low-achieving students, somewhat lower.

Table 18.3 provides information on neighborhoods. The median family income of neighborhoods averages $43,500 and is somewhat higher in low-population-density areas than in high-population-density areas. Eighteen percent of households are married couples with children; this is lower in high-density areas. Almost 6 percent of housing units are vacant, and 61 percent of the population is living in the same house that they lived in five years before. On average, there are almost fifty amenities within a half-mile of a school, but schools in low-density areas have substantially fewer local amenities.

While we measure multiple neighborhood characteristics, if these characteristics are highly correlated then we might not be able to distinguish among them in the multivariate analyses. Online appendix table 18.A1a gives the correlation coefficients for the neighborhood variables (online

TABLE 18.3 *Descriptive Statistics on Neighborhoods*

School Neighborhood Features	Full Sample		By Population Density	
	Observation	Overall	Low Population Density	High Population Density
Median family income ($10,000)	1,320	4.35	4.64	4.07
Population density (10,000)	1,320	5.41	3.10	7.75
Percentage of population who are nonwhite	1,320	61.18	57.28	65.13
Percentage of households married couple with kids under eighteen	1,320	17.83	20.38	15.23
Percentage of housing units vacant	1,320	5.88	5.58	6.18
Percentage of population living in same house five years ago	1,320	61.40	62.97	59.80
Percentage of population age twenty-five with B.A.	1,320	9.38	8.73	10.04
Distance from school to nearest subway (miles)	1,320	0.56	0.86	0.26
High violent-crime rate (top quartile)	1,424	0.24	0.18	0.30
General amenities factor—centered	1,346	0.00	−0.56	0.52
Sum of amenities within 0.5 miles	1,347	49.16	35.00	62.49

Source: Authors' calculations based on data from U.S. Bureau of the Census (2000) and WalkScore (2011).

appendix available at: http://www.russellsage.org/duncan_murnane_online_appendix.pdf). The strongest correlation in the table is between median family income and the percentage of the adult population with greater than a bachelor's degree (0.89). It will be difficult to separate the effects of these two neighborhood characteristics. Median family income also varies strongly with the percentage of white residents (0.68). The other strong correlation is between the amenities factor and population density (0.66). Because of the relatively high correlations among measures, we use the neighborhood variables both together as a group and individually in the multivariate analyses. When entered individually, a given variable likely measures an aggregate characteristic of the neighborhood and not the specific characteristic included in the model.

Online appendix table 18.A1b provides the correlations between school and neighborhood characteristics. Independent variation at each level is necessary in order to distinguish the effects of neighborhoods from the effects of schools. The table shows relatively high correlations between school and neighborhood race—0.61 between the percentage of black students and the percentage of nonwhite residents—and between student poverty and neighborhood median family income—0.61 between the percentage of students eligible for a lunch subsidy and neighborhood median family income. However, even in these areas there is meaningful independent variation, and all other correlations are low.

METHODS

We assess the effects of neighborhoods on teacher choices using three approaches. First, we model the number of applicants a school receives for each position using ordinary least-squares regression. We use these models to estimate the importance of neighborhoods using the community-district indicator variables. Second, we use logit models to estimate the relationship between neighborhood characteristics and a teacher's decision of whether or not to apply for transfer to another school. Finally, we use conditional logit models to estimate where a teacher applies, given that he or she applies to schools within the transfer system. In this way, we can examine the kinds

of neighborhoods to which teachers are trying to transfer. This section describes each of these approaches.

Applications per Vacancy

Equation 18.1 describes the first set of analyses in which the log of applications per vacancy is modeled as a function of school and neighborhood characteristics as well as community-district indicator variables. We use the log transformation of the applications measure because of the skewed distribution (see online appendix figure 18.A1a).

$$\ln A_{sy} = \beta_0 + S_{sy}\beta_1 + N_{sy}\beta_2 + C_s + \tau_y + \varepsilon_{sy} \tag{18.1}$$

The log of applications, A, for school s in year y is a function of that school's characteristics, S, the neighborhood characteristics specific to the school, N, as well as indicator variables for the community district, C, and the year. We compare results from the full model to results of specifications that do not include the neighborhood measures in order to assess the importance of including neighborhood measures.

