TEACHERS WITHOUT BORDERS:
Consequences of Teacher Labor Force Mobility

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Abstract

In many states an initial response to teacher shortages was to grant reciprocal certification for individuals traditionally prepared out-of-state. To date, there has been little research investigating the effectiveness of these out-of-state prepared teachers; however, three hypotheses predict that teachers prepared out-of-state may be less effective: (1) labor markets force mobility on less qualified teachers; (2) out-of-state prepared teachers have less familiarity with the curricula, standards, and culture of the importing state; and (3) the attrition patterns of out-of-state prepared teachers. We examined the effectiveness of out-of-state prepared teachers using unique student level data from North Carolina and found that out-of-state prepared instructors are significantly less effective than in-state prepared and alternative entry peers in elementary grades mathematics and reading. After testing the three hypotheses above, evidence suggests that a lack of familiarity with the state’s educational environment and attrition patterns help explain out-of-state prepared teachers’ ineffectiveness.
**Introduction**

In many states high population growth, teacher attrition, teacher retirements, and more employment opportunities for women have been responsible for teacher shortages (Bacolod, 2007; Common Core of Data; Ingersoll & Smith, 2003). These shortages, coupled with a need for more highly effective teachers to promote student achievement growth, have pushed many states to experiment with alternatives to solely licensing instructors prepared at in-state traditional education programs. Lateral/Alternative entry programs, which reduce barriers to employment by allowing individuals without teacher education credentials to complete requirements for certification while concurrently teaching, have been a common state policy response (Feistritzer, 2011; National Research Council, 2010; Shen, 1997). For example, from 2000-01 to 2009-10 the number of alternative entry teachers in North Carolina public schools increased 125 percent, from 6,626 to 15,028, and the percentage of alternative entry teachers in the state’s workforce rose from 7.79 to 14.87 (authors’ analysis).

Through licensing agreements with national teacher accreditation and certification associations, such as the National Council for the Accreditation of Teacher Education or the National Association of State Directors of Teacher Education and Certification, a frequently used but little studied alternative approach has been for states to grant more reciprocal teacher certification licenses and expand the number of traditionally prepared teachers from other states. This policy broadens the pool of potential teachers by facilitating the interstate movement of experienced teachers and teacher candidates, especially from states that over-produced instructors in their education programs to those states in need of additional teachers. In North Carolina, for example, the states that have contributed the largest share of the out-of-state prepared teacher pool are New York, Pennsylvania, Ohio, and Michigan—all states with recent decreases in their student populations (Common Core of Data)—and over the past decade, the number of out-of-state prepared instructors has increased 36 percent, from 21,316 to 29,006 (authors’ analysis).

Despite these three options (in-state, out-of-state, and alternative entry) for staffing schools, prior research on teacher effectiveness has generally combined in-state and out-of-state traditionally prepared teachers into a single category and compared the effectiveness of
traditionally prepared teachers with that of alternatively prepared instructors (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Clotfelter, Ladd, & Vigdor, 2007, 2010; Kane, Rockoff, & Staiger, 2008). From a policy perspective, classifying in-state and out-of-state traditionally prepared teachers together ignores differential financial costs associated with these groups of instructors, including those of preparation, recruitment, development, and replacement which make distinctions between the categories important (Alliance for Excellent Education, 2004). Furthermore, combining those traditionally prepared in-state with out-of-state prepared instructors ignores potential differences in teacher preparation and labor markets across states which may affect teachers’ effectiveness (National Research Council, 2010).

Both theoretical and prior research evidence suggests three hypotheses predicting that out-of-state prepared teachers may be less effective than their in-state prepared peers: (1) teacher candidates with lower levels of human capital may need to be more mobile to find employment (Boyd, Lankford, Loeb, & Wyckoff, 2005; Reininger, 2012); (2) differences in state curricula, standards, and culture may make out-of-state prepared teachers less familiar with the educational environment of the importing state, and therefore, less effective in raising student achievement (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009); and (3) out-of-state prepared teachers who acquire human capital through on-the-job experience may become more competitive for positions back in their state of origin, causing high rates of teacher turnover and the potential for differential attrition (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006).

In this paper we examine the effectiveness of early-career out-of-state prepared teachers and address each hypothesis by answering the following research questions:

1) How does the effectiveness of traditionally prepared out-of-state teachers compare to that of individuals traditionally prepared in-state, or admitted into the profession through alternative entry programs?

2) If effectiveness differences exist between out-of-state prepared teachers and the groups specified above, what accounts for those performance disparities—lower levels of human capital, less familiarity with the educational environment, and/or the attrition patterns of out-of-state prepared instructors?
By way of preview, we find that out-of-state prepared teachers consistently underperform in-state traditionally prepared elementary school teachers in both mathematics and reading. In addition, out-of-state prepared teachers are significantly less effective than alternative entry instructors across all model specifications. Upon testing hypotheses to account for these findings, our results indicate that out-of-state prepared teachers’ (1) lack of familiarity with the state’s education environment and (2) high rates of turnover, coupled with the ineffectiveness of departing out-of-state prepared teachers, help explain their poor performance.

In the following sections we summarize the research investigating the effects of teacher preparation and detail our research-based hypotheses for why out-of-state prepared teachers may be less effective. We then discuss the data and methods used for this research. Next, we present the results for both research questions, and finally, we conclude with a discussion of potential policy responses.

Prior Research on the Effects of Teacher Preparation

Recent changes in teacher labor markets—due to increased demand for teachers, particularly in certain high-need subject areas and schools—and concerns regarding low levels of student performance have pushed policymakers to open more alternative routes into the teaching profession (Shen, 1997). For instance, in 1998-99 the number of new teachers entering the profession through alternative pathways stood at 10,000. By 2005-06, that number had increased five-fold, and in 2009-10 approximately forty percent of teachers entering the profession within the last five years had done so through alternative routes (Feistritzer, 2011). This rapid increase in the alternatively prepared teaching population has provided researchers the opportunity to examine the efficacy of traditional teacher preparation, relative to alternative preparation, and within the past decade a number of studies have compared the effectiveness of traditionally and alternatively prepared/certified teachers.

Overall, this body of research has generated two broad findings. First, teachers holding regular certification/traditional preparation appear to be more effective in the early stages of their careers (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Clotfelter, Ladd, & Vigdor, 2007, 2010; Goldhaber & Brewer, 2000; Kane, Rockoff, & Stagier, 2008; Henry, Bastian, Fortner, Kershaw, Purtell, Thompson, & Zulli, 2013). These returns to certification/preparation fade
quickly, however, such that the efficacy of the credential as a signal of teacher quality is limited (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006). For example, high school teachers holding an initial or continuing license in North Carolina public schools are more effective than those currently holding lateral entry licenses, but compared with those teachers who previously held a lateral entry license, no differences in effectiveness exist (Clotfelter, Ladd, & Vigdor, 2010). Second, there is more variation in teacher effectiveness within preparation categories than between them, meaning factors outside preparation may better determine a teacher’s classroom success (Boyd, Goldhaber, Lankford, & Wyckoff, 2007; Kane, Rockoff, & Staiger, 2008; Henry et al. 2013). Despite the tenor of these findings four methodological or sample issues provide justification for further research on the relative effectiveness of teachers prepared through different programs or entering through different teacher preparation portals.

