Inputs and Impacts in Charter Schools: KIPP Lynn

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Detailed Terms
The charter school landscape includes a variety of organizational models and a few national franchises. The nation’s largest network of charter schools is the Knowledge is Power Program (KIPP), with 80 schools operating or slated to open soon. KIPP schools target low income and minority students and subscribe to an approach some have called No Excuses (Abigail Thernstrom and Stephen Thernstrom 2003). No Excuses schools feature a long school day and year, selective teacher hiring, strict behavior norms, and encourage a strong student work ethic.

KIPP schools have often been central in the debate over whether schools alone can substantially reduce racial achievement gaps. Descriptive accounts of KIPP suggest positive achievement effects (see, e.g., Jay Mathews 2009), but critics argue that the apparent KIPP advantage reflects differences between students who attend traditional public schools and students that choose to attend KIPP schools (see, e.g., Martin Carnoy, Rebecca Jacobsen, Lawrence Mishel, and Richard Rothstein 2005). There are few well-controlled studies of KIPP schools that might help sort out these competing claims, and none that focus on KIPP.1

This paper reports on a quasi-experimental evaluation of the only KIPP school in New England, KIPP Academy Lynn. KIPP Lynn opened in the fall of 2004 and is the only charter school in Lynn, Mass., a low income city north of Boston. KIPP Lynn is a middle school that serves about 300 students in grades 5–8. Like most other Massachusetts charter schools, KIPP Lynn is funded primarily through tuition paid by students’ home districts. Tuition is typically set to match sending districts’ average per pupil expenditure, though this is offset by state subsidies to the sending district when a student first transfers.

Each KIPP school sets its own curriculum, but KIPP Lynn shares many features with other KIPP schools. KIPP Lynn has a long school year, starting in August and including some Saturdays, and a long school day, running from 7:30 in the morning to 5:00 in the afternoon. Students are expected to conform to a behavioral code and receive “paychecks,” points awarded for good work that can be spent on field trips and other perks. Parents or guardians, students, and teachers are asked to sign a “Commitment to Excellence,” a promise to come to school on time and work hard, among other things.

As at other KIPP schools, KIPP Lynn’s non-union teachers work long hours and are expected to be on call to assist their students in the evening. Many KIPP Lynn teachers are graduates of the national Teach For America (TFA) internship program. KIPP Lynn teachers are much younger than middle school teachers in the Lynn Public Schools (LPS), and more likely to be African American.

Most KIPP Lynn students live in Lynn and would otherwise attend an LPS school. The population of Lynn is more than two-thirds white, but 70 percent of the 13,000 students in LPS are nonwhite. This is documented in Table 1, the first two columns of which show average characteristics of fifth graders, the entry grade for KIPP Lynn. (Some applicants who have already completed fifth grade enter KIPP Lynn by repeating a grade, as do a small number of sixth graders.) LPS fifth graders are 42 percent Hispanic, 17 percent black, and 11 percent Asian. KIPP fifth graders are 57 percent Hispanic and 24 percent black, with few Asians. Roughly 19 percent of students are classified as special education at both LPS and KIPP. LPS has a moderately

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1 See, for example, the studies linked at http://www.kipp.org/01/independentreports.cfm. Caroline M. Hoxby and Sonali Murarka’s (2009) quasi-experimental study of New York City charters includes four KIPP schools. Will Dobbie and Roland G. Fryer Jr. (2009) use quasi-experimental methods to study charter schools in Harlem.
higher proportion classified as having limited English proficiency (LEP), 22 percent versus 17 percent at KIPP. Many charter schools in the Northeast are disproportionately nonwhite, but KIPP Lynn is unusual in enrolling such a high proportion of Hispanic, LEP, and special education students. This is significant, because critics have charged that charter schools ignore or have been unsuccessful with these populations.2

Statewide regulations require Massachusetts charter schools to use a lottery when oversubscribed. KIPP Lynn was undersubscribed when it opened in the fall of 2004 and only marginally oversubscribed in 2005. More recently, however, more than 200 students have applied for about 90 seats. The 2005-2008 admissions lotteries are used here to develop a quasi-experimental research design. These randomized lotteries allow us to estimate the causal effect of KIPP Lynn on achievement, solving the problem of selection bias that plagues most studies of school effectiveness.

I. Data and Empirical Framework

A. Data

We started with lists of applicants to KIPP Lynn for 2005 through 2008. These four applicant cohorts were matched to the Massachusetts Student Information Management System (SIMS), a database with demographic and other information for all public school students in the state. We found 91 percent of KIPP applicants in the SIMS database, though winners are somewhat more likely to be matched than losers.3 Applicants’ SIMS records were then matched

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2 For example, this United Federation of Teachers report: http://www.uft.org/news/issues/uft_report-separate_and_unequal.pdf