Whether a Teacher Applies to Transfer

Although the first set of analyses benefit from simplicity, they are unable to adjust for the characteristics of teachers, which may differ across neighborhoods and schools. A more thorough analysis uses teacher-level data. In this set of analyses, we model active teachers' choices of whether to apply.[5] We model the likelihood of applying for transfer as a function of teacher characteristics, school characteristics, and neighborhood characteristics as given by equation 18.2:

$$P_{tsy}\left(\text{teacher } t \text{ applying}\right) = \frac{e^f}{1+e^f}, \tag{18.2}$$

where $f = \alpha_0 + T_{tsy}\alpha_1 + S_{sy}\alpha_2 + N_{sy}\alpha_3 + \sigma_y + \omega_{sy}$. The probability that teacher t in school s in year y applies to transfer is a function of that teacher's characteristics, T, the characteristics of the school from which he or she is applying, S, the neighborhood characteristics of the school from which he or she is applying, N, an indicator variable for the year, s, and a random error, w.

Where a Teacher Applies to Transfer

Finally, to model preferences of where to apply, we use a logit model for applying to a given school. We limit the sample to elementary schools so that we do not need to distinguish teaching fields. In this model, each teacher has a separate observation for each school to which he or she could apply. The standard errors are then clustered by school to adjust for the multiple teachers with the option to apply to each school. Equation 18.3 summarizes this approach:

$$P_{tly}\left(\text{teacher applying to school } l\right) = \frac{e^g}{1+e^g}, \tag{18.3}$$

where $g = \gamma_0 + T_{ty}\gamma_1 + S_{ly}\gamma_2 + N_{ly}\gamma_3 + \rho_y + \varphi_{tly}$. In equation 18.3, the probability that teacher t applies to school l in year y is a function of the teacher's characteristics, T, the characteristics of the school to which he or she might apply, S, the characteristics of the neighborhood of the school

TABLE 18.4 *Modeling Log (Applicants per Vacancy) as a Function of School Characteristics, at the School Level*

Variables	Model 1	Model 2	Model 3	Model 4
Proportion middle schools	−0.480***	−0.454***	−0.471***	−0.472***
Proportion high schools	−0.021	0.093	0.069	0.078
Proportion "other," nonelementary schools	−0.925*	−0.787*	−0.663~	−0.695~
Enrollment (per 1,000)	−0.011*	−0.014**	−0.014**	−0.016**
Percentage qualifying for free or reduced-price lunch	−0.004*	0.001	0.001	0.002
Attendance rate	0.010	0.011	0.010	0.009
Percentage black	−0.006**	−0.006*	−0.008**	−0.004
Percentage Hispanic	−0.004~	−0.003	−0.006*	−0.002
Percentage Asian	0.004~	−0.001	0.000	0.000
Percentage ELL	−0.001	−0.003	−0.002	−0.003
Percentage female	0.002	−0.002	−0.000	−0.002
Percentage of faculty with five-plus years' experience	0.000	−0.000	0.001	0.001
Suspensions/enrollment	0.291	0.081	0.132	0.012
High-violent-crime school (top quartile)	−0.100	−0.134~	−0.102	−0.120~
Observations	1015	1013	980	980
R-squared	0.188	0.285	0.217	0.295
District indicators		x		x
Neighborhood controls			x	x

Source: Authors' calculations based on data from the New York City Department of Education (2006–2008), not publicly available.
Note: x indicates the item in the left column was included in the regression.
***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, ~$p < 0.1$

to which he or she might apply, *N,* an indicator variable for the year, ρ, and a random error term, φ.

Additional Models

As just discussed, because of the potential differential role of neighborhood characteristics in areas with different population densities, we run the analyses that estimate the effects of neighborhood characteristics (equations 18.2 and 18.3) separately for teachers in high- and low-population-density schools. In addition, we assess the differential effects of neighborhoods on teachers with different characteristics using both interaction and separate equations.

RESULTS

Let us now turn to the results of our analyses.

Applicants per Vacancy

Table 18.4 gives the results of the first set of analyses modeling the log of applicants per vacancy. Because of space, table 18.4 includes only the estimates for the school characteristics. Models 1 to 4 include all schools. The first column gives the coefficients for when only the school characteristics are included in the model. The second column adds in fifty-eight indicator variables for the fifty-nine community school districts. The third column does not include these indicator

variables but does include the neighborhood characteristics. The final column has both the indicators and the characteristics. Looking first at the *R*-square, we see that neighborhood measures explain a substantial proportion of the variation in applications. The school characteristics alone account for 18.8 percent of the variation. The addition of the neighborhood characteristics in model 3 increases this explained variation to 21.7 percent. The community district indicators further increase this explained variation to 29.5 percent.