First, most of the prior research is based on teachers’ certification status at a particular point in time, not on their preparation prior to beginning teaching. Preparation is the fixed education and training an individual brings with them into the teaching profession, while certification varies over time depending upon the grade, course, the types of students being taught, and teachers’ professional development experiences. Two teachers, one who entered the profession with regular certification through a traditional preparation program, and another who entered with alternative certification and acquired regular certification through additional coursework and passing required tests, can hold the same certification status after a few years of experience. Therefore, research that draws conclusions about the value of traditional teacher preparation, while using certification status as a proxy for traditional preparation, may not be accurately estimating preparation effects (Goldhaber & Brewer, 2000).

Second, research documents significant amounts of heterogeneity in preparation components and requirements within traditional and alternative portals, yet many studies only include these two broad categories in their analyses (Darling-Hammond, Berry, & Thoreson, 2001; Greenberg, Pomerance, & Walsh, 2011; National Research Council, 2010). Third, to best measure the influence of teacher preparation, research should focus on teachers early in their careers, when the effects of preparation are the strongest (Goldhaber and Liddle, 2011, Henry et al. 2013). To date, only a few studies limit their analyses to this early-career sub-sample (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Henry et al., 2013), while others draw inferences
about the value of teacher preparation based upon the effectiveness of teachers more than a
decade removed from formal training (Clotfelter, Ladd, & Vigdor, 2007, 2010; Goldhaber &
Brewer, 2000).

Finally, due to teacher selection into training portals (Boyd, Grossman, Lankford, Loeb,
& Wyckoff, 2006) and the non-random attrition of teachers from the profession (Chingos &
Peterson, 2011; Goldhaber, Gross, & Player, 2011; Henry, Bastian, & Fortner, 2011; Krieg,
2006), great care must be taken when interpreting preparation estimates. Without a measure of
teachers’ academic ability or general human capital prior to entering a teacher preparation
program, estimates of teachers’ effectiveness combine the effects of selection and preparation;
likewise, if teachers exit the profession from certain portals at greater rates than others, or if
more or less effective teachers exit at greater rates from certain portals, then these estimates
combine the effects of teacher preparation and longevity (Henry, Bastian, & Fortner, 2011;
Henry, Fortner, & Bastian, 2012).

While there is a burgeoning research literature on performance disparities between
regular and alternatively certified teachers, and some research contrasting traditionally and
alternatively prepared teachers, there is currently a dearth of literature focusing on out-of-state
prepared instructors. To date, two studies have separately examined the effectiveness of out-of-
state prepared teachers: (1) Henry and colleagues, 2013, in North Carolina, and (2) Goldhaber
and Liddle, 2011, in Washington State. Henry et al. found that teachers prepared out-of-state
were significantly less effective than traditionally prepared in-state teachers in elementary grades
mathematics and reading, where out-of-state prepared teachers are highly concentrated, and in
high school mathematics and science. While this work represents an important advance in
teacher preparation research, this study did not: (1) compare the effectiveness of out-of-state
prepared teachers with that of teachers from any other route into the profession other than in-
state prepared teachers or (2) investigate explanations for these performance disparities. These
points will be addressed in this study. In contrast, Goldhaber and Liddle return few effectiveness
differences between teachers in Washington prepared at in-state education programs and out-of-
state prepared teachers.

In the next section we lay out our hypotheses concerning disparities in performance for
out-of-state prepared teachers that motivated this study.
Explanations of Performance Disparities for Out-of-State Prepared Teachers

The Quality of Imported Teachers

Prior research indicates that teachers have geographically small labor markets, preferring to work close to their hometown and/or undergraduate institution (Boyd, Lankford, Loeb, & Wyckoff, 2005; Reininger, 2012). Additionally, research shows that teachers with higher levels of human capital are, on average, more effective (Clotfelter, Ladd, & Vigdor, 2007, 2010; Dobbie, 2011; Goldhaber, 2007; Greenwald, Hedges, & Laine, 1996; Henry, Bastian, & Smith, 2012; Rockoff, Jacob, Kane, & Staiger, 2011). Taken together, we hypothesize that in states/labor markets where the supply of teachers exceeds demand—especially in low-growth states where education programs prepare more teachers than can be absorbed into the workforce—if the labor market operates with reasonable efficiency the teachers with higher levels of human capital will be hired locally and the teachers with lower levels of human capital will be forced to broaden their job search to states experiencing teacher shortages. Quite simply, labor market forces, such as insufficient levels of local demand for new teachers and teacher preferences for proximity to home, may push less-skilled and lower human capital teachers to seek teaching positions in states, such as North Carolina, with teaching shortages.

To empirically examine this hypothesis we test whether a measure of teacher human capital mediates the effectiveness differences between out-of-state prepared and in-state prepared and alternative entry teachers. From the view of the importing state, the relevant question is the level of human capital of the imported out-of-state prepared teachers compared with the human capital of the in-state prepared and alternative teachers hired in the importing state. To select a mediator for this analysis, a measure of individual human capital taken prior to entry into the teaching profession that is significantly associated with student achievement gains is required. From these criteria we selected a standardized, composite measure of all available teacher test scores—SAT/ACT, Praxis I exams, Praxis II exams—which is shown in prior work to be significantly associated with teachers’ ability to increase students’ achievement (Clotfelter, Ladd, & Vigdor, 2007, 2010; Goldhaber, 2007). If out-of-state prepared teachers are no longer

1 In prior research another indicator of teacher human capital, the Barron’s ranking for a teacher’s undergraduate institution, has sometimes been positively associated with student achievement gains (Clotfelter, Ladd, & Vigdor, 2007, 2010). However, in our preliminary analyses the Barron’s ranking was not correlated with achievement gains after adjusting for other covariates. Thus, we rely only on teacher test scores to test our first hypothesis.
significantly less effective or the magnitude of the effectiveness differences is markedly reduced after the inclusion of this human capital indicator, this would suggest that the quality of imported teachers helps explain the underperformance of out-of-state prepared instructors.

**Teachers’ Lack of Familiarity with the Importing State**

As a result of the state standards/accountability movement and No Child Left Behind, each state has unique standards, curriculum, and assessments on which their educational systems are built. Importantly, the differences between states in these standards and assessments are substantial, and to the extent that teacher preparation programs are regulated by states, in-state colleges and schools of education may structure their course content and academic requirements to enable their graduates to become more familiar with the state curricula and academic content than individuals prepared elsewhere (Carnoy & Loeb, 2002; Porter, Polikoff, & Smithson, 2009). Through student teaching and other field experiences, pre-service teachers at in-state colleges and schools of education will also enjoy more opportunities to engage in teaching practice in educational environments—types of students, curriculum/content, and schools—similar to their future, in-service classroom placements. Based on recent research which suggests that early-career instructors benefit from greater pre-service exposure to the school environments in which they will teach and the academic content they are expected to teach, we hypothesize that out-of-state prepared teachers will be less familiar with North Carolina’s educational environment and therefore, less effective than in-state prepared teachers (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009). Out-of-state prepared teachers may also underperform in-state prepared and alternative entry instructors, many of whom have been long-term North Carolina residents, due to a lack of familiarity with the importing state’s culture and students.

