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Brian A. Jacob

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What is This?

Do Principals Fire the Worst Teachers?

Brian A. Jacob

University of Michigan, National Bureau of Economic Research

This article takes advantage of a unique policy change to examine how principals make decisions regarding teacher dismissal. In 2004, the Chicago Public Schools (CPS) and Chicago Teachers Union signed a new collective bargaining agreement that gave principals the flexibility to dismiss probationary teachers for any reason and without the documentation and hearing process that is typically required for such dismissals. With the cooperation of the CPS, I matched information on all teachers who were eligible for dismissal with records indicating which teachers were dismissed. With these data, I estimate the relative weight that school administrators place on a variety of teacher characteristics. I find evidence that principals do consider teacher absences and value-added measures, along with several demographic characteristics, in determining which teachers to dismiss.

Keywords: *teachers, principals, value-added, teacher hiring, teacher tenure*

EFFORTS to improve teacher quality traditionally have focused on the supply side of the teacher labor market. Many studies have documented that both wages and working conditions play important roles in teacher mobility (Boyd, Lankford, Loeb, & Wyckoff, 2005; Dolton & van der Klaauw, 1999; Hanushek, Kain, O'Brien, & Rivkin, 2005; Scafidi, Stinebrickner, & Sjoquist, 2003; Stinebrickner, 1998, 2002), and recent evidence suggests that targeted salary bonuses can induce individuals to teach in high-need areas (Clotfelter, Glennie, Ladd, & Vigdor, 2008). Similarly, dozens of studies have explored the relative effectiveness of teachers with traditional versus alternative (or no) certification (e.g., Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Kane, Rockoff & Staiger, 2008).

In contrast, there has been remarkably little research on the demand side of the teacher labor market, including personnel decisions. This is particularly unfortunate because policies focusing on teacher hiring, promotion, and dismissal may be important levers for improving the quality of public schools. For example, there is evidence that principals do not hire the "best" teachers (Ballou, 1996; Ballou & Podgursky, 1997; Pflaum & Abramson, 1990), and the teacher effectiveness literature has found surprisingly little relationship between many commonly used proxies for teacher quality and student outcomes (e.g., Hanushek, 1997). Yet there is some evidence that they would be able to distinguish between the most and least effective teachers in their buildings (Jacob &

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Lefgren, 2008). Recent research suggests that an important way in which the most effective principals influence student performance is through recruitment and retention of effective teachers (Beteille, Kalogrides & Loeb, 2009).[1]

One reason for the lack of research in this area is the common but mistaken perception that disadvantaged school districts are in a state of perpetual shortage of certified teachers in all areas.[2] Another reason is that data on teacher applications, hiring, and dismissal that are linked to student and teacher information are generally quite hard to obtain. Finally, dismissals for cause—as opposed to layoffs (often referred to as reductions-in-force or excessing)—are extremely rare. Whereas principals may informally push a teacher out, this will generally appear as a voluntary move on the part of a teacher. This makes it impossible to even identify true dismissals let alone examine the teacher characteristics associated with a principal's dismissal decision.

In this article, I use detailed administrative data on teachers, students, and principals to examine how principals make decisions regarding teacher dismissal. This analysis is possible because of a recent policy change in Chicago. In 2004, the Chicago Public Schools (CPS) and Chicago Teachers Union signed a new collective bargaining agreement that gave principals the flexibility to dismiss probationary teachers for any reason and without the documentation and hearing process that is typically required for dismissals in other districts. With the cooperation of the CPS, I matched information on all teachers who were eligible for dismissal with records indicating which teachers were dismissed. By comparing the characteristics of dismissed versus nondismissed probationary teachers within the same school and year, I estimate the relative weight that school administrators place on a variety of teacher characteristics, including proxies for teacher productivity.

Several factors make the new CPS policy ideal for examining principal personnel decisions. First, this analysis relies on actual personnel decisions as opposed to the self-reports of administrators. Second, unlike past teacher mobility studies, this analysis is able to distinguish between voluntary and involuntary separations. Third, the availability of data such as teacher absence rates and student

achievement allows one to create excellent measures of teacher productivity.

I find evidence that principals do consider teacher productivity in determining which teachers to dismiss. Principals are significantly more likely to dismiss teachers who are frequently absent and who have received worse evaluations in the past. Elementary teachers who were dismissed had significantly lower value added with regard to student achievement in prior years compared with their peers who were not dismissed. In addition, principals were significantly less likely to dismiss teachers with stronger educational qualifications as measured by things such as the competitiveness of their undergraduate college, whether they ever failed the teacher certification exam, and whether they had a Master's degree. Finally, dismissed teachers who were subsequently rehired by a different school are substantially more likely to be dismissed again relative to first-year teachers in the school.

These results provide suggestive evidence that reforms along the lines of the Chicago policy might improve student achievement. To be clear, however, the analysis presented in this article does not seek to evaluate the causal impact of this new policy. Instead, it uses the existence of the policy, in conjunction with detailed data on teachers and principals, to provide descriptive evidence on principal beliefs and/or preferences. This is important because principal beliefs and preferences are key factors in determining whether this policy (or, e.g., the teacher evaluations policies being enacted as part of Race to the Top legislation) will improve student achievement. In related work, I have directly examined the causal impact of this dismissal policy, and I have found evidence that the introduction of the Chicago policy reduced teacher absenteeism (Jacob, 2010).

This analysis also reveals that 38.8% to 46.2% (28% to 34%) of elementary (secondary) principals—including those in some of the worst performing schools in the district—did not dismiss any teachers despite how easy it was to do so under the new policy. The apparent reluctance of many Chicago principals to use the additional flexibility granted under the new contract may indicate that issues such as teacher supply and/or social norms governing employment relations are more important factors than

policymakers have realized. It is possible that the mere threat of dismissal led to changes in teacher effort that made actual dismissal unnecessary. However, given the large fraction of principals who made no dismissals and the relatively modest improvements in student performance in these schools over this period, this latter explanation seems unlikely to fully explain the lack of dismissals.

I also find evidence that several teacher demographic characteristics are associated with the probability of dismissal. Principals are more likely to dismiss male teachers even after controlling for other demographics, prior absences, formal evaluations, and teacher value added. Older teachers are more likely to be dismissed, particularly those working in buildings with younger principals.

These results raise some concerns, but it would be incorrect to conclude on the basis of this evidence alone that principals in Chicago were acting in a discriminatory manner. As described in more detail below, the analysis reported here cannot control for many direct measures of teacher qualities that principals could legitimately consider in making a dismissal decision (e.g., energy, enthusiasm, ability to relate to children, familiarity with the best instructional practices). To the extent that these qualities are correlated with characteristics like age and gender, the results presented below may not reflect discriminatory behavior. Moreover, the sample selection introduced by nonrandom hiring may lead to biased estimates of the relationship between dismissal and any easily observable, predetermined teacher characteristic such as age or gender. If, for example, male teachers were less productive on average than female teachers were (or even if the principal believed this to be the case), then the marginal male teacher who was hired must be more attractive on some other, likely unobservable, dimension relative the marginal female teacher hired. Nonetheless, these results suggest that additional research into the decision-making process of principals may be warranted.

The remainder of the article proceeds as follows: I review the prior literature and provide background on teacher dismissals in the CPS. Next I describe the data and methodology. Then I present the results and conclude.

Prior Literature

As noted above, there has been relatively little research on policies related to the demand side of the teacher labor market. One relatively common type of study that touches on personnel issues examines the self-reported preferences of school administrators. In a comprehensive review of this literature, Harris, Rutledge, Ingle, and Thompson (2006) conclude that principals emphasize teacher enthusiasm and communication skills in hiring decisions. Harris et al. (2006) also interviewed 30 principals from a Florida district and analyzed their responses. Principals in their study reported that they strongly value many different teacher qualities, including strong teaching skills, caring, knowledge of subject, ability to work with others, experience, enthusiasm, and communication skills.

Other notable studies in this vein explore teacher hiring practices through statewide surveys of administrators: one in New York (Balter & Duncombe, 2005a, 2005b, 2006) and the other in Pennsylvania (Strauss, Bowes, Marks & Plesko, 2000). These studies report that district officials emphasize the importance of a candidate's undergraduate major, prior teaching experience, subject matter knowledge, and references but do not focus on factors such as the caliber of the candidate's academic institution in the hiring process.

Whereas these studies are useful in identifying potentially important teacher qualities, they have several important limitations. Because they rely on self-report data, they cannot reliably determine the relative importance principals place on these characteristics—that is, how much they would be willing to trade off one quality for another. Studies that directly examine teacher mobility can, in theory, circumvent these concerns (e.g., Boyd et al., 2005; Hanushek et al., 2005). However, because the transfer of a teacher from one school to another is the result of both the teacher's desire to move and the school's desire to hire him or her, these studies are unable to separate teacher and school preferences.

Other studies have attempted to more directly examine principals' beliefs and behaviors related to teacher personnel decisions. Ballou (1996) analyzed surveys of recent college graduates from 1976 to 1991, focusing on items that asked respondents who had completed teacher training

about their experiences in applying for and obtaining a teaching job. He found that applicants from more competitive colleges are no more likely to obtain positions than are those from lower tier schools and that math and science majors are less likely to obtain positions than are education majors. Moreover, he presented evidence that this is not simply due to greater choosiness on the part of these applicants or from negative selection into the pool of teacher candidates. The only measure of academic quality that he found to be positively related to probability of finding a job is GPA. He concluded that public schools do not necessarily hire the most qualified candidates.

Several recent studies come to a somewhat different conclusion. Boyd et al. (2010) used data on applications to transfer and hiring decisions in New York City to separate teacher and school preferences. The authors found that schools hire those applicants with the highest value added and preservice quality (as measured by the teacher's certification test score and college quality). This analysis suggests that principals currently working in urban school districts may indeed hire the "best" candidates. Although this analysis is by far the most compelling work to date on the topic, it has several limitations, including the fact that the authors only observe teacher hires and not job offers, which means that they cannot precisely focus on administrator preferences per se.[3]

A recent set of papers using data from the Miami–Dade County School District also sheds light on the role of principals in driving school performance, with a particular focus on their role in personnel decisions such as teacher recruitment, retention and development. Beteille et al. (2009) found that the most effective principals, defined as those school leaders whose schools had the highest value-added measure during their tenure, are more likely to dismiss ineffective teachers and retain effective teachers. Moreover, effective principals hire more effective teachers than their peers do. This work suggests that the primary channel through which principals influence student performance is affecting the composition of the teachers in their building.

Looking at the literature on personnel economics more generally, one finds only limited evidence that firms consider clear, objective measures of productivity in determining employee termination. Elvira and Zatzick (2002) found that employee performance ratings were negatively associated with layoffs, but it is not clear that this really measures productivity. Zwerling and Silver (1992) found that civil service exam scores were not associated with involuntary termination among postal workers, and Wilson (2005) found no relationship between employee absenteeism and job dismissal. Brown (1990) examined employee retention in the context of the military. He found that soldiers with a high school diploma and higher Armed Forces Qualification Test scores were more likely to be eligible for re-enlistment—that is, they were less likely to be "laid off" by the military. There is evidence that employers prioritize other skills that are generally unobservable to the econometrician. For example, there is evidence that employers value soft skills (Murnane & Levy, 1996).

Teacher Dismissals in Chicago

As in many public school districts, teacher layoffs and dismissals in the CPS are highly regulated. In situations where teacher positions must be eliminated because of enrollment changes or a budget shortfall, the collective bargaining agreement outlines a procedure by which the least experienced teachers are let go first. This is typically known as a *reduction in force*.

In the past, it has been extremely difficult for principals to dismiss teachers outside the auspices of a reduction in force. Like most other districts, the state school code in Illinois and district collective bargaining agreement in Chicago provides considerable protection for tenured teachers that make it very time consuming and difficult for principals to dismiss these teachers for cause. Unlike many smaller, suburban districts in Illinois, however, the collective bargaining agreement in Chicago also made it very difficult for principals to dismiss nontenured teachers. Perhaps for this reason, formal principal evaluations in Chicago are remarkably generous. In 2007, for example, only 15 of the 11,621 teachers who were evaluated in 2007 received a rating of unsatisfactory, and only 641 out of 11,621 (5.5%) received a rating of satisfactory. The remaining teachers were rated excellent or superior.

