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Who teaches whom? Race and the distribution of novice teachers

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Abstract

This paper focuses on one potentially important contributor to the achievement gap between black and white students, differences in their exposure to novice teachers. We present a model that explores the pressures that may lead school administrators to distribute novice teachers unequally across or within schools. Using a rich micro-level data set provided by the North Carolina Department of Public Instruction, we find that novice teachers are distributed among schools and among classrooms within schools in a way that disadvantages black students.

JEL Classification: I20

Keywords: Minority achievement gap; Teacher quality

1. Introduction

Recent years have witnessed a resurgence of interest in the achievement gap between various minority groups, such as African-Americans or Hispanics on the one hand and European-American students on the other. Such interest has emerged among academics, with Jencks and Phillips' edited volume, *The Black–White Test Score Gap* (1998) providing a recent authoritative overview of the academic literature on the gap between African-American and white students. It has also emerged among policy makers as black–white test score gaps on the National Assessment of Educational Progress widened in the 1990s after a significant narrowing in the 1970s and 1980s. The widening of the gap is cause for concern for many reasons, including the fact that the gap in test scores explains a larger percentage of the income gap between the races than it did in the 1960s (Jencks & Phillips, 1998).

This paper focuses on one potentially important contributor to the gap, differences between black and white students in their exposure to novice teachers. Our empirical analysis is based on a rich micro-level data provided by the North Carolina Department of Public Instruction through the North Carolina Education Research Data Center at Duke University. This data set makes it possible to match teachers with groups of students both across schools and across classrooms within schools and, hence, permits us to look at how teachers are distributed in much greater detail than has typically been possible. We focus primarily on differences between black and white students since other minority groups in North Carolina are small, although the number of Hispanics students is now growing rapidly. In 2001, white students accounted for about 61 percent of the state's students and black students for about 31 percent. Hispanics accounted for less than

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5 percent and American Indians and Asians each accounted for less than 2 percent.[1]

Section 2 sets the stage and reviews the literature showing that the experience of teachers—or more precisely, the lack thereof—matters for student achievement. Section 3 uses publicly available data to document that across districts in North Carolina minority students are significantly more likely than white students to face an inexperienced teacher. The main contribution of this paper is to extend the analysis beyond the district level to examine patterns within districts and schools.

To that end, we present in Section 4 a model that explores the pressures that may lead school administrators to distribute novice teachers unequally across or within schools. Central to that model are the constraints such administrators face on the demand side from parents who care about the learning of their children and on the supply side from teachers who prefer some teaching environments to others. We then demonstrate in Sections 5 and 6 how those pressures have played out for 7th graders in North Carolina schools. We find that black students are much more likely than white students to face a novice teacher, and that much of the differential exposure reflects differences across schools and across classrooms within districts.

2. Minority achievement gaps and prior teaching experience

Explanations for minority achievement gaps include the role of family background, early childhood experiences, cultural and psychological factors, neighborhood and community factors, and, last but not least, school factors, including the quality of teachers. Although the widely cited Coleman Report (Coleman et al., 1966) downplayed the role of school factors relative to family background characteristics as an explanation of differences in student achievement, school factors still contribute in significant ways to minority achievement gaps.

In particular, teachers clearly matter. Even researchers such as Erik Hanushek, whose meta-analyses show little impact of measurable educational inputs on student achievement, would agree with the proposition that some teachers are far more effective in helping students learn than are other teachers (Hanushek, 1986, 1997). However, measuring the quality of teachers is not a straightforward task and even more difficult has been determining with any precision which characteristics of teachers contribute to teacher quality.

The most sophisticated recent empirical studies of the overall impacts of teachers on student achievement are based on detailed longitudinal data on student test scores. William Sanders and various coauthors, for example, have been using such data from Tennessee since 1992 to measure the value-addedness of teachers throughout the state (Sanders & Horn, 1998; Sanders, Saxton, & Horn, 1997). From their analyses they conclude that race, socioeconomic level, class size and classroom heterogeneity are poor predictors of student academic growth and instead that "the effectiveness of the teacher is the major determinant of student academic progress" (Sanders & Horn, 1998, p. 247). While other researchers have raised questions about whether Sanders et al. have in fact successfully isolated teacher effects from other independent factors contributing to student academic achievement (Kupermintz, Shepard, & Linn, 2001), they do not question the basic conclusion that teachers matter. That conclusion is also consistent with recent work by Hanushek, Kain, and Rivkin (1998), who use student-level data from Texas to document the importance of teacher effects.

From a policy perspective, simply knowing that teachers matter is not sufficient. In addition, one needs to know what makes teachers effective so that policies can be fashioned to increase teacher quality. Many factors could potentially determine how effective a teacher will be in the classroom.[2] One set of factors would include difficult-to-measure personal characteristics and practices such as a teacher's personality, her attitude, her expectations for her students and how she runs the classroom. Another set would include the culture of the environment in which she is placed and the nature of the support systems to which she has access. A third set is the readily measurable characteristics of the teachers themselves. These might include, for example, years of experience, skills, the quality and nature of pre-service training, participation in professional development programs, and personal characteristics such as gender, race, and age. Often what is relevant is not the teacher's characteristics alone, such as the fact that she has training in biology or is white, but how those characteristics relate to her teaching assignment. Thus a teacher trained in biology is likely to be less effective in a physics class than in a biology class or a white teacher may be less effective in a class of minority students than in one of white students.

The larger project of which this paper is a part focuses on the third set of factors, measurable characteristics of teachers. These factors are of interest because they are more amenable to macro-level policy levers than are many of the other factors. In addition, previous research provides some, albeit not always unassailable, evidence

[1]Between 1993 and 2001, Hispanic students increased from 1.1 percent of all students to 4.4 percent and the white share decreased from 66 to 61 percent.

[2]For an excellent recent overview of the literature, see Mayer, Mullens, and Moore (2000).

that many of these characteristics matter for student achievement, at least in some situations and according to some studies. For example, Ferguson (1991) shows that variation in teacher qualifications across Texas school districts accounts for 43 percent of the explained variance in math test score gains from grade three to grade five and Ferguson and Ladd (1996) show that such variation accounts for 31 percent of the explained variation in 8th and 9th grade test scores across Alabama school districts.

The specific characteristic of interest for the present paper is whether or not the teacher has any prior teaching experience. This focus reflects both the nature of our data and our conviction that students exposed to teachers with no experience are less well served than those exposed to more experienced teachers. Even if such teachers ultimately blossom into excellent teachers, their first year of teaching is undoubtedly difficult and, in many ways, can be viewed as a year of on-the-job training. To be sure, in some cases the enthusiasm and idealism of new teachers or good induction programs may offset their inexperience, but, in most situations, the challenges of managing a classroom for the first time are likely to dominate. Those challenges can be especially severe when, as is often the case, new teachers are put into classrooms with large numbers of difficult-to-educate students.

