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Time-out on Timing:

The Relationship between the Timing of Teacher Hires and Teacher Quality

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Time-out on Timing: The Relationship between the Timing of Teacher Hires and Teacher Quality

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Abstract

Interest in understanding how principals and school districts hire teachers has increased as empirical evidence on teacher effectiveness has grown. Case studies suggest late hiring timelines are pervasive in large urban school districts and result in the loss of more qualified teachers to surrounding suburbs. This paper uses labor market fixed effects regression techniques to provide the first empirical estimates of the relationship between the timing of teacher hires and teacher qualifications. Using the 1999-2000 SASS, I find that urban and low SES districts make over half of their teacher hires late. However, analyses find no relationship between timing and teacher qualifications including selectivity of university attended, certification, and masters degree. Null results persist across multiple specifications and subgroup analyses.

Recent academic articles and publications by advocacy groups have brought to light the potential problem of late timelines for hiring teachers in large urban school districts. Focusing on a small handful of states or districts, these case studies find that large proportions of new teacher hires are made during late summer or once the school year has already begun (Levin, Mulhern, & Schunck, 2005; Levin & Quinn, 2003; Liu & Johnson, 2006; Papa & Baxter, 2008). Further, some suggest that these late hires result in urban districts missing the chance to hire some of the most qualified teachers (Levin, Mulhern, & Schunck, 2005; Levin & Quinn, 2003; The New Teacher Project, 2007).

Although both researchers and advocates have reported on the pervasiveness of late teacher hiring and speculated on its effects on teacher quality, these findings have been based on small case studies. To date, there has not been a careful empirical study of late hiring and whether it is associated with lower quality hires.

In its publications, The New Teacher Project (TNTP) argues that late hiring timelines in large urban school districts result in the loss of well-qualified job candidates to surrounding suburbs (Levin, Mulhern, & Schunck, 2005; Levin & Quinn, 2003; TNTP, 2007). They note that while many candidates who attended selective universities and graduated with high GPAs apply for and are interested in jobs in large urban districts like the Chicago Public Schools (TNTP, 2007), these candidates often accept jobs from competing suburban districts because they are offered first. TNTP uses applicant tracking data, phone surveys, and focus groups to compile evidence in four urban districts. The multiple data sources and geographic diversity of the districts provide substantial information about the timing of hires and job candidates' reports of why they withdrew from the applicant pool in the urban districts. However, response rates in

TNTP's study are low, particularly for their analysis comparing job candidates who withdrew from the urban districts to those who were eventually hired. TNTP's analyses indicate that those who withdrew as applicants from the urban districts had higher GPAs, were more likely to have a degree in their teaching fields, and were more likely to have completed coursework in education than those who were hired. The extent to which the later hiring timelines of the urban districts were the cause of the disparity in candidate qualifications remains unclear.

While this work suggests that earlier hiring timelines on the part of principals or districts will result in hiring teachers with better qualifications (i.e. those with higher GPAs and degrees from more selective institutions), recent evidence indicates that, in general, principals might not always hire the most qualified or even be able to identify the most effective teachers. Several studies suggest that principals do not hire the "best" teachers (Ballou, 1996; Ballou & Podgursky, 1997; Pfuam & Abramson, 1990). For example, Ballou (1996) finds that teachers who attended more selective colleges and universities are not more likely than teachers who attended less selective institutions to be hired to fill teaching vacancies. Baker and Cooper (2005) find further evidence that many principals put little emphasis on a candidate's academic background. In a recent analysis focused on teacher value-added, Jacob and Lefgren (2008) find that while principals are able to identify their best and worst teachers, they are unable to distinguish among those in the middle. Given that principals have difficulty discerning the effectiveness of most of their teachers, they are likely even less able to predict the effectiveness of potential job candidates.

Recent qualitative studies of principals' preferences for teacher characteristics also suggest that principals may not be focused on traditional indicators of quality such as selectivity of college or university or GPA. Author (2008) and Harris, Rutledge, Ingle and Thompson

(2006) explore principals' preferences for teacher characteristics through qualitative interviews with principals. Both studies find that principals do not consider teaching candidates' GPAs, where they attended college, years of education or number of degrees to be important factors when making hiring decisions. These studies support findings from previous empirical work indicating that principals are not highly focused on these credentials and qualifications.

The current study adds to the body of research and case studies that has examined the timing of teacher hires and explored whether there appears to be a relationship between timing and teacher qualifications. Using a nationally representative data set, I estimate the relationship between the timing of teacher hires and several teacher credentials and qualifications. This is the first quantitative study of the association between the timing of teacher hires and teacher qualifications.

The results below provide the first nationally representative estimates of the timing of teacher hires and the best evidence to date on the relationship between the timing of teacher hires and teacher qualifications. Descriptive results indicate that on average, for the 1999-2000 school year, U.S. school districts hired 45 percent of their teachers after the first half of summer or once the school year had already begun. Low SES school districts and urban districts report a greater proportion of late hires than their high SES and suburban counterparts. These findings support results from previous studies by TNTP and others (e.g. Liu & Johnson, 2006) that indicate that a large portion of teacher hires are made late in the summer or once the school year has already begun. Further, as previous case studies suggest, I find that late hiring is more pervasive in urban districts and districts serving large proportions of disadvantaged students than in their suburban and more advantaged counterparts.

Results from labor market fixed effects regressions reveal that there is no association between the timing of teacher hires and teacher credentials including the Barron's ratings of their undergraduate universities, certification, and master's degree. These null results are consistent across multiple specifications for all three dependent variables of interest. While these results do not corroborate suggestive evidence from prior case studies, they do provide the best evidence to date on the relationship between the timing of teacher hires and teacher qualifications.

Literature

Prior Research on Timing

Several studies have documented that a large portion of teacher hires are made during late summer or once the school year has already begun (Levin & Quinn, 2003; Levin, Mulhern & Schunck, 2005; Liu & Johnson, 2006; The New Teacher Project, 2007). In their four-state study of a random sample of first and second year teachers, Liu and Johnson (2006) find that almost two-thirds were hired less than a month before the start of school or once the new school year had already begun. The authors note that late hiring is particularly pronounced in California and Florida compared with Massachusetts and Michigan, where over a third of teachers are hired once the school year has already begun.

In three separate reports, The New Teacher Project (TNTP) documents how barriers in urban school districts create a late hiring timeline that results in the loss of many highly qualified new teacher applicants (Levin & Quinn, 2003; Levin, Mulhern & Schnuck, 2005; TNTP, 2007). In their 2003 study of four urban districts across the United States, Levin and Quinn find that late timelines for vacancy notification (i.e. when retiring or resigning teachers have to give notice that they are leaving), teacher union transfer requirements, and late budget timetables combined

with poor forecasting of enrollment result in late hiring timelines. Papa and Baxter (2008) also document later hires for urban schools, compared with suburban.

Interestingly, Levin and Quinn (2003) find that applicants substantially outnumber available positions in all four urban districts in their study; in one case the ratio of applicants to available positions was 20:1. However, the four urban districts in the study failed to make many job offers by mid- to late-summer, at which point large portions of their applicant pool had withdrawn (withdrawals ranged from 31 to 60 percent). Many withdrawers reported accepting jobs with neighboring districts. The study indicates that while the urban case study districts tended to do the bulk of their hiring in August, competing suburban districts had hired most of their new teachers by May or June. Further, the authors suggest that the most qualified applicants were those who took jobs with other districts. Using a combination of applicant tracking data, phone surveys of withdrawers, and focus groups, they find that those who withdrew had higher undergraduate grade point averages, were more likely to have a degree in the field in which they taught, and were more likely to have completed coursework in education than the candidates who were eventually hired by the sample districts. Of concern is the fact that this facet of the case study has a response rate of 35 percent.

In another case study, this one focused on the teacher hiring process in the Chicago Public Schools (CPS), TNTP (2007) finds that despite an ample and highly qualified applicant pool, applicants who applied to CPS in July were almost twice as likely to be hired as those who applied in March or April. In Chicago, as in TNTP's earlier four-district study (Levin & Quinn, 2003), surveys of applicants who withdrew from the CPS hiring process indicate that the late hiring timeline was a key reason for their withdrawal. Interestingly, a qualitative study focused on understanding CPS principals' preferences and perspectives on the hiring process (Author,

2008) finds that principals perceive that timing matters, reporting that when they hire teachers affects the quality of candidates they are able to hire, with late hires resulting in candidates they believe are less qualified. However, the author also finds that principals do not focus on credentials and qualifications (i.e. certification, master's degree, selectivity of college or university) when looking for teachers to fill vacancies in their schools.