Now consider the coefficients on the school characteristic variables. Middle schools, in particular, receive fewer applicants per position. They are relatively evenly spread across neighborhoods, so neighborhood characteristics do not explain the relationship between middle schools and applications. The inclusion of neighborhood characteristics does little to change the estimates on the school-level measures. Similarly, the relationship between school enrollment and applicants per vacancy is not meaningfully affected by neighborhood controls. On average, larger schools receive fewer applicants per position than do smaller schools.

Neighbor characteristics that are included in these models explain only a small amount of the relationship between student characteristics and teachers choices. The characteristics of schools most clearly tied to teacher retention in other analyses using administrative data on schools are the percentage of students eligible for subsidized lunch (a measure of poverty) and the percentage of black students.[6]

Table 18.4 shows that once neighborhood characteristics are included in the model, the percentage of poor students is no longer negatively associated with applications per transfer. This student measure has also tended to be the weakest of these measures for predicting teachers' career trajectories in earlier analyses. The inclusion of neighborhood characteristics does less to reduce the negative relationship between the percentage of black students and the number of applicants per position. The coefficients lose significance in some models, but the point estimates are only partially reduced. For example, the coefficient on percentage of black students falls from −0.006 to −0.004 in the full model. Across models, schools in the top quartile of violent crime receive fewer applicants per vacancy, though the effect is only borderline significant.[7]

Overall, we find evidence that neighborhoods affect teachers' decisions but that they do not explain the relationships between school characteristics and teacher application decision. We now move on to model the relationship between neighborhood characteristics and teachers' choices more carefully.

Whether a Teacher Applies for Transfer

Table 18.5 summarizes the results from models predicting the likelihood that a teacher applies to transfer as a function of neighborhood characteristics surrounding his or her current school.[8] All models include controls for both teacher and school characteristics. Estimates in the section on the left are from multivariate models. In univariate models, on the right, each neighborhood characteristic is entered separately so that the coefficient represents a separate estimation, with the exception of linear and squared terms for the same measure being included together. Within each section, the first column displays estimates from the full sample, the second column from the sample of teachers working in schools in low-population-density neighborhoods, and the third column from the sample of teachers in high-population-density neighborhoods.

Table 18.5 shows across all models that teachers are less likely to seek to transfer if they currently teach in a neighborhood with higher median family income. An increase in family income of $10,000 reduces the odds of applying by approximately 8 percent. As shown in online appendix table 18.A2a, without teacher controls, teachers in neighborhoods with a higher proportion of nonwhite residents are more likely to seek transfer and those in neighborhoods with a higher

TABLE 18.5 *The Odds Ratios That a Teacher Applies for Transfer as a Function of the Neighborhood Characteristics Surrounding His or Her Current School*

	Multivariate Models			Univariate Models		
	Full Sample	Low Density	High Density	Full Sample	Low Density	High Density
Median family income/$10,000	0.917**	0.948	0.891*	0.963**	0.945*	0.977
Population density/10,000	1.050	1.093	1.232~	1.051	1.076	1.122
Population density squared	0.998	0.996	0.989	0.997	0.999	0.994
Percentage nonwhite	0.999	0.997	0.999	1.003	1.001	1.002
Percentage households married with kids	0.994	0.989	0.998	0.995	0.987~	0.999
Percentage lots vacant	1.010	1.011	1.014	1.003	1.005	1.000
Percentage same house for five years	1.004	1.001	1.009	1.006	1.004	1.011
Percentage education B.A. or more	1.016~	0.998	1.034*	0.994	0.993	0.997
Subway distance	1.143	1.270	0.942	1.065	1.114	1.054
Subway distance squared	0.972	0.953	0.878	0.976	0.968	0.779
High violent crime	0.975	0.992	1.004	1.055	1.065	1.010
Amenity factor	0.918	0.995	0.753**	0.975	1.019	0.858~
Amenity factor squared	0.985	0.999	1.081	0.982	0.994	1.073
Observations	76300	39535	36765			
χ^2	1117.685	641.2161	615.4564			

Source: Authors' calculations based on data from U.S. Bureau of the Census (2000) and WalkScore (2011) and the data in table 18.1.