Empirical studies confirm that the prior experience of a teacher matters for student learning, but one must be careful to distinguish studies that use simple linear measures or rough categories of teacher experience from those that focus more specifically on the teachers with no or very limited experience. In addition, one must pay attention to the quality of the empirical studies.

The empirical literature builds on the economist's concept of an education production function in which student outcomes, as typically measured by their test scores, are modeled as a function of a vector of school inputs, including class size, teacher experience and teacher education, and vectors of family background and community characteristics. In his meta-analysis of the education production function literature as of 1994, Erik Hanushek (1997) concludes that teacher experience, along with teacher education and teacher-pupil ratios, does not exert a consistent and statistically significant positive impact on student achievement. Out of 207 estimates for teacher experience, he reports that 66 percent were statistically insignificant, and that only 29 percent were statistically significant in a positive direction (Hanushek, 1997, Table 3). However, if one were to treat all the positive signs as true impacts regardless of their statistical significance, 59 percent of the estimates would be positive. Both proportions, it should be noted, are greater than those for other measures of school inputs such as teacher-student ratios and teacher education. Further if one were to restrict the sample of estimates to those that were derived from the preferred value-added specification, the percentage of positive signs would rise to 67 percent (Hanushek, 1997, Table 7). Moreover, based on the same set of studies, but a different method of aggregating the results, Hedges and Greenwald unambiguously conclude that the experience of teachers does indeed matter and that the "relations between inputs and outcomes are consistently positive and large enough to be educationally important"(Hedges & Greenwald, 1996).

Many of the studies included in the various meta-analyses do not include a very fine breakdown of the teacher experience variable. That matters because experience is likely to affect student achievement in a nonlinear way. In her overview of the literature, for example, Darling-Hammond (2000) concludes that the benefits of experience appear to level off after 5 years so that there are no detectable differences between teachers with 5 and 10 years of experience, but that teachers with 5–10 years of experience are more effective than new teachers.

The most convincing evidence that novice teachers are less effective than more experienced teachers emerges from the work by Hanushek, Kain, and Rivkin (HKR) (1998) and more recently by Clotfelter, Ladd, and Vigdor (2004b). Using student-level data for Texas students in grades four, five, and six, HKR find that, relative to 5 or more years of experience, the absence of experience reduces student gains in math and reading by one-tenth of a standard deviation (Hanushek et al., 1998, Table 7). Teachers with 1 year of experience are also less effective than their more experienced peers, but the magnitude of the impact is slightly smaller. These results are believable because they emerge from value-added models that include individual student fixed effects. The inclusion of fixed effects, which is feasible only in large micro-data sets, rules out most alternative explanations for the results. Clotfelter et al. (2004b) estimate very similar returns to early experience in a study that employs an extended set of student background characteristics, school fixed effects, and pays particular attention to the subset of schools that appear to randomly assign students to classrooms.

It seems reasonable to conclude from this previous research that teachers with no prior experience are undoubtedly on average less effective than other teachers. Consequently, students who are exposed to such teachers are likely to receive an inferior education compared to other students. No education system can avoid the need for new teachers. Normal retirements and other reasons for leaving teaching will generate vacancies that need to be filled. In an education system in which the number of students is expanding, the need for bodies will inevitably lead to the hiring of teachers with no prior experience. The question for this paper is the extent to which new teachers with no prior teaching

Table 1
Descriptive data for North Carolina counties

	Students			Teachers	
	Number	Minority (percent)	Subsidized lunch (percent)	Novice (percent)	5-year turnover rate
Five largest districts					
Mecklenburg (Charlotte)	100,368	51.7	39.0	8.7	19.3
Wake (Raleigh)	95,018	35.3	21.7	6.5	11.2
Guilford (Greensboro)	62,072	48.2	38.8	8.2	11.5
Cumberland (Fayetteville)	51,300	56.3	56.3	10.2	8.5
Forsyth (Winston-Salem)	43,434	45.0	35.2	6.6	11.9
Urban districts					
Coastal (9)	14,765	45.5	49.2	7.1	13.3
Piedmont (13)	9451	44.3	42.6	7.7	14.8
Mountain (11)	8822	31.8	34.6	6.9	12.7
Rural districts					
Coastal (20)	4031	41.6	53.0	6.7	12.7
Piedmont (30)	9822	46.2	50.6	8.1	14.3
Mountain (30)	9822	12.5	37.7	5.1	8.9

Note: Number of districts in each category in parentheses.
Source: Student data: ABCs Supplemental Data, 2000.
Teacher Data: NC Statistical Profile, 2000 and NC Teacher Education Report, Appendix C.

experience are disproportionately assigned to the districts, schools and classrooms serving minority students, particularly those who are African American.

3. Race and the distribution of novice teachers across districts in North Carolina

Table 1 provides descriptive data on students and teachers in North Carolina, grouped by district. The state is divided into 117 districts. Although a few of the state's 100 counties are divided into an inner city district and a suburban district, most of the districts are county-wide. For ease of exposition, we refer to the larger districts by the names of their respective counties even when the district name is a combination of a county and a city name, as in Charlotte-Mecklenburg.

The top panel provides information for the five largest districts in the state, listed in order of size. Mecklenburg, which includes the city of Charlotte is the largest district with 100,000 students, 52 percent of whom are members of minority groups. Wake, which includes the state capital of Raleigh, has 95,000 students, 35 percent of whom are minority. The other three districts (and their main cities) are Guilford (Greensboro), Cumberland (Fayetteville), and Forsyth (Winston-Salem). Guilford has 62,000 students (45 percent minority), Cumberland has 51,000 students (56 percent minority) and Forsyth has 43,000 students (48 percent minority).

The bottom panel reports similar information for three groups of urban school districts (excluding the largest districts) and three groups of rural districts, divided into their geographic locations on the coast, in the central Piedmont region, and in the mountain region in the west. These geographic divisions capture some significant differences across the state. The coastal region has a large black and low-income population. The mountain region is also a low-income area but is populated disproportionately by white families. In the Piedmont area, the urban districts have above-average minority student shares, but the rural districts have a lower minority share than the state average.

The final two columns of the table provide summary information on the proportions of novice teachers in each area and also on the average annual turnover rate of teachers between 1995 and 2000. The share of novice teachers ranges from a low average of 5.1 percent in the rural mountain area to a high of 10.2 percent in Cumberland County.

That teachers with no prior experience are unevenly distributed across districts with respect to the race or ethnicity of the students in North Carolina emerges clearly from the descriptive regression results reported in Table 2. The dependent variable in columns 1 and 2 is the percent of all teachers in each of the state's districts who have no prior teaching experience.[3] Of most interest

[3]Because some of the data are missing for one district, the regressions are based on 116 of the total 117 districts in the state.