More to the point, prior to the adoption of the new policy, virtually no teachers were dismissed

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for cause in the CPS. Of course, it is likely that a fraction of teachers who switched schools or left the CPS entirely were informally "counseled out" by school administrators. But prior to the new policy, it was not possible to distinguish these "involuntary" separations from truly voluntary attrition.

The adoption of a new collective bargaining agreement on July 1, 2004, made substantial changes to the tenure system in Chicago that provided principals with the ability to easily dismiss nontenured teachers beginning in the 2004–2005 school year. In the analysis that follows, the academic years 2001–2002 through 2003–2004 constitute the prepolicy period and the academic years 2004–2005 through 2006–2007 constitute the postpolicy period. The July 2004 contract created a new three-tiered classification system for Chicago teachers: (a) Temporarily Assigned Teachers are individuals who are in a temporary placement (such as a long-term substitute who is filling in for a teacher on leave) and are not earning tenure, (b) Probationary Appointed Teachers are individuals who have been regularly appointed to a position but have been teaching for fewer than 5 consecutive years (during this period, Chicago teachers received tenure after 4 years of service), and (c) tenured teachers.

Nonrenewal works in the following way: Each February, principals are able to log into a district computer system that has a list of all of the Probationary Appointed Teachers in their school. The principal can then check one of two boxes: renew or nonrenew.[4] The administrative ease with which administrators can dismiss a probationary teacher—with a simple click of a button—is noteworthy. In essence, the collective bargaining agreement adopted in July 2004 dramatically reduced the costs of firing a probationary teacher in the district. This policy change made Chicago the only large, public school district in the country to provide principals with this type of flexibility over personnel decisions.[5]

Teachers are notified by formal letter of nonrenewal sometime in late April or early May. If a principal chooses to nonrenew a teacher, the teacher is guaranteed health benefits through August 31st of the current year and is allowed to apply to positions in other Chicago public schools. Moreover, the teacher is eligible for unemployment benefits because nonrenewal is viewed as a layoff rather than a dismissal for cause.[6] However, nonrenewed teachers are not guaranteed another job in the CPS.[7] Although principals are required to provide district officials with at least one reason for the nonrenewal decision, they are not required to justify or explain their decision and they do not need to provide teachers with this reason.[8]

Data

The data for this study come from several sources. Teacher personnel files provide information on teacher background, current assignment, and (for probationary teachers) whether they were renewed. We supplement these teacher-level data with information on school demographics, principal characteristics from personnel files, and student test score information (which is used to construct value-added measures of teacher effectiveness).

The initial sample includes probationary teachers in the Chicago Public Schools in three consecutive years: 2004–2005, 2005–2006, and 2006–2007. I exclude individuals who were employed by the central office, including speech pathologists, nurses, counselors and teachers working in administrative or professional development capacities. Moreover, I exclude teachers in a handful of alternative schools that serve severely disabled students or other special populations as well as teachers on leave or who were employed less than half time. For a small number of teachers who taught subjects such as art or music in multiple schools, I include only the observation in the school that is listed as their primary appointment.[9]

The final sample consists of 16,246 elementary school teachers and 7,764 high school teachers within 588 schools.[10] Table 1 presents summary statistics for the sample. Women comprise 83.7% of the sample in elementary schools and 60.1% in secondary schools. The elementary (secondary) teachers are 48.5% (65.1%) White, compared with 28.2% (26%) and 18.4% (10.4%) for Black and Hispanic teachers, respectively. Of elementary (secondary) teachers in this sample, 26% (23.1%) are younger than 28 years old, and 12.5% (15.7%) are older than 50 years of age. Interestingly, there are a number of teachers with more than 4 years

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TABLE 1

Summary Statistics

	Elementary schools		High schools	
	All probationary teachers	Probationary teachers who were dismissed	All probationary teachers	Probationary teachers who were dismissed
Number of observations	16,246	1,858	7,764	822
Fraction nonrenewed	0.114	1	0.106	1
Demographics				
Male	0.163	0.222	0.399	0.501
Black	0.282	0.314	0.260	0.294
Hispanic	0.184	0.148	0.104	0.112
White	0.485	0.496	0.561	0.533
Asian	0.048	0.043	0.074	0.061
1st year probationary teacher	0.303	0.407	0.327	0.408
2nd year probationary teacher	0.292	0.291	0.297	0.270
3rd year probationary teacher	0.230	0.178	0.224	0.167
4th year probationary teacher	0.174	0.124	0.152	0.156
Years of experience	5.290	5.519	4.944	5.903
Worked in Chicago Public Schools prior to starting as a tenure track teacher	0.327	0.388	0.277	0.394
Age ≤27	0.260	0.223	0.231	0.137
Age 28–35	0.339	0.279	0.327	0.232
Age 35–50	0.276	0.305	0.285	0.355
Age 50+	0.125	0.193	0.157	0.277
Education				
Master's degree+	0.453	0.459	0.516	0.522
Education major	0.546	0.495	0.230	0.242
Math or science major	0.085	0.087	0.207	0.242
Social science or humanities major	0.163	0.164	0.368	0.330
Art major	0.051	0.064	0.069	0.049
Other major	0.064	0.067	0.055	0.057
Vocational major	0.045	0.051	0.047	0.050
Barron's rating[a]	2.124	2.053	2.301	2.147
Failed at least one test	0.227	0.245	0.225	0.262
Has not passed any tests	0.047	0.067	0.062	0.086
Other teacher background				
Teacher new to school	0.300	0.425	0.304	0.391
In multiple schools	0.006	0.010	0.001	0.000
Part time	0.073	0.088	0.005	0.004
School characteristics				
Predominantly minority	0.143	0.135	0.244	0.266
Predominantly Black	0.396	0.491	0.389	0.477
Predominantly Hispanic	0.233	0.192	0.062	0.061
Mixed or integrated	0.228	0.182	0.306	0.196
Achievement level (% meeting national norms or achieving proficiency)	56.925	52.679	25.439	21.961
Enrollment/100	7.735	7.122	16.826	14.680
Magnet school	0.083	0.074	0.192	0.118

(continued)

TABLE 1. (continued)

	Elementary schools		High schools	
	All probationary teachers	Probationary teachers who were dismissed	All probationary teachers	Probationary teachers who were dismissed
Principal characteristics				
New to school	0.130	0.194	0.161	0.168
Male	0.311	0.276	0.509	0.416
Black	0.480	0.582	0.506	0.590
White	0.319	0.231	0.323	0.207
Hispanic	0.184	0.172	0.163	0.187
Age	53.594	52.698	54.346	53.357
Bachelor's degree in education	0.690	0.698	0.405	0.434
Barron's rating[a]	2.011	1.920	2.174	2.119
Effectiveness				
Prior year rating = None	0.637	0.731	0.696	0.774
Prior year rating = Satisfactory	0.096	0.301	0.103	0.349
Prior year rating = Excellent	0.449	0.477	0.474	0.489
Prior year rating = Superior	0.455	0.222	0.423	0.161
0 current year absences (Sept.–Mar.)	0.111	0.097	0.110	0.098
1–5 current year absences (Sept.–Mar.)	0.551	0.463	0.525	0.400
6–10 current year absences (Sept.–Mar.)	0.252	0.285	0.272	0.306
11–20 current year absences (Sept.–Mar.)	0.068	0.124	0.082	0.163
21+ current year absences (Sept.–Mar.)	0.019	0.031	0.011	0.033
Prior year value added estimate = none	0.937	0.966	0.791	0.815
Estimated prior year value-added	0.022	−0.398	−0.022	−0.065

Note. The sample includes probationary teachers in the 2004–2005, 2005–2006, and 2006–2007 school years. We exclude individuals employed in positions other than teachers, teachers in specialized alternative schools, and teachers on leave or who are employed at under half time. For the small number of teachers employed in multiple schools we keep only the observation listed as their primary appointment.

a. Barron's rating: 1 = not competitive or unrated to 5 = most competitive.

of experience in the CPS who were nonetheless classified as probationary teachers during this period. The reason for this is that prior to the 2004 contract, the CPS frequently hired teachers but did not appoint them to tenure-track positions. As part of the new collective bargaining agreement, these teachers were moved to the tenure track and thus became probationary teachers regardless of their level of experience.[11]

Of elementary (secondary) teachers, 54% (23%) received a bachelor's degree in education, and about 28% attended colleges or universities that were rated as noncompetitive (or were unrated) by Barron's Guide to Colleges. On the other hand, roughly 11% of the teachers attended colleges rated highly competitive or most competitive. According to Illinois state certification information, 22.7% (22.5%) of elementary (secondary) teachers in the sample had failed at least one certification exam in the past, and 4.7% (6.2%) had never passed a certification exam. This latter group consists of

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older teachers who entered the system before such exams were mandatory.

Measures of Teacher Quality

The analysis incorporates three proxies for teacher quality. First, I use teacher absences because they are measured extremely well, they are easily interpretable, and they impose substantial financial and nonfinancial costs on the school, which has to arrange for and pay substitutes. Moreover, several recent studies have documented that teacher absences have a strong, negative association with student achievement, which provides evidence that this association is causal (Clotfelter, Ladd, & Vigdor, 2009; Miller, Murnane, & Willet, 2008a, 2008b).[12] Indeed, in other work using Chicago data from a similar time period, I show that a teacher's absences are negatively associated with principal evaluations of the teacher and with a teacher's value-added contribution to student achievement (Jacob & Walsh, in press). Finally, there is considerable evidence that absences are at least partly discretionary. Research suggests that teacher absences are more frequent on Mondays and Fridays (Educational Research Service, 1980), higher among temporary teachers, correlated with more general shirking in the workplace (Bradley, Green, & Leeves, 2007), and negatively associated with buy-back provisions that allow teachers to receive payment for unused absences (Ehrenberg, Ehrenberg, Rees, & Ehrenberg, 1991). Hansen (2009) finds that teacher absences in North Carolina correspond to experience, tenure in a school, the presence of a new principal, and proximity to retirement in ways that would suggest absences are a good proxy for discretionary effort.

Teachers in Chicago are allotted 10 to 12 paid sick or personal days per year. Teachers can accumulate unused sick days across years, up to a maximum of 315 days. These days can be cashed in upon leaving the district at a rate of 100% for those teachers retiring with at least 40 years of experience and at a 90% rate for teachers with 20 to 40 years of experience. In addition, teachers get 3 personal days per year, which can be used for emergencies, religious holidays, or personal business. There are some restrictions regarding the use of personal days (e.g., teachers cannot use

all 3 days in succession and they cannot be used in the first or last week of school or on a day before or after a holiday), although unused personal days get banked as sick days.[13]

Using daily level teacher attendance data from payroll records, I calculated the total number of days each teacher was absent between September 1st and March 1st during the academic year in which the dismissal decision was made, excluding "excused absences" for professional development or other sanctioned activities.[14] For new hires, I counted absences accrued only after the teachers' date of hire.

The second measure is the formal performance rating the principal gave the teacher in prior years. Traditionally principals rate teachers every 1 to 3 years (depending on the tenure status of the teacher) on a 4-point scale that includes superior, excellent, satisfactory, and unsatisfactory.[15] These ratings do not determine promotion or compensation, with the exception of an unsatisfactory rating, which is necessary to proceed with a dismissal for cause. Many principals and district administrators believe that these ratings are inflated and not terribly informative. Indeed, only a handful of teachers in our sample received an unsatisfactory rating in the past. However, there does appear to be variation in this measure, with 45.5% (42.3%), 44.9% (47.4%), and 9.6% (10.3%) of rated elementary (secondary) teachers receiving superior, excellent, and satisfactory ratings, respectively. Of course, principal ratings are not an objective measure of teaching effectiveness, although prior work suggests that they may be highly predictive of teacher value added at the tails (Jacob & Lefgren, 2008).