The TNTP case studies suggest that teacher hiring timelines affect the quality of candidates that are eventually hired, and that late hires made by urban districts appear to lead to the hiring of candidates with weaker qualifications. This work, while informative, does not provide estimates of the relationship between the timing of teacher hires and teacher characteristics. The current study models this relationship with nationally representative data using labor market fixed effects regression techniques and extensive controls, accounting for district, school, and teacher characteristics that might be correlated with both the timing of teacher hires and teacher qualifications.

Teacher Quality

The TNTP studies described above imply that late teacher hiring will force districts to choose from a lower quality applicant pool defined by qualifications including GPA, degree and relevant coursework. A substantial and growing body of research in education examines the relationship between teacher quality and student outcomes. This research aims to estimate the effects of teacher "value-added," or the effect that individual teachers have on student achievement. To varying degrees, these studies endeavor to control for student, classroom and school characteristics that might be confounded with teacher effects in order to estimate the achievement test score gains made by students that are attributable to their teachers.

Evidence from these studies consistently shows that teacher quality, as measured by teacher value-added, affects student achievement and varies substantially (Aaronson, Barrow, & Sander, 2007; Hanushek, 1986, 1997; Hanushek, Kain, O'Brian, & Rivkin, 2005; Harris & Sass, 2008; Kane, Rockoff, & Staiger, 2006; Nye, Konstantopoulos, & Hedges, 2004; Rockoff, 2004). For example, Rivkin, Hanushek and Kain (2005) note that consistent high quality instruction during the primary school years could substantially compensate for disadvantages associated with low socioeconomic status. While many studies use econometric methods to control for selection and omitted variable bias, using experimental data, Nye, Konstantopoulos, and Hedges (2004) find teacher effects that are similar in size to estimates of the afore-mentioned studies.

This body of research has also been remarkably consistent in finding that few observable teacher characteristics help to explain variation in teacher effectiveness (Aaronson et al., 2003; Hanushek, 1986, 1997; Hanushek et al., 2005; Kane et al., 2006; Nye et al., 2004; Rockoff, 2004). Most studies find no relationship between years of education or whether a teacher has a master's degree and teacher effectiveness (Hanushek, 1997; Hanushek, et al., 2005; Nye, et al., 2004). Results are mixed regarding teacher licensure and certification status, with some finding small positive effects (Clotfelter, Ladd & Vigdor, 2006, 2007a, 2007b; Goldhaber & Brewer, 2000) and others finding little or no effect (Hanushek et al., 2005; Kane et al., 2006). Interestingly, Kane, Rockoff, and Staiger (2006) find that evidence of effectiveness in a teacher's first two years in the classroom better predicts future effectiveness than certification.

Two observable teacher characteristics do appear to be related to teacher quality: experience (Clotfelter, et al., 2006, 2007a, 2007b; Hanushek et al., 2005; Harris & Sass, 2008; Rockoff, 2004; Nye et al., 2004) and a teachers' cognitive ability as measured by test scores, IQ, or by the selectivity of the institutions that they attended (Clotfelter, et al., 2007a, 2007b;

Ehrenberg & Brewer, 1994, 1995; Hanushek, 1997; Rockoff, Jacob, Kane, & Staiger, 2008). Inexperienced teachers, particularly those who have been teaching for only a year or two, have a negative effect on student achievement (Hanushek, et al., 2005; Rockoff, 2004; Nye, et al., 2004). However, studies also find that after an initial improvement following the first couple of years, the positive effect of additional experience levels off (Hanushek, et al., 2005; Rockoff, 2004; Nye, et al.; 2004).

Hiring Preferences and Practices

While evidence indicates that teacher quality is important, that it varies substantially and that one of the few individual characteristics linked in the current research to a teacher's effectiveness may be cognitive ability (as measured by IQ or a proxy such as selectiveness of college or university attended), evidence on principals' hiring practices and preferences suggests that principals may not focus on this when hiring. Several recent studies suggest that principals do not hire the "best" teachers (Ballou, 1996; Ballou & Podgursky, 1997; Pfuam & Abramson, 1990). Interestingly, a recent analysis of the 1993-94 Schools and Staffing Survey by Baker and Cooper (2005) provides evidence that supports previous findings that principals do not focus on where teaching candidates went to school (Ballou, 1996). The authors find that many principals appear to put less emphasis on a candidate's academic background, and that this varies by principals' academic backgrounds, with principals who attended more selective universities themselves more likely to hire teachers who attended selective universities. Further, they find that this relationship is particularly pronounced in high poverty schools.

Although research documenting how teachers are hired is limited, two recent studies explore these practices through statewide surveys of administrators in New York (Balter & Duncombe 2005a, 2005b, 2006) and Pennsylvania (Strauss, Bowes, Marks & Plesko 2000).

These studies find 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 the caliber of the candidate's academic institution in the hiring process.

Two recent qualitative studies of principals' preferences for teacher characteristics, one in Chicago (Author, 2008) and the other in a mid-sized Florida district (Harris, et al., 2006) both find that principals do not report focusing on teaching candidates' GPAs, where they attended college, years of education or number of degrees when making hiring decisions. In the Chicago sample, principals most often reported looking for teachers who care about children, have classroom management skills and are willing to go beyond contractual obligations. They also mention, but do not emphasize, content knowledge and teaching skills (Author, 2008). Harris, et al. (2006) find that principals reported looking for strong teaching skills, caring, knowledge of subject, ability to work with others, experience, enthusiasm and communication skills.

Method

Data

I use the 1999-2000 Schools and Staffing Survey (SASS) to describe the timing of teacher hires and to examine the relationship between timing and teacher qualifications. The SASS gathers data on nationally representative samples of districts, principals, and schools and has been administered in six cross-sectional cycles. For the current study, I use data on school districts, public schools, and public school teachers from the 1999-2000 SASS; the only wave of the survey that includes questions about the timing of teacher hires. The sampling frame for the public school sample was the 1997-1998 Common Core of Data (CCD) which includes all elementary and secondary schools in the United States. The sample design for the 1999-2000 SASS sampled schools and then Local Education Agencies (school districts). To ensure a

sizeable teacher sample, schools were sampled with a probability proportionate to the square root of their number of teachers, with between one and 20 teachers sampled per school.[1]

Variables

Dependent variables. The three dependent variables included in these analyses are all teacher credentials. They include Baron's rating of teachers' undergraduate college or university, certification, and highest degree obtained (i.e. master's versus bachelors).

Barron's ratings. Barron's ratings are indicators of college selectivity and come from Barron's Profiles of American Colleges. Some value-added studies suggest that indicators of a teacher's own ability, as measured by the selectivity of the college or university that a teacher attended, test scores, or I.Q. scores, have a positive, though small, effect on student achievement (Clotfelter, Ladd & Vigdor, 2007a, 2007b; Ehrenberg & Brewer, 1994, 1995; Hanushek, 1997). Barron's ratings categorize colleges and universities into six selectivity groups ranging from 0, or non-competitive to 5, or most competitive. Barron's ratings are a popular measure of college quality and are predictive of indicators such as future earnings (Zhang, 2005).

The average Barron's rating for the undergraduate institution attended by sample teachers is 2.01. The standard deviation is 1.06. The modal Barron's rating category for sample teachers is two. It represents 49 percent of the sample and indicates a "competitive" college or university.

Certification. Although value-added research generally finds that the effects of teacher certification on student achievement are small (Clotfelter, Ladd & Vigdor, 2006, 2007a, 2007b; Goldhaber & Brewer, 2000) or null (Hanushek et al., 2005; Kane et al., 2006), principals and administrators might still indicate a preference for hiring certified teachers, as they are often required to do so. Fully eighty percent of sample districts from the 1999-2000 SASS report that

[1] This information comes from: http://nces.ed.gov/surveys/sass/methods9900.asp

certification is required. Approximately 89% of sample teachers are certified in their main field with either regular or probationary certification (Table 1).

Master's Degree. Value-added estimates of the effect of having a master's degree on student achievement generally indicate little or no effect. However, it is interesting to consider whether principals and administrators take more education as a positive signal about a candidate's ability when he or she is being considered for a teaching position. Forty seven percent of sample teachers report having master's degrees.

Key independent variables. The independent variables of interest were constructed using district-level responses to survey items about the timing of teacher hires for the 1999-2000 school year. They include the proportion of hires made at the following four time points in 1999: spring of the prior school year, first half of summer, second half of summer, and fall of the current school year. I also constructed a dichotomous version of the independent variable of interest, indicating the proportion of teachers hired 'early,' or during the prior school year/first half or summer, or 'late,' defined as second half of summer or fall of the current school year.