Note: All models include controls for teacher and school characteristics. For univariate models, each neighborhood characteristic is estimated separately. Standard errors clustered by current school. Complete results presented in online appendix tables 18.A2a to 18.A2c.

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, ~$p < 0.1$

proportion of households with families are less likely to seek transfer. However, these relationships do not hold up to the inclusion of any of the controls.

As discussed, neighborhood characteristics could have different effects in different types of neighborhoods. Because of this, we rerun the models for low- and high-density areas separately. The multivariate models in table 18.5 show that, although teachers working in neighborhoods with higher median family income are less likely to seek transfer in general, the effects are strongest in neighborhoods with high population densities.[9] In these areas, teachers are also less likely to apply to transfer if the amenities in the area are greater. Later, we explore whether certain kinds of amenities are more highly associated with transfer requests.

Where a Teacher Applies for Transfer

Factors affecting whether a teacher applies to transfer may differ from factors that affect where he or she applies for transfer. Table 18.6 presents the likelihood a teacher applies for transfer to a school as a function of that school's surrounding neighborhood characteristics. Models reflect the same approach taken for the estimates presented in table 18.5. Online appendix tables 18.A3a to 18.A3c display alternative model specifications as well as standard errors. Beginning with the full sample results, teachers are more likely to apply to transfer to schools in neighborhoods with higher median family income. An increase in median income of $10,000 increases the odds of applying to a given school by approximately 8 percent. Teachers are also more likely to apply to

TABLE 18.6 *The Odds Ratios That a Teacher Applies for Transfer to a School as a Function of the Neighborhood Characteristics Around That School*

	Multivariate Models			Univariate Models		
	Full Sample	Low Density	High Density	Full Sample	Low Density	High Density
Median family income/ $10,000	1.069*	1.116*	0.978	1.081***	1.111***	1.059*
Population density/10,000	0.984	0.978	1.343***	0.943	0.969	1.354***
Population density squared	1.002	0.993	0.986***	1.005*	0.980	0.986***
Percentage nonwhite	0.998	1.002	0.993	0.993**	0.995	0.991**
Percentage households married with kids	1.000	1.001	1.000	0.997	1.015*	0.978**
Percentage lots vacant	1.000	1.020	0.995	1.007	1.010	1.000
Percentage same house for five years	0.988~	0.989	0.993	0.983***	0.988~	0.975**
Percentage education B.A. or more	0.995	1.001	1.010	1.015***	1.009	1.024***
Subway distance	1.234	0.995	5.779*	1.042	1.123	3.103
Subway distance squared	0.981	1.023	0.312	1.010	1.003	0.479
High violent crime	0.971	0.691*	1.192	0.821*	0.614***	0.9685
Amenity factor	1.029	0.816~	0.996	1.066*	0.886	1.1678*
Amenity factor squared	1.021	0.916*	1.188*	1.047*	0.976	1.142*
Observations	1540257	852171	756066			
χ^2	22307.050~	889.3649	1984.586***			

Source: Authors' calculations based on data from U.S. Bureau of the Census (2000) and WalkScore (2011) and the data in table 18.1.

Note: Only elementary-level, nonspecialist teachers are included in these analyses. All models include controls for teacher and school characteristics. For univariate models, each neighborhood characteristic is estimated separately. Standard errors clustered by school to which teachers applied. Complete results are presented in appendix tables 18.A3a to 18.A3c.

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, ~$p < 0.1$

schools in neighborhoods with a higher proportion of white residents. A 10 percent increase in white residents increases the probability of applying by approximately 6 percent. Although the local violent crime rate did not affect a teacher's propensity to apply for transfer, it is related to where a teacher applies.[10] Teachers are substantially less likely to apply to schools in neighborhoods in the top quartile of violent crime. In addition, they are more likely to apply to schools in neighborhoods with many amenities; however, this relationship does not hold up to the inclusion of other neighborhood characteristics.

Comparing results between low- and high-population-density neighborhoods, we see that median family income appears more salient for schools in low-density neighborhoods, while amenities are far more important in high-density areas. In fact, the relationship between amenities and applications is negative for low-density areas, perhaps indicating other disadvantages such as greater difficulty parking in close proximity to retail amenities. Violent crime is also more predictive of applications in low-density areas than in high-density areas.