The third measure is a value-added indicator of teacher effectiveness. This measure is meant to capture the extent to which each teacher contributes to student achievement growth, as measured by the standardized tests taken by students in the CPS. This is an objective and direct measure of one important dimension of teacher effectiveness, but value-added indicators have several important limitations. First, only a modest fraction of teachers work in grades and subjects in which students take standardized tests. Hence, it is not possible to calculate value-added measures for a large fraction of the teachers in our sample, including teachers in Grade 2 or below, most teachers in Grades 10

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or above, and any teacher in a noncore subject. Second, it is not clear that one should consider the value-added measures from the year in which the nonrenewal decision was made. Nonrenewal decisions are made in late February or early March, and the standardized tests are not administered until May. To the extent that the decision to nonrenew a teacher influences his or her performance in the final months of school, one might be worried that the current year's value-added measures would systematically understate the effectiveness of nonrenewed teachers and, thus, introduce a mechanical negative association between value added and nonrenewal. If one chooses to focus on value added from prior years, this means that it is not possible to consider the value added for 1st-year teachers. Finally, value-added indicators capture only one (albeit important) dimension of teacher effectiveness.

With these caveats in mind, I attempt to construct value-added indicators for as many teachers in the sample as possible. Unlike some school districts, Chicago traditionally has not maintained reliable data linking teachers to classrooms, particularly at the elementary level. Working with CPS officials, however, I was able to obtain such links for a limited sample, thus allowing me to create value-added measures for some, but not all, teachers in the analysis file. The appendix provides more detail on the construction of the value-added measures used in this analysis.

Empirical Strategy

The goal of this analysis is to determine whether any teacher, principal, or school characteristics are associated with the likelihood that a teacher will be dismissed. To do so, I estimate the probability that teacher i in school j in year t was dismissed, y_{ijt}, as a function of various teacher characteristics, X, and principal and/or school characteristics, Z:

$$y_{ijt} = X_{it}\beta + Z_{jt}\Gamma + X_{it}Z_{jt}\Pi + \alpha_{jt} + \varepsilon_{ijt}. \quad (1)$$

Note that the sample includes teachers at risk of being dismissed in the given year—that is, all probationary teachers. If a teacher is dismissed and not rehired, leaves the district voluntarily, or receives tenure, he or she is no longer in the risk set and, thus, is excluded from the analysis. The vector X includes an indicator of the teacher's probation year to capture the effect of "surviving" dismissal in year t on the likelihood of being dismissed in year $t + 1$.

To examine the influence of specific school-level characteristics, we estimate specifications that include a set of observable school and/or principal characteristics. However, when I estimate the influence of teacher characteristics on the likelihood of dismissal, I include a complete set of School × Year fixed effects (α_{jt}) to account for unobserved school-level factors that might be correlated with teacher characteristics and the probability of dismissal. Finally, in some specifications, I include interactions between teacher and school characteristics, which can be identified even if School × Year fixed effects are included in the model.

Following the standard approach for discrete-time hazard models, I initially estimated Equation 1 using a conditional Logit specification, conditioning on the teacher's School × Year. I then re-estimated Equation 1 as a linear probability model (LPM) with School × Year fixed effects. Whereas the use of linear models for binary outcomes has several well-known limitations (e.g., a potential reduction in efficiency, predictions outside the unit interval, heteroskedastic error terms), in this case the estimated effects from the LPM are virtually identical to those one obtains from a conditional Logit. Given the equivalence of results, I present marginal effects from the LPM for ease of interpretation. In all models, I report standard errors clustered by school to account for arbitrary heteroskedasticity within a School × Year as well as serial correlation within a school across years.

With several reasonable assumptions, the coefficients estimated from the model above can be interpreted as reflecting principals' preferences for particular teacher attributes (see below for a discussion of these assumptions). The first assumption is that the principals are aware of the policy and observe the teacher characteristics included in the model. The second assumption involves the standard concern with omitted variables. If the model does not include a teacher characteristic that principals consider in the dismissal decision and that is also correlated with one of the included variables, the estimate for the included characteristic may be biased.

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One potentially important variant of this omitted-variables concern involves the supply of teachers. If it is more difficult to find qualified teachers in certain subjects or grade levels, then the principal may be less likely to dismiss teachers in these areas. To the extent that teachers in harder-to-staff areas are concentrated among particular demographic groups or tend to graduate from particular institutions, one might be concerned that estimated coefficients on these teacher characteristics are biased. As a control for the supply of teachers in particular areas, all regressions include a series of variables that indicate the teacher's program area including, for example, regular education Grades 1 to 3, regular education Grades 4 to 8, secondary math, secondary science, bilingual education, vocational education, and so forth. Schools fund teachers from a variety of revenue streams and, according to discussions with school administrators, it is often difficult for principals to reallocate positions across funds. For this reason, if a school experiences a decline in a particular revenue fund, the principal may be more inclined to dismiss teachers funded by this revenue source. To control for these factors, all regressions also include a series of binary variables that indicate the revenue source from which each teacher position is funded.

Another potentially important form of selection bias is introduced through the hiring process itself. For example, if a principal has a strong preference for female teachers, then a male teacher hired by the principal must have some unobservable asset relative to an observationally equivalent female teacher hired by the principal. Because one cannot observe this quality, it may lead one to understate the principal's preference for female teachers. This selection will be particularly important for very easily observable characteristics such as teacher race, gender, and age. In theory, one could circumvent this concern by focusing on teachers who were not hired by the current principal, although even in this case one might be concerned about correlation of preferences across principals within the same school, particularly if certain views are commonly held in the profession (e.g., male teachers are not as effective as female teachers). In practice, there are not sufficient numbers of cases in which principals switched schools or were newly hired to obtain precise estimates from this approach.

Fortunately, this type of selection will not bias the primary teacher productivity measures—that is, absences, value added, and principal ratings—because these factors only become known after hiring. To the extent that the principal was not aware of an individual's educational background or prior failure of the state certification exam, estimates of these coefficients would not suffer from this type of bias either.

Of course, it is still possible that the estimates of these characteristics suffer from a more standard omitted variable bias. For example, it may be the case that high rates of absenteeism are associated with a bad attitude or shirking in other dimensions, and it is these factors—rather than the absences per se—that the principal is reacting to in dismissing teachers with more absences. In this case, one may not be able to say something definitive about teacher views regarding teacher absenteeism per se but rather about behaviors and/or characteristics associated with absenteeism, all of which presumably speak to productivity in some form or another.

Results

This section presents the main findings of the analysis. First I present some basic facts about teacher dismissals under this policy, and then I examine how school, principal, and teacher characteristics are associated with the likelihood of dismissal. I report a variety of sensitivity analyses and examine how the effects vary by school and principal characteristics. I present results on the relationship between teacher value-added and the probability of dismissal. Finally I explore interactions between teacher and school (or principal) characteristics.

Some Basic Facts About Teacher Dismissals in Chicago

Table 2 provides summary statistics on the prevalence of teacher dismissal under this new policy. Several interesting facts stand out. First, whereas 8.8% to 12.5 % of probationary teachers were dismissed each year under the new policy, 28% to 46.2% of schools did not dismiss any teachers. This did not change dramatically between 2005 and 2007. Less experienced probationary teachers were substantially more

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TABLE 2

Basic Statistics on Teacher Dismissal in Chicago

	Elementary schools			High schools		
	2005	2006	2007	2005	2006	2007
Number of teachers per school	35.7	34.5	33.6	68.1	65.6	66.7
Number of probationary teachers per school	12.3	11.6	10.3	26.6	25.6	23.4
Among schools with any probationary teachers, fraction that dismissed at least one probationary teacher	.581	.612	.538	.660	.695	.720
Overall fraction of probationary teachers who were dismissed	.116	.125	.100	.123	.103	.088
Fraction of probationary teachers who were dismissed						
1 year of experience	.161	.163	.143	.163	.111	.083
2 years of experience	.082	.137	.105	.061	.115	.090
3 years of experience	.090	.089	.087	.088	.058	.088
4 years of experience	.074	.100	.073	.120	.109	.100
Among probationary teachers who were dismissed, fraction who were rehired as a teacher in the district						
1 year of experience	.506	.507	.547	.564	.449	.455
2 years of experience	.513	.521	.518	.441	.507	.490
3 years of experience	.640	.573	.561	.585	.607	.549
4 years of experience	.622	.674	.561	.619	.682	.458

Note. Based on author's calculations using CPS administrative data.

likely to be dismissed than were others, which is consistent with the idea that principals learn the most about a new teacher in his or her 1st year. The total fraction of teachers dismissed declined somewhat from 2005 to 2007, but not as dramatically as one might have expected, particularly for elementary schools. This may be because of slow uptake of the part of some principals, which would moderate the impact of certain principals' dismissing their stock of bad apples in the 1st year.

These statistics seem to suggest that the introduction of the dismissal policy had a large impact on job separations in the district. However, the numbers of teachers who were nonrenewed in any given year likely overstates the impact of the policy because a number of young teachers would likely have left the CPS in the absence of the policy, either voluntarily or due to subtle encouragement on the part of the principals. If the dismissal policy merely formalized previously informal dismissals, then one would not necessarily expect to find a substantial change in separations. Even in this case, however, the policy may have influenced teacher productivity if it

changed the expectation or transparency of the dismissal process.

Table 3 shows how teacher separations changed after the introduction of the dismissal policy. In the years prior to the introduction of the policy, roughly 10% to 15% of 1st-year probationary teachers left the CPS and an additional 4% moved to a different CPS school. In the years after the policy, the corresponding rates were roughly 18% and 10%, respectively. Comparing the year immediately prior to the policy (2004) with the first 2 years of the policy (2005 and 2006), the separation rate increased by roughly 9 percentage points in years immediately following the policy. In contrast, there was virtually no change among more experienced teachers (i.e., those with 6 to 15 years of experience) who were not subject to the policy.[16] In summary, the dismissal policy appears to have had at least a modest impact on teacher separations, although the impact is not as large as the overall nonrenewal numbers would suggest.[17]

Although there was a positive correlation between low student performance and the prevalence of teacher dismissal in a school, it was

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TABLE 3
Teacher Separations Over Time

	Prepolicy			Postpolicy		
	2002	2003	2004	2005	2006	2007
Teachers hired 1 year earlier (excluding temporary teachers)						
Fraction who left the district next year	.140	.035	.101	.186	.185	.170
Fraction who switched to another school within the district next year	.040	.015	.053	.109	.100	.111
Teachers hired 6–15 years earlier (excluding temporary teachers)						
Fraction who left the district next year	.072	.065	.100	.091	.092	.120
Fraction who switched to another school within the district next year	.057	.042	.049	.063	.064	.073

Note. Based on author's calculations using CPS administrative data.

not merely high-performing schools that failed to dismiss any of their teachers. In 2005, 65% of schools in the lowest quartile of student achievement in the district dismissed at least one teacher compared with 46% of the highest-achieving schools in the district. Splits using school value-added measures yield comparable results.

As part of the dismissal process, principals were asked to indicate one or more of the following prespecified reasons for the dismissal: deficiencies with instruction (i.e., planning, subject matter knowledge), classroom environment (i.e., classroom management, teacher–pupil relationships), professional and personal responsibilities (i.e., attendance, tardiness, professional judgment), communication (i.e., parent conference skills, relations with staff), or attitude (i.e., lack of cooperation, lack of respect for others). The most common reason cited for dismissal involved classroom environment, which principals cited in 52.6% to 66.0% of cases. The next most common reasons were instruction (45.2% to 55.9% of cases), followed by professional responsibility (37.4% to 65.6% of cases).

Finally, it is worth noting that in any given year, more than half of the dismissed teachers were rehired the following year by another school in the district. For example, 50.6% (56.4%) of 1st-year probationary elementary (secondary) teachers who were dismissed in the spring of 2005 were rehired by a CPS school in the fall of 2005. Among 3rd- and 4th-year probationary elementary

(secondary) teachers who were dismissed, the rate was 62.2% to 64% (58.5% to 61.9%). Given that at least some of the dismissals under the policy were the result of position cuts, in which case the teacher's former principal may have provided the teacher with a good recommendation, it is not surprising that some fraction of dismissed teachers were rehired. However, it is also likely that some fraction of teachers dismissed due to poor performance were rehired by other CPS schools. It is not clear why principals would rehire teachers who had been dismissed from a different school for performance reasons. Nonrenewal decisions are not made public to all principals in the district, but a hiring principal could almost certainly get this information by contacting the candidate's former principal.