3 Controlling for year of application and whether the applicant comes from LPS, the match differential is about ten percent. Looking at LPS applicants only, however, the differential falls to 0.029 (SE = 0.027). An analysis using only applicants from LPS generates results almost identical to those reported here.
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We corrected most of the entries by reviewing
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By virtue of random assignment, we should expect
cohort is the only one observed in eighth grade.
LPS students had low
fourth grade math and ELA scores, about a third
likely to be nonwhite. LPS students
are poor and mostly nonwhite, but students at
KIPP Lynn applicants and enrolled students
of KIPP Lynn lottery applicants. LPS students
years at KIPP Lynn in our sample period.
Table 1 reports descriptive information for
samples of fifth graders attending LPS and KIPP
Lynn during our study period, and for our sample
of KIPP Lynn lottery applicants. LPS students
are poor and mostly nonwhite, but students at
KIPP Lynn tend to be poorer and are even more
likely to be nonwhite. LPS students had low
fourth grade math and ELA scores, about a third
of a standard deviation below the state average.
KIPP Lynn applicants and enrolled students
were even further behind.
Lottery winners and losers are similar, a fact
documented in column (4) of Table 1, which
reports differences in demographic characteristics
and baseline scores between winners and losers.3
By virtue of random assignment, we should expect
these differences to be small. In practice, however,
our reconstruction of the KIPP lotteries is based
on spreadsheets with some missing information.
We corrected most of the entries by reviewing
the lottery records with school staff but may not
have fixed the problem entirely. It is therefore
especially encouraging that most pre-treatment
characteristics come out balanced. Only one vari-
able (proportion Asian) shows a marginally signif-
ificant difference between winners and losers. The
F-statistic for a joint test of balance on all charac-
teristics gives little cause for concern.
Although lottery winners and losers look
similar at the time the lotteries were held, subse-
quent attrition may lead to important differences
in the follow-up sample if the attrition process is
nonrandom (attrition here means exit to a private
school or a move out of state). Of particular con-
cern is whether we are more likely to have test
score outcomes for winners than for losers. We
observe math and ELA scores for about 85 per-
cent of charter lottery losers. Lottery winners are
about five points more likely to have follow-up
scores, but these differences shrink and become
insignificant with controls. These small follow-
up differentials seem unlikely to impart substan-
tial selection bias in our impact analysis.

B. 2SLS Strategy
We’re interested in the causal effect of KIPP
Lynn on MCAS scores, where this effect is mod-
eled as a function of time spent in KIPP. The
equation of interest is

\[
\begin{align*}
\gamma_{igt} &= \alpha_i + \beta_g + \sum_j \delta_{ij} d_{ij} + \gamma' X_i \\
&\quad + \rho s_{igt} + \epsilon_{igt},
\end{align*}
\]

where \(\gamma_{igt}\) denotes the scores of student \(i\) tested in
year \(t\) in grade \(g\). The variable \(s_{igt}\) records years
spent at KIPP Lynn as of the test date, counting
any repeated grades. The \(\text{(average)}\) causal effect
of interest is \(\rho\). The terms \(\alpha_i\) and \(\beta_g\) are year-of-
test and grade-of-test effects, while \(X_i\) is a vector
of demographic controls with coefficient \(\gamma\), and
\(\epsilon_{igt}\) is an error term that captures random fluc-
tuation in test scores. The dummys \(d_{ij}\) indicate
three of the four KIPP Lynn application cohorts, indexed by \(j\).

The first stage uses the randomly assigned lot-
tery offers as an instrument for \(s_{igt}\) and takes the form:

\[
\begin{align*}
s_{igt} &= \lambda_i + \kappa_g + \sum_j \mu_{ij} d_{ij} + \Gamma' X_i \\
&\quad + \pi Z_i + \eta_{igt},
\end{align*}
\]

where \(\lambda_i\) and \(\kappa_g\) are year-of-test and grade effects.
The excluded instrument is the lottery offerer

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4 We look at first time applicants only. We also exclude
applicants from sixth or seventh grade as few of these end
up attending KIPP.

5 These are from regressions that control for year and
grade of application, applicants’ sibling status (siblings who
apply together are more likely to get in, since a winning
sibling improves the loser’s position on the waiting list), and
interaction of sibling status with year of application. Note
applicants with siblings already enrolled are excluded from
our sample.
dummy $Z_i$, with first stage effect $\pi$. The reduced form generated by this system comes from substituting (2) for $x_{igt}$ in (1). The reduced form effect is the coefficient on $Z_i$ in a regression of $y_{igt}$ on $Z_i$ with the same controls and data structure as in free equations (1) and (2). Because the model is just-identified, 2SLS estimates of $\rho$ are given by the ratio of reduced form to first stage coefficients.

II. Results

A. Lottery Results

The lottery first stage coefficient is a little over 1.2 years, as can be seen in the first column of Table 2. In other words, by the time they were tested, lottery winners had spent an average of 1.2 years more at KIPP than lottery losers. The addition of demographic variables and baseline scores has almost no effect on the first stage estimates. In a world with perfect lottery compliance, no late entry or grade repetition, and no loss to follow-up, the first stage in our sample would be 1.75, but this is reduced by the fact that some winners never enroll in KIPP or leave before finishing, and some losers end up in KIPP later. On the other hand, although KIPP schools are sometimes said to encourage weaker students to leave (see, e.g., the discussion in chapter 46 of Mathews, 2009), we found that lottery winners were about as likely as losers to change schools in grades 6–8, a result discussed more fully in our working paper (Joshua D. Angrist, Susan M. Dynarski, Thomas J. Kane, Parag A. Pathak and Christopher R. Walters 2010).