Controls. Models are specified that include a range of district-, school-, and teacher-level controls. District-level controls include variables such as number of schools in the district, enrollment, core per pupil expenditures, proportion of free lunch eligible students and proportion of minority students. Controls are also included for school-level student gender, race/ethnicity, and socioeconomic status as well as school type and level. Some model specifications also include district- school- and individual-level teacher controls. These include controls for race/ethnicity, gender, years of experience (both overall and as a teacher and in their current school), certification, and highest degree obtained. See Table 1 for a full list of controls and associated summary statistics.

Sample

The 1999-2000 SASS includes surveys of districts, public schools, public school principals and public school teachers. The sample includes approximately 4,700 school districts, 8,500 public school principals, 8,400 public schools, and 42,000 public school teachers. Response rates are 88.6 percent for districts, 90 percent for principals, 88.5 percent for schools, and 83.1 percent for teachers. Districts have an average of 26 schools. On average 39 percent of students within districts are eligible for free- or reduced-price lunch programs. District-level public school enrollment averages 19,232 students in kindergarten through 12th grade, and districts employ an average of 1,190 full time teachers. The average district-level core per pupil expenditure for fiscal year 1998 was $4,309.

Fifty two percent of sample schools are elementary, and 30 percent are high schools (the remainder teach in middle or combined schools). Inexperienced teachers (having taught three years or less) make up 16 percent of the sample and 85 percent are white. Approximately 15 percent of sample teachers are new to their current school, and five percent are first year teachers. Twenty five percent of sample teachers are male.

Analysis sample. I use the 1999-2000 SASS restricted data files, as they allow merging of district-level measures with school- and teacher-level variables and contain information about where sample teachers went to college. Although the full SASS sample includes about 42,000 teachers, 5,028 are missing district-level data. As the key independent variables are at the district-level, the analytic sample is reduced to approximately 37,000 teachers. Further, 3,402 teachers are missing either the college they attended or Barron's ratings. This further reduces the analysis sample for Barron's ratings to approximately 34,000 teachers.

The analytic sample includes only full-time, regular teachers hired in 1989 or later resulting in a sample of 25,740 teachers. This subset is used because in these analyses I assume that the timing of current year hires and the characteristics of those who are hired are generally similar over time and it seems unreasonable to assume that hiring practices including timing and teacher characteristics would remain unchanged over a longer period.

The sample is reduced further because all models are estimated using labor market fixed-effects (see section below for details). I define labor markets as Metropolitan Statistical Areas (MSAs). MSAs, defined as large population nuclei, are created by the United States Census Bureau. MSAs include adjacent communities that have high levels of social and economic integration with the core area.[2] The 1999-2000 SASS includes 329 MSAs. As approximately 60 percent of school districts are affiliated with a MSA (those that are not are primarily rural), the full analysis sample is reduced to about 13,400.

The analytic sample is quite similar to the full sample in terms of the timing of their teacher hires. Although three of the differences are statistically significant, they are generally small, and the proportion of teachers hired late is virtually identical across the two samples. The districts in the analysis sample are substantially larger than those in the full sample in terms of number of schools and population. Because only districts within MSAs are included in the analysis sample, it is composed entirely of urban and suburban districts, unlike the full sample which is 45 percent rural districts. The analysis sample includes schools that serve larger populations of minority students and have more minority teachers as well. Teachers in the analysis sample are less experienced than those in the full sample. Importantly, results reported below generalize only to urban and suburban school districts.

Analysis Plan

[2] http://quickfacts.census.gov/qfd/meta/long_metro.htm

Model

The analyses presented here are at the district-level, as the independent variables of interest were collected from districts rather than schools. School- and teacher-level data are used to explore interactions between the timing of teacher hires and school and teacher characteristics. I predict teacher qualifications using indicators of the timing of district-level teacher hires as independent variables, along with district, school, and teacher-level controls. Specifically, I model teacher qualifications as a function of district, school, principal and teacher characteristics:

$$\text{Teacher Char}_i = a_i + \beta_1 \text{District}_i + \beta_2 \text{Timing}_i + \beta_3 \text{School}_i + \beta_4 \text{Teacher}_i + \beta_5 \text{MSA}_i + e_i$$

where Teacher Char_i is one of the three dependent variables I analyze; Barron's ratings of undergraduate institutions, certification, and master's degree for teacher i.

District_i includes district-level controls that might be related to the timing of teacher hires and to the characteristics of newly hired teachers (e.g. district-level information on poverty, student race, district size); School_i consists of school-level controls (e.g. average student characteristics); Teacher_i is comprised of teacher-level controls (e.g. teacher race/ethnicity, gender); Timing_i is a set of four (or two – late, or post-mid-summer versus early, or pre-mid-summer) district-level variable(s) that measure when new teachers were hired for the 1999-2000 school year. Finally, as all specifications include labor market fixed effects; MSAi is a set of dummy indicators for metropolitan statistical areas. The parameters of interest in this model are the coefficients on Timing (β_2). These provide an estimate of the association between the timing of teacher hires and teacher qualifications, conditional on the other variables included in the models.

I use labor market fixed effects for all specifications, where labor markets are defined as MSAs. Labor market fixed effects provide *within* labor market estimates of the relationship between the timing of teacher hires and indicators of teacher quality, thereby controlling for labor market characteristics that may be associated with the timing of teacher hires and teacher credentials. For example, evidence indicates that teachers are likely to teach close to where they are from (Boyd, Lankford, Loeb, & Wyckoff, 2005a, 2005b; Reininger, 2006), thus making it likely that teachers within a labor market will be more similar than teachers across labor markets. Labor market fixed effects account for both observed, and, importantly, unobserved within labor market teacher characteristics.

I estimate models using fixed effects OLS for Barron's ratings which are on a six point scale and use fixed effect logits to estimate the association between timing and the dichotomous dependent variables (certification and master's degree). Because Barron's ratings are on a six-point scale that may not be cardinal in nature, I also estimated ordered logistic models. All of the estimates provided in the tables below include standard errors that are cluster-adjusted at the district-level to account for non-independence of schools within districts and of teachers within schools. In the SASS, schools are the PSUs. Thus, for analyses where school, principal, or teacher-level variables are the independent variables of interest, cluster-adjusting standard errors at the school-level would be an obvious choice. However, in this case, standard errors are cluster-adjusted at the district-level to account for non-independence within districts as the independent variables of interest were measured at the district- rather than school-level. Unweighted estimates of the relationship between the timing of teacher hires and teacher qualifications are provided. Weighted models were estimated when possible, but results were similar and are not shown. Missing data on all covariates is handled by including a set of

missing data dummy variables (missing data dummies are not included for independent variables of interest).

Specifications

I estimate several specifications of control variables for the full analysis sample. First, I estimate unconditional models including only the independent variables that describe timing. Second, I estimate models that include only district- and school-level controls. These specifications are most likely to provide results of interest to district and school administrators and policy-makers. Information on whether earlier hiring timelines predict hiring teachers who attended more selective colleges or are more likely to be certified or have master's degrees, regardless of other teacher characteristics, is of value both to principals in determining their hiring timelines and to district administrators who make policy decisions that have direct ramifications for school-level hiring timelines (e.g. when to permit within district teacher transfers and when to provide schools with budgetary and enrollment data).

Estimates are also provided that add controls for teacher characteristics. These estimates may bring us closer to observing the causal relationship between timing and teacher credentials such as Barron's ratings. For example, if estimates without teacher characteristics indicate that earlier hiring is associated with hiring teachers who attended colleges with better Barron's ratings, we might conclude that the relationship between timing and Barron's ratings is causal. However, if the addition of individual teacher characteristics (e.g. teacher race) were to reduce or eliminate the observed association between timing and Barron's ratings, it would indicate that leaving out additional teacher characteristics was resulting in overestimates of the relationship due to omitted variable bias. Estimates without additional teacher characteristics are still of more value to principals and administrators, as they will want to understand whether earlier

hiring is more likely to result in more qualified teachers, regardless of whether these qualifications are correlated with other teacher characteristics.

Estimates are provided for a number of important subgroups. I estimate models for core subject teachers (I include both regular elementary classroom teachers and those who teach reading, mathematics, science, or social studies.). Models are also estimated for elementary and secondary schools, for schools that are below and above their labor market average for free- and reduced-price lunch eligible students, and for the quartile of districts that hired the most new teachers in 1999-2000 (those that hired 15 percent or more of their teaching force) and the quartile of districts that hired the fewest new teachers (those that hired eight percent or less of their teaching force). Ideal for this analysis would be the subsample of teachers hired during the current school year, as this group provides a sample of all teachers hired for the 1999-2000 school year and thus would better capture the relationship between the timing of teacher hires and teacher qualifications. Unfortunately, this subsample is small and standard errors indicated that I had statistical power to detect only very large effects. Thus, coefficient estimates for this group are not included below.