The Relationship Between School, Principal, Teacher Characteristics, and Teacher Dismissal

Table 4 examines the relationship between school-level characteristics and teacher dismissal. Each column represents a separate ordinary least squares regression in which the dependent variable is a binary indicator that takes on a value of one if the teacher was dismissed. School fixed effects are not included, but the standard errors are adjusted for clustering at the school level.

In both elementary and secondary schools, principals in larger schools dismissed a smaller fraction of probationary teachers. In elementary schools, higher student achievement is associated

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TABLE 4

The Relationship Between School Characteristics and Teacher Dismissal (Dependent Variable = Nonrenewed)

	Elementary schools		High schools	
	1	2	3	4
School characteristics				
School achievement (percent meeting national norms or achieving proficiency)	−.151**	−.094**	.001	.001**
	(.033)	(.033)	(.001)	(.001)
Predominantly minority	−.006	−.002	−.020	−.013
	(.015)	(.015)	(.016)	(.017)
Predominantly Hispanic	.014	.012	−.040	−.042
	(.018)	(.018)	(.028)	(.029)
Mixed or integrated	.027	.020	−.052**	−.051**
	(.020)	(.019)	(.024)	(.023)
Enrollment/100	−.004**	−.003**	−.002**	−.001*
	(.001)	(.001)	(.001)	(.001)
Magnet school	.018	.010	−.058**	−.058**
	(.015)	(.016)	(.020)	(.018)
Multiple schools in building	.029	.025	−.035**	−.046**
	(.017)	(.017)	(.014)	(.013)
Year 2006	.028**	.020**	−.020	−.026**
	(.009)	(.010)	(.013)	(.013)
Year 2007	.009	.007	−.036**	−.024**
	(.010)	(.010)	(.012)	(.011)
Principal characteristics				
New to school	.057**	.054**	.002	−.004
	(.012)	(.012)	(.013)	(.013)
Male	−.007	−.005	−.025**	−.024**
	(.008)	(.008)	(.011)	(.011)
Black	.022	.011	.025	.009
	(.017)	(.017)	(.019)	(.018)
Hispanic	.004	−.003	.030	.033*
	(.010)	(.011)	(.021)	(.020)
Age	−.001**	−.001**	−.001	−.000
	(.001)	(.001)	(.001)	(.001)
Bachelor's degree in education	.002	−.002	−.005	−.005
	(.009)	(.009)	(.011)	(.012)
Barron's rating (1 = not competitive or unrated to 5 = most competitive)	−.015**	−.014**	−.017**	−.012*
	(.005)	(.005)	(.008)	(.007)
Controls for teacher characteristics	No	Yes	No	Yes
Mean of dependent variable	.114	.114	.106	.106
Number of observations	16,246	16,246	7,764	7,764
Number of teachers	8,700	8,700	4,117	4,117
Number of schools	480	480	108	108
R-squared	.020	.063	.022	.093

Note. Each column is an ordinary least squares regression with standard errors clustered by school in parentheses. All specifications include missing value indicators for principal demographics, and school achievement. Specifications with teacher characteristics include controls for teacher effectiveness, teacher education, teacher demographics, teacher experience and status, and a set of teacher fund and certification area indicators. For elementary schools, school achievement is the enrollment weighted fraction of third-, fifth-, and eighth-grade students in the school year testing at or above proficiency on the Illinois Standards Achievement Test (ISAT) averaged across math and reading. For high schools school achievement is the fraction of students in the school year testing at or above national norms on the Prairie State Achievement Examination (PSAE).
* $p < 0.10$, ** $p < 0.05$.

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with a smaller fraction of probationary teachers, but the opposite pattern occurred at the secondary level. Principals who attended more competitive colleges and principals who were older dismissed a smaller proportion of teachers in both elementary and high schools. Male high school principals dismissed a significantly smaller percentage of their teachers although principal gender did not play as important a role at the elementary level. Finally, principals new to the building dismissed a substantially larger fraction of teachers in elementary schools but not in high schools. These results are suggestive, but it is important to recognize that the presence of unobserved school or principal characteristics that are associated with dismissal behavior might still lead to biased estimates.

Table 5 explores the association between teacher characteristics and the likelihood of dismissal, relying solely on variation within School × Years to identify the effects. The estimates shown in Column 1 indicate that two proxies for teacher quality—prior year principal evaluations and current year teacher absences—both influence the likelihood of dismissal. Teachers who were rated satisfactory in the prior academic year were 22.1 percentage points more likely to be nonrenewed relative to teachers who were rated superior. Teachers rated excellent were 4.3 percentage points more likely to be dismissed. Given an average dismissal rate of roughly 11%, these results suggest that teacher performance as measured in prior evaluations is strongly associated with dismissal. In this way, the policy facilitated principals' ability to dismiss teachers with relatively poor performance in the past.

Teachers who were absent more than 10 times between September and March of the current year were 11.3 to 12.9 percentage points more likely to be nonrenewed than were their colleagues who were never absent. Teachers absent 6 to 10 days were 3.5 percentage points more likely to be dismissed. In analyses not presented here, I confirm that these results are robust to the inclusion of personal days and to normalizations that account for differential employment length during the current school year.

The specification shown in Column 2 includes several other potential proxies for teacher quality. The results indicate that principals value teachers with stronger educational backgrounds as measured by college quality, certification test scores, and advanced degrees. For example, the coefficient of –0.009 on Barron's rating means that, all else equal, a teacher who attended a highly competitive college (ranking = 4) is nearly 3 percentage points (roughly 15%) less likely to be dismissed than is a teacher who attended a least competitive (or unrated) college (ranking = 1).[18] On the other hand, on average, principals do not seem to value certification exam performance or advanced degrees, at least after conditioning on the other proxies of quality.

The specification in Column 3 includes a host of teacher demographics along with the proxies for relative supply in a teacher's field (i.e., certification area, funding source, etc.). Perhaps the most important thing to note is that the inclusion of these other characteristics does not materially change the coefficients on the teacher quality indicators. Prior evaluations, ratings, and undergraduate college quality remain significant predictors of nonrenewal.

However, it is also worth noting that several teacher demographics—including age, gender, and race—are associated with the likelihood of dismissal even after conditioning on the measures of teacher productivity and qualifications described above. Principals are 3.8 percentage points more likely to dismiss male teachers than female teachers, which is an effect of more than 25% given the baseline dismissal rate of 10% to 12%. Principals are considerably more likely to dismiss older teachers. For example, teachers 36 to 50 years of age are 4 percentage points (33%) more likely to be dismissed relative to teachers aged 22 to 28. Teachers older than 50 are 10 percentage points (nearly 100%) more likely to face dismissal than are their youngest counterparts.[19] Black teachers are 2.1 percentage points less likely to be dismissed than their colleagues are.

The bottom panel shows estimates for several indicators of teacher status. Principals are significantly more likely to dismiss teachers who were in the system in other positions prior to starting on the tenure track. For the most part, this includes individuals who started as temporary (i.e., uncertified) teachers, teacher's aides, or certified teachers who were not assigned to the tenure track. Probationary teachers in Years 2 to 4 who worked at the same school in the previous

TABLE 5

The Relationship Between Teacher Characteristics and Dismissal (Dependent Variable = Nonrenewed)

	All schools			Elementary schools	High schools
	1	2	3	4	5
Teacher effectiveness					
Satisfactory prior year rating relative to superior	.221** (.018)	.221** (.018)	.185** (.018)	.190** (.021)	.169** (.033)
Excellent prior year rating relative to superior	.043** (.007)	.044** (.007)	.037** (.007)	.045** (.008)	.017 (.011)
1–5 current year absences (Sept.–Mar.)	.002 (.006)	.002 (.006)	.018** (.006)	.019** (.008)	.016 (.010)
6–10 current year absences (Sept.–Mar.)	.035** (.007)	.036** (.007)	.057** (.008)	.058** (.009)	.056** (.014)
11–20 current year absences (Sept.–Mar.)	.113** (.011)	.113** (.011)	.131** (.011)	.130** (.013)	.128** (.020)
21+ current year absences (Sept.–Mar.)	.129** (.021)	.129** (.021)	.152** (.021)	.127** (.022)	.232** (.049)
Teacher education					
Master's degree+		.007 (.004)	−.007 (.004)	−.006 (.006)	−.010 (.007)
Barron's rating (1 = not competitive or unrated to 5 = most competitive)		−.009** (.002)	−.005** (.002)	−.005* (.003)	−.005 (.003)
Failed at least one test		.003 (.005)	.007 (.005)	.004 (.006)	.012 (.009)
Teacher demographics					
Age 28–35			.005 (.005)	.002 (.007)	.011 (.009)
Age 35–50			.040** (.007)	.032** (.008)	.057** (.014)
Age 50+			.100** (.010)	.092** (.012)	.115** (.019)
Black			−.021** (.006)	−.023** (.008)	−.019** (.009)
Hispanic			−.004 (.006)	−.010 (.007)	.014 (.010)
Male			.038** (.006)	.041** (.008)	.034** (.008)
Part-time teacher			.013 (.011)	.014 (.012)	−.004 (.043)
Teacher in multiple schools			.006 (.040)	.023 (.042)	−.193* (.107)
Teacher Status					
Worked in Chicago Public Schools prior to starting as a tenure track teacher			.026** (.008)	.029** (.010)	.023 (.014)
PAT 2–4 and dismissed in prior year			.080** (.019)	.049** (.021)	.134** (.035)
PAT 2–4, in same school, and not dismissed in prior year			−.045** (.007)	−.049** (.008)	−.038** (.012)
PAT 2–4, in different school, and not dismissed in prior year			−.021 (.013)	−.020 (.017)	−.026 (.021)
Mean of dependent variable	.112	.112	.112	.114	.106
Number of observations	24,010	24,010	24,010	16,246	7,764
Number of teachers	12,670	12,670	12,670	8,700	4,117
Number of schools	588	588	588	480	108
R-squared	.173	0.174	.195	.209	.168

Note. Each column is an ordinary least squares regression with school year fixed effects and standard errors clustered by school in parentheses. All specifications include a set of teacher fund and certification area indicators, a quadratic in years of experience, and missing value indicators for efficiency ratings, absences, and age. PAT = Probationary Appointed Teachers.

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year are substantially less likely to be dismissed than are 1st-year probationary teachers. This is consistent with principals' learning the most about teachers in their 1st year on the job.[20]

Interestingly, probationary teachers who were dismissed from another school in the prior year and rehired by the current school are substantially more likely to be dismissed. For example, elementary school teachers who were dismissed from another school in the prior year were 4.9 percentage points (about 45%) more likely to be dismissed relative to 1st-year teachers in the school. In high school, previously dismissed teachers were 13.4 percentage points (more than 130%) more likely to be dismissed than were 1st-year teachers. These results suggest that many of the initial nonrenewal decisions were not idiosyncratic, stemming from a particularly bad match, or based on temporary difficulties experienced by the teacher. Rather, this suggests that, at least in many cases, the initial nonrenewal decision reflected a concern with the teacher's general productivity.

The results in Columns 4 and 5 show the full set of results separately for elementary and high schools. With only a few exceptions, the determinants of teacher dismissal are roughly equivalent across the two school levels.

Sensitivity Analyses

Table 6 presents the estimates from a variety of alternative specifications to test the robustness of the main results. The baseline model shown in Column 1 is a replication of the estimates shown in Table 4, Column 4. Column 2 presents odds ratios from a conditional Logit specification to test whether the imposition of a linear functional form is biasing the results. As mentioned earlier, the linear model appears to yield inferences essentially equivalent to the nonlinear model.

Columns 3 through 7 report specifications with alternate samples and/or alternate definitions of the dependent variable. The specification in Column 3 uses a measure of teacher dismissal that considers teachers who were nonrenewed and not rehired at the same school as never dismissed because principals have indicated that a nontrivial fraction of nonrenewal decisions in the 1st or 2nd year of the policy were driven by potential budget concerns and many of these

teachers were later rehired. Column 4 drops all observations in which the principal did not make an active decision to renew or nonrenew the teacher. Column 5 sets the principal rating measures to missing if the teacher or the principal were not in the same school in the previous year, under the assumption that in such cases the principal may not be as aware of the teacher's past performance. Column 6 limits the sample to schools in which at least one teacher was dismissed because it is possible that some principals were not fully aware of the nonrenewal policy, particularly in 2005. Column 7 combines the restrictions imposed in Columns 4 and 6. In each of these cases, the main findings described above remain consistent.