Lottery winners score about 0.4 standard deviations (hereafter, $\sigma$) higher than losers on math, a robust, reduced-form result reported in column (2) in the top half of Table 2. The reduced forms for ELA, reported in the bottom half of the table, are more variable across specifications, ranging from 0.15–0.18 $\sigma$ as the set of controls varies. This variability probably reflects the modest imbalance between winners and losers in the proportion LEP documented in Table 1. The estimated effect on ELA is marginally significant in models with demographic and baseline score controls.

Because the first stage coefficients are larger than one, the 2SLS estimates are smaller than the reduced-form estimates, though they also have a different interpretation. The 2SLS estimates imply that math scores increase by about 0.35 $\sigma$ for each year at KIPP Lynn. The 2SLS estimates for ELA show per year gains on the order of 0.12–0.15 $\sigma$. The most precise of these is 0.12 $\sigma$, estimated in models with demographic and baseline score controls (standard error $= 0.058$). These effects are remarkably similar to the middle school results in Attila Abdulkadiröglu et al. (2009) using a larger sample of charter schools in Boston. Measured against Lynn’s Hispanic-white score gaps of about 0.5 $\sigma$ in math and 0.6 $\sigma$ in ELA, both the math and ELA effects are substantial.

B. Hispanic Subgroups and Interactions

KIPP Lynn serves more Hispanic students than is typical of charter schools in the Northeast. Table 3 looks at effects in the Hispanic subgroup. Concerns about access for Hispanics notwithstanding, effects are reasonably similar for Hispanic and non-Hispanic students, though ELA estimates for the latter are impressive.

<table>
<thead>
<tr>
<th>Table 2: Lottery Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A. Math</strong> ($N=856$ w/baseline scores)</td>
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<tr>
<td>Controls</td>
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<tr>
<td>Basic</td>
</tr>
<tr>
<td>(0.063)</td>
</tr>
<tr>
<td>Demographics &amp; baseline scores</td>
</tr>
<tr>
<td>(0.066)</td>
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</tbody>
</table>

**Panel B. ELA** ($N=856$ w/baseline scores)

| Controls | First stage | Reduced form | 2SLS |
| Basic | **1.223*** | **0.183** | **0.150** |
| (0.063) | (0.117) | (0.094) |
| Demographics & baseline scores | **1.234*** | **0.149** | **0.120** |
| (0.066) | (0.073) | (0.058) |

Notes: Grades are pooled. Basic controls include those from the regressions in Table 1 as well as year-of-test and grade-of-test dummies. Robust standard errors (clustered at the student level) are reported in parentheses.

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6 We report separate first stages for math and ELA because samples differ slightly by subject.

7 The 2005 cohort contributes one score after one year (in fifth grade), one after two years (in sixth grade), one after three years (in seventh grade), and one after four years (in eighth grade) for an average of 2.5 years in KIPP across grades. A similar calculation for the other cohorts, which are seen in fewer grades, produces 2.0 potential years in KIPP for the 2006 cohort, 1.5 potential years in KIPP for the 2007 cohort, and 1 year of potential years in KIPP for the 2008 cohort. The average of these is 1.75.
Charter skeptics have sometimes argued that while relatively motivated and able students may benefit from charter school attendance, weaker students lose out. We briefly explored this type of treatment effect heterogeneity by estimating a model that adds an interaction between applicants’ baseline (fourth grade) scores and years at KIPP Lynn, normalized so that the main effect of years at KIPP Lynn is evaluated at the mean of the baseline score distribution. Panel B of Table 3 shows that KIPP Lynn raises achievement more for weaker students. Children with baseline scores half a standard deviation below the applicant mean appear to get a rough 0.06 \( \sigma \) additional achievement boost from each year they spend at KIPP Lynn. This finding echoes a similar negative interaction with baseline scores reported in our Boston study (Abdulkadiroğlu et al., 2009).

### III. Concluding Comments

Our estimates suggest that KIPP Lynn generated substantial score gains for lottery winners, with effects on the order of 0.35\( \sigma \) for math and 0.12\( \sigma \) for ELA. The characteristics of lottery winners and losers are similar and lottery based 2SLS estimates are insensitive to controls for demographic variables and baseline scores. KIPP Lynn benefits Hispanic and non-Hispanic applicants about equally, with larger gains for students with low baseline scores. Our estimates for KIPP Lynn are also remarkably similar to those reported for Boston charters in Abdulkadiroğlu et al. (2009). The results reported here are for a single school, but KIPP runs many similar schools across the country. The key elements of KIPP’s No Excuses model feature in other charter schools, such as those in our Boston sample. Our results suggest the major elements of this model combine to produce noteworthy achievement gains, at least as measured on statewide standardized tests.

### REFERENCES