Results

Descriptive results

Districts hire 25 percent of their new teachers during the previous school year, and another 30 percent during the first half of summer, on average (Table 2). Approximately one-third (34%) of teachers are hired during the second half of summer, and 11 percent are hired once the school year has already begun. Thus, districts hire nearly half of their new teachers (45%) 'late,' or during the second half of summer and once the school has already begun.

As Table 2 indicates, the timing of teacher hires across elementary versus high schools is relatively similar. Interestingly, schools that are below their labor market average socioeconomic status hired over half (52%) of their teachers during the 'late' time period, compared with high SES schools which hired 41 percent of their teachers during the second half of summer or once the school year had already begun. As the final columns in Table 2 indicate, urban districts also hire teachers later, on average, than their suburban counterparts. Not surprisingly, teachers in high SES and suburban districts have somewhat higher Barron's ratings and are more likely to be certified than teachers in low SES and urban districts, although differences are relatively small.

Table 3 presents descriptive results across districts based on the timing of their teacher hires. The columns show weighted descriptive statistics for districts grouped by when they reported making the majority of their hires. For example, if a district made the majority of its hires during the first half of summer, then it is included in that category (Column 3). As would be expected, districts varied substantially across categories in the timing of their teacher hires. Districts that do the majority of their hiring later in the summer or once the school year has already begun tend to be large districts in terms of population, student enrollment, number of schools and number of teachers. Thirty percent of districts that do the majority of their hiring during the school year are urban, compared with only 12 percent of all districts.

The proportion of African-American students varies relatively little across timing categories. However, districts that do the majority of their hiring during the current school year have larger proportions of Hispanic and Asian students and fewer white students. They have fewer white teachers as well (68% compared with 85% for the full sample). Teacher characteristics including years of teaching experience, whether teachers are certified or have

Master's degrees, and average Barron's ratings of teachers' undergraduate institutions are similar across all of the timing categories.

Regression results

Barrons ratings

Table 4 presents coefficients and standard errors from OLS labor market fixed effects regressions predicting Barron's ratings using the proportion of teachers hired at various points in time. The analysis sample, as described above, includes full-time, regular teachers hired by their current schools in 1989 or later. The first three columns show coefficients and standard errors for three points in time – proportion of hires made during the first half of summer, those made during the second half of summer, and hires made during the 1999-2000 school year (omitted category is hires made during prior school year). Columns 4 through 6 show coefficients and standard errors for a single timing variable that indicates the proportion of teacher hires made "late," or during the second half of summer and the 1999-2000 school year (omitted category is hires made during the prior school year and first half of summer). Columns 1 and 4 show coefficients and standard errors for unconditional models, or models that include only timing variables. Columns 2 and 5 add district- and school-level controls. Columns 3 and 6 add teacher controls at the district-, school-, and individual teacher-levels. Results are unweighted and standard errors are cluster-adjusted at the district-level.

The proportion of teachers hired at various points in time does not appear to relate to the Barron's ratings of the undergraduate colleges and universities that teachers attended. There are no statistically significant coefficients on the timing variables, regardless of what additional controls are included in the models or how timing is constructed. Further, coefficients are small in magnitude, with the largest point estimate in the model being -.085 for the relationship

between the proportion of new hires made during the first half of summer and Barron's ratings, conditional on district and school-level controls. As the standard deviation for Barron's ratings for the full teacher sample is very close to 1 (1.06), a coefficient of -.085 is under a tenth of a standard deviation. Most estimates are close to zero, and standard errors indicate that I would be able to detect significant effects ranging from one-tenth to two-tenths of a standard deviation. Including school- and district-level controls somewhat reduces the size of the coefficients. Controlling for teacher characteristics, for the most part, does not result in a further reduction. While Table 4 includes coefficients for all control variables, subsequent tables indicate groups of controls using Xs to present results parsimoniously.

Table 5 provides subgroup estimates from models predicting Barron's ratings. All models include district- and school-level controls, but do not control for any teacher characteristics. Subgroups include core subject teachers, elementary schools, secondary schools, schools below or above their labor market average for free- and reduced-price lunch eligibility, and the quartile of districts overall that made the most (>15% of their teaching force) and the fewest (<8% of their teaching force) new hires for 1999-2000.

Like results for the full analysis sample, subgroup estimates indicate virtually no statistically significant or consistent associations between the timing of teacher hires and Barron's ratings. There is only one marginally significant coefficient on an independent variable of interest, and point estimates are small, with many near zero. Standard errors are somewhat large; in some cases I am unable to detect significant effects as large as one-fifth to one-third of a standard deviation. Results do not show a stronger relationship between the timing of teacher hires and Barron's ratings for low- versus high-SES schools, nor is the relationship more pronounced for core subject teachers.

In addition to using the full Barron's scale as an outcome, I also use dichotomous versions (results not shown). One is an indicator of whether sample teachers attended undergraduate institutions that were in the top two most selective categories (seven percent of sample teachers). The two other dichotomous Barron's indicators that I tried include one indicating whether teachers were in the bottom two Barron's categories – non-competitive and less competitive (30 percent of the sample), and another including only teachers in the bottom category (12 percent of the sample). Results for these analyses did not differ substantially from results using the full Barron's scale.

Because Barron's ratings are on a six-point scale that may not be cardinal in nature, I also estimated ordered logistic models (results not shown). These models did not include fixed effects as I was unable to run ordered logits in Stata using fixed effects. Results were similar. When run with weights (results not shown), coefficients change slightly and standard errors increase by approximately on-third. However, the overall pattern of results does not change substantially when weighted. Weighted subgroup regressions (not shown), did indicate several statistically significant subgroup coefficients, although in some cases the results were in the opposite direction than what would be expected and did not indicate a consistent pattern.

Certification

Coefficients and standard errors for labor market fixed effects logits predicting whether teachers are certified using the proportion of teachers hired at various points in time are shown in Table 6. Groupings of control variables and independent variables of interest are the same as those shown in Table 4. Odds ratios are to the right of coefficients for independent variables of interest. Similar to overall results for Barron's ratings, Table 6 shows no substantial association between the proportion of teachers hired at various points in time within a district and

certification. Standard errors indicate that coefficients would need to be very large to detect a statistically significant relationship, as standard errors range from approximately .25 to .65. While there are no statistically significant coefficients, it is important to note that while columns 1 and 4 indicate that the relationship between timing and credentials is essentially zero for unconditional estimates, the relationship between proportion of hires made at later points in time and whether a teacher is certified, while not statistically significant, is positive once district- and school-level controls are added (columns 2 and 5). This positive relationship is odd and counterintuitive. It is unclear why this is the case.

I estimated identical models, both weighted and unweighted, using OLS (results not shown). The pattern of results is similar, indicating a positive relationship between proportion of teachers hired at later time-points and certification once district- and school-level controls are added. OLS estimates produce much smaller standard errors than the conditional logits. Thus, while effects are small (never larger than .05 of a standard deviation for unweighted estimates and .08 for weighted) some coefficients in the OLS models are statistically significant.

Table 7 provides estimates of the association between the proportion of teachers hired at various time-points and whether teachers are certified for various subgroups.[3] While there are again no statistically significant results in this table, standard errors are very large for these conditional logistic models. Unexpectedly, results for low SES schools indicate that the proportion of teachers hired late (column 6) is positively associated with teacher certification. The odds ratio shows that in low-SES schools where teachers are hired late, teachers are almost two times more likely to be certified than in low-SES schools where teachers are hired during the prior year or the first half of summer. These estimates are very imprecise, however, and should not be taken as conclusive evidence of a relationship. Weighted and unweighted estimates of

[3] Models for elementary schools would not converge, thus these results are not included in the table.

these models using OLS labor market fixed effects (results not shown) indicate the same pattern of results, although coefficients on the proportion of teachers hired late are never larger than one-tenth of a standard deviation

Master's degree

Table 8 provides coefficients, standard errors and odds ratios from labor market fixed effects logistic regressions predicting whether a teacher has a master's degree using the variables indicating the proportion of teachers hired at various time-points. There are no statistically significant results in this table. While the coefficients on the proportion of hires made during the current school year in columns 1 through 3 indicate that the latest hires are associated with teachers who are more likely to have a master's degree, the coefficients on late hiring in columns 4 through 6 are essentially zero, indicating no relationship between the timing of teacher hires and whether teachers have master's degrees.