Column 8 reports results for a sample of probationary teachers who "survived" dismissal in prior years—specifically, teachers in the 2006 and 2007 cohorts who were not dismissed in the prior year and who remained in the same school. Given that principals had an opportunity to dismiss these teachers, one might expect that time-varying performance measures (e.g., absences) or less easily observable characteristics (e.g., quality of teacher's college) might be more salient and easily observable permanent characteristics (i.e., age, gender, race) might be less salient in the principal's dismissal decision for this set of teachers. In contrast, the results for this group are roughly equivalent to those for the full sample.

Columns 9 through 10 report results for schools that indicated budget cuts did and did not play an important role in teacher dismissals. Principals are not required to provide any justification for dismissing probationary teachers under the new policy. Specifically, principals were permitted to nonrenew a teacher even in the absence of any necessary reduction in force. However, informal conversations with school officials suggest that some principals used dismissal primarily in response to budget cuts while others made dismissal decisions independent of budget considerations. In both cases, one would expect principals to dismiss teachers with the lowest perceived value to the school. However, if those principals who nonrenew teachers on the basis of budget considerations focus explicitly on program area, revenue source, or seniority, the inclusion of these schools will attenuate the coefficients on the teacher productivity measures.

TABLE 6

Sensitivity of Results to Alternative Samples and Specifications (Dependent Variable = Nonrenewed)

	Baseline	Conditional logit	Dependent variable = nonrenewed and not rehired	Sample = excludes no decision	Rating set to missing if not in same school last year	Sample = schools where 1+ fired	Sample = schools where 1+ fired, excluding no decision	Sample = teachers who were not dismissed in the prior year and who remained in the same school	Sample = schools that indicated they did not make nonrenewal decisions in response to anticipated cuts	Sample = schools that indicated they made at least some nonrenewal decisions in response to anticipated cuts
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Teacher effectiveness										
Satisfactory prior year rating relative to superior	0.185** (0.018)	8.090** (1.295)	0.015** (0.007)	0.181** (0.019)	0.227** (0.024)	0.253** (0.023)	0.241** (0.024)	0.207** (0.030)	0.258** (0.042)	0.172** (0.071)
Excellent prior year rating relative to superior	0.037** (0.007)	2.345** (0.292)	0.000 (0.003)	0.045** (0.008)	0.039** (0.007)	0.058** (0.009)	0.068** (0.010)	0.049** (0.010)	0.040** (0.020)	0.028 (0.030)
1–5 current year absences (Sept.–Mar.)	0.018** (0.006)	1.208** (0.097)	0.010** (0.004)	0.020** (0.007)	0.017** (0.006)	0.023** (0.009)	0.025** (0.010)	0.009 (0.010)	0.017 (0.016)	0.065** (0.025)
6–10 current year absences (Sept.–Mar.)	0.057** (0.008)	1.931** (0.176)	0.025** (0.004)	0.065** (0.009)	0.057** (0.008)	0.078** (0.011)	0.085** (0.012)	0.041** (0.012)	0.076** (0.021)	0.139** (0.032)
11–20 current year absences (Sept.–Mar.)	0.131** (0.011)	3.773** (0.404)	0.060** (0.008)	0.143** (0.013)	0.131** (0.011)	0.179** (0.015)	0.185** (0.016)	0.103** (0.017)	0.174** (0.030)	0.230** (0.042)
21+ current year absences (Sept.–Mar.)	0.152** (0.021)	4.209** (0.734)	0.081** (0.015)	0.157** (0.024)	0.152** (0.021)	0.205** (0.028)	0.199** (0.031)	0.097** (0.028)	0.293** (0.059)	0.148** (0.073)
Teacher education										
Master's degree+	−0.007 (0.004)	0.931 (0.048)	−0.001 (0.003)	−0.007 (0.005)	−0.006 (0.004)	−0.008 (0.006)	−0.008 (0.007)	−0.013* (0.007)	−0.004 (0.011)	−0.006 (0.018)
Barron's rating (1 = not competitive or unrated to 5 = most competitive)	−0.005** (0.002)	0.926** (0.024)	−0.002* (0.001)	−0.007** (0.002)	−0.005** (0.002)	−0.008** (0.003)	−0.009** (0.003)	−0.001 (0.003)	−0.008 (0.006)	−0.007 (0.010)
Failed at least one test	0.007 (0.005)	1.081 (0.064)	−0.003 (0.003)	0.009 (0.006)	0.007 (0.005)	0.008 (0.007)	0.013 (0.008)	0.001 (0.008)	−0.020 (0.014)	0.018 (0.019)

(continued)

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TABLE 6. (continued)

	Baseline	Conditional logit	Dependent variable = nonrenewed and not rehired	Sample = excludes no decision	Rating set to missing if not in same school last year	Sample = schools where 1+ fired	Sample = schools where 1+ fired, excluding no decision	Sample = teachers who were not dismissed in the prior year and who remained in the same school	Sample = schools that indicated they did not make nonrenewal decisions in response to anticipated cuts	Sample = schools that indicated they made at least some nonrenewal decisions in response to anticipated cuts
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Teacher demographics										
Age 28–35	0.005	1.032	0.002	0.004	0.004	0.006	0.005	0.004	-0.009	0.028
	(0.005)	(0.077)	(0.003)	(0.006)	(0.005)	(0.007)	(0.008)	(0.008)	(0.014)	(0.019)
Age 35–50	0.040**	1.601**	0.008*	0.040**	0.039**	0.054**	0.052**	0.028**	0.065**	0.081**
	(0.007)	(0.138)	(0.004)	(0.008)	(0.007)	(0.010)	(0.011)	(0.010)	(0.020)	(0.027)
Age 50+	0.100**	2.884**	0.041**	0.115**	0.100**	0.136**	0.150**	0.071**	0.127**	0.165**
	(0.010)	(0.284)	(0.006)	(0.012)	(0.010)	(0.013)	(0.015)	(0.014)	(0.026)	(0.039)
Black	-0.021**	0.796**	-0.022**	-0.018**	-0.021**	-0.028**	-0.024**	0.001	0.006	-0.075**
	(0.006)	(0.050)	(0.004)	(0.007)	(0.006)	(0.008)	(0.009)	(0.008)	(0.013)	(0.027)
Hispanic	-0.004	0.941	-0.009**	-0.009	-0.005	-0.006	-0.012	-0.009	0.015	-0.057**
	(0.006)	(0.073)	(0.004)	(0.006)	(0.006)	(0.008)	(0.009)	(0.009)	(0.018)	(0.023)
Male	0.038**	1.521**	0.011**	0.038**	0.038**	0.050**	0.048**	0.028**	0.039**	0.049**
	(0.006)	(0.092)	(0.003)	(0.007)	(0.006)	(0.007)	(0.008)	(0.009)	(0.013)	(0.024)
Part-time teacher	0.013	1.194	0.014*	0.020	0.011	0.025	0.033*	-0.007	0.033	0.008
	(0.011)	(0.142)	(0.007)	(0.013)	(0.011)	(0.017)	(0.018)	(0.014)	(0.034)	(0.033)
Teacher in multiple schools	0.006	0.878	-0.019	-0.002	0.005	0.004	-0.015	0.047	-0.067	0.135
	(0.040)	(0.320)	(0.018)	(0.049)	(0.040)	(0.060)	(0.068)	(0.066)	(0.088)	(0.152)
Teacher status										
Worked in Chicago Public Schools prior to starting as a tenure track teacher	0.026**	1.434**	0.012**	0.035**	0.026**	0.037**	0.045**	0.034**	0.001	0.093**
	(0.008)	(0.128)	(0.005)	(0.009)	(0.008)	(0.011)	(0.012)	(0.011)	(0.023)	(0.035)
PAT 2–4 and dismissed in prior year	0.080**	1.642**	0.020**	0.073**	0.090**	0.100**	0.093**		0.095**	0.060
	(0.019)	(0.220)	(0.010)	(0.021)	(0.018)	(0.024)	(0.025)		(0.037)	(0.060)
PAT 2–4, in same school and not dismissed in prior year	-0.045**	0.611**	-0.011**	-0.046**	-0.047**	-0.061**	-0.059**		-0.044**	-0.075**
	(0.007)	(0.042)	(0.004)	(0.008)	(0.006)	(0.009)	(0.010)		(0.019)	(0.024)

(continued)

TABLE 6. (continued)

	Baseline	Conditional logit	Dependent variable = nonrenewed and not rehired	Sample = excludes no decision	Rating set to missing if not in same school last year	Sample = schools where 1+ fired	Sample = schools where 1+ fired, excluding no decision	Sample = teachers who were not dismissed in the prior year and who remained in the same school	Sample = schools that indicated they did not make nonrenewal decisions in response to anticipated cuts	Sample = schools that indicated they made at least some nonrenewal decisions in response to anticipated cuts
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PAT 2–4, in different school and not dismissed in prior year	−0.021 (0.013)	0.788 (0.116)	−0.003 (0.007)	−0.020 (0.016)	−0.033** (0.013)	−0.025 (0.019)	−0.023 (0.021)		−0.054* (0.029)	0.002 (0.045)
Mean of dependent variable	0.112	0.157	0.035	0.143	0.112	0.159	0.193	0.080	0.134	0.162
Number of observations	24,010	16,848	24,010	18,711	24,010	16,877	13,868	8,862	3,923	2,105
Number of teachers	12,670	10,687	10,687	11,167	12,670	10,703	9,451	6,750	3,210	1,672
Number of schools	588	519	519	582	588	521	521	554	173	103
R-squared	0.195		0.135	0.316	0.195	0.168	0.288	0.205	0.172	0.192

Note. Each column is an ordinary least squares regression with school-year fixed effects and standard errors clustered by school in parentheses, except Column 2, which presents odds ratios from a conditional logit. All specifications include a set of teacher fund and certification area indicators, a quadratic in years of experience, and missing value indicators for efficiency ratings, absences, and age. PAT = Probationary Appointed Teachers.

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Using a survey administered to principals in Spring 2007, I explore this possibility.[21] Column 9 presents results for schools where the principal indicated that anticipated position closings were very important to some or all of his or her nonrenewal decisions. Column 10 shows the results for schools where the principal indicated that these factors were very minor or not at all important to his or her nonrenewal decisions. The two sets of schools appear to value many teacher characteristics similarly, including teacher age, gender, educational background, and performance as measured by absences and prior rating. However, schools making nonrenewal decisions in light of budget cuts were significantly less likely to dismiss Black and Hispanic teachers (relative to White teachers) than were schools not facing cuts. Similarly, schools facing cuts were significantly more likely to dismiss teachers with prior nonteaching experience in the district.

Finally, in results not shown here, I find that the determinants of teacher dismissal were quite stable across the 3 cohort years in this sample.[22]

Heterogeneity of Effects Across Schools

Table 7 explores whether principal responses varied across schools. Preliminary analyses indicated that the relationships were comparable for elementary and high schools, so the results presented here include all schools. Columns 2 and 3 present results for schools in the top and bottom half of Chicago school achievement distribution.[23] Perhaps most importantly, principals across school types appear to place similar weight on many of the teacher productivity measures, including absences and prior ratings. However, principals in higher achieving schools are less likely to dismiss teachers with a Master's degree and more likely to dismiss teachers that failed a certification, whereas these characteristics are not significant predictors of dismissal in lower achieving schools.

Several other interesting differences appear with respect to the demographics. Most notably, the higher dismissal rates among male teachers appear to be driven largely by low-achieving schools. In low-achieving schools, male teachers are 6.7 percentage points more likely to be dismissed than are female teachers. Conversely, the lower dismissal likelihood for Black and Hispanic teachers appears to be driven by low-achieving schools. I explore this finding in more detail below.