Table 2
District-level regressions

	Proportion of novice teachers		5-year turnover rate	
Minority (%)	0.06** (6.95)	0.08** (5.05)	0.11** (16.32)	0.18** (9.00)
Free lunch (%)	—	−0.02 (0.80)	—	−0.12** (3.65)
Log students	—	0.10 (0.17)	—	−2.38** (3.25)
Central city	—	−1.32* (1.73)	—	−0.62 (0.65)
Rural area	—	−1.52* (2.91)	—	−2.46** (3.74)
Constant	4.65** (12.19)	5.62** (2.14)	8.56** (8.88)	21.95** (6.66)
Adj. R^2	0.30	0.36	0.40	0.55

116 observations, absolute *t*-values in parentheses.
Source: See Table 1. Designation of central city and rural area are from the US Department of Education, Common Core of Data (CCD). The omitted category is an LEA that serves a metropolitan area but not just its central city.

is the association between that variable and the racial composition of the district's students, defined as the percent of a district's students who are members of a minority group. Column 1 indicates that districts with high proportions of minority students typically have higher proportions of novice teachers than those with smaller shares of minority students. The 0.06 coefficient implies that a one standard deviation difference in the percent of minority students in a district is associated with a difference of 1.7 percentage points in the proportion of novice teachers in the district. Overall, about 30 percent of the variation across districts in the percent of inexperienced teachers is associated with variation in the percent of minority students.

The second column indicates that the relationship between the shares of minority students and of novice teachers remains positive and strong even after controlling for various other characteristics of the districts, such as the percent of students on free and reduced price lunch, the size of the district, and whether the district serves a city area or a rural area. The negative signs on the two last variables are relative to a mixed district that serves a metropolitan area that is significantly larger than its central city. Of interest is that even with the inclusion of the percent of students on free and reduced price lunch, the minority share coefficient is positive and statistically significant. While those two variables are positively correlated across districts, a large amount of independent variation remains in part because the low-income districts in the western part of the state typically are disproportionately white.

Columns 3 and 4 repeat the exercise for a related measure, the 5-year rate of teacher turnover. Higher turnover of teachers generates a need for new teachers, some of whom will be new to the profession. Consistent with the patterns for inexperienced teachers, a strong positive correlation emerges between the share of the district's students who are minority and the 5-year turnover rate of teachers.

These descriptive regressions indicate that novice teachers are unevenly distributed across districts in North Carolina. By themselves, however, the district-level patterns provide at most a crude picture of the differential exposure of minority and white students to novice teachers. For the reasons highlighted in the next section, students and teachers are not likely to be evenly distributed by race across schools within each district or across classrooms in each school. As a result, the district-level picture of differential exposure of black and white students to inexperienced teachers is incomplete and potentially misleading.

4. A model of the allocation of teachers and students

In considering the incidence of novice teachers across the classrooms of a state, it is useful to model how such teachers are distributed across districts separately from how they are distributed within districts. Their distribution across districts largely reflects aspects of supply and demand, such as teacher salaries, location, mix of students, available resources and working conditions on the one hand and teacher preferences on the other. Districts with high salaries, good locations, high-achieving or affluent students, plentiful resources and good working conditions are likely to be able to retain teachers more readily than other districts and hence have less need for new teachers. Various authors have investigated the effects of factors such as these on the ability of districts to attract and retain teachers and have found that teacher retention tends to be higher in districts with better salaries, higher pupil test scores, smaller classes, and lower proportions of low-income and minority students (see, for example, Greenberg & McCall, 1974; Murnane & Olsen, 1989; Mont & Rees, 1996; Hanushek et al., 1998; Scafidi, Sjoquist, & Stinebrickner, 2002). As for the distribution of students among districts, policy makers have little direct role because the main determinant of the number and mix of students in each district is the residential location decisions of families.[4]

[4]We do not mean to imply that districts have no impact on those residential decisions. The quality of schools clearly is one of the factors that affects a family's decision of where to live.

In contrast, the processes generating assignment patterns within districts are more complex than those across districts because district and school officials play a major role not only in assigning teachers to schools and to classrooms but also in assigning students. Another key difference is that salary schedules differ across districts but are uniform within districts. Given that raising a teacher's salary outside the normal step increases related to experience and educational credentials is generally not an option, the main way a school or district administrator can improve the real income, or job satisfaction, of an experienced teacher who remains within a district is to reassign her to a classroom or a school offering a more satisfying teaching experience. In making both the student and teacher assignments, local policy makers must attend not only to the job satisfaction of teachers but also to the reactions of parents and the expected educational outcomes for children. Previous studies (Greenberg & McCall, 1974; Murnane, 1981) have employed the concept of "internal labor markets" to model the movement of teachers within districts, but they have generally not emphasized the role of school authorities in influencing this movement.

As a way of focusing on the simultaneous allocation of teachers and grouping of students within districts and within schools, we develop a simple model intended to reflect these forces. Our purpose is to provide possible reasons why teachers of a given quality might not be allocated evenly across all schools or across all groups of students in a given school. One obvious possible reason is rank discrimination. Our model seeks to go beyond that explanation. To do so, we posit two types of students, which types may or may not correspond to actual identifiable groups.

4.1. Basic model

We consider an administrator of a school or of a district who has the power to assign teachers to schools or to classrooms within schools. We assume that the administrator aims to maximize a measure of output per pupil, designated L for learning, where learning should be interpreted as the change in a student's achievement level during the school year and represents the value added by the school. Defined in this way, learning is not an absolute or cumulative measure of achievement. Nor is it independent of what the student brings to the classroom. Learning in any classroom is assumed to be a function of two sets of characteristics: those of teachers and those of the group of students being taught. We refer to the latter as peers. For simplicity of exposition, we most often refer to the administrator as a school principal and to the classroom as the relevant unit within which teachers and students are matched. However, we intend the model to be general enough to apply as well to district superintendents making decisions about the matching of teachers and students across schools.

For simplicity, we reduce the relevant set of teacher characteristics to a single binary indicator, Q, which takes on the value one for a high-quality teacher and the value zero for a low-quality teacher. In the spirit of the empirical work in this paper, Q might indicate whether the teacher has prior teaching experience.

Similarly, we reduce peer characteristics to a binary indicator, P, which takes on the value one for "difficult-to-educate" pupils and zero for "easy-to-educate" pupils. The difference between the two types might reflect the fact that the difficult-to-educate students come to school less ready to learn and hence need more attention or, as in Lazear (1999), that their propensity to create distractions in the classroom detracts from the learning of their classmates. A pupil's type influences the learning of all pupils assigned to the same class. Conditional on a given composition of students, however, we assume that an individual pupil's learning is independent of type. Thus the amount of learning

$$L_{ij} = L(Q_j, \overline{P}_j) \quad (1)$$

achieved by pupil i in classroom j can be expressed as follows: where $\overline{P}_j$ measures the proportion of difficult-to-educate ($P = 1$) pupils in classroom j.