Table 9 shows subgroup results from labor market fixed effects logistic regressions using master's degree as the dependent variable. Again, there are no statistically significant results. Results suggest that the proportion of teachers hired late in elementary schools is negatively associated with teachers having a master's degree, while later hires in high-SES schools, and, in particular in the quartile of schools that made the fewest new hires for the 1999-2000 school year appear to be somewhat positively associated with having a master's degree. Weighted and unweighted OLS labor market fixed effects models indicated a similar pattern of results to those in Tables 8 and 9 (results not shown).

All models described in this results section were also run separately for teachers who were hired during the current school year. While this would be an ideal sample for these analyses, the sub-sample was too small and standard errors indicated that I had statistical power

to detect only very large effects. Further, these results did not indicate a consistent pattern in terms of a relationship between timing and teacher qualifications. Thus, results are not shown.

Discussion

This study provides the first quantitative evidence on the association between the timing of teacher hires and teacher qualifications. Using a nationally representative sample of districts, schools, and teachers, I estimate the association between the proportion of teachers hired at various points in time and teacher qualifications including the selectivity of their undergraduate institutions, certification and master's degree using labor market fixed effects.

A handful of studies have documented that many teacher hires seem to take place during late summer or once the school year has already begun (Levin & Quinn, 2003; Levin, Mulhern & Schunck, 2005; Liu & Johnson, 2006; The New Teacher Project, 2007). Further, TNTP case studies report that late hiring timelines in several mid-sized and large urban districts result in the loss of qualified teachers to surrounding suburban districts that hire earlier (Levin & Quinn, 2003; Levin, Mulhern & Schunck, 2005; The New Teacher Project, 2007). These studies suggest that if urban districts move up their hiring timelines, they will hire better teachers.

The current study provides the first nationally representative estimates of when school districts hire teachers. Descriptive results indicate that districts hire a large portion of teachers during the second half of summer or once school has already begun. Across all districts in the 1999-2000 SASS, 45 percent of hires were made after the second half of summer, with over half of hires in urban districts and low-SES schools taking place during this late period.

While descriptive results agree with case study findings that late hiring is pervasive and more pronounced in urban districts, further analyses do not support the notion that hires made during the prior school year or early summer are associated with better credentialed teachers than

hires made during late summer or once the school year has already begun. Results indicate no association between the proportion of teachers hired at various time-points and the teacher qualifications and credentials that were analyzed including Barron's ratings of teachers' undergraduate institutions and whether teachers are certified or have master's degrees.

Previous publications that report an association between the timing of teacher hires and teacher credentials (Levin & Quinn, 2003; Levin, Mulhern & Schnuck, 2005; TNTP, 2007) have been descriptive case studies in a small handful of school districts. The estimates provided here indicate that the relationship described in those case studies between the timing of teacher hires and teacher credentials does not exist in a nationally representative sample. The labor market fixed effects regressions employed here compare school districts within labor markets. Thus, models are estimated using competing urban and suburban districts, which should highlight the association if it exists.

Given that current educational policy research indicates that principals and districts do not preference teachers with better qualifications in their hiring (Baker & Cooper, 2005; Ballou, 1996; Ballou & Podgursky, 1997; Pfuam & Abramson, 1990), that they are not always able to discern the effectiveness of their existing faculty (Jacob and Lefgren, 2008) and that principals do not consider credentials, including highest degree obtained and the prestige of candidates' colleges and universities to be important qualifications in the hiring process (Author, 2008; Harris et al. 2006), perhaps it should not come as a surprise that these characteristics do not vary systematically with the timing of teacher hires. If principals do not consider these qualifications to be important or to be indicative of whether a teacher will succeed in the classroom, then we would not expect teachers with Master's degrees or who attended more selective colleges to be hired earlier than their less credentialed counterparts. And, in fact, they are not.

Although the 1999-2000 SASS surveyed a large, nationally representative sample of districts, schools, and teachers, the information provided about the timing of teacher hires provides a useful but imperfect means for estimating the relationship between timing and teacher qualifications. These data are collected at the district- rather than the school-level. Approximately three-quarters of teacher hiring decisions are made at the school-level by principals.[4] School-level responses to questions about timing would likely have less measurement error than district-level responses.

District-level survey respondents would have had to request information about the timing of hires from individual schools, (which would likely improve accuracy, but could also be very time consuming), or would have to use centrally gathered information such as the date that a new hire's paper work is submitted or an official district hire date. These district variables may not accurately reflect when hiring decisions were made within schools, and are also distinct from information on when a job was offered. Data on when jobs were offered versus when hires were made could potentially reveal a relationship between timing and teacher qualifications. While school-level data is desirable in some respects, school-level variables could also introduce more concerns about omitted variable bias. For example, it is possible that principals who hire late also hire teachers with lesser qualifications, regardless of timing.

Even if the SASS data included school-level reports, it might still be hard to argue that the relationship between the timing of hires and teacher qualifications is causal rather than just correlational. These data, which are not the results of an experiment that would have the potential to provide definitive estimates of the relationship between timing of hires and teacher qualifications, leave the analyses vulnerable to problems of both selection and omitted variable bias. Any variable that is correlated with both my outcome measure of interest and with the

[4] Author's calculation using 1999-2000 SASS.

timing of teacher hires that is unmeasured and thus not included in the models results in biased estimates. Although I use extensive district, school, principal, and teacher-level controls, as well as labor market fixed effects to reduce the likelihood of omitted variable bias, it is still possible that important variables may be omitted from my analyses.

The 1999-2000 SASS are, to my knowledge, the only quantitative data available with information on the timing of teacher hires and teacher qualifications and credentials. Thus, uncovering new evidence about this relationship will require new data collection efforts. There may be value in collecting school-level offer data from a reasonably large, representative sample. This survey could include detailed questions about when all new job offers were made and accepted within the school for the current year. A new study could also target newly hired teachers; the ideal sample for answering these questions.

In addition to gathering information on school- and teacher-level demographics and teacher qualifications such as college attended, level of education, degree, and years of experience, it would also be worthwhile to consider collecting longitudinal data on the achievement of students within these teachers' classrooms to examine whether there is a relationship between the timing of teacher hires and teacher value-added. A further benefit of a study focused on understanding the relationship between timing and teacher qualifications would be to allow for data collection on a wide variety of teacher characteristics that principals may be more focused on and that some research suggests is associated with teacher effectiveness.

Another possible means for studying the relationship between the timing of teacher hires and teacher credentials/teacher effectiveness would be to use an experimental design and randomly assign a sample of schools to one or several different 'treatment' conditions and a control condition. For example, the late date through which teachers are allowed to transfer

schools within their districts (e.g. July 15th in Chicago) has been criticized as one of the causes of late hiring in previous research by TNTP (2003, 2007). Randomly assigning some districts to an early transfer date while others maintain a later date would provide random variation in one of the factors believed to cause late hiring in large, urban districts.

Although late hiring may not result directly in a less credentialed teaching force, it is important to remember that late hires, particularly in large numbers, are still likely to cause problems for teachers, schools and districts. Hires made right before or even after school has already begun are likely to disrupt the beginning of the school year. Disruptions are most obvious if school is already in session once a hire is made, but late summer hires likely result in new teachers missing professional development, induction, and orientation opportunities as well as the chance to prepare adequately for teaching in their new schools. Late hiring is likely to be another barrier to insuring that substantive instruction begins as quickly as possible when school starts. Further, the fact that late hiring is more prevalent in disadvantaged and urban districts indicates that any problems or disruptions that result from late hires will be more pronounced in these already beleaguered schools.