One might also imagine that principal decisions would differ based on the competence of the principal. On one hand, one might suspect that more effective principals would be better able and/or more inclined to use nonrenewal to remove low-quality teachers, in which case one would expect the coefficients on the productivity measures to be larger. On the other hand, it is also possible that highly effective principals do a better job of screening applicants during the hiring process and encouraging poor teachers to leave, in which case the relationship between observed productivity measures and dismissal might be lower. To explore this possibility, I estimate the baseline model for schools with value-added measures above and below district median respectively.[24] Overall, the pattern of results appears remarkably similar across these groups (results available upon request).

Given that a principal's age and college quality appear to be at least somewhat predictive of dismissal propensity (Table 4), Columns 4 through 9 in Table 7 examine whether a principal's age and/or educational background influence the weight he or she places on different teacher characteristics. Although there is no striking difference across college quality categories in terms of principals' valuation of teacher prior ratings or absences, principals who attended the most competitive colleges (similar to principals from high-achieving schools) seem to place more emphasis on teachers' educational background than do their peers from less competitive colleges.[25]

There is no clear pattern of effects by principal age with respect to valuation of teacher prior ratings, current absences, or educational background. Interestingly, however, there appears to be some evidence of an interaction between principal and teacher age—namely, younger principals appear to be slightly more likely to dismiss older teachers as compared with older principals. I explore this finding in more detail below.

Teacher Value Added and Dismissal

The results in Table 5 provide evidence that principals consider some measures of teacher

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TABLE 7

Heterogeneity of Teacher Dismissal Effects (Dependent Variable = Nonrenewed)

	Baseline	Principal's Barron's rating					Principal's age		
		High-achieving schools	Low-achieving schools	Not competitive or unrated	Less competitive	Competitive, very competitive, or most competitive	<50	50–57	58+
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Teacher effectiveness									
Satisfactory prior year rating relative to superior	.185** (.019)	.182** (.028)	.195** (.026)	.282** (.046)	.170** (.023)	.152** (.038)	.195** (.039)	.177** (.026)	.187** (.034)
Excellent prior year rating relative to superior	.037** (.007)	.037** (.009)	.043** (.012)	.091** (.022)	.023** (.009)	.038** (.012)	.039** (.015)	.035** (.010)	.039** (.013)
1–5 current year absences (Sept.–Mar.)	.018** (.007)	.005 (.008)	.029** (.012)	.011 (.016)	.016* (.010)	.023** (.011)	.030** (.014)	.021** (.010)	–.001 (.011)
6–10 current year absences (Sept.–Mar.)	.057** (.008)	.036** (.010)	.079** (.014)	.077** (.019)	.058** (.012)	.047** (.013)	.075** (.016)	.056** (.012)	.041** (.015)
11–20 current year absences (Sept.–Mar.)	.131** (.012)	.082** (.014)	.174** (.019)	.154** (.032)	.121** (.017)	.140** (.020)	.180** (.027)	.128** (.018)	.098** (.019)
21+ current year absences (Sept.–Mar.)	.152** (.021)	.079** (.027)	.223** (.033)	.106** (.051)	.159** (.031)	.165** (.035)	.183** (.043)	.134** (.031)	.147** (.035)
Teacher education									
Master's degree+	–.007 (.005)	–.011** (.005)	–.002 (.008)	.002 (.013)	–.004 (.006)	–.014* (.008)	–.025** (.010)	–.005 (.006)	.003 (.008)
Barron's rating (1 = not competitive or unrated to 5 = most competitive)	–.005** (.002)	–.006** (.002)	–.004 (.004)	–.007 (.007)	–.002 (.003)	–.010** (.003)	–.003 (.005)	–.004 (.003)	–.009** (.004)
Failed at least one test	.007 (.005)	.013* (.007)	.003 (.009)	–.012 (.014)	.007 (.007)	.018** (.009)	–.001 (.013)	.011 (.008)	.004 (.009)
Teacher demographics									
Age 28–35	.005 (.006)	.012* (.007)	–.001 (.010)	–.010 (.017)	.009 (.008)	.005 (.008)	.003 (.012)	.014* (.008)	–.005 (.009)
Age 35–50	.040** (.007)	.035** (.009)	.045** (.013)	.032 (.021)	.046** (.010)	.035** (.012)	.063** (.017)	.043** (.010)	.020 (.013)
Age 50+	.100** (.010)	.089** (.015)	.111** (.015)	.124** (.031)	.101** (.014)	.089** (.016)	.117** (.023)	.110** (.015)	.074** (.017)

(continued)

TABLE 7. (continued)

	Baseline	High-achieving schools	Low-achieving schools	Principal's Barron's rating			Principal's age		
				Not competitive or unrated	Less competitive	Competitive, very competitive, or most competitive	<50	50–57	58+
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Black	−.021**	−.010	−.028**	.010	−.036**	−.003	−.014	−.021**	−.023**
	(.006)	(.007)	(.009)	(.018)	(.008)	(.011)	(.013)	(.009)	(.010)
Hispanic	−.004	.003	−.026**	−.020	.002	−.005	−.007	−.001	−.006
	(.006)	(.007)	(.012)	(.016)	(.008)	(.010)	(.014)	(.008)	(.011)
Male	.038**	.020**	.067**	.007	.043**	.041**	.044**	.036**	.035**
	(.006)	(.007)	(.011)	(.016)	(.009)	(.009)	(.013)	(.009)	(.010)
Part-time teacher	.013	.019	.006	.015	.012	.008	.015	.014	.013
	(.011)	(.014)	(.019)	(.035)	(.015)	(.020)	(.023)	(.015)	(.025)
Teacher in multiple schools	.006	−.019	.052	.077	.026	−.044	.033	.014	−.016
	(.041)	(.048)	(.078)	(.172)	(.052)	(.070)	(.114)	(.059)	(.067)
Teacher status									
Worked in Chicago Public Schools prior to starting as a tenure track teacher	.026**	.027**	.031**	.050**	.044**	−.014	.011	.035**	.023
	(.008)	(.011)	(.013)	(.025)	(.012)	(.013)	(.019)	(.013)	(.015)
PAT 2–4 and dismissed in prior year	.080**	.050*	.097**	.051	.070**	.121**	.108**	.078**	.039
	(.020)	(.028)	(.028)	(.041)	(.026)	(.041)	(.034)	(.034)	(.032)
PAT 2–4, in same school and not dismissed in prior year	−.045**	−.039**	−.051**	−.065**	−.042**	−.039**	−.031**	−.033**	−.075**
	(.007)	(.009)	(.011)	(.017)	(.010)	(.012)	(.015)	(.010)	(.013)
PAT 2–4, in different school and not dismissed in prior year	−.021	−.016	−.017	−.018	−.030*	−.010	−.031	.005	−.051**
	(.014)	(.018)	(.023)	(.038)	(.018)	(.026)	(.028)	(.022)	(.024)
Mean of dependent variable	.112	.089	.140	.134	.112	.100	0.134	.107	.101
Number of observations	24,010	13,334	10,084	3,791	12,566	7,653	5,468	11,346	7,042
Number of teachers	12,670	7,314	5,617	2,395	7,340	4,655	3,683	7,124	4,634
Number of schools	588	291	273	121	345	220	197	363	229
R-squared	.195	.170	.214	.209	.189	.210	.196	.194	.193

Note. Each column is an ordinary least squares regression with school-year fixed effects and standard errors clustered by school in parentheses. All specifications include a set of teacher fund and certification area indicators, a quadratic in years of experience, and missing value indicators for efficiency ratings, absences, and age. High achieving schools are schools with above median mean proficiency rates (or fraction at national norms in high schools) across the 2001–2002, 2002–2003, and 2003–2004 school years. PAT = Probationary Appointed Teachers.

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qualifications and/or performance (e.g., absences, educational background, prior evaluations) in making their dismissal decisions. There is some evidence that subjective principal ratings (Jacob & Lefgren, 2008) and teacher absences (Clotfelter, Ladd, & Vigdor, 2009; Miller et al., 2008a, 2008b) are associated with student learning. However, to the extent that one views student achievement as the primary outcome of interest, one should directly assess how a teacher's ability to improve student achievement influences the likelihood of dismissal.

Table 8 presents some evidence on this issue by focusing on the relationship between teacher value added and dismissal. Unfortunately, as mentioned above, it is only possible to calculate teacher value added for a limited number of teachers in our sample. For elementary schools, we have value-added indicators on (virtually) all math and reading teachers in Grades 2 to 5 in a set of 327 schools, which is roughly two thirds of the elementary schools in the district.[26] For high schools, the data includes value-added measures for all core-subject ninth-grade teachers.

To examine the relationship between the other teacher characteristics and dismissal in the value-added sample, Columns 1 and 4 in Table 7 replicate Columns 4 and 5 from Table 4. The estimates for this subsample are much less precise than are those for the full sample, and many of the estimates are not statistically different than zero. However, if one examines the magnitude of the point estimates, most results appear comparable across the two samples. Interestingly, the mean dismissal rate in this sample is considerably lower than it is among all probationary teachers. Only 6.2% of elementary teachers in the value-added sample are dismissed relative to 11.4% in the full elementary sample.

Given the limited student achievement data available, the estimated teacher value-added indicators that I use as predictors likely will be measured with considerable error. Hence, to correct for this attenuation bias, I use an instrumental variables strategy in which I split the data sample used to calculate the value-added measures and use the value-added measures calculated from one half of the sample as an instrument for the value-added measures calculated from the other half of the sample.[27] This strategy will not help correct any

inconsistency in the estimates arising from nonrandom sorting of students and teachers, nor will it correct for classroom-year sources of error arising (e.g., a dog barking in the parking lot during the end-of-the-year test), but it will correct for the attenuation bias stemming from the measurement error in the value-added indicators associated with sampling variability.

Columns 2 and 5 present the main estimates from dismissal models that include value-added measures of teacher effectiveness along with teacher demographics and School × Year fixed effects but no other teacher qualification or performance characteristics. The value-added measures have been normalized to mean 0 and standard deviation 1. For elementary schools, the point estimate of −.071 indicates that a 1 standard deviation increase in teacher value added is associated with a 7.1 percentage point (over 100%) decrease in the likelihood of dismissal. The inclusion of other teacher performance measures in Column 3 (e.g., teacher absences and prior principal rating) does not change the coefficient on the value-added measure, which suggests that the other quality measures are only weakly correlated with value added in this sample.

In contrast to the results for elementary schools, I find that teacher value added has zero association with dismissal among the sample of 9th-grade core subject teachers in high schools. One potential reason for the difference across grade levels is that the outcome measure for the 9th-grade value-added measures is the PLAN test, which is given in the fall of a student's 10th-grade year. PLAN is developed by ACT to test knowledge and skills in math, science, and language arts; it resembles the ACT in that it is not tightly linked to any particular curriculum. Hence, because of both the timing of the exam (in the fall of the following year) and the content of the exam, the 10th-grade value-added measures may not capture teacher effectiveness as well as the elementary value-added measures.