We test this lack of familiarity hypothesis in two ways. First, based on the theory that teachers in adjacent states might be more familiar with the importing state given regional similarities, we separate out-of-state prepared instructors into two groups—those entering North Carolina with preparation from a university in a contiguous state and those entering North Carolina with preparation from a university in a non-contiguous state. For this hypothesis to

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2 Through the recent adoption of the Common Core, state standards and assessment systems will soon become more similar. During the study period for this analysis (2005-06 through 2009-10), however, there were significant differences between states.

3 This test of the lack of familiarity hypothesis is particularly salient since North Carolina imports over 50% of its early-career out-of-state prepared teachers from four states in different parts of the country—New York, Pennsylvania, Michigan, and Ohio.
hold, we expect: (1) teachers prepared in non-contiguous states to be less effective, particularly underperforming their in-state prepared peers who have greater exposure to the state’s schools, curricula, and culture; and (2) teachers prepared in contiguous states to perform similarly to their in-state prepared and alternative entry peers. Second, we compare the effectiveness of out-of-state prepared teachers in their first year teaching (when they should possess less knowledge of the state’s educational environment) with that of first year in-state prepared and alternative entry teachers. For this hypothesis to hold, we expect first year out-of-state prepared teachers to be less effective, particularly underperforming their in-state prepared peers whose traditional training increased their familiarity with the state’s educational environment.

Teacher Turnover and Differential Attrition

If, as the first hypothesis and the research cited there suggests, teachers have strong preferences to teach in their home state but are forced through competition to seek teaching positions in other states, we hypothesize that as out-of-state prepared teachers acquire more human capital through experience in the classroom, they will become more attractive for open teaching positions in their states of origin. If this is true, out-of-state prepared teachers can be expected to leave North Carolina public schools at significantly greater rates than teachers with other forms of preparation. Since teachers have been shown to become more effective during their first few years on the job, this turnover may adversely influence student achievement, reduce school stability, substantially increase teacher recruitment/replacement costs, and contribute to large numbers of novice teachers in the workforce (Alliance for Excellent Education, 2004; Henry, Bastian, & Fortner, 2011; Henry, Fortner, & Bastian, 2012; Ronfeldt, Loeb, & Wyckoff, 2013). To establish whether turnover is higher among out-of-state prepared teachers than in-state prepared or alternative entry instructors, we compare teachers’ odds of leaving North Carolina public schools.

In addition to the potential adverse effects of overall teacher turnover rates, differential attrition may also contribute to out-of-state prepared teachers’ ineffectiveness. If the most effective out-of-state prepared teachers exit the state’s public schools, the quality of the remaining out-of-state prepared population would be reduced. Conversely, if the least effective out-of-state prepared teachers exit North Carolina, then the poor performance of out-of-state prepared teachers may actually represent an upwardly biased estimate of their effectiveness. We
test this differential attrition hypothesis by examining the effectiveness of out-of-state prepared teachers who: (1) will leave North Carolina public schools before beginning their sixth year of teaching; and (2) will not return to North Carolina public schools in the following school year (last year). Finally, we examine the extent to which the effort and effectiveness of out-of-state prepared teachers decreases in their last year of employment in North Carolina public schools, a phenomenon known as the Ashenfelter Dip (Ashenfelter, 1978).

Data and Sample

The main objectives for this study were to estimate the comparative effectiveness of out-of-state prepared teachers in elementary school mathematics and reading and to investigate three potential explanations for out-of-state prepared teachers’ underperformance. This required developing and applying a teacher preparation coding scheme, matching students to their classroom teachers, building longitudinal analysis files with student, teacher, classroom, and school characteristics, and estimating effects. The following sections detail our classification of teachers, study sample, and covariates used in the analyses.

Classification of Teachers

Our classification of teachers is based on a combination of the formal education and specific preparation teachers possessed when they began teaching. This means we grouped teachers into exclusive and fixed categories according to their formal preparation—earning a degree or completion of a certificate program—most proximate to entering the profession, whether they completed their preparation in-state or in another state, and whether they had completed all requirements for initial certification. In total, we created three policy relevant teacher preparation categories for this analysis: (1) out-of-state prepared (fully certified upon first entering the teaching profession after earning an undergraduate/graduate degree or completing a licensure/certification program); (2) in-state prepared (fully certified upon first entering the teaching profession after earning an undergraduate/graduate degree or completing a
licensure/certification program); and (3) alternative entry (not fully certified upon first entering the teaching profession).\(^4\)

In order to classify North Carolina elementary school teachers into these groups, we relied on administrative data from three sources: (1) institutional data from the University of North Carolina General Administration (UNCGA) that identified in-state publicly prepared teachers at the undergraduate, graduate, and licensure/certificate level; (2) teacher education, licensure audit, and certified salary files from the North Carolina Department of Public Instruction (NCDPI); and (3) identifiers of Teach For America corps members in the state. From these datasets we employed several key pieces of information to classify teachers. First, we calculated the year an individual began teaching, which facilitated the identification of an individual’s most proximate preparation prior to entry. Second, using the NCDPI licensure audit file we determined the basis for a teacher’s original teaching license. If this initial basis indicated that a teacher had not completed all licensure requirements upon first entering the profession, we classified teachers as alternative entry (without regard to the state from which they received their final degree before beginning to teach). Finally, using the UNCGA and the NCDPI education files, we determined an individual’s graduation year, degree level, and degree origin and assigned individuals to a single teacher preparation category. For example, if an individual earned an undergraduate degree from an out-of-state institution, did not earn any additional degrees (at an in-state institution) before entering the profession, and had completed all licensure requirements prior to entry, we classified them into the out-of-state prepared category. If an individual earned multiple degrees prior to beginning teaching, we classified them according to the degree most proximate to their entry into the profession. We believe this coding scheme and its focus on the fixed preparation and training of teachers as they enter the profession represents an advance over coding schemes based on teachers’ certification status and allows us to accurately estimate the effects of preparation.\(^5\)

\(^4\) Approximately 2% of the sample was unclassifiable because: (1) they did not have a college graduation year in the administrative data; (2) their highest degree earned prior to beginning teaching was less than a bachelor’s degree; or (3) administrative data recorded the person teaching more than one year prior to their earliest graduation year. We retained these unclassifiable teachers in analyses but do not report their effects. Results for unclassifiable teachers are available upon request.

\(^5\) Here, estimates of preparation would include both the training and formal education received by participants and the selection of participants into particular preparation pathways or portals.
**Study Sample**

The data for this analysis span the 2005-06 through the 2009-10 school years and are limited to teachers with less than five years teaching experience. We restrict our sample to these early-career teachers for three reasons. First, we believe teachers are most likely to display measurable and relevant preparation influences early in their careers, before on-the-job learning overwhelms effects. Second, for states considering policy mechanisms to improve the quality of their teacher workforce, individuals who recently entered the profession entail particular significance since they comprise more than twenty-five percent of the teaching population (Ingersoll & Merrill, 2010). Finally, we limit our sample because out-of-state prepared teachers are highly concentrated in elementary schools, representing nearly 37 percent of the early-career, tested-grades (3-5) instructors (See Table 3 for unique teacher counts from models).