Differential Relationships for Different Teachers

These results show the average relationship for all teachers, but there is likely variation across teachers in their preferences for neighborhood characteristics. Surprisingly, we find only small differences

in the relationship between neighborhood characteristics and application behavior by teacher race/ethnicity, gender, and age (online appendix tables 18.A4a and 18.A5a give these results).[11]

For the teachers in schools in low-density areas, we found slight evidence that they were less likely to apply from schools in higher-median-income neighborhoods (coefficients of 0.94–0.97). In separate estimates by teacher characteristics, we find a stronger relationship for white teachers (0.91) than for black or Hispanic teachers (1.05 and 0.95, respectively) and a stronger relationship for female teachers (0.92) than for male teachers (1.01), but the estimates are not statistically different from zero. For teachers in schools in high-population-density areas, we find that on average, teachers are less likely to apply to transfer if they currently work in neighborhoods with higher median income or stronger amenities. When we estimate the models separately by teacher characteristics, we find that across the board, teachers are less likely to apply to transfer from schools in higher-median-income neighborhoods. Amenities also predict fewer applications to transfer away, though the effect appears stronger for women than for men.

The models of applications to schools in low-density areas show that teachers are more likely to apply to schools in neighborhoods with higher median income and less violent crime, while in high-density areas, they are more likely to apply to neighborhoods with more amenities. For schools in low-density neighborhoods, the positive relationship with median family income is relatively consistent across teacher groups. The relationship between violent crime and applying is negative for most teacher groups, but less strong for black teachers and for older teachers. For schools in high-density areas, the nonlinear relationship with population density holds up across teacher types, while the relationship with amenities is stronger for white teachers and for female teachers.

Effects of Different Kinds of Amenities

As we have described, in high-density areas, teachers are less likely to request transfers from and more likely to request transfers to neighborhoods with greater amenities. We wondered, however, whether some kinds of amenities are more highly associated with transferring than other kinds. By rotating the general amenity factor loadings, we create four orthogonal measures of amenities: leisure, practical, residential, and community. The "leisure" factor signals areas with nearby bars, fitness centers, movie theaters, and coffee shops. Neighborhoods characterized as having "practical" amenities have a higher concentration of grocery, hardware, clothing, and drugstores. The "residential" factor signals areas with few amenities of any kind. Finally, the "community" factor represents neighborhoods with many parks, schools, and libraries.

Table 18.7 reports estimates for whether (on left) and where (on right) teachers apply for transfer as a function of the different amenity factors. In the overall sample, including both high- and low-population-density areas, teachers are less likely to apply for transfer from and more likely to apply for transfer to "community" neighborhoods—those with many parks, schools, and libraries. Consistent with prior analyses, the relationships between amenities and requests for transfer are stronger in higher-population-density areas. More specifically, teachers in high-density neighborhoods are significantly less likely to request transfer from neighborhoods that have many practical amenities and are significantly more likely to apply for transfer to schools that have more amenities for leisure nearby.

DISCUSSION

To our knowledge, this is the first study to estimate the effects of neighborhood characteristics on teachers' career decisions. We find that neighborhoods do play a role in teachers' choices. First, neighborhoods add substantial predictive power to models that include rela-

TABLE 18.7 *Modeling Whether and Where a Teacher Applies to Transfer as a Function of Different Kinds of Amenities (Odds Ratios Presented)*

	Whether Teacher Applies for Transfer			Where Teacher Applies for Transfer		
Kinds of Amenities	Overall	Low Density	High Density	Overall	Low Density	High Density
Leisure	0.940	0.954	0.889~	1.046	0.921	1.154*
	(0.040)	(0.050)	(0.063)	(0.050)	(0.068)	(0.072)
Practical	0.947	1.023	0.784**	0.962	0.992	0.886~
	(0.038)	(0.045)	(0.068)	(0.046)	(0.057)	(0.059)
Residential	1.008	0.997	1.072	1.013	1.001	0.965
	(0.028)	(0.026)	(0.089)	(0.039)	(0.046)	(0.090)
Community	0.930*	0.947	0.911~	1.090*	0.988	1.076
	(0.029)	(0.040)	(0.045)	(0.041)	(0.062)	(0.053)
Neighborhood controls	x	x	x	x	x	x
School controls	x	x	x	x	x	x
Teacher controls	x	x	x	x	x	x

Source: Authors' calculations based on data from U.S. Bureau of the Census (2000) and WalkScore (2011) and the data in table 18.1.
Note: x indicates item in left column was included in the regression.
***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, ~$p < 0.1$

tively rich measures of school characteristics. Second, neighborhood characteristics predict teachers' choices.