Principal–Teacher Interactions and Dismissal

To this point, we have seen evidence that principals do consider some measures of teacher qualifications, effort, and productivity when making nonrenewal decisions. This suggests that

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TABLE 8

The Relationship Between Teacher Value-Added and Dismissal (Dependent Variable = Nonrenewed)

	Elementary schools			High schools		
	(1)	(2)	(3)	(4)	(5)	(6)
Value added in prior year		−.071**	−.070**		−.004	−.010
		(.021)	(.021)		(.022)	(.022)
Teacher effectiveness						
Satisfactory prior year rating relative to superior	.148*		.117*	.081		.082*
	(.080)		(.061)	(.067)		(.045)
Excellent prior year rating relative to superior	.059		.044	−.003		−.002
	(.037)		(.037)	(.030)		(.030)
1–5 current year absences (Sept.–Mar.)	−.010		−.014	.022		.022
	(.027)		(.031)	(.022)		(.029)
6–10 current year absences (Sept.–Mar.)	.003		−.005	.051*		.051*
	(.032)		(.036)	(.027)		(.031)
11–20 current year absences (Sept.–Mar.)	−.034		−.039	.094**		.095**
	(.052)		(.055)	(.038)		(.037)
21+ current year absences (Sept.–Mar.)	.026		.070	.351**		.353**
	(.035)		(.102)	(.118)		(.083)
Teacher education						
Master's degree+	−.005		−.004	−.021		−.021
	(.022)		(.023)	(.015)		(.016)
Barron's rating (1 = not competitive or unrated to 5 = most competitive)	−.014		−.018*	.001		.001
	(.010)		(.011)	(.007)		(.007)
Failed at least one test	.012		.008	.037*		.036*
	(.026)		(.026)	(.021)		(.019)
Teacher demographics						
Age 28–35	−.033	−.023	−.026	−.007	−.013	−.007
	(.028)	(.026)	(.027)	(.022)	(.019)	(.020)
Age 35–50	−.041	−.034	−.042	.018	.006	.018
	(.028)	(.030)	(.032)	(.028)	(.022)	(.023)
Age 50+	.032	.034	.015	.087**	.078**	.085**
	(.056)	(.046)	(.048)	(.033)	(.031)	(.032)
Black	.027	.040	.027	.010	.030	.010
	(.031)	(.028)	(.029)	(.021)	(.020)	(.021)
Hispanic	−.006	−.002	−.011	.025	.030	.025
	(.017)	(.032)	(.032)	(.024)	(.027)	(.027)
Male	.046	.034	.028	.013	.006	.013
	(.034)	(.029)	(.029)	(.018)	(.015)	(.016)
Part-time teacher	−.051	−.060	−.063	−.089*	−.096	−.092
	(.046)	(.052)	(.053)	(.051)	(.215)	(.213)
Teacher status						
Worked in Chicago Public Schools prior to starting as a tenure track teacher	−.008	−.020	−.026	.007	.010	.006
	(.038)	(.042)	(.043)	(.030)	(.029)	(.029)
PAT 2–4 and dismissed in prior year	.119	.164**	.148**	.202**	.229**	.203**
	(.114)	(.073)	(.076)	(.078)	(.052)	(.052)

(continued)

TABLE 8. (continued)

	Elementary schools			High schools		
	(1)	(2)	(3)	(4)	(5)	(6)
PAT 2–4, in same school and not dismissed in prior year	−.053 (.041)	−.053 (.033)	−.039 (.036)	−.081** (.021)	−.092** (.024)	−.082** (.024)
PAT 2–4, in different school and not dismissed in prior year	−.042 (.067)	−.059 (.061)	−.033 (.063)	−.083 (.058)	−.095 (.059)	−.085 (.058)
Mean of dependent variable	.062	.062	.062	.094	.094	.094
Number of observations	1,017	1,017	1,017	1,621	1,621	1,621
Number of teachers	803	803	803	1,134	1,134	1,134
Number of schools	327	327	327	100	100	100
R-squared	.546			.344		

Note. All columns restrict the sample to teachers with value added scores and include school-year fixed effects. See appendix for details on value added estimation. Value added scores are standardized at the teacher level within year to have a mean of 0 and a standard deviation of 1. Columns 1 and 5 are ordinary least squares regressions with standard errors clustered by school in parentheses. All other columns are two-stage least squares (2SLS) regressions using one half-classroom sample estimate of value added as an instrument for the other half-classroom sample estimate with heteroskedasticity robust standard errors in parentheses. The sample in Columns 4 and 8 is limited to school years with principals who fired at least one teacher in the value added sample. PAT = Probationary Appointed Teachers.

this policy might improve student achievement in the long run. However, one of the primary concerns with this and other similar policies is that principals will dismiss teachers capriciously and/or on the basis of illegitimate (i.e., non-productivity-related) criteria.

The results presented earlier (Table 5) demonstrate that principals were substantially more likely to dismiss male teachers and older teachers even after controlling for background and productivity measures. Similarly, principals were somewhat less likely to dismiss Black teachers after controlling for other factors.

Whereas these results raise some potential concerns, it would be incorrect to conclude on the basis of this evidence alone that principals in Chicago were acting in a discriminatory manner. First, although the models above include some proxies for teacher effectiveness, they undoubtedly cannot capture many of the individual teacher qualities that principals consider essential. For example, if older teachers are less adept with technology, have a more difficult time relating to children, or are less aware of recent innovations in curriculum and pedagogy, principals who are concerned solely with teacher productivity may legitimately dismiss a larger fraction of senior

teachers. Second, as discussed in the previous section, selection generated through the hiring process makes it difficult to interpret the results for characteristics like age, race, and gender, which were clearly known by the principal ex-ante.

To shed additional light on the issue of principal discrimination, Table 9 examines whether interactions between teacher and principal characteristics are significant predictors of dismissal. Note that the inclusion of School × Year fixed effects ensures that these interactions are identified by differences in principal behavior across teachers within the same school. If principals are more likely to dismiss teachers of different race, gender, and/or age, one might be more concerned about potential discrimination. However, it is important to stress that even the results presented next are merely suggestive and that unobserved factors may still influence dismissal decisions.

As a point of comparison, Column 1 reproduces the baseline model with one change that will facilitate interpretation of the subsequent results—that is, teacher age is specified as a linear term instead of grouped into discrete categories. Consistent with the results shown in Table 4, older

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TABLE 9

The Relationship Between Teacher, Principal, and Student Characteristics as They Relate to Teacher Dismissal

	(1)	(2)	(3)	(4)	(5)
Black	−.022**	−.014**	−.005	−.006	−.006
	(.006)	(.006)	(.007)	(.008)	(.008)
Hispanic	−.004	−.005	.010	.005	.005
	(.006)	(.006)	(.008)	(.008)	(.008)
Male	.036**	.035**	.036**	.035**	.035**
	(.006)	(.006)	(.006)	(.006)	(.006)
Age	.003**	.003**	.003**	.003**	.003**
	(.000)	(.000)	(.000)	(.000)	(.000)
Percent of students in school same race as teacher			−.026**		−.009
			(.008)		(.012)
Teacher and principal different race		.014**			.007
		(.005)			(.006)
Teacher and principal different gender		.005			.005
		(.006)			(.006)
Principal Age × Teacher Age / 100 (both demeaned)		−.010**			−.010**
		(.003)			(.003)
Teacher racial composition relative to the district (fraction of teachers in district same race as teacher – fraction of teachers in the school same race as teacher)				.024	.003
				(.019)	(.027)
Teacher racial composition relative to the district squared				−.130	−.125
				(.103)	(.104)
Mean of dependent variable	.112	.112	.112	.112	.112
Number of observations	24,010	24,010	24,010	24,010	24,010
Number of teachers	12,670	12,670	12,670	12,670	12,670
Number of schools	588	588	588	588	588

Note. Each column is an ordinary least squares regression with school-year fixed effects and standard errors clustered by school in parentheses. The specifications in columns 1-5 differ only insofar as which independent variables are included in the model. All specifications include controls for teacher effectiveness, teacher education, teacher demographics, teacher experience and status, and a set of teacher fund and certification area indicators. Specifications with principal and teacher race or gender interactions also include principal demographic missing value indicators interacted with teacher male, Black, and Hispanic.

teachers are more likely to be dismissed even after controlling for other demographic, educational, and productivity measures. Specifically, a coefficient of 0.003 indicates that the average principal would be 3 percentage points (about 27%) more likely to dismiss a 50-year-old teacher relative to a 40-year-old teacher, all else equal. (Note that all of the other predictors shown in the baseline model are included in the specification, though they are not presented in the table for the sake of parsimony.)

Column 2 includes interactions between principal and teacher race, gender, and age. There is no significant interaction between principal–teacher gender, though the analogous interactions

for principal–teacher race and age are statistically significant. For example, the results suggest that younger principals are more likely to dismiss older teachers than are younger principals. Similarly, principals are more likely to dismiss teachers of a different race, all else equal.

Although these results raise additional concern, at least in the case of principal–teacher race it is possible that other school-level factors may at least partially explain the results above. We next examine whether the racial composition of students in the school (Column 3) or desegregation mandates (Column 4) are important factors in teacher dismissal and may explain why principals are more likely to dismiss teachers of a different race.

Given the widespread belief that same-race role models are crucial for low-income students, it would not be surprising if principals took into account the composition of their student body when making dismissal decisions. Indeed, insofar as prior research has demonstrated that, all else equal, students learn more when taught by a teacher of the same race (Dee, 2004; Hanushek et al., 2005), this might be a legitimate determination on the part of the principal. Column 3 provides support for this hypothesis. I find that as the fraction of students in the school that share the race of the teacher rises, the likelihood that the teacher will be dismissed declines. Specifically, the coefficient of –0.026 suggests that an increase of 50 percentage points in the fraction of students who share the teacher's race decreases the likelihood that the teacher will be dismissed by slightly more than 1 percentage point, or 10%.[28]

Column 4 examines whether desegregation mandates may have influenced principal dismissal decisions. According to the consent decree that the CPS signed with the U.S. Department of Justice in September 1980, the district committed to developing a comprehensive student desegregation plan (Chicago Public Schools, 1994). The plan stipulated that the racial/ethnic composition and experience level of teachers in each school faculty should be within plus or minus 10% of the district-wide proportion of such teachers. Under the plan, the district was supposed, to the extent possible, to follow teacher assignment and transfer practices to facilitate this goal.[29] To account for this, we include a quadratic term in the difference between the fraction of teachers in the district of a certain race and the fraction of teachers in the school of the same race. This variable will be negative if a teacher race group is overrepresented in the school relative to the district. In this case, a principal might be more likely to dismiss the teacher. Conversely, when a teacher race group is underrepresented in the school relative to the district, the variable will be positive and the principal may be less likely to dismiss the teacher. The estimates are imprecise, but the point estimates are consistent with this phenomenon.

The specification shown in Column 5 includes the student–teacher, principal–teacher, and relative teacher racial composition variables in the same model. The coefficients on both the teacher–student race and principal–teacher race interactions decrease (in absolute value) and are no longer statistically significant. This suggests that some combination of desegregation mandates and a focus on teacher role model effects may explain the propensity for principals to dismiss teachers of a different race.

Conclusions

This article examines a new policy that provided Chicago Public School principals the flexibility to dismiss probationary teachers for any reason and without the documentation and hearing process that is typically required for dismissals in other districts. By comparing the characteristics of dismissed versus nondismissed probationary teachers within the same school and year, the analysis aims to learn which teacher characteristics principals value most highly and whether there are any important interactions between school or principal characteristics and the dismissal decision.

I find evidence that principals do consider teacher productivity in determining which teachers to dismiss. Principals are significantly more likely to dismiss teachers who are frequently absent and who have received worse evaluations in the past. Elementary teachers who were dismissed had significantly lower value added with regard to student achievement in prior years compared with their peers who were not dismissed. In addition, principals were significantly less likely to dismiss teachers with stronger educational qualifications as measured by things such as the competitiveness of their undergraduate college, whether they ever failed the teacher certification exam, and whether they had a Master's degree. Finally, dismissed teachers who were subsequently rehired by a different school are substantially more likely to be dismissed again relative to 1st-year teachers in the school.

These results provide suggestive evidence that reforms along the lines of the Chicago policy might improve student achievement, consistent with results from a related paper (Jacob, 2010). At the same time, this analysis reveals that many principals—including those in some of the worst performing schools in the district—did not dismiss any teachers despite how easy it was under the new policy. This result is consistent

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with the fact that existing teacher contracts in many large, urban school districts actually provide considerably more flexibility than is commonly believed and yet administrators rarely take advantage of such flexibility (Ballou, 2000; Hess & Loup, 2008; Price, 2009). The apparent reluctance of many Chicago principals to use the additional flexibility granted under the new contract may indicate that issues such as teacher supply and/or social norms governing employment relations are more important factors than policymakers have realized.

I also find evidence that several teacher demographic characteristics are associated with the probability of dismissal. Principals are more likely to dismiss male teachers even after controlling for other demographics, prior absences, formal evaluations, and teacher value added. Older teachers are more likely to be dismissed, particularly those working in buildings with younger principals. Although these results do not necessarily indicate that principals are acting in a discriminatory manner, they suggest that additional research into the decision-making process of principals is warranted.