We make the following additional assumptions regarding the learning function:

$(A1) \quad L(1, \overline{P}_j) > L(0, \overline{P}_j) \forall \overline{P}_j,$

$(A2) \quad L_2(Q, \overline{P}_j) < 0,$

$(A3) \quad L_{22}(Q, \overline{P}_j) < 0,$

$(A4) \quad L_2(1, \overline{P}_j) > L_2(O, \overline{P}_j) \forall \overline{P}_j.$

Assumption (A1) indicates that for a given set of pupils, high-quality (experienced) teachers produce more learning than low-quality (novice) teachers, and this relationship holds regardless of the mix of pupils in the classroom. Assumptions (A2) and (A3) together imply that learning is a strictly decreasing, concave function of the share of students in the classroom who are difficult-to-educate. That is, for any quality of teacher, learning decreases as the teaching environment becomes harsher and at an increasing rate. This concavity assumption is not inconsequential and we return to its relevance below. Assumption (A4) says that the marginal product of high-quality relative to low-quality teachers increases as the mix of students become

(*footnote continued*)
Instead, we are simply emphasizing the difference between a state-level administrator who has no direct impact on which students are in which districts (other than by altering districts) and district- or school-level officials who directly affect student assignments.

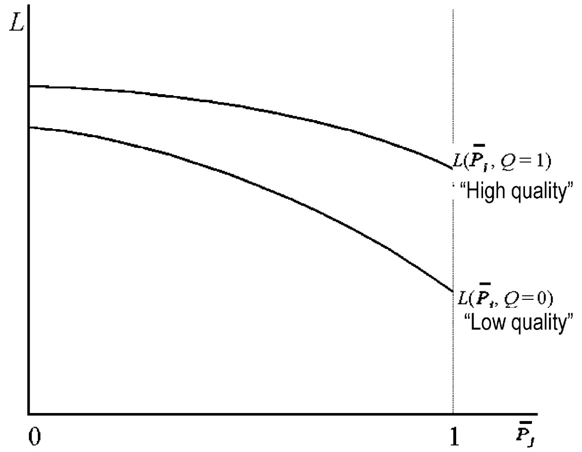

Fig. 1. The technology of learning.

more difficult to teach. Fig. 1 illustrates a version of the learning function consistent with these assumptions. Learning is graphed as a function of the mix of student for both high-quality ($Q_j = 1$) and low-quality ($Q_j = 0$) teachers.

Consider a school principal whose task is to match a given set of teachers with a given set of students and whose objective is to maximize the average level of learning across classrooms. To keep the problem manageable, we assume that the principal has no control over class size. A logical extension of the model would treat class size as a choice variable and as a factor that influences learning.

Provided she is not constrained by pressures from teachers or parents, the administrator can maximize learning by the following actions. If her teaching staff consists of teachers of both types, she should place a disproportionate number of difficult-to-teach students in classrooms with the high-quality teachers. This prediction follows directly from the assumption that high-quality teachers have a comparative advantage in teaching hard-to-educate students.[5] Alternatively if all her teachers are of the same quality (regardless of whether they are all low quality or all high quality), she will maximize student learning by mixing students of different types in each classroom, rather than separating them. This conclusion follows from the concavity of the learning function. Any departure from even mixing would reduce learning more in the classrooms with the disproportionate shares of hard-to-educate students than learning would rise in the other classrooms.

The main point is that with the learning technology as specified in assumptions A1–A4, the administrator has no incentive to segregate students unless she is doing so to give the high-quality teachers to the hard-to-educate students. With other technologies, of course, her incentives could differ. For example, if the administrator had teachers of only one quality and the learning function were convex, the administrator's optimal strategy would be to separate students by type, as in a "tracked" environment, in a way that would widen the differences in learning between the hard- and easy-to-educate students. Thus, the technology of learning could well affect the resulting allocations of teachers and students. For the rest of this section, we retain the original, and in our view quite plausible, assumptions about the technology in order to demonstrate how external pressures may move the administrator away from a benign or favorable treatment of difficult-to-educate students to one that puts them at a learning disadvantage.

Any school administrator is constrained, at least to some extent, by pressures from both parents and teachers. The following sections discuss demand side constraints that are rooted in the expectations and demands of parents and their children, and supply side constraints that are rooted in teachers' tastes for working in less difficult environments.

4.2. Demand side constraints from parents

Families are entitled to enroll their children in the school and classroom to which they are assigned. A family can either accept a given assignment or, by incurring some additional cost, can try to shift its child to another classroom within the same school or to another school. In making its decision about whether to incur the additional costs, a family is assumed to be interested in maximizing the learning of its child.

One option that might not require the family to move is to send the child to another public school within the same district. Alternatively, if the family is willing to incur greater costs, it might move to another district or opt for a private school. As an alternative to one of these "exit" options, families dissatisfied with the amount of learning offered in a given school may use the power of "voice" to alter the policies and practices within the school (an option that may be enhanced by the threat of exit). Those families may lobby to influence the administrator's decision about classroom assignments or simply seek to have her replaced. However subtle or attenuated they may be, threats such as these may discourage school administrators from taking actions that might drive pupils out of the district or make their parents so dissatisfied that they make the

[5]Whether she should segregate the classes completely depends on the relevant slopes at the extremes of the two learning functions—a class with all difficult-to-educate students for a high-quality teacher and a class of all easy-to-educate students for a low-quality teacher. As drawn in Fig. 1, the administrator will maximize learning by avoiding the extremes of fully segregated classes.

administrator's life difficult. In particular, these implicit threats could well affect how the administrator matches teachers and students.

Consider, for example, a situation in which parents of each type of child insist that their children learn at least some minimum amount. If the administrator allows the level of learning in any one classroom to fall below one of these reservation levels, the parents of the relevant students will either abandon the school or take some action to force a policy change. Fig. 2 illustrates one such scenario. Families of the two types of students are assumed to have different threshold levels of learning. In this example, the reservation learning level demanded by the parents of difficult-to-educate students (L_d) is set low on the grounds that they are likely to view themselves as having few alternatives. As drawn, the constraint is non-binding and does not affect the administrator's decision. In contrast, the parents of the easy-to-educate students have a high reservation level of learning (L_e). Such students will opt out of the public school or attempt to force the administrator's hand if they are assigned either to a low-quality teacher or to a classroom where more than half their peers are difficult to educate (Larreau, 1987). The higher reservation level of learning for this group largely reflects the parents' perceptions of their alternatives. The presence of a nearby private school with the power to screen out difficult-to-educate students, for example, could contribute to a high-reservation learning level for this group.