The effects of neighborhood characteristics differ between urban areas with relatively low and high population density. Not surprisingly, neighborhood characteristics are more important to teachers in high-density areas. In lower-density areas, it is likely easier for teachers to travel, and thus, the immediate surroundings of the school are less important. In applying to schools, teachers tend to favor neighborhoods with higher median family income and less violent crime. In higher-density areas, teachers also favor neighborhoods with greater local amenities, particularly for practical (grocery, hardware, drugstores) and leisure (bars, fitness centers, coffee shops, movie theaters) purposes.

There are two important caveats to these findings. First, it may be that our estimates of the importance of neighborhood characteristics are biased by important omitted variables. If a school characteristic that we do not include in the model is correlated with neighborhood characteristics in the model, then these neighborhood characteristics may simply proxy for school characteristics. The potential omitted variables bias seems more concerning in regards to neighborhood median family income than amenities, since the correlation between median income and measured school characteristics is much stronger than is the correlation between amenities and these school characteristics. Nonetheless, bias remains a concern in this study's analyses, which are all correlational.

A second caveat is that though neighborhood characteristics are potentially salient, they explain little of the relationship between the student characteristics of schools and teachers' career choices. Teachers demonstrate preferences for schools with lower proportions of black students and low-achieving students. Including neighborhood indicator variables and neighborhood characteristics in the models does little to change these relationships. Nonetheless, whether teachers respond to neighborhoods or to the more immediate school environment, they are systematically leaving schools serving students who are likely to have the least supports for education at home. These labor-market dynamics likely disadvantage these students further.

NOTES

Online appendix available at: http://www.russellsage.org/duncan_murnane_online_appendix.pdf.

1. An expanded version of this chapter is available at www.teacherpolicyresearch.org/portals/1/pdfs/Explaining_the_short_careers_of_high_achieving_teachers_AER_final.pdf (accessed March 20, 2011).
2. We know if a teacher was hired but do not know who else may have received a job offer for the same position. In terms of estimating school preferences for teachers, we would prefer to know all teachers who received job offers in the first place.
3. Boyd, Lankford, et al. (forthcoming) provide more detail on the transfer-system data.
4. Boyd et al. (2005) provide more detail on the sources of these data.
5. By "active" teacher we mean teachers that are in the human-resources database as paid regular teachers at the beginning of the school year who are working at 70 percent of full-time or more. Teachers who had taken leave, had quit, or were of unknown status were dropped from our sample. This reduced our sample down to more than 70,000 teachers each academic year. For instance, although teachers who quit or were on leave make up some of the teachers who entered the Transfer Request System, there were relatively few. It did not make sense to include these teachers because we were interested in accounting for the effects of teachers' current school workplace on their applying and transferring behaviors. Since these teachers were not currently in schools, such models could not apply.
6. We also ran models that included the percentage of lowest-performing students in schools. Schools with more lowest-achieving students received fewer applicants per vacancy, on average. The effect was moderately significant in model 1 and was statistically significant in models with district indicators (models 2 and 4). Because we only have test-score data on grades 4 through 8, the inclusion of this measure greatly reduces the sample. We do not present these results here, but they are available upon request from the authors.
7. In a related study, Boyd et al. (forthcoming) used a composite measure for school crime that included violent crime in addition to other forms of crime. Schools with higher crime on this general measure received significantly fewer applicants per vacancy. We used violent crime here to match our neighborhood measures for crime that focus on violent crime.
8. Online appendix tables 18.A2a to 18.A2c present results from the full models with alternative specifications and standard errors. Because the sample changes across different model specifications, we also reran all models using a constant sample. The results were similar and are available on request from the authors.
9. Online appendix table 18.A2b presents some evidence that teachers in low-population-density areas, more than teachers in high-density areas, are less likely to apply for transfer when working in neighborhoods with higher proportions of families with kids.
10. We tried examining whether teachers' choices about whether and where to apply for transfer were associated differentially with different neighborhood crime measures, such as property crime, rape, murder, and assault. However, the propensities of the different forms of crime were so highly correlated that we could not distinguish their separate effects.
11. We also looked separately at less experienced (five or fewer years) and high-value-added (above the mean) teachers. The relationships between neighborhood characteristics and decisions about whether and where to apply were not statistically different for novice and high-value-added teachers than for other teachers. We do not present the results here, but they are available upon request from the authors.

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