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Table 1. Weighted means and proportions for dependent variables, key independent variables, controls and other variables of interest for full 1999-2000 SASS and for primary analysis sample

	Full SASS Sample	Analysis Sample	Sig. Dif. P<.05
Key Independent Variables, District:			
Prop. new hires prior school year	0.253	0.260	
Prop. of new hires 1st 1/2 summer	0.299	0.291	*
Prop. new hires 2nd 1/2 summer	0.341	0.321	*
Prop. new hires current school year	0.107	0.128	*
Prop new hires prior school year/1st 1/2 summer	0.552	0.551	
Prop. New hires 2nd 1/2 summer/current school year	0.448	0.449	
District-level variables			
Number of schools in district	26.27	48.01	*
Core per pupil expend fy98	$4,309	$4,380	*
Prop. students eligible for free lunch	0.385	0.355	*
Prop. minority students	0.221	0.273	*
Total district population	126,205	242,693	*
District fte teacher count	1,190	2,275	*
District K-12 enrollment	19,232	37,072	*
Has an agreement with a teachers' union	0.727	0.771	*
Urban district	0.121	0.235	*
Suburban district	0.426	0.765	*
Rural district	0.454	0.000	*
School-level variables			
Prop. male students	0.509	0.506	
Prop. Black students	0.140	0.183	*
Prop. Hispanic students	0.145	0.198	*
Prop. American Indian/Native Alaskan students	0.020	0.010	*
Prop. Asian students	0.038	0.051	*
Prop. White students	0.657	0.559	*
Spec. ed, voc. or alt. ed school	0.046	0.052	
Prop. free lunch eligible students	0.406	0.422	*
Elementary School	0.516	0.561	*
Secondary School	0.298	0.258	*
Middle school	0.151	0.157	*
Combined School	0.035	0.024	*
District-level teacher controls			
Proportion Hispanic teachers	0.047	0.059	*
Proportion Black teachers	0.044	0.060	*
School-level teacher controls			
Proportion Black teachers	0.073	0.103	*
Proportion Hispanic teachers	0.057	0.074	*
Proportion American Indian teachers	0.010	0.008	
Proportion Asian teachers	0.015	0.022	*
Proportion white teachers	0.846	0.793	*
Teacher-level controls			
Has taught 3 years or fewer	0.159	0.236	*
Masters degree	0.466	0.418	*
Certified	0.893	0.879	*
Newly hired	0.148	0.205	*
First year teacher	0.053	0.075	*
Average Barron's rating	2.021	2.091	*
Male	0.252	0.239	
Black	0.077	0.100	*
Hispanic	0.055	0.078	*
American Indian	0.009	0.008	
Asian	0.015	0.023	*
~n	38,736	13,400	

Sample sizes vary due to missing data for individual variables.
The analysis sample includes only districts associated with a Metropolitan Statistical Area and full-time, regular teachers who were hired by their schools in 1989 or later.

Table 2. Weighted means and proportions for key independent variables and dependent variables for full sample, analysis sample, and subgroup analytic samples

	Full Sample	Analysis Sample		Elementary Schools	Secondary Schools		Low SES School	High SES School		Many New Hires	Few New Hires		Urban District	Suburban District	
Key Independent Variables															
Prop. new hires prior school year	0.25	0.26		0.28	0.26		0.22	0.28	*	0.26	0.27	*	0.23	0.27	*
Prop. of new hires 1st 1/2 summer	0.30	0.29	*	0.27	0.31	*	0.26	0.31	*	0.33	0.28	*	0.25	0.30	*
Prop. new hires 2nd 1/2 summer	0.34	0.32	*	0.31	0.32		0.34	0.31	*	0.30	0.33	*	0.32	0.32	
Prop. new hires current school year	0.11	0.13	*	0.14	0.12	*	0.17	0.11	*	0.11	0.11		0.20	0.11	*
Prop new hires prior school year/1st 1/2 summer	0.55	0.55		0.55	0.56	*	0.48	0.59	*	0.59	0.55	*	0.48	0.58	*
Prop. New hires 2nd 1/2 summer/current school year	0.45	0.45		0.45	0.44	*	0.52	0.41	*	0.41	0.45	*	0.52	0.42	*
Dependent Variables															
Average Barron's rating	2.02	2.09	*	2.05	2.16	*	2.01	2.14	*	2.20	2.03	*	2.03	2.13	*
Master's degree	0.47	0.42	*	0.40	0.45	*	0.41	0.43		0.38	0.42	*	0.42	0.42	
Certified	0.89	0.88	*	0.89	0.88		0.85	0.90	*	0.87	0.90	*	0.86	0.89	*
~n	38,736	13,400		4,412	7,071		5,315	9,144		3,727	2,411		4,751	8,447	

Sample sizes vary due to missing data for individual variables.
The analysis sample includes only districts associated with a Metropolitan Statistical Area and full-time, regular teachers who were hired by their schools in 1989 or later.
Low (high) SES schools are defined as those schools that fall below (above) the labor market average SES.
The "many new hires" subgroup includes the quartile of district that hired the largest proportion of teachers (>=15% of their total teaching force) in 1999-2000.
The "few new hires" subgroup includes the quartile of district that hired the smallest proportion of teachers (<=8% of their total teaching force) in 1999-2000.
*Asterisk indicates statistically significant difference between the two comparison subgroups ($p<.05$)

Table 3. Weighted means and proportions for dependent variables, key independent variables, controls and other variables of interest for full 1999-2000 SASS and for districts categorized by when they reported making the majority of their hires.

	Full Sample	Majority of Hires Prior School Year*	Majority of Hires 1st 1/2 Summer*	Majority of Hires 2nd 1/2 Summer*	Majority of Hires Current School Year*	<50% of Hires Late**	>=50% of Hires Late**
Key Independent Variables, District:							
Prop. new hires prior school year	0.253	0.683	0.106	0.076	0.086	0.388	0.075
Prop. of new hires 1st 1/2 summer	0.299	0.146	0.629	0.163	0.095	0.393	0.176
Prop. new hires 2nd 1/2 summer	0.341	0.125	0.207	0.670	0.135	0.173	0.560
Prop. new hires current school year	0.107	0.046	0.058	0.091	0.685	0.045	0.189
Prop new hires prior school year/1st 1/2 summer	0.552	0.829	0.735	0.239	0.180	0.782	0.251
Prop. New hires 2nd 1/2 summer/current school year	0.448	0.171	0.265	0.761	0.820	0.218	0.749
District-level variables							
Number of schools in district	26.27	20.33	15.84	33.88	109.52	17.00	40.00
Core per pupil expend fy98	$4,309.04	$4,452.75	$4,187.52	$4,319.28	$4,445.83	$4,318.56	$4,302.33
Prop. students eligible for free lunch	0.385	0.357	0.371	0.400	0.438	0.360	0.413
Prop. minority students	0.221	0.213	0.216	0.225	0.311	0.209	0.240
Total district population	126,205	85,096	62,428	178,033	575,431	66,918	212,522
District fte teacher count	1,190	805	618	1,709	5,164	656	1,980
District K-12 enrollment	19,232	13,605	9,803	26,236	90,002	10,714	31,855
Has an agreement with a teachers' union	0.727	0.767	0.711	0.728	0.725	0.731	0.731
Urban district	0.121	0.121	0.109	0.128	0.302	0.110	0.141
Suburban district	0.426	0.476	0.450	0.414	0.365	0.465	0.388
Rural district	0.454	0.403	0.441	0.458	0.333	0.425	0.470
School-level variables							
Prop. male students	0.509	0.512	0.503	0.507	0.515	0.507	0.509
Prop. Black students	0.140	0.139	0.135	0.165	0.172	0.130	0.165
Prop. Hispanic students	0.145	0.149	0.131	0.120	0.269	0.146	0.147
Prop. American Indian/Native Alaskan students	0.020	0.020	0.016	0.023	0.021	0.018	0.024
Prop. Asian students	0.038	0.047	0.025	0.025	0.106	0.036	0.038
Prop. White students	0.657	0.646	0.693	0.667	0.433	0.671	0.626
Spec. ed, voc. or alt. ed school	0.046	0.033	0.039	0.049	0.047	0.037	0.051
Prop. free lunch eligible students	0.406	0.376	0.380	0.423	0.574	0.377	0.459
Elementary School	0.516	0.530	0.484	0.500	0.643	0.504	0.525
Secondary School	0.298	0.297	0.316	0.307	0.229	0.306	0.297
Middle school	0.151	0.146	0.168	0.152	0.096	0.161	0.138
Combined School	0.035	0.027	0.032	0.041	0.032	0.029	0.040
District-level teacher controls							
Proportion Hispanic teachers	0.047	0.050	0.044	0.043	0.055	0.048	0.048
Proportion Black teachers	0.044	0.041	0.039	0.053	0.075	0.037	0.055
School-level teacher controls							
Proportion Black teachers	0.073	0.078	0.064	0.080	0.130	0.068	0.089
Proportion Hispanic teachers	0.057	0.056	0.045	0.047	0.108	0.053	0.059
Proportion American Indian teachers	0.010	0.012	0.009	0.009	0.010	0.010	0.010
Proportion Asian teachers	0.015	0.014	0.012	0.008	0.069	0.013	0.018
Proportion white teachers	0.846	0.840	0.870	0.857	0.684	0.856	0.824
Teacher-level controls							
Has taught 3 years or fewer	0.159	0.168	0.158	0.157	0.169	0.162	0.159
Masters degree	0.466	0.458	0.456	0.492	0.442	0.452	0.481
Certified	0.893	0.898	0.896	0.884	0.868	0.898	0.881
Newly hired	0.148	0.166	0.143	0.141	0.140	0.156	0.138
First year teacher	0.053	0.057	0.050	0.050	0.056	0.054	0.050
Average Barron's rating	2.021	2.060	2.000	1.970	2.170	2.020	1.990
~n	38,736	9,156	10,101	12,296	2,945	20,560	16,725

Sample sizes vary due to missing data for individual variables.