In this scenario, the administrator will assign any low-quality teachers to classrooms comprised entirely of difficult students. If there are enough easily educated students to form a majority in one or more classrooms, the administrator will assign them high-quality teachers. Any other assignment will cause the easily educated students to exit the school or make life difficult for the administrator. If they are too few to form a majority in a single classroom, easily educated students are likely to exit the school. In sum, demand side constraints may lead both to systematic segregation of students by type and to an allocation of teachers that puts the difficult-to-educate students at a disadvantage relative to the pattern that would otherwise be chosen by the administrator interested in maximizing average learning.

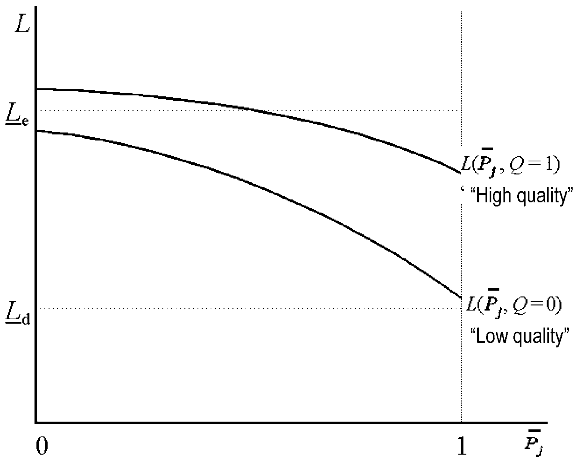

Fig. 2. Demand side constraints from parents.

4.3. Supply side constraints from teachers

An added constraint on administrators stems from the fact that teachers may be reluctant to accept assignments in certain classrooms or schools, particularly when they have alternative employment options in other schools, districts or professions. Their willingness to accept certain teaching positions is likely to depend on their compensation and the extent to which their job satisfaction is affected by the proportion of their students who are hard-to-educate.[6]

Fig. 3 illustrates one scenario in which supply side constraints of this sort force the administrator to deviate from what would otherwise be her preferred policy. In this scenario, demand side constraints are assumed to be non-binding. Low-quality ($Q=0$) teachers will accept a classroom with any mix of students. In contrast, high-quality teachers ($Q=1$) will accept assignment only to classrooms in which the proportion of difficult-to-educate students is below the level indicated by $\overline{P}_1^*$. If they are not assigned to classrooms that meet this standard, high-quality teachers will resign.

If we equate teacher quality, Q, with experience, it is reasonable to presume that any position vacated by an experienced (high quality) teacher will be filled by a novice (low quality) teacher. Under these conditions, suppose that an administrator must assign an evenly divided group of students to either of two classrooms. If the administrator begins with at least one experienced teacher, she has two options, as illustrated in Fig. 3. First, she could assign a majority of the easily educated students to the experienced teacher and a majority of the difficult students to an inexperienced teacher. The former group of students would attain a learning level of L_1 and the latter group L_2. Alternatively, she could let the experienced teacher go and assign all students to evenly mixed classrooms with inexperienced teachers. In this case, all students would achieve a uniform learning level L_3. As depicted in Fig. 3, the administrator would

[6]In North Carolina, some school districts offer greater monetary compensation to teachers who accept assignments in low performing "Equity-plus" schools. Our conversations with school and district administrators suggest that these incentives are not sufficient to alter teachers' decisions significantly. In practice, standardized teacher contracts and other institutional considerations may prevent administrators from using strong financial incentives.

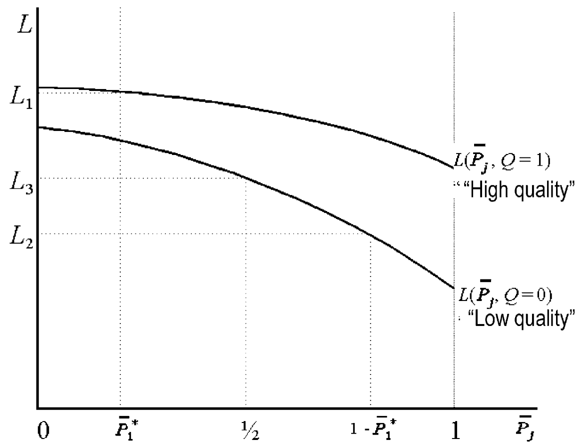

Fig. 3. Supply side constraints from teachers.

choose to retain the experienced teacher but that result depends on the shapes of the curves. In general, the administrator's decision depends on whether the boost to overall learning associated with retaining an experienced teacher exceeds the loss in learning associated with the greater segregation of students.[7]

4.4. Implications

Although we do not explicitly test it in this paper, the model is useful in highlighting the factors that could generate an uneven distribution of teachers among different groups of students either within schools or across the schools within a school district. One key factor is the technology of learning. Under the assumptions that we have made about that technology, an unconstrained administrator interested in maximizing learning would allocate the high-quality teachers to the difficult-to-educate students. Even with that technology, however, the fact that administrators are constrained by the preferences of parents and teachers alters the outcome. The model shows how these factors can push the administrator to allocate high-quality teachers to the easier-to-educate students even though that may widen the learning differences among groups of students.

The model generates several testable hypotheses about how various observable characteristics of school districts might affect how teachers are allocated among schools. Factors that increase the bargaining power of affluent parents, such as greater accessibility of private schools or proximity of other nearby public school alternatives, should lead principals and other administrators to tilt resources such as experienced teachers towards advantaged students. Other factors, such as school accountability programs that require schools and districts to raise the achievement of disadvantaged students, may have the reverse effect. Factors that increase the bargaining power of experienced teachers, such as competition from nearby districts or the presence of high-paying jobs in other sectors, should lead principals to assign experienced teachers more consistently to more attractive positions. In its current general form, however, the model is not sufficiently precise to generate specific predictions of the direction or the magnitude of the patterns of teacher assignment. Thus, the empirical challenge for this paper is to determine the direction of the differences in teacher qualifications across policy-relevant groups of students. We leave to future research a more detailed empirical assessment of the factors that generate the results we observe in this paper.

Our particular empirical focus is on differences in the exposure of black and white students to novice teachers. To the extent that black students, for whatever reason, are disproportionately represented in the difficult-to-educate segment of the student population, the model would predict within-district variation by race in access to low-quality teachers and, in particular, to novice teachers. We document the magnitude of these within-district differentials and combine them with differentials across districts to provide a more complete picture than has to date been available of the differential treatment of black and white students along this dimension.

5. Analytical framework and basic results

A careful analysis of the differences between black and white students in the probability of being taught by a novice teacher must incorporate differences within as well as across districts. The availability of North Carolina data from "school activity reports" makes that type of analysis possible. Below we present results based on all 7th grade students in math and English courses. An "activity" in this grade is a particular section of a math or an English course at a particular time of day in a particular school. Thus, activities can be interpreted as classes. Although we are not able to identify the particular students in each class, we do have information on the numbers of students of each racial or ethnic group in each class. In addition, we are able to identify the teacher for each class and can link that with information on years of experience from the state's teacher salary file.