For this analysis, the key data feature is our use of actual classroom rosters, which allowed us to validly match students to approximately ninety-three percent of individual instructors over the five-year study period, construct classroom level covariates, and account for multiple teachers within a subject-year for a given student. Numerous other student, teacher, classroom, and school characteristics were merged into these files and used in various model specifications to account for factors influencing student achievement outside the control of a teacher preparation category. In total, across elementary school mathematics and reading models, we analyzed 886,865 test scores, 447,347 unique students, and 12,192 unique teachers.

**Dependent Variables and Covariates**

For this analysis students’ prior and current test score performance is based on the North Carolina grade three pre-test and the End-of-Grade (EOG) mathematics and reading exams in grades 3-5.6 These EOG exams are criterion-referenced—based on the North Carolina Standard Course of Study objectives for each course—vertically equated across years to allow for meaningful comparisons, and have been rigorously analyzed to ensure valid psychometric properties (North Carolina Department of Public Instruction, 2011). To remove any secular trends, all tests were standardized within subject, grade, and year, such that a standardized value of zero represents the average score for that subject-year, and consecutive standardized values of

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6 Before the 2009-10 school-year North Carolina discontinued the 3rd grade pretest. Therefore, value-added outcomes are not available for 3rd grade teachers in that year.
zero for a particular student indicate that she made gains equivalent to the average student. Additionally, we included year fixed effects in our model specifications. The focal variables used in this analysis are indicator variables for in-state prepared and alternative entry teachers in comparison with out-of-state prepared teachers (reference category). To adjust for factors influencing teacher effectiveness outside the control of teacher preparation, including potential distributional differences by teacher preparation type, models also include a rich set of student, classroom, teacher, and school covariates, as listed in Table 1. Finally, depending on the model specification or hypothesis test, some models drop or include control variables for particular analyses.

Table 1: Covariates for Analyses

<table>
<thead>
<tr>
<th>Student Covariates</th>
<th>Class and Teacher Covariates</th>
<th>School Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Prior test scores (reading and math)</td>
<td>16) Class size</td>
<td>21) School size</td>
</tr>
<tr>
<td>2) Classmates prior test scores</td>
<td>17) Heterogeneity of prior achievement within the classroom</td>
<td>22) School size squared</td>
</tr>
<tr>
<td>3) Days absent</td>
<td>18) Teacher out-of-field status</td>
<td>23) Violent acts per 1,000 students</td>
</tr>
<tr>
<td>4) Structural mobility</td>
<td>19) Single year indicators for teacher experience</td>
<td>24) Short-term suspension rate</td>
</tr>
<tr>
<td>5) Within year mobility</td>
<td>20) Teacher preparation categories</td>
<td>25) Total per-pupil expenditures</td>
</tr>
<tr>
<td>6) Other between year mobility</td>
<td>a. Out of state prepared (reference group)</td>
<td>26) District teacher supplements</td>
</tr>
<tr>
<td>7) Race/ethnicity</td>
<td>b. In-state prepared</td>
<td>27) Racial/ethnic composition</td>
</tr>
<tr>
<td>8) Gender</td>
<td>c. Alternative entry</td>
<td>28) Concentration of poverty</td>
</tr>
<tr>
<td>9) Poverty status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Gifted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Disability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) Currently limited English proficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13) Was limited English proficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14) Overage for grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15) Underage for grade</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: We included these covariates in our preferred rich covariate adjustment and school fixed effects analyses. Student fixed effects exclude time-invariant student characteristics; school-year fixed effects exclude school-level variables. Most models testing hypotheses for out-of-state prepared teacher ineffectiveness include these covariates, substituting or adding variables as needed per the empirical test performed.

Methodology

Teacher Value-Added

The goal of this analysis is to estimate the relative effectiveness of out-of-state prepared teachers compared to in-state prepared and alternative entry instructors. To do this we utilize our extensive administrative database and specify an ordinary least squares (OLS) value-added
model with a rich set of student, classroom, teacher, and school covariates (Table 1). We use cluster-adjusted standard errors at the school-year level to account for the nesting of students and teachers within schools that, if left unadjusted, could result in reduced standard errors and significance tests that produce false positives. The equation used to estimate teacher preparation category effects is as follows:

\[ Y_{ijst} = \beta_0 + \beta_1 Y_{it-n} + \beta_2 \text{Instate} + \beta_3 \text{Alternative} + \beta_x X_{ijst} + \beta_z Z_{jst} + \beta_w W_{st} + \epsilon_{ijst} \]  

(1)

where \( Y_{ijst} \) is the test score for student \( i \) in classroom \( j \) in school \( s \) at time \( t \);

\( \beta_2 \) and \( \beta_3 \) estimate the average effect of in-state prepared and alternative entry instructors relative to out-of-state prepared teachers;

\text{In-state} and \text{Alternative} are indicator variables that equal 1 if the teacher entered teaching through that category and 0 if not;

\( Y_{it-n} \) represents the prior test scores for student \( i \);

\( X_{ijst} \) represents a set of individual student covariates;

\( Z_{jst} \) represents a set of classroom and teacher covariates;

\( W_{st} \) represents a set of school covariates;

and \( \epsilon_{ijst} \) is a disturbance term representing all unexplained variation.

In response to our preferred rich covariate adjustment model, the fundamental question is how well it controls for endogeneity threats. Recent studies assessing alternative identification strategies have shown that covariate adjusted estimates, when rich covariates are available, substantially reduce bias in effect estimates in comparison to estimates from a randomized control trial (Bifulco, 2012; Glazerman, Levy, & Myers, 2003; Shadish, Clark, & Steiner, 2010). Furthermore, we prefer the OLS approach because rich covariate adjustment models estimate teacher preparation category effects based on the entire (statewide) sample of teachers, rather than the more limited sample of within-unit variation in fixed effects approaches. However, if the non-random assignment of teachers to students or unmeasured school factors, such as school leadership quality, affect student test performance and are (1) correlated with the preparation categories and (2) omitted from models, then fixed effects will produce preferred, internally valid estimates of teacher preparation effectiveness.
Therefore, to assess the robustness of our preferred OLS value-added model, we employ three fixed effects specifications—school fixed effects, school-by-year fixed effects, and student (levels model) fixed effects. Here, the school fixed effects limit comparisons to students and teachers within the same school, thereby eliminating any uncontrolled, time-invariant school factors that may influence estimates, while the school-by-year fixed effects restrict teacher preparation comparisons to students and teachers in the same school and year to control for unmeasured school and temporal trends. Our student fixed effects model is a levels (no prior test score) specification that uses students as their own control and compares students’ test score outcomes (deviation from the students’ mean scores standardized by grade and year) when taught by an out-of-state prepared teacher to outcomes when instructed by an in-state prepared or alternative entry teacher. These fixed effects models continue to include a rich set of student, classroom, teacher, and school covariates to isolate the effect of preparation categories—we exclude time-invariant student characteristics from the student fixed effects models and school covariates from the school-by-year fixed effects models. Because these fixed effects approaches only identify coefficients based on within-unit (school, school-by-year, or student) variation, the results table (Table 3) for our first research question includes counts of unique teachers contributing to the preparation category estimates. Furthermore, all results tables provide observation counts for the student test records that contributed to the teacher preparation estimates. For instance, observation counts for school fixed effects models exclude schools in which no out-of-state prepared teachers worked or only out-of-state prepared teachers worked during our study period. Due to the small sample of student test records identifying estimates in the student fixed effects models—see Table 3 for counts—we only use the OLS, school fixed effects, and school-by-year fixed effects models to test our three research-based hypotheses.