*Each district was categorized by when they reported making the majority of their hires (e.g. if a district reported that the largest number of hires was made during the 1st half of summer, then that is the only category of the four in which that district

** Each district was categorized by whether they made less than 50 percent or greater than or equal to 50 percent of their hires during the second half of summer and once the 1999-2000 school year had already begun.

Table 4. OLS labor market fixed effects regressions predicting Barron's ratings for full-time, regular teachers who were hired in 19
or later with district-, school-, and teacher-level controls

Dep Variable: Barron's Ratings	(1)	(2)	(3)	(4)	(5)	(6)
Key Independent Variables, District:						
Prop. new hires prior school year	(omitted)					
Prop. of new hires 1st 1/2 summer	-0.028	-0.085	-0.058			
	(0.066)	(0.066)	(0.064)			
Prop. new hires 2nd 1/2 summer	-0.054	-0.030	-0.041			
	(0.064)	(0.063)	(0.061)			
Prop. new hires current school year	-0.063	-0.044	-0.055			
	(0.097)	(0.086)	(0.084)			
Prop new hires prior school year/1st 1/2 summer				(omitted)		
Prop. new hires 2nd 1/2 summer/current school year				-0.046	-0.004	-0.025
				(0.049)	(0.050)	(0.048)
District-level controls						
Number of schools in district (100)		-0.170*	-0.143*		-0.162*	-0.138*
		(0.069)	(0.058)		(0.069)	(0.057)
Core per pupil expend fy98 ($1000)		0.004	0.004		0.004	0.004
		(0.009)	(0.009)		(0.009)	(0.009)
Prop. students eligible for free lunch		-0.107+	-0.141**		-0.108+	-0.142**
		(0.057)	(0.051)		(0.057)	(0.051)
Prop. minority students		0.106	0.088		0.109	0.088
		(0.083)	(0.097)		(0.083)	(0.097)
Total district population (1000s)		-0.000	-0.000		-0.000	-0.000
		(0.000)	(0.000)		(0.000)	(0.000)
District fte teacher count (1000s)		0.022	0.012		0.022	0.012
		(0.019)	(0.014)		(0.019)	(0.014)
District total enrollment (1000s)		0.001*	0.002*		0.001*	0.002*
		(0.001)	(0.001)		(0.001)	(0.001)
Has an agreement with a teachers' union		-0.040	-0.012		-0.038	-0.010
		(0.053)	(0.046)		(0.053)	(0.046)
School-level controls						
Prop. male students		-0.077	-0.110		-0.073	-0.108
		(0.143)	(0.141)		(0.142)	(0.141)
Prop. African American students		-0.172*	0.005		-0.170*	0.006
		(0.069)	(0.081)		(0.069)	(0.081)
Prop. Hispanic students		-0.226*	-0.210*		-0.225*	-0.210*
		(0.088)	(0.096)		(0.088)	(0.096)
Prop. American Indian/Native Alaskan students		-0.138	-0.242		-0.122	-0.230
		(0.173)	(0.172)		(0.172)	(0.171)
Prop. Asian students		0.179	0.036		0.180	0.035
		(0.131)	(0.145)		(0.130)	(0.144)
Spec. ed, voc. or alt. ed school		-0.053	-0.060		-0.054	-0.060
		(0.050)	(0.049)		(0.050)	(0.049)
Prop. free lunch eligible students		-0.030	0.009		-0.032	0.008
		(0.053)	(0.052)		(0.053)	(0.052)
High school		0.111**	0.106**		0.111**	0.105**
		(0.021)	(0.021)		(0.021)	(0.021)
Middle school		0.060+	0.068*		0.061+	0.068*
		(0.032)	(0.032)		(0.032)	(0.032)
Combination of grades		0.053	0.055		0.053	0.054
		(0.043)	(0.042)		(0.043)	(0.042)

(Table 4 continued)						
District-level teacher controls						
Proportion Hispanic teachers			-0.027			-0.024
			(0.082)			(0.083)
Proportion Black teachers			0.455*			0.462*
			(0.190)			(0.191)
School-level teacher controls						
Proportion Black teachers			-0.211*			-0.211*
			(0.097)			(0.097)
Proportion Hispanic teachers			0.001			0.003
			(0.117)			(0.117)
Proportion American Indian teachers			0.483**			0.485**
			(0.181)			(0.181)
Proportion Asian Teachers			0.019			0.020
			(0.164)			(0.162)
Teacher-level controls						
Has taught 3 years or fewer			0.079**			0.080**
			(0.021)			(0.021)
Masters degree			0.165**			0.166**
			(0.021)			(0.021)
Certified			-0.005			-0.005
			(0.025)			(0.025)
Male			0.012			0.012
			(0.018)			(0.018)
Black			-0.403**			-0.404**
			(0.048)			(0.048)
Hispanic			-0.162**			-0.162**
			(0.046)			(0.046)
American Indian			-0.084			-0.085
			(0.072)			(0.071)
Asian			0.207**			0.206**
			(0.059)			(0.059)
Constant	2.072**	2.144**	2.044**	2.059**	2.099**	2.014**
	(0.042)	(0.102)	(0.102)	(0.026)	(0.093)	(0.093)
Observations	13403	13403	13403	13403	13403	13403
R-squared	0.19	0.20	0.22	0.19	0.20	0.22

Robust standard errors in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

Barron's ratings are on a 0 (non-competitive) to 5 (highly competitive) scale. Mean for SASS teacher sample is 2.02, standard deviation is 1.07.

All standard errors are cluster-adjusted at the district-level.

Table 5. OLS labor market fixed effects regressions predicting Barron's ratings for various subgroups of full-time, regular teachers who were hired in 1989 or later with district-, school-, and teacher-level controls

	Core Subject Teacher		Elementary School		Secondary School		Low SES School		High SES School		Many New Hires		Few New Hires	
Dep Variable: Barron's Ratings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Key Independent Variables, District:														
Prop. new hires prior school year	(omitted)													
Prop. of new hires 1st 1/2 summer	-0.106		-0.048		-0.159+		-0.072		-0.113		-0.170		0.219	
	(0.084)		(0.129)		(0.093)		(0.150)		(0.076)		(0.145)		(0.160)	
Prop. new hires 2nd 1/2 summer	-0.062		-0.027		-0.031		-0.003		-0.068		-0.111		0.090	
	(0.078)		(0.105)		(0.085)		(0.121)		(0.072)		(0.138)		(0.120)	
Prop. new hires current school year	-0.092		0.089		-0.099		-0.107		-0.066		0.011		-0.128	
	(0.115)		(0.145)		(0.114)		(0.194)		(0.099)		(0.204)		(0.176)	
Prop new hires prior school year/1st 1/2 summer		(omitted)												
Prop. New hires 2nd 1/2 summer/current school year		-0.034		0.023		0.004		-0.002		-0.031		-0.010		-0.063
		(0.061)		(0.084)		(0.068)		(0.099)		(0.056)		(0.106)		(0.093)
Constant	2.109**	2.055**	1.978**	1.942**	2.338**	2.260**	1.914**	1.878**	2.276**	2.220**	2.594**	2.484**	2.232**	2.343**
	(0.142)	(0.131)	(0.216)	(0.199)	(0.142)	(0.133)	(0.176)	(0.146)	(0.151)	(0.144)	(0.217)	(0.188)	(0.296)	(0.290)
District-level controls	X	X	X	X	X	X	X	X	X	X	X	X	X	X
School-level controls	X	X	X	X	X	X	X	X	X	X	X	X	X	X
District-level teacher controls														
School-level teacher controls														
Teacher-level controls														
Observations	8102	8102	4118	4118	6532	6532	4864	4864	8539	8539	3462	3462	2249	2249
R-squared	0.23	0.23	0.26	0.26	0.21	0.21	0.24	0.24	0.21	0.21	0.20	0.20	0.32	0.32

Robust standard errors in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

Barron's ratings are on a 0 (non-competitive) to 5 (highly competitive) scale. Mean for SASS teacher sample is 2.02, standard deviation is 1.07.

All standard errors are cluster-adjusted at the district-level.

Core subject teachers are those who teach regular elementary school, mathematics, science, English, or social studies.

Low (high) SES schools are defined as those schools that fall below (above) the labor market average SES.

The "many new hires" subgroup includes the quartile of district that hired the largest proportion of teachers (>=15% of their total teaching force) in 1999-2000.

The "few new hires" subgroup includes the quartile of district that hired the smallest proportion of teachers (<=8% of their total teaching force) in 1999-2000.