Appendix

Construction of Teacher Value-Added Measures

For elementary schools, I obtained teacher–student links for core-subject classroom teachers in the 2004–2005 and 2005–2006 school years. This allows me to calculate value-added measures in the nonrenewal year for the 2005 and 2006 cohorts and in the year prior to nonrenewal for the 2006 and 2007 cohorts. Preliminary analyses and conversations with CPS officials concluded that these links were only reliable for teachers in Grades 2 to 5 in roughly three quarters of the schools. Given the limited data, I estimate relatively simple models in which the dependent variable, *y*, is the math or reading achievement score of student *i* with teacher *j* in school *k* in year *t*:

$$y_{ijkt} = f(y_{ijk+1}) + X_i\beta + \theta_{jt} + \gamma_k + \varepsilon_{ijk}. \quad \text{(A1)}$$

I control for prior student achievement flexibly using polynomials of both prior math and reading scores y_{ijk+1}. I also control for a standard set of student demographics, *X*, including age, gender, race, special education status, free-lunch eligibility, and so forth. Finally, I include school-fixed effects, γ_k, which ensure that the value-added measures are identified by comparisons of teachers within the same school. Standard errors are corrected to account for clustering of students within classroom.[30]

For secondary schools, it is only possible to reliably calculate value-added measures for individuals who teach 9th-grade math, reading, or science. During the years covered in this study, high school students in Chicago took a series of standardized tests developed by the makers of the ACT exam. In preparation for the ACT, which Chicago students typically take in 11th grade, students take the EXPLORE and PLAN exams in the fall of the 9th and 10th grades, respectively. These exams are developed by ACT to test knowledge and skills in math, science, and language arts. Working with CPS officials, I obtained achievement scores for 9th- and 10th-grade students along with course files and teacher records that allow me to link students to teachers. Unlike elementary school, I have such data on all teachers who taught a 9th-grade math, science, or language arts course. Using these data, I create value-added measures for 9th-grade teachers using the fall 10th-grade score (on the PLAN exam) as the posttest and the fall 9th-grade score (on the EXPLORE exam) as the pretest.

Specifically, I estimate models in which the dependent variable, *y*, is the math or reading achievement score of student *i* with teacher *j* in school *k* in year *t*:

$$PLAN_{ijkt} = f(EXPLORE_{ijk+1}) + X_i\beta \\ + \theta_{jt} + \gamma_k + \varepsilon_{ijk}. \quad \text{(A2)}$$

As with the elementary school models, I control for prior student achievement flexibly using polynomials of prior math, reading, and science scores along with a standard set of student demographics; classroom demographics such as race composition, fraction male, class size, semester, and class period; and school fixed effects. Using these data, I am able to calculate value-added measures for the 2003–2004, 2004–2005, and 2005–2006 school years, which means that I will have a measure of teacher effectiveness

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prior to the nonrenewal year for all cohorts and a measure in the actual nonrenewal year for the 2005 and 2006 (but not the 2007) cohort.

Notes

1. This void is not unique to education research. There is a vast economics literature on employee compensation, for example, but relatively few empirical studies that examine the factors employers consider when hiring or dismissing workers. The one notable exception involves discrimination: There is a large body of work devoted to determining whether, and under what circumstances, employers discriminate against women and racial minorities. Interestingly, this research has not provided strong evidence that employers generally consider factors related to productivity in hiring or dismissing employees.

2. Although there are often shortages in certain subjects and grade levels, even some of the most disadvantaged districts in the country have an ample supply of teachers for most positions. For example, the Chicago Public Schools (CPS) regularly receives 10 applications for each position. In 2005, an alternative certification program, New York City Teaching Fellows, received more than 17,500 applications for 2,000 spots (personal communication, Andy Sokatch of the New Teacher Project, 2007).

3. Another potentially important caveat involves teacher selection into the transfer pool. The authors find that teachers with better preservice measures of quality (certification scores, college competitiveness) are more likely to apply to transfer and teachers with higher value-added scores are less likely to apply to transfer. This "selection" into the transfer pool means that their reported estimates of school hiring preferences may be somewhat different from what one would obtain looking at the entire population of teachers. For example, their results may understate the value schools place on teacher preservice characteristics if, for example, the transfer applicants are all above what schools view as a minimal bar of quality.

4. If the principal checks the nonrenewal box, he or she must indicate at least one of the following five reasons for the nonrenewal: deficiencies with instruction (e.g., planning, methods, subject matter knowledge), deficiencies with environment (e.g., classroom management, teacher–pupil relationships), deficiencies with professional and personal responsibilities (e.g., attendance, tardiness, professional judgment), deficiencies with communication (e.g., parent conference skills, relations with staff), or deficiencies with attitude (e.g., lack of cooperation, lack of respect for others).

5. Principals are not required to make any decision for a particular teacher. If a principal either chooses to renew a Probationary Appointed Teacher (PAT) or takes

no action, then the teacher is still eligible to be laid off through the standard reduction-in-force process. The procedure for tenured teachers was essentially unchanged from the old policy. Temporarily Assigned Teachers were not considered hired in any permanent sense, and principals were under no obligation to rehire them each year; they have even less protection than do PATs in the new system.

6. PATs who are rehired by November 1st will not experience a break in service for tenure purposes.

7. PATs who are displaced through the standard reduction-in-force process are guaranteed health benefits through August 31st and are eligible for unemployment insurance. They are also guaranteed a position as a cadre teacher, which means that they are guaranteed work as a substitute every day and receive a higher rate of pay and better benefits than a day-to-day substitute receives. In contrast, nonrenewed teachers have to apply to be a cadre teacher and are accepted on a case-by-case basis after displaced PATs. Tenured teachers who are displaced through the reduction-in-force process receive even more benefits (personal communication, Nancy Slavin, Director of Teacher Recruitment, Chicago Public Schools, June 22, 2007).

8. If a principal chooses to nonrenew a PAT in his or her 4th year (i.e., immediately prior to tenure), the principal is required to inform the teacher which reason(s) were listed but is not required to further justify or explain the decision.

9. Including all observations for these teachers does not change our results.

10. In this article, I refer to any school that primarily serves students in grades K–8 as an elementary school and any school that primarily serves students in grades 9–12 (or 6–12) as a secondary (or high) school.

11. Moving forward, all fully certified teachers are immediately placed on the tenure track.

12. Using North Carolina data, Clotfelter, Ladd, and Vigdor (2009) employed teacher fixed effects and found that each 10 days of teacher absences decrease student achievement by 2.6% of a standard deviation. Miller, Murnane, and Willet (2008a) focused on one disadvantaged urban district and also used teacher fixed effects. They found that each 10 days of teacher absences reduce students' mathematics achievement by 3.3% of a standard deviation. In the context of a developing economy, Duflo and Hanna (2006) provided experimental evidence that teacher absences reduce student performance.

13. Information on teacher absence policy comes from a review of the recent CPS teacher collective bargaining agreements. Teachers with 13 or more years of experience are entitled to 11 paid sick or personal days per year, and (as of 2008) teachers with 18 or more years of experience are entitled to 12 paid days. Starting in 2009, teachers were allowed to accumulate up to 320

days of sick leave across years. Teachers who retire at age 65 or older would get to cash in 85% of their sick days. Teachers who retire before 65 years of age with fewer than 20 years of experience cannot cash in any of their sick days. For leaves due to illness longer than 10 days, teachers must apply for a personal illness leave.

14. Unfortunately, I do not have additional details, such as whether the teacher notified the principal ahead of time or simply did not show up in school.

15. More than 95% of efficiency ratings were given to teachers between April and June, with the rest assigned between January and March. When available, we use the April–June rating. In practice, less than 3% of teachers with ratings are assigned multiple ratings in a single academic year. For these teachers, we used the latest rating. For teachers with no ratings in the immediately prior year, we assigned them the ratings received in the most recent prior year available.

16. Interestingly, I see a quite different pattern among temporary teachers. The separation rates for this group appear to have decreased following the introduction of the policy. It is not clear what might explain this pattern among temporary teachers except that perhaps principals may have kept temporary teachers in part to replace the probationary teachers they were able to dismiss.

17. An alternate strategy for estimating the fraction of dismissed teachers who would not have left voluntarily is to compare the separation rates of renewed versus nonrenewed teachers under the new policy. Among those 1st-year teachers in 2004–2005 who were renewed, only 89% were teaching in the CPS in the following year (and 11% left voluntarily). In comparison, 56% of 1st-year teachers who were not renewed in 2004–2005 ended up teaching in the CPS in the following year. Assuming that 11% of the nonrenewed teachers would have left voluntarily as was the case with the renewed teachers, I can calculate that 75% $[(.44 - .11) / (.44) = .75]$ of the separations among nonrenewed teachers were involuntary or, rather, would not have occurred in the absence of the policy.

18. Barron's rating can be thought of as both a proxy for the cognitive ability of the individual teacher as well as a measure of the quality of the individual's undergraduate education. In preliminary analyses, we explored several different ways to measure the quality of the teacher's undergraduate college, including the ACT/SAT scores of students in the school and the Barron's rating of the school's competitiveness. All of these measures produced qualitatively similar results. For the sake of simplicity and because a nontrivial fraction of schools were missing ACT/SAT information, we chose to focus on a linear measure of the college's competitiveness ranging from 1 (*noncompetitive or unrated*) to 5 (*most competitive*) taken from the Barron's Guide to Colleges. The Barron's rankings are highly correlated with the average ACT/SAT scores of incoming students and with more informal perceptions of the quality of the institution.

19. Note that the models shown in Table 5 include a quadratic in experience as well as the off-track indicator to account for the correlation between teacher age and prior (nonteaching) experience in the CPS.

20. In most specifications, there are no significant differences between 2nd- through 4th-year teachers in dismissal likelihood.

21. The survey was administered to principals who registered their schools to attend CPS job fairs in May or June 2007, which included 320 of the 584 schools in our sample. The survey asked about nonrenewal decisions in the 2005–2006 and 2006–2007 school years. As part of the survey, principals were asked, "What level of importance did anticipated position closings have on your nonrenewal decisions (in past years)?" Principals responding "Very important to all of my nonrenewal decisions" or "Very important to some of my nonrenewal decisions" were categorized as making at least some nonrenewal decisions because of anticipated budget cuts. Roughly 29% of responses fell into this category. Principals responding "Very minor to my nonrenewal decisions" or "Not at all important to my nonrenewal decisions" were categorized as not making nonrenewal decisions on the basis of anticipated budget cuts. Roughly 44% of responses fell into this category.

22. I also compared teachers who were dismissed for deficiencies in classroom instruction and/or environment versus those who were dismissed for other reasons (e.g., deficiencies in professional responsibilities, communication or attitude), but I did not find any appreciable differences in the estimates.

23. For elementary schools, school achievement is the enrollment weighted fraction of third-, fifth-, and eighth-grade students in the school year testing at or above proficiency on the Illinois Standards Achievement Test (ISAT) averaged across math and reading. For high schools, school achievement is the fraction of students in the school year testing at or above national norms on the Prairie State Achievement Examination (PSAE). Data from the years 2002–2004 (prior to the implementation of the new policy) are used to determine school achievement.

24. School value-added measures are calculated by regressing student-level achievement scores on prior student achievement and a vector of standard student demographics (e.g., race, gender, free-lunch eligibility, etc.) and then aggregating the residuals to the school level.

25. This is due in part (but not entirely) to the fact that principals from the most competitive colleges are more likely to work in high-achieving than low-achieving schools.

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26. These schools are roughly comparable to all CPS schools on standard observable measures.

27. For example, if Teacher A had 26 students in her class during a particular year, I would calculate two value-added measures for the teacher, each of which would use a randomly selected 13 students. These two measures are highly correlated with each other and thus provide powerful instruments.

28. Additional analyses not presented here confirm that the linear specification of the same-race variable provides the best fit for the data. In results not reported here, we find that this phenomenon applies to White, Black, and Hispanic teachers, though the standard errors increase considerably. I also confirm that this result is not driven by an interaction between student poverty and/or student achievement and teacher race.

29. The consent decree was lifted in 2006, however, and did not apply to schools during the 2006–2007 school year. It is possible that principals and district officials may have maintained some of the procedures and systems for at least some time afterward.

30. Because I estimate each of the years separately, there is only one teacher observation per sample and I thus cannot separately identify classroom-level covariates or distinguish between idiosyncratic teacher–year effects and true value added.

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Author

BRIAN A. JACOB is the Walter Annenberg Professor of Education Policy and Professor of Economics at the University of Michigan. His research examines policies relating to standards and accountability and teacher labor markets.