**Teacher Turnover**

To test part of our third hypothesis, we examine teacher turnover using a logistic regression framework with last year (not returning to North Carolina public schools in the following school year) as the dependent variable, out-of-state prepared teachers as the reference category, and a set of classroom, teacher, and school covariates to control for differences in
employment context that may influence teacher persistence in North Carolina public schools. The equation for this specification is as follows:

\[
Pr(\text{lastyear}_{it} = 1) = \frac{\exp(\text{teacherprep}_i \alpha + \text{Class}_{it} \beta + \text{School}_{it} \tau)}{1 + \exp(\text{teacherprep}_i \alpha + \text{Class}_{it} \beta + \text{School}_{it} \tau)} \tag{2}
\]

where \(\text{lastyear}_{it}\) is a binary indicator for whether a teacher returns to North Carolina public schools in the following school year;

\(\text{teacherprep}_i\) is a set of teacher preparation indicators for in-state and alternative entry instructors in reference to out-of-state prepared teachers;

and \(\text{class}_{it}\) and \(\text{school}_{it}\) are a set of classroom/teacher and school contextual factors that may influence teacher persistence.

Results

Descriptive Information

Before reviewing the teacher preparation results from rich covariate and fixed effects models, we briefly present descriptive information regarding students’ academic achievement and economic status in the schools and classrooms in which our sample of teachers work. Here, we use standard independent sample t-tests to determine whether there are statistically significant differences in the school/classroom environments of out-of-state prepared teachers and in-state prepared or alternative entry instructors. Examining Table 2, the data show that in comparison to alternative entry teachers, early-career out-of-state prepared instructors teach: (1) students with higher average prior test scores; (2) in classrooms where fewer students qualify for subsidized lunches; and (3) in schools where more students pass their EOG tests and fewer students qualify for subsidized lunches. In comparison to in-state prepared teachers, early-career out-of-state prepared instructors also teach in classrooms and schools with a lower percentage of students qualifying for subsidized lunches. Overall, the data suggest that, relative to in-state prepared or alternative entry instructors, out-of-state prepared teachers are not distributed into more challenging working conditions (in fact the reverse is more consistent with the data), as

\[7\text{ In addition to this logistic regression, we also performed logit regressions with school and school-by-year fixed effects. Results from these models were very similar to our presented findings in Table 7.}\]
measured by student performance and economic disadvantage indicators, which might adversely influence their effectiveness.

### Table 2: Teacher Preparation Category Descriptive Information

<table>
<thead>
<tr>
<th>Teacher Preparation Category</th>
<th>Students’ Average Prior EOG Scores</th>
<th>Classroom Percent Free or Reduced Price Lunch</th>
<th>Average School Performance Composite</th>
<th>School Percent Free or Reduced Price Lunch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
<td>ES Read</td>
</tr>
<tr>
<td>Out-of-State Prepared</td>
<td>-0.069 (-0.539)</td>
<td>-0.079 (-0.510)</td>
<td>47.77 (26.59)</td>
<td>49.27 (26.29)</td>
</tr>
<tr>
<td>In-State Prepared</td>
<td>-0.073 (0.482)</td>
<td>-0.069* (0.465)</td>
<td>50.60** (25.07)</td>
<td>51.42** (24.44)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>-0.335** (0.602)</td>
<td>-0.343** (0.611)</td>
<td>53.32** (28.75)</td>
<td>55.42** (28.04)</td>
</tr>
</tbody>
</table>

Note: In the table above, students’ average prior EOG scores and classroom percent free reduced-price lunch identify unique teacher-classroom combinations. Average school performance composite (number of tests passed at a school divided by the number of tests taken) and school free reduced-price lunch identify unique teacher-school-year combinations. * Indicates values statistically different than those for out-of-state prepared teachers at the 0.05 level; ** indicates values statistically different than those for out-of-state prepared teachers at the 0.01 level.

### How Effective are Out-of-State Prepared Teachers?

For our preferred rich-covariate adjustment model, Table 3 shows that both in-state prepared and alternative entry teachers significantly outperform out-of-state prepared teachers in mathematics and reading. In-state prepared instructors are 0.024 and 0.012 standard deviations more effective in mathematics and reading, respectively; alternative entry teachers are 0.030 and 0.013 standard deviations more effective. Using school, school-by-year, or student fixed effects to adjust for the sorting of students and teachers or other unmeasured school characteristics does not alter the substance of these results. Out-of-state prepared teachers significantly underperform their in-state prepared and alternative entry peers across all model specifications.
### Table 3: Elementary School Mathematics and Reading Outcomes

<table>
<thead>
<tr>
<th>Teacher Preparation Category</th>
<th>Rich Covariate Adjustment</th>
<th>School Fixed Effects</th>
<th>School-Year Fixed Effects</th>
<th>Student Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
<td>ES Read</td>
</tr>
<tr>
<td>In-state Prepared</td>
<td>0.024**</td>
<td>0.012**</td>
<td>0.019**</td>
<td>0.011**</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>0.030**</td>
<td>0.013*</td>
<td>0.029**</td>
<td>0.025**</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>715,172</td>
<td>1,008,362</td>
<td>638,290</td>
<td>883,837</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Student Covariates**: ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

**Classroom/Teacher Covariates**: ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

**School Covariates**: ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

**Unique Teacher Counts Contributing to Preparation Category Estimates**

| In-state Prepared           | 5,330 | 5,413 | 4,509 | 4,603 | 3,672 | 3,753 | 3,577 | 3,682 |
| Alternative Entry           | 1,278 | 1,323 | 1,083 | 1,117 | 871  | 903  | 753  | 796  |

Note: All coefficients are in relation to out-of-state prepared teachers. * indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

While the significant results in Table 3 are not large, approximately one to three percent of a standard deviation, depending upon the subject, this effect size is comparable to findings from other early-career teacher preparation research (Boyd et al., 2006; Kane, Rockoff, & Staiger, 2008). To make these estimates more tangible, we used the average gains in EOG scale score points between elementary grades and the average standard deviation on elementary grades EOG tests to convert the effects in Table 3 into equivalent days of student learning in a 180 day school calendar. Here, in comparison to students instructed by out-of-state prepared teachers, the in-state prepared effects of 0.024 and 0.012 in the rich covariate adjustment mathematics and reading models are worth approximately 6 and 3.5 additional days of student learning, respectively; the alternative entry effects of 0.030 and 0.013 are worth approximately 7.5 and 3.7 additional days of student learning in mathematics and reading, respectively (Henry, Thompson, Fortner, Bastian, & Marcus, 2011). In practical terms for statewide student achievement, the
magnitude of these effects must be considered alongside the size of the teacher preparation category. As shown in the bottom panel of Table 3, out-of-state prepared teachers are the second largest source of elementary school teachers in North Carolina, comprising approximately 37 percent of the early-career tested-grades teacher workforce. During this five year study period these teachers taught nearly 200,000 students in grades 3-5, meaning, for example, that replacing all out-of-state prepared teachers with in-state prepared teachers would be equivalent to 1.2 million days of additional student learning in elementary grades mathematics. Consequently, the poor performance of out-of-state prepared teachers has widespread effects. In the following sections we attempt to explain the performance of out-of-state prepared teachers.