The probability that a typical black student has an inexperienced teacher can be calculated as follows:

$$X_B = \frac{\sum_i \sum_j \sum_k B_{ijk} X_{ijk}}{\sum_i B_i},$$

[7] It should be noted that retaining an experienced teacher could have beneficial effects not captured in this static model. For example, such a teacher could make a novice teacher more productive by serving as a mentor.

where X equals 1 if the teacher is inexperienced and 0 otherwise, B is the number of black students, and the subscripts i, j and k refer to the classroom, the school and the district, respectively. X_B is simply a weighted average summed across all activities, schools and districts, of the probability of a teacher having experience, where the weights are numbers of black students. The comparable exposure rate for white students would be similar, with the weights being the number of white students in each activity.

This approach allows us to calculate typical exposure rates to inexperienced teachers at the state level and at more disaggregated levels. In addition, it allows us to decompose the aggregate black–white differences in exposure rates into district level, school level, and classroom effects.

5.1. Decomposition of black–white differences

In addition to the actual exposure rates for each racial group (X_B and X_W), we calculate the following two hypothetical exposure rates:

X_{B1} (or X_{W1}) is the probability that a typical black (or white) student would face a novice teacher assuming that novice teachers were evenly distributed across schools within each district.

X_{B2} (or X_{W2}) is the probability that a typical black (or white) student would face a novice teacher assuming that novice teachers were evenly distributed across classrooms within each school.

Using these hypothetical exposure rates and the average rate of exposure to novice teachers for all students in the state (X), we can decompose the total black–white difference in exposure to novice teachers into three effects. The *district effect* indicates the difference in exposure of blacks and whites due to the fact that blacks and whites are enrolled in districts with different overall percentages of inexperienced teachers. The *school effect* indicates the difference in exposure that arises due to differences between schools attended by blacks and whites within districts. Analogously, the *classroom effect* indicates the difference in exposure due to differential assignments of black and white students across classrooms within schools. These effects can be calculated as follows:

District effect:

$$(X_{B1} - X) - (X_{W1} - X) = X_{B1} - X_{W1}.$$

School effect:

$$(X_{B2} - X_{B1}) - (X_{W2} - X_{W1}) = (X_{B2} - X_{W2}) - (X_{B1} - X_{W1}).$$

Classroom effect:

$$(X_B - X_{B2}) - (X_W - X_{W2}) = (X_B - X_W) - (X_{B2} - X_{W2}).$$

5.2. Results for 7th grade math and English, 2000–2001

The basic results for 7th grade math and English students for the 2000–2001 school year are reported in Table 3. The table reports the probabilities of being exposed to an inexperienced teacher for typical black and white seventh graders in math and English for the state as a whole, for the five largest districts, and six groups of districts. Looking first at the statewide results, we see first that the probability that a typical black 7th grader in math has a novice teacher is 0.128, which is 54 percent higher than the 0.083 probability for a typical white student. In English, the probability for a black student exceeds that for a white student by 38 percent.

The second panel reports comparable probabilities for the five largest North Carolina districts. The black–-white difference is largest in Wake County where it exceeds 50 percent in both subjects. It is also high in Cumberland in math and Forsyth in English. The third panel reports results for the three groups of urban school districts (excluding the largest districts) and three groups of rural districts. Black students appear to be particularly disadvantaged in terms of their exposure to novice teachers in math in both urban and rural coastal districts and somewhat less disadvantaged in the mountain areas, where black students are under-represented The main point, however, is that in almost all cases shown in the table, and for the state as a whole, black students are at a disadvantage relative to white students in terms of their exposure to novice teachers and, as indicated in the table, in most cases the differences are statistically significant.[8] As emphasized earlier, these patterns could reflect the fact that black students are disproportionately represented in districts with above-average proportions of inexperienced teachers, in schools within districts with that characteristic, or in classrooms within schools with that characteristic.

Table 4 indicates that all three levels are implicated. For the state as a whole, the decomposition of the black–white differences indicates that differences across districts and across schools each account for between 35 and 38 percent of the overall difference while differences across classrooms account for 25–29 percent. The

[8]The table reports the differences in percentage form but the tests refer to the differences in the reported exposure rates. Thus while the magnitudes of the percentage differences are sensitive to whether attention is focused on the share of novice teachers or on its reverse, the share of experienced teachers, the magnitude and the statistical significance of the differences are independent of which way the teacher variable is defined.

Table 3
Exposure to a novice teacher, 7th grade math and English, 2001

	Math			English		
	Black	White	% Diff.	Black	White	% Diff.
State of NC	0.128	0.083	54*	0.106	0.077	38*
Five largest districts						
Mecklenburg (Charlotte)	0.182	0.137	33*	0.167	0.119	40*
Wake (Raleigh)	0.122	0.076	67*	0.167	0.110	52*
Guilford (Greensboro)	0.094	0.077	22*	0.119	0.119	0
Cumberland (Fayetteville)	0.245	0.156	57*	0.090	0.084	13
Forsyth (Winston-Salem)	0.153	0.144	6	0.119	0.060	98*
Urban districts						
Coastal	0.140	0.063	122*	0.062	0.050	24*
Piedmont	0.083	0.080	4	0.131	0.065	100*
Mountain	0.060	0.057	5	0.080	0.079	1
Rural districts						
Coastal	0.159	0.060	165*	0.027	0.038	−29
Piedmont	0.091	0.064	42*	0.108	0.079	37*
Mountain	0.104	0.096	8	0.105	0.077	36*

Source: Calculations by the authors based on data from the North Carolina Department of Public Instruction.
*Statistical significance at the 5 percent level.

implication is that if each and every school uniformly distributed its inexperienced teachers among classrooms, about 2/3 of the black–white difference in exposure probabilities would remain. If, in addition, every district uniformly distributed its experienced teachers among schools, 36–37 percent of the black–white difference would remain as a result of differences across districts in the share of novice teachers.[9]

As shown in the second panel, the patterns vary across the largest five districts. In Mecklenburg, more than two-thirds of the black–white difference in exposure to inexperienced teachers is attributable to how the students are distributed among schools rather than across classrooms within schools. In Wake, in contrast, the classroom effect dominates. In that district, new teachers are more evenly distributed among schools but less evenly distributed among classrooms with differing racial mixes within schools. Guilford's relatively small overall black–white gap is attributable fully to differences at the classroom, rather than the school level.