Table 6. Logistic labor market fixed effects regressions predicting whether certified for full-time, regular teachers who were hired in 1989 or later with district-, school-, and teacher-level controls

Dep Variable: Certified	(1)		(2)		(3)		(4)		(5)		(6)	
Key Independent Variables, District:												
Prop. new hires prior school year	(omitted)											
Prop. of new hires 1st 1/2 summer	0.127	1.14	0.022	1.02	0.013	1.01						
	(0.569)		(0.647)		(0.639)							
Prop. new hires 2nd 1/2 summer	0.009	1.01	0.110	1.12	0.130	1.14						
	(0.479)		(0.466)		(0.466)							
Prop. new hires current school year	0.066	1.07	0.397	1.49	0.376	1.46						
	(0.511)		(0.435)		(0.422)							
Prop new hires prior school year/1st 1/2 summer			*				(omitted)					
Prop. New hires 2nd 1/2 summer/current school year							-0.018	0.98	0.185	1.20	0.196	1.22
							(0.288)		(0.236)		(0.237)	
District-level controls			X		X				X		X	
School-level controls			X		X				X		X	
District-level teacher controls					X						X	
School-level teacher controls					X						X	
Teacher-level controls					X						X	
Observations	13715		13715		13715		13715		13715		13715	

Robust standard errors in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

Approximately 89% of sample teachers are certified in their main field with either regular or probationary (all certification requirements completed, regular certification pending) certification. Six percent of the teacher sample is not certified in their main field, and the remaining teachers have either provisional, temporary, emergency certification or waivers.

Standard errors are cluster-adjusted at the district-level to account for non-independence within districts and schools.

Odds ratios appear to the right of independent variable coefficients of interest.

Table 7. Logistic labor market fixed effects regressions predicting whether certified for full-time, regular teachers who were hired in 1989 or later with district- and school-level controls for various subgroups

	Core Subject Teacher		Secondary School		Low SES School		High SES School		Many New Hires		Few New Hires	
Dep Variable: Certified	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Key Independent Variables, District:												
Prop. new hires prior school year	(omitted)											
Prop. of new hires 1st 1/2 summer	-0.140 0.87		0.221 1.25		0.284 1.33		0.006 1.01		0.126 1.13		-0.344 0.71	
	(0.911)		(1.013)		(1.495)		(0.745)		(1.550)		(1.507)	
Prop. new hires 2nd 1/2 summer	0.081 1.08		-0.137 0.87		0.859 2.36		-0.187 0.83		0.600 1.82		-0.174 0.84	
	(0.638)		(0.757)		(1.001)		(0.647)		(1.070)		(1.422)	
Prop. new hires current school year	0.118 1.13		0.004 1.00		0.619 1.86		0.314 1.37		0.152 1.16		-0.206 0.81	
	(0.581)	*	(0.760)		(0.985)		(0.670)		(1.258)		(1.607)	
Prop new hires prior school year/1st 1/2 summer		(omitted)										
Prop. New hires 2nd 1/2 summer/current school year		0.139 1.15		-0.170 0.84		0.668 1.95		-0.051 0.95		0.417 1.52		-0.035 0.97
		(0.319)		(0.435)		(0.427)		(0.404)		(0.497)		(0.841)
District-level controls	X	X	X	X	X	X	X	X	X	X	X	X
School-level controls	X	X	X	X	X	X	X	X	X	X	X	X
District-level teacher controls												
School-level teacher controls												
Teacher-level controls												
Observations	7790	7790	6224	6224	4608	4608	8366	8366	3172	3172	1869	1869

Robust standard errors in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

Approximately 89% of sample teachers are certified in their main field with either regular or probationary (all certification requirements completed, regular certification pending) certification. Six percent of the teacher sample is not certified in their main field, and the remaining teachers have either provisional, temporary, emergency certification or waivers.

Standard errors are cluster-adjusted at the district-level to account for non-independence within districts and schools.

Odds ratios appear to the right of independent variable coefficients of interest.

Core subject teachers are those who teach regular elementary school, mathematics, science, English, or social studies.

Low (high) SES schools are defined as those schools that fall below (above) the labor market average SES.

The "many new hires" subgroup includes the quartile of district that hired the largest proportion of teachers (>=15% of their total teaching force) in 1999-2000.

The "few new hires" subgroup includes the quartile of district that hired the smallest proportion of teachers (<=8% of their total teaching force) in 1999-2000.

Note: Conditional logistic regressions for elementary school subgroup would not converge.

Table 8. Logistic labor market fixed effects regressions predicting whether teacher has MA for full-time, regular teachers who were hired in 1989 or later with district-, school-, and teacher-level controls

Dep Variable: Masters Degree	(1)		(2)		(3)		(4)		(5)		(6)	
Key Independent Variables, District:												
Prop. new hires prior school year	(omitted)											
Prop. of new hires 1st 1/2 summer	-0.179	0.84	-0.157	0.85	-0.190	0.83						
	(0.415)		(0.467)		(0.486)							
Prop. new hires 2nd 1/2 summer	-0.163	0.85	-0.116	0.89	-0.121	0.89						
	(0.362)		(0.349)		(0.370)							
Prop. new hires current school year	0.181	1.20	0.366	1.44	0.377	1.46						
	(0.443)		(0.301)		(0.314)							
Prop new hires prior school year/1st 1/2 summer							(omitted)					
Prop. New hires 2nd 1/2 summer/current school year							0.019	1.02	0.073	1.08	0.084	1.09
							(0.225)		(0.177)		(0.189)	
District-level controls			X		X				X		X	
School-level controls			X		X				X		X	
District-level teacher controls					X						X	
School-level teacher controls					X						X	
Teacher-level controls					X						X	
Observations	14254		14254		14254		14254		14254		14254	

Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%
Forty-seven percent of sample teachers have masters degrees.
Standard errors are cluster-adjusted at the district-level to account for non-independence within districts and schools.
Odds ratios appear to the right of independent variable coefficients of interest.

Table 9. Logistic labor market fixed effects regressions predicting whether teacher has MA for full-time, regular teachers who were hired in 1989 or later with district- and school-level controls for various subgroups

	Core Subject Teacher		Elementary School		Secondary School		Low SES School		High SES School		Many New Hires		Few New Hires	
Dep Variable: Masters Degree	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Key Independent Variables, District:														
Prop. new hires prior school year	(omitted)													
Prop. of new hires 1st 1/2 summer	-0.200 0.82		-0.071 0.93		-0.234 0.79		0.066 1.07		-0.172 0.84		0.274 1.32		-0.186 0.83	
	(0.582)		(0.970)		(0.635)		(1.316)		(0.467)		(1.132)		(0.837)	
Prop. new hires 2nd 1/2 summer	-0.271 0.76		-0.405 0.67		-0.116 0.89		-0.213 0.81		-0.003 1.00		-0.170 0.84		0.380 1.46	
	(0.441)		(0.693)		(0.464)		(0.850)		(0.409)		(0.884)		(0.751)	
Prop. new hires current school year	0.359 1.43		0.102 1.11		0.332 1.39		0.213 1.24		0.327 1.39		0.528 1.70		0.618 1.86	
	(0.381)	*	(0.468)		(0.465)		(0.781)		(0.353)		(0.883)		(0.919)	
Prop new hires prior school year/1st 1/2 summer		(omitted)												
Prop. New hires 2nd 1/2 summer/current school year		-0.025 0.98		-0.239 0.79		0.092 1.10		-0.123 0.88		0.139 1.15		-0.088 0.92		0.529 1.70
		(0.232)		(0.297)		(0.253)		(0.305)		(0.246)		(0.463)		(0.462)
District-level controls	X	X	X	X	X	X	X	X	X	X	X	X	X	X
School-level controls	X	X	X	X	X	X	X	X	X	X	X	X	X	X
District-level teacher controls														
School-level teacher controls														
Teacher-level controls														
Observations	8522	8522	4271	4271	6834	6834	5114	5114	8962	8962	3527	3527	2293	2293

Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%
Forty-seven percent of sample teachers have masters degrees.
Standard errors are cluster-adjusted at the district-level to account for non-independence within districts and schools.
Odds ratios appear to the right of independent variable coefficients of interest.
Core subject teachers are those who teach regular elementary school, mathematics, science, English, or social studies.
Low (high) SES schools are defined as those schools that fall below (above) the labor market average SES.
The "many new hires" subgroup includes the quartile of district that hired the largest proportion of teachers (>=15% of their total teaching force) in 1999-2000.
The "few new hires" subgroup includes the quartile of district that hired the smallest proportion of teachers (<=8% of their total teaching force) in 1999-2000.

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