**Why Do Out-of-State Prepared Teachers Underperform?**

*The Quality of Imported Teachers*

To empirically examine our first hypothesis concerning the human capital of imported instructors, we test whether an indicator of teacher quality—a standardized, composite measure of all available teacher test scores—mediates the effectiveness differences between out-of-state prepared and in-state prepared and alternative entry teachers shown in Table 3. Following the mediation procedures set forth in Shrout and Bolger, we began by determining whether our teacher test score measure was significantly associated with student achievement (Shrout & Bolger, 2002). Results presented in the top panel of Table 4—from a model with a rich-set of student, classroom/teacher, and school covariates, but without teacher preparation covariates—show that a composite measure of teacher test scores strongly predicts student achievement gains (In the elementary grades reading school-by-year fixed effects model the p-value was 0.059). This finding corroborates prior research and indicates that, on average, teachers with higher levels of human capital are more effective (Clotfelter, Ladd, & Vigdor, 2007, 2010; Goldhaber, 2007). Next, to determine whether this human capital indicator mediates the effectiveness differences between our teacher preparation categories, we ran our rich covariate and fixed effects models (school and school-by-year) and included the teacher test score variable. The

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8 Approximately 18% of the teachers in our study sample were originally missing a value for the composite teacher test score variable. In order to run our mediation analyses on the same sample of teachers and students we created a dataset with all available information about our sample teachers and the classrooms and schools in which they work and used the SAS proc mi (multiple imputation) command to impute the missing teacher test score values. Findings from a non-imputed mediation analysis are comparable to the presented results and available upon request.
bottom panel of Table 4 shows that even after controlling for teacher test scores, in-state prepared and alternative entry teachers remain significantly more effective than out-of-state prepared teachers. Comparing the teacher preparation category results in Table 4 with those in Table 3, we find no evidence of mediation. All of the in-state prepared coefficients are equivalent between the tables, while the alternative entry effects in math are slightly larger with the mediator included. With these findings we reject our first hypothesis as an explanation for out-of-state prepared teachers’ underperformance. Human capital differences between out-of-state prepared teachers and those in-state prepared and alternative entry instructors working in North Carolina do not appear to explain why out-of-state prepared teachers underperform. It is still possible, however, that human capital differences do exist between out-of-state prepared teachers working in North Carolina and their peers who were hired in their states of origin.

Table 4: Examining the Quality of Imported Instructors

<table>
<thead>
<tr>
<th>Do Teacher Test Scores Significantly Predict Student Achievement Gains?</th>
<th>Rich Covariate Adjustment</th>
<th>School Fixed Effects</th>
<th>School-Year Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardized Teacher Test Scores</td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
</tr>
<tr>
<td></td>
<td><strong>0.029</strong></td>
<td><em>0.005</em></td>
<td><strong>0.028</strong></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>715,172</td>
<td>1,008,362</td>
<td>714,198</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do Teacher Test Scores Mediate the Teacher Preparation Effects?</th>
<th>Rich Covariate Adjustment</th>
<th>School Fixed Effects</th>
<th>School-Year Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-State Prepared</td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
</tr>
<tr>
<td></td>
<td><strong>0.023</strong></td>
<td><em>0.012</em></td>
<td><strong>0.019</strong></td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.003)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
</tr>
<tr>
<td></td>
<td><strong>0.035</strong></td>
<td><em>0.013</em></td>
<td><strong>0.034</strong></td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.005)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Standardized Teacher Test Scores</td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
</tr>
<tr>
<td></td>
<td><strong>0.030</strong></td>
<td><em>0.005</em></td>
<td><strong>0.029</strong></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>715,172</td>
<td>1,008,362</td>
<td>638,290</td>
</tr>
</tbody>
</table>

Note: The coefficients on standardized teacher test scores in the top panel test whether this measure of human capital significantly predicts student achievement. The coefficients in the bottom panel, when compared to those in Table 3, indicate whether teacher test scores mediate the differences in teacher preparation category effectiveness. * indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.
Teachers’ Lack of Familiarity with the Importing State

We test our lack of familiarity hypothesis in two ways. First, we separated out-of-state prepared teachers into two groups—those entering North Carolina with preparation from a contiguous state (Virginia, Tennessee, Georgia, and South Carolina) and those entering with preparation from a non-contiguous state—and ran separate models comparing contiguous and non-contiguous out-of-state prepared instructors (as the reference group) to our other teacher preparation categories. Here, we hypothesized that teachers prepared in contiguous states, due to a greater familiarity with North Carolina’s educational environment and culture, would perform comparably to in-state prepared and alternative entry instructors, while teachers prepared in non-contiguous states would continue to underperform. As shown in Table 5, results for in-state prepared teachers in the elementary school reading models substantiate our hypothesis. In the rich covariate, school, and school-by-year fixed effects specifications, out-of-state prepared teachers from contiguous states perform comparably to in-state prepared teachers (top panel of Table 5), while out-of-state prepared teachers from non-contiguous states continue to be less effective than in-state prepared teachers (bottom panel of Table 5). While our hypothesis holds for alternative entry instructors in the rich covariate reading models, alternative entry teachers remain significantly more effective than both contiguous and non-contiguous out-of-state prepared teachers in the fixed effects specifications. Results from the elementary school mathematics models do not support our hypothesis—whether prepared in states contiguous or non-contiguous to North Carolina, out-of-state prepared teachers remain less effective than in-state prepared and alternative entry instructors. Because most elementary school classrooms in North Carolina are self-contained, meaning the same teacher is responsible for both mathematics and reading instruction, these in-state prepared reading findings suggest that the importance of regional familiarity differs across the two subjects. Whether these reading results are due to differences in the curriculum across states or unfamiliarity with the state’s students and culture is not discernible from these data.
Table 5: Out-of-State Teacher Performance from Contiguous and Non-Contiguous States

<table>
<thead>
<tr>
<th>Teacher Preparation Category</th>
<th>Out-of-State Teachers from Contiguous States as the Reference Group</th>
<th>Out-of-State Teachers from Non-Contiguous States as the Reference Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rich Covariate Adjustment</td>
<td>School Fixed Effects</td>
</tr>
<tr>
<td></td>
<td>ES Math</td>
<td>ES Read</td>
</tr>
<tr>
<td>In-state Prepared</td>
<td>0.021**</td>
<td>0.005</td>
</tr>
<tr>
<td>(0.008)</td>
<td>(0.006)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>0.027**</td>
<td>0.006</td>
</tr>
<tr>
<td>(0.010)</td>
<td>(0.007)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>490,941</td>
<td>702,387</td>
</tr>
</tbody>
</table>

Note: All coefficients are in relation to out-of-state prepared teachers (contiguous or non-contiguous state preparation). * indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