6. Further analysis and discussion

As highlighted in Section 4, the processes generating the patterns within districts is complex because of the simultaneous allocation of both students and teachers to schools and classrooms. We begin this section by looking more closely at the link between the racial segregation of the students and the distribution of inexperienced teachers. Given that racial tracking is one of the mechanisms that districts can use to segregate students, we then look at how district decisions about the tracking of students translates into differential exposure rates of black and white students to inexperienced teachers.

6.1. Racial segregation of the students

Differential exposure rates by race to inexperienced teachers cannot emerge unless students are segregated by race. One implication of this observation is that in districts that are not very racially segregated at the classroom level, the black–white difference in exposure to inexperienced teachers is likely to be relatively small. The reverse, however, is not true. Segregation at the student level need not lead to differential exposure to inexperienced teachers. Such segregation at the student level could be offset, for example, by a uniform distribution of inexperienced teachers among classrooms. Alternatively, black students could be treated even more favorably than white students as might be the case if administrators sought to maximize overall achievement, along the lines of the model described in Section 4 for the unconstrained administrator.

[9]Note that this assumes no behavioral effects, such as the potential that more teachers might leave teaching which would then raise the proportion of inexperienced teachers.

Table 4
Decomposition into district, school, and classroom effects, 7th grade math and English, 2001

	Total black–white difference	District effect	School effect	Classroom effect
NC State				
Math	0.0451	0.0171	0.0165	0.0114
		38%	37%	25%
English	0.0295	0.0106	0.0104	0.0085
		36%	35%	29%
Five largest districts				
Mecklenburg				
Math	0.0447	—	0.0313	0.0135
			70%	30%
English	0.0567	—	0.0391	0.0176
			69%	31%
Wake				
Math	0.0464	—	0.0170	0.0294
			37%	63%
English	0.0202	—	0.0075	0.0126
			37%	63%
Guilford				
Math	0.0170	—	−.0002	0.0171
			0%	100%
English	−0.0007	—	−0.0085	0.0078
			< 0%	>100%
Cumberland				
Math	0.0887	—	0.0579	0.0309
			65%	35%
English	0.0057	—	−0.0086	0.0143
			< 0%	>100%
Forsyth				
Math	0.0084	—	0.0090	−0.0005
			>100%	< 0%
English	0.0590	—	0.0485	0.0104
			82%	18%

Source: Calculated by the authors based on data from the North Carolina Department of Public Instruction.

Using the same data source as in the previous tables, we have calculated measures of the extent to which seventh grade students are segregated by race at the state level, in each district and also at the school level. Such segregation indices take on values between 0 and 1 with higher values representing greater segregation.[10] The total segregation index for a district starts with segregation at the classroom level and then aggregates over classrooms within schools and over all schools within the district.

[10]The segregation index of students is defined as $S=(N–E_{AN})/N$ where E_{wn} is the proportion of non-whites in the class of a typical white seventh grader (in math or English) and N is the overall proportion of non-whites in the area. See Clotfelter (1999).

The first set of columns in Table 5 reports total segregation indices for the five largest districts, and their decomposition into segregation at the school and classroom levels. These indices were calculated based on all seventh grade classes in math and English. The second set of columns repeats the information from Table 3 on the black–white differences in exposure rates for math.

Consider Wake County. From the perspective of student segregation, Wake is an outlier in that the bulk of the student segregation emerges within schools, not across schools. That pattern reflects the district's history of integrating its schools by establishing a large number of magnet schools and paying close attention to racial balance in assigning students to schools. As a result, in 2001, no 7th grade black students were in schools where

Table 5
Comparison of racial segregation of students to the probability of exposure to a novice teacher in math, 7th graders, 2000–2001

	Segregation of students			Exposure to novice teachers in math		
	Total	% across schools	% across classrooms	Black–white difference in probability (%)	% across schools	% across classrooms
Mecklenburg	0.328	52	48	0.045 (33%)	70	30
Wake	0.284	29	71	0.046 (67%)	37	63
Guilford	0.373	68	32	0.017 (22%)	0	100
Cumberland	0.203	63	37	0.089 (57%)	65	35
Forsyth	0.376	61	39	0.008 (6%)	>100%	<0%

Source: Calculations by the authors based on data from the North Carolina Department of Public Instruction.

more than 90 percent of the students were minority students and only 24 percent of black students were in schools where more than 50 percent of the students were minority. This latter proportion is less than half the figure for the other four large North Carolina districts. As a result, much of the student segregation appears within, rather than across schools. Correspondingly, as shown in Table 5, a higher share of the differential exposure to inexperienced teachers is attributable to differences across classrooms within schools rather than to differences across schools.

Guilford is interesting because, like all of the other districts in the table other than Wake, the bulk of its student segregation is attributable to differences across schools. Yet in contrast to the other districts, all of the differential exposure to novice teachers occurs at the class room level. Thus, it appears that Guilford has compensated in part for the segregation of its students across schools by evenly distributing its novice teachers across schools.

6.2. Academic tracking of students

One mechanism districts might use to segregate students is through their academic placement into remedial, standard, and advanced courses. The question here is the extent to which that tracking leads to black–white differences in exposure to novice teachers.[11]

Table 6 indicates that across the state 7th grade black students are over-represented in remedial courses and under-represented in advanced courses relative to their white counterparts in both math and English courses.[12] The relevance of this fact for the probabilities of exposure to inexperienced teachers can be found in Table 7. For black and white students combined, the probability that a student is exposed to an experienced teacher falls monotonically across remedial, standard and advanced courses. In math, for example, the probability of having an inexperienced teacher is 0.127 for remedial courses, 0.098 for standard courses and 0.061 for advanced courses. Hence, even if there were no differences within academic levels by race of the student in the probability of exposure to an inexperienced teacher, black students would be more likely to face an inexperienced teacher by dint of their over-representation in remedial courses and their under-representation in advanced courses.

Those differences are exacerbated by the fact that even within a given academic course level, in most cases black students are disadvantaged relative to white students. Within standard courses, for example, the probability of having an inexperienced teacher is 57 percent higher for a black student than a white student in math and 37 percent higher in English. Some portion

Table 6
Distribution of students by level of course, 7th grade math and English, 2000–2001

	Percent of students			
	Math		English	
	Black	White	Black	White
Remedial	8.96	4.25	12.76	6.44
Standard	88.26	89.64	83.39	84.31
Advanced	2.79	6.11	3.85	9.25
Total	100.00	100.00	100.00	100.00

Source: Calculations by the authors based on data from the North Carolina Department of Public Instruction. Chi squared tests show that the patterns by race are statistically significant for both math and English at the 5 percent level.

[11]For a more expansive investigation of the effects of tracking in one North Carolina district, see Mickelson (2001).

[12]Remedial courses for this purpose include special education, abridged/adapted courses and applied/technical courses. Advanced courses include honors/advanced/academically gifted courses.

of this difference is attributable, however, to the variation across districts in the incidence of inexperienced teachers rather than to decisions made by district policy makers. To focus on those decisions, we look at patterns within individual districts.