Second, based on research by Boyd and colleagues, we hypothesized that the lack of familiarity effects will occur during an out-of-state prepared instructor’s first year teaching, before they become acculturated to the state’s educational environment and culture (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009). To test this explanation we limited our sample to first year teachers only and compared the effectiveness of out-of-state prepared instructors to in-state prepared and alternative entry teachers. Here, Table 6 shows that first year in-state prepared teachers are significantly more effective in two mathematics models (rich covariate and school fixed effects) while alternative entry teachers are significantly more effective in one mathematics (rich covariate) and two reading models (school and school-by-year fixed effects). These alternative entry findings may be more indicative of familiarity with the state’s culture—first year alternative entry teachers also lack exposure to the state’s schools and curricula gained during traditional training—while the mathematics results for in-state prepared teachers may be attributable to greater familiarity with the educational context and/or culture. Overall, our two tests provide some support for the lack of familiarity hypothesis.
Table 6: Comparing the Effectiveness of First Year Teachers

<table>
<thead>
<tr>
<th>Teacher Preparation Category</th>
<th>Rich Covariate Adjustment</th>
<th>School Fixed Effects</th>
<th>School-Year Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
</tr>
<tr>
<td>In-state Prepared</td>
<td>0.023** (0.008)</td>
<td>0.006 (0.006)</td>
<td>0.023** (0.009)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>0.035* (0.015)</td>
<td>0.020 (0.12)</td>
<td>0.028 (0.015)</td>
</tr>
</tbody>
</table>

Observations Used | 147,560 | 207,437 | 101,305 | 138,953 | 46,872 | 63,759

Note: All coefficients are in relation to first-year out-of-state prepared teachers. * indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

Teacher Turnover and Differential Attrition

To empirically test our final hypothesis we started by estimating the odds of teachers exiting North Carolina public schools. Here, results in Table 7 indicate that in-state prepared teachers have approximately one-half the odds of exiting North Carolina public schools as their out-of-state prepared peers, while alternative entry instructors are significantly more likely to exit teaching in the state. These results are consistent with our hypothesis that as out-of-state prepared teachers gain human capital through teaching experience in North Carolina, they will become more competitive for open teaching positions in their states of origin. These high rates of turnover for out-of-state prepared teachers could also signal a lack of commitment to teaching in the state that is manifested in a withdrawal of job-related effort. We further investigate this possibility in our differential attrition analyses.

Table 7: Logistic Regression Results for Teacher Turnover

<table>
<thead>
<tr>
<th>Teacher Category</th>
<th>Odds Ratio and Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-state Prepared</td>
<td>0.464** (-14.48)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>1.291** (3.62)</td>
</tr>
</tbody>
</table>

Observations Used | 22,910

Note: Odds ratios are in relation to out-of-state prepared teachers, with teachers exiting North Carolina public schools as the dependent variable. * indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.
In order to investigate potential differential attrition, we limited our sample to out-of-state prepared teachers only. Next, using NCDPI certified salary files, we created two attrition variables: (1) will leave, a time-invariant indicator equal to one for out-of-state prepared teachers who exited North Carolina public schools before beginning their sixth year of teaching; and (2) last year, a time-varying indicator equal to one for out-of-state prepared teachers who did not return to North Carolina public schools in the following school year. Models controlling for will leave indicate whether more or less effective out-of-state prepared teachers exited North Carolina public schools, while models controlling for last year determine whether out-of-state prepared teachers not returning to North Carolina public schools the following school year are more or less effective than those who will stay for another year. Originally, we hypothesized that the differential attrition of the most effective out-of-state prepared teachers might explain their overall ineffectiveness. However, given the high rates of turnover for out-of-state prepared teachers shown in Table 7, results from this last year analysis are particularly important, because if out-of-state prepared teachers exit the state at substantially higher rates and are significantly less effective upon exiting (less effective than staying teachers or themselves in previous school years), this would provide evidence to understand their overall ineffectiveness.

Examining the top portion of Table 8, it is clear that the most effective out-of-state prepared teachers are not exiting North Carolina public schools. In the rich-covariate and school fixed effects specifications, out-of-state prepared teachers who will leave are significantly less effective than peers who will stay. This indicates that the differential attrition of the most effective out-of-state prepared teachers does not explain their overall effectiveness findings. Next, the middle portion of Table 8 demonstrates that out-of-state prepared teachers who will not return to North Carolina public schools the following school year are significantly less effective than their peers who will stay another year. While these last year results may simply indicate that exiting out-of-state prepared teachers are less effective than peers who stay, it is also possible that exiting out-of-state prepared teachers knew they were going to leave North Carolina and that the last year findings are due to a withdrawal of job-related effort (Ashenfelter, 1978). To examine this possibility we included a teacher fixed effect—comparing effectiveness within teachers over time—in our last year models to determine whether out-of-state prepared teachers’ effectiveness dips in their final year. Results from these models in the bottom panel of Table 8 indicate that in their last year out-of-state prepared teachers are significantly less effective in
mathematics than in previous years; no evidence exists for effectiveness drops in elementary grades reading.

Due to the significant effects of teacher turnover on school district budgets and student achievement, the high rate of attrition for out-of-state prepared teachers is a concern (Alliance for Excellent Education, 2004; Ronfeldt, Loeb, & Wyckoff, 2013). While we originally hypothesized that the differential attrition of the most effective out-of-state prepared teachers might explain their underperformance, it is actually the differential attrition of less effective out-of-state prepared teachers—less effective than peers who remain and themselves in previous years (math only)—coupled with high turnover rates that help explain our findings.\(^9\) Overall, it appears that out-of-state prepared teachers who leave North Carolina public schools are less effective, and since they exit in large numbers, their performance while in the state’s classrooms brings down the average effectiveness of the preparation category as a whole.

### Table 8: Teacher Effectiveness for Out-of-State Teachers Who Stay or Leave

<table>
<thead>
<tr>
<th>Focal Variables</th>
<th>Rich Covariate Adjustment</th>
<th>School Fixed Effects</th>
<th>School-Year Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
</tr>
<tr>
<td>Will Leave</td>
<td>-0.024**</td>
<td>-0.024**</td>
<td>-0.021**</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.005)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>260,144</td>
<td>354,849</td>
<td>188,603</td>
</tr>
<tr>
<td>Last Year</td>
<td>-0.035**</td>
<td>-0.025**</td>
<td>-0.033**</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.007)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>260,144</td>
<td>354,849</td>
<td>183,146</td>
</tr>
</tbody>
</table>

**Teacher Fixed Effects: Testing for an Ashenfelter Dip**

<table>
<thead>
<tr>
<th>Focal Variable</th>
<th>ES Math</th>
<th>ES Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last Year</td>
<td>-0.021*</td>
<td>-0.000</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>32,386</td>
<td>43,503</td>
</tr>
</tbody>
</table>

Note: Coefficients for the top two models are in relation to out-of-state prepared teachers who will not exit North Carolina public schools before beginning a sixth year of teaching or who will return for another school year. In the teacher fixed effects model an out-of-state prepared teacher’s effectiveness in his/her last year is compared with his/her effectiveness in previous school years. *indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

\(^9\) See Appendix Table 1 for results that compare out-of-state prepared teachers who will stay with in-state prepared and alternative entry instructors. Relative to the results shown in Table 3, coefficients from these models are reduced by approximately one-quarter (mathematics) and one-half (reading), respectively.
Discussion

In response to a need for both more and better teachers, over the past two decades states have experimented with alternatives to solely licensing instructors prepared at in-state traditional education programs. While alternative entry programs have garnered the most policy and research attention during this time, many states have also reduced barriers to employment and broadened their potential labor pool of traditionally prepared instructors by granting reciprocal certification for out-of-state prepared teachers. Collectively, these reciprocal certification policies have helped facilitate the interstate movement of teachers and have aided high-growth states meet the demand for more teachers. Until recently, however, the effects of this policy choice were largely unexplored. Therefore, in this study we separated traditionally prepared teachers into two groups—in-state and out-of-state prepared—and assessed both the comparative effectiveness of out-of-state prepared instructors and potential explanations for differences in out-of-state prepared teacher performance.

Results indicated clear effectiveness differences within the traditionally prepared teacher population: in-state prepared teachers significantly outperformed their out-of-state prepared peers in elementary school mathematics and reading across all model specifications. Furthermore, alternative entry teachers were also significantly more effective across all subjects and models. As shown in Appendix Table 2, these alternative entry findings are also fairly robust to model specifications that separate two high performing groups of teachers—Teach For America and Visiting International Faculty—from the main alternative entry category. Overall, out-of-state prepared teachers are the second largest and least effective source of early-career instructors in North Carolina elementary schools. In response to these findings, other states may wish to perform similar analyses to assess the effects of their own reciprocal certification policies.

Moving forward with effective policy responses requires an understanding of why out-of-state prepared teachers struggle, and here, our results suggest two factors that help explain out-of-state prepared teachers’ performance. First, out-of-state prepared teachers are less effective due to their lack of familiarity with North Carolina’s educational environment and culture. Out-of-state prepared teachers trained in contiguous states perform comparably to in-state prepared
teachers in reading while those trained in non-contiguous states are less effective; first year in-state prepared teachers are more effective than first year out-of-state prepared instructors in mathematics while first year alternative entry teachers are more effective in reading. These findings are consistent with the composition of imported teachers in North Carolina—a majority come from more urban, distant regions of the Northeast and Midwest, particularly New York, Pennsylvania, Michigan, and Ohio. Furthermore, these findings align with previous research which indicates the importance of training/preparation experiences that mirror the educational environment of future employment (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009).

Second, early-career out-of-state prepared teachers are less effective due to their attrition patterns. The odds that out-of-state prepared teachers will exit North Carolina public schools are approximately twice those of in-state traditionally prepared instructors—this attrition may be attributable to teachers seeking positions in their states of origin and/or difficulties faced by out-of-state prepared teachers from more distant states assimilating into the communities where they work. This turnover, coupled with the ineffectiveness of departing out-of-state prepared teachers (less effective than peers who stay and themselves in previous years), indicates that the average effectiveness of out-of-state teachers is brought down by those who leave. Overall, many North Carolina students are taught by less effective, exiting out-of-state prepared instructors.

In response to these findings several policy solutions seem appropriate. First, North Carolina could increase the total number of in-state prepared teachers in the workforce by improving the yield for in-state preparation programs—the percentage of graduates of in-state preparation programs hired in North Carolina. Second, North Carolina could also increase the production of in-state prepared (undergraduate, graduate, and licensure only) teachers and allow more alternative entry instructors into the workforce. There are two potential concerns with these policy solutions: (1) increasing the quantity of newly prepared in-state and alternative entry teachers could compromise the quality of those teachers if selection/hiring requirements are lowered or if in-state institutions of higher education reduce the quality of preparation in response to growth; and (2) due to the increasing student population of North Carolina public schools, the in-state and alternative entry supply is unlikely to meet demand in the short-term. As alternative policy mechanisms the state could: (1) institute rigorous selection/hiring practices for out-of-state prepared teachers, including intensive recruiting in contiguous states (or those states deemed similar to North Carolina) and focusing on teachers’ non-cognitive characteristics
(Duckworth, Quinn, & Seligman, 2009; Rockoff, Jacob, Kane, & Staiger, 2011); and (2) direct increased resources to induction, mentorship, and other support services that ease an out-of-state prepared teacher’s transition to the state’s curriculum and work environment and aid their assimilation into the communities in which they teach. Finally, the attrition findings from this work—exiting out-of-state prepared teachers adversely impact student achievement—suggest that in addition to better selecting teachers and promoting on-the-job learning with novice teacher induction programs, it may be beneficial for states, assuming the challenges of using teacher value-added scores can be overcome, to proactively filter out less effective early-career teachers.

Given the current labor market context, where individuals are more mobile and change positions more frequently, understanding the potential effects of greater mobility for the teaching profession is critical. Our work suggests that teachers prepared in other states address areas of shortage in importing states, but, on average, are not familiar enough with or committed enough to the importing state. Therefore, we contend that states must craft policies that recognize the labor market(s) for their own state in order to improve teacher effectiveness.
References


### Appendix Table 1: Out-of-State Staying Teachers as the Reference Group

<table>
<thead>
<tr>
<th>Teacher Preparation Category</th>
<th>Rich Covariate Adjustment</th>
<th>School Fixed Effects</th>
<th>School-Year Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Math</td>
<td>Read</td>
<td>Math</td>
</tr>
<tr>
<td>In-state Prepared</td>
<td>0.018** (0.004)</td>
<td>0.006* (0.003)</td>
<td>0.014** (0.004)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>0.025** (0.007)</td>
<td>0.007</td>
<td>0.025** (0.007)</td>
</tr>
<tr>
<td>Out-of-state Prepared Teachers Who Will Leave</td>
<td>-0.024** (0.007)</td>
<td>-0.024** (0.005)</td>
<td>-0.020** (0.006)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>715,172</td>
<td>1,008,362</td>
<td>601,558</td>
</tr>
</tbody>
</table>

Note: All coefficients are in relation to out-of-state prepared teachers who stay. * indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

### Appendix Table 2: Splitting the Alternative Preparation Category

<table>
<thead>
<tr>
<th>Teacher Preparation Category</th>
<th>Rich Covariate Adjustment</th>
<th>School Fixed Effects</th>
<th>School-Year Fixed Effects</th>
<th>Student Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES Math</td>
<td>ES Read</td>
<td>ES Math</td>
<td>ES Read</td>
</tr>
<tr>
<td>In-state Prepared</td>
<td>0.024** (0.004)</td>
<td>0.012** (0.003)</td>
<td>0.019** (0.004)</td>
<td>0.011** (0.003)</td>
</tr>
<tr>
<td>Alternative Entry</td>
<td>0.019* (0.008)</td>
<td>0.005</td>
<td>0.015* (0.007)</td>
<td>0.019** (0.006)</td>
</tr>
<tr>
<td>Teach For America</td>
<td>0.074** (0.019)</td>
<td>0.037* (0.015)</td>
<td>0.089** (0.020)</td>
<td>0.038* (0.016)</td>
</tr>
<tr>
<td>Visiting International Faculty</td>
<td>0.050** (0.015)</td>
<td>0.032** (0.012)</td>
<td>0.055** (0.014)</td>
<td>0.042** (0.011)</td>
</tr>
<tr>
<td>Observations Used</td>
<td>715,172</td>
<td>1,008,362</td>
<td>638,290</td>
<td>883,837</td>
</tr>
</tbody>
</table>

Note: All coefficients are in relation to out-of-state prepared teachers. * indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.