Tables 8 and 9 replicate Tables 6 and 7 for the two largest counties, Mecklenburg and Wake. Table 8 indicates that the distribution of students among academic levels in Mecklenburg is very similar to that for the state. In contrast, the proportions of students in remedial courses in Wake County are much higher than in the state, especially for black students, and the proportions are somewhat lower in the advanced courses.

Table 9 illustrates that the two districts have pursued relatively similar strategies with respect to the assignment of inexperienced teachers (see the first column in each box) to courses by academic level. In both districts,

Table 7
Probability of exposure to a novice teacher, by level of course, 7th grade math and English

	Math				English			
	Black and white	Black	White	% Difference	Black and white	Black	White	% Difference
Remedial	0.127	0.137	0.116	18*	0.097	0.106	0.088	21*
Standard	0.098	0.130	0.083	57*	0.088	0.107	0.078	37*
Advanced	0.061	0.056	0.063	−11	0.066	0.094	0.066	42*

Source: Calculations by the authors based on data from the North Carolina Department of Public Instruction.
*Statistical significance at the 5 percent level.

Table 8
Distribution of students by level of course, Mecklenburg and Wake

	Mecklenburg				Wake			
	Math		English		Math		English	
	Black	White	Black	White	Black	White	Black	White
Remedial	8.19	2.31	11.28	4.08	16.02	3.60	38.19	13.02
Standard	87.71	91.84	77.18	61.13	83.27	89.33	58.39	82.01
Advanced	4.10	5.86	11.54	34.79	0.71	7.07	3.42	4.97
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Calculations by the authors based on data from the North Carolina Department of Public Instruction. Chi squared tests indicate that all patterns by race are statistically significant at the 5 percent level.

Table 9
Probability of exposure to a novice teacher by level of course, 7th grade math and English, Mecklenburg and Wake

	Math				English			
	Black and white	Black	White	Percent difference	Black and white	Black	White	Percent difference
Mecklenburg								
Remedial	0.122	0.133	0.082	62	0.101	0.102	0.099	3
Standard	0.171	0.195	0.147	33*	0.153	0.195	0.147	33*
Advanced	0	0	0	0	0	0	0	0
Wake								
Remedial	0.076	0.082	0.063	30	0.082	0.098	0.053	85*
Standard	0.097	0.131	0.082	60*	0.094	0.106	0.089	19*
Advanced	0	0	0	0	0	0	0	0

Source: Calculations by the authors based on data from the North Carolina Department of Public Instruction.
*Statistical significance at the 5 percent level.

the incidence of inexperienced teachers is greatest for standard courses and no novice teachers are assigned to the advanced courses. The main point, however, it that there are large and statistically significant differences between the exposure rates of blacks and whites within the standard course level. Thus, these data suggest that within these two districts, tracking of students into courses of different levels is one, but clearly not the only, mechanism, that leads to differentially high exposure of black students to inexperienced teachers.

7. Conclusion

Emerging from this analysis are three main conclusions. The first is that black 7th graders in North Carolina are far more likely to face a novice teacher in math and English than are their white counterparts. The differences are about 54 percent in math and 38 percent in English for the state as a whole, over 50 percent in some of the large urban districts, and even larger on average in the smaller districts along the coast. Although these differences do not by themselves explain black–-white gaps in achievement, they (along with other differences in teacher characteristics) certainly warrant attention as a potentially important contributor to the explanation. In subsequent analysis we plan to look at other grades to see how persistent the patterns are over a student's school experience and also to examine whether the patterns are similar for other characteristics of teachers deemed to be important for student learning.

Second, almost two-thirds of the overall black–white difference in exposure to novice teachers reflects patterns within, rather than across, school districts in North Carolina. Within districts, novice teachers are disproportionately assigned to the schools and to the classrooms within schools that disproportionately serve black students. As far as we know ours is the first study to document patterns such as these at the classroom level for all students in a state. One implication of this finding is that policies designed to achieve more uniformity across districts will not eliminate the disadvantage faced by black students in the assignment of novice teachers.

Third, although the patterns within districts could result from explicit racial prejudice on the part of the school administrators, the model developed in Section 4 suggests other possible explanations based on the technology of learning and constraints (real or perceived) placed on administrators by parents and teachers. As developed in Section 4 in the context of easy- and hard-to-educate students, the more power that parents of some students have to influence the decisions of school administrators, the more likely it is that other students will end up with low-quality or novice teachers. Similarly, the stronger are the preferences of experienced teachers for working with easy-to-educate students, the more likely it is that other students will end up with novice teachers. Understanding these pressures is essential to a full appreciation of the effects of education reforms such as spending equalization or accountability programs and in finding policy levers that could change the patterns.

In subsequent works, we hope to explore in some detail the nature of these pressures from parents and teachers. For example, one aspect in our model is the credibility of threats from parents. When parents have relatively few options outside the public schools in a given area, threats to abandon the school will be less credible than when they have more options. Since these options depend on the range of schools available and the ability of parents to enroll in those schools, one research strategy will be to examine the extent to which the availability of such options affects the outcomes of interest. Similarly, the easier it is for teachers to move from one school to another or to find employment opportunities outside of teaching, the greater the challenge that school administrators will face in retaining them. Of particular importance for within-district moves are the policies that affect the ease of transfers across schools and the availability of opening in other schools.

Finally, we note that North Carolina's school-based accountability system, which has been in place since 1996–97, could well be having an impact on how novice teachers are distributed relative to black and white students across the state. At a conceptual level, the direction of the impact is not clear. The new system could alter the administrator's objective function and might raise the reservation learning level of the parents of the hard-to-educate students thereby improving their bargaining position relative to the parents of high-achieving students. Survey results indicate, for example, that the state's accountability system has led school principals to pay more attention to their low-performing students (Ladd & Zelli, 2002). To the extent that black children are more likely to be in the lower performing and harder-to-educate group than white children, we would predict that the accountability system would reduce the gap in exposure rates to novice teachers between black and white students. At the same time, the availability of positive rewards and recognition for teachers in successful schools combined with the additional scrutiny and shame for teachers associated with failing schools exacerbates the pressure for experienced teachers to move away from schools serving large proportions of low-performing students, many of whom are black, in favor of schools with higher achieving students (Ladd & Walsh, 2002). The research presented in this paper underscores the importance of understanding the net effect of these pressures on the distribution of novice teachers among schools and provides the basis for a careful analysis of how the accountability system has affected the distribution over time. In related research we document that the net effect of the North Carolina accountability program has been to make it more difficult for low-performing schools to retain teachers (Clotfelter, Ladd, & Vigdor, 2004a; Clotfelter et al., 2004b).

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