THE GENDER GAP IN CHARTER SCHOOL ENROLLMENT*

Sean P. Corcoran**
Jennifer L. Jennings

New York University

This version: September 25, 2014

Abstract: Many studies have investigated whether students in charter schools differ systematically from those in traditional public schools, with respect to prior achievement, special education, or ELL status. None, however, has examined whether charters are gender balanced. Analyzing enrollment data for all U.S. schools over 11 years, we find charters enroll a higher fraction of girls, a gap that has grown steadily over time and is larger in secondary grades and KIPP schools. We then use longitudinal student-level data from North Carolina to examine whether differential rates of attrition explain this gap. We find boys are more likely than girls to exit charters once enrolled, and gender differences in attrition are larger than in traditional schools. The difference is not large enough to explain the full enrollment gap between charter and traditional schools in North Carolina, however, suggesting gaps exist upon initial enrollment.

Abstract word count: 142

Key words: charter schools, gender gap, attrition, mobility

* We thank the North Carolina Education Research Data Center for providing access to confidential student-level data. Annie Tan, Juli Simon Thomas and Lila Nazar de Jaucourt lent valuable research assistance to this project. Julian Betts and other participants at the 2009 National Center on School Choice conference offered particularly helpful feedback. Any remaining errors are solely our own.

** Contact author. New York University, Institute for Education and Social Policy, 665 Broadway, Suite 805, New York, NY 10003. Email: sean.corcoran@nyu.edu. Phone: (212) 992-9468

I. INTRODUCTION

The charter school literature has devoted considerable attention to the extent to which students attending charters differ from those in traditional public schools, with respect to academic ability, race and ethnicity, socioeconomic background, special education, and English learner status (Abdulkadiroğlu et al. 2011; Angrist et al. 2010; Bifulco and Ladd 2006; Buckley and Schneider 2005; Dobbie and Fryer 2011; Hoxby and Murarka 2007; Imberman 2011; Raymond 2009; Tuttle et al. 2013; Zimmer et al. 2009). No study, however, has examined whether charters enroll or retain a higher fraction of girls. This omission is somewhat surprising. Gender gaps in achievement and attainment are subjects of longtime interest to academics and policymakers, have grown in recent decades in favor of women, and are larger in disadvantaged communities where charters tend to locate (Buchmann et al. 2008).

Whether and how boys and girls sort into charters is important for a number of reasons. First, the distributional consequences of charter schools ultimately depend on who attends them. To date, research on charter schools has emphasized careful estimation of treatment effects associated with attending a charter school (Betts and Tang 2008). Who enrolls—and who remains—in charters has been less studied (Zimmer and Guarino 2013). Second, selection of students into schools determines the peer composition of charter and non-charter schools alike (Bifulco et al. 2009; Booker et al. 2005; Dee and Fu 2004; Weiher and Tedin 2002), and there is robust evidence that boys and girls perform better when a larger fraction of their peers are girls (Black et al. 2013; Hoxby 2000; Lavy and Schlosser 2011; Whitmore 2005). Third, a gender imbalance may be indicative of selection into charters on the basis of non-cognitive skills, such as behavior, or preferences for distinctive educational environments that are correlated with gender.

Taken together, the efficacy and distributional consequences of charter schools cannot be fully understood without attention to the sorting of students and families into schools. In this paper,

we provide the first analysis of charter enrollment and retention by gender. Analyzing enrollment data in a nationwide panel of charter and non-charter public schools from 1999-00 through 2010-11, we find that charter schools enroll a higher fraction of girls than observationally similar schools in the same locales—about 1.9 percentage points on average. The gap is larger in the secondary grades, has grown as the sector has expanded, and is as large as 3-5 points in some states. While gaps of 2-3 percentage points might not seem large at first glance, the vast majority of schools do not deviate far from parity. Therefore, a two point gap is a substantial tip in the gender balance, equivalent to the difference between the 50th and 75th percentile of U.S. schools. The gap is only slightly smaller than charter-traditional school gaps estimated for special education students and English language learners, which have commanded substantial public policy attention (CREDO 2013).

To examine potential mechanisms behind this difference, the second part of the paper uses our national panel and student-level data from North Carolina to examine whether differential rates of attrition explain the gender gap in enrollment, and whether gender gaps are larger in charter schools known to have strict behavioral norms. Conditional on observed student characteristics, we find the overall likelihood of attrition is higher in charter schools than in traditional public schools, for both boys and girls. Boys are more likely to exit charters than girls, and this differential is somewhat larger than in traditional public schools. In an analysis of *within*-year attrition, we find weak evidence that boys exit charters at a higher rate than girls. On balance, the difference in attrition is not enough to explain the full enrollment gap between charter and traditional schools in North Carolina, suggesting gaps exist upon initial enrollment.

In the following section, we describe mechanisms that could result in charter schools enrolling a higher fraction of girls. We then briefly examine the existing literature on charters and school choice for evidence of gender differences in enrollment. Following that, we describe the data and empirical methodologies used in this paper, and present our main results on the gender gap in

charter school enrollment. We conclude with a brief discussion of the implications of our findings for future research on charter schools and school choice systems more broadly.

II. WHY MIGHT CHARTER SCHOOLS ENROLL MORE GIRLS?

There are a number of reasons one might expect the gender composition of charter schools to differ from that of traditional public schools:

Student preferences. Charter schools may have differential appeal to boys and girls. Girls may be more likely to apply to charters because of differences in curriculum or program offerings, particularly in middle and high school, where schools differ in their academic focus and provision of extracurricular activities (such as athletics). Previous research has demonstrated girls are more likely to choose academically-oriented programs (Hastings et al. 2006) and programs with arts or humanities themes. There is also substantial evidence that girls are more engaged with school in general and have higher educational aspirations (DiPrete and Buchmann 2013), and thus may be more likely to welcome a more challenging or differentiated curriculum offered at a charter school.[1]

Parental preferences. Parents may prefer different environments for their sons and daughters. For example, parents are concerned with safety, particularly as students enter adolescence, and thus may prefer charters, which tend to be smaller than traditional public schools. Parents may also view the probability of success at a charter school as gender-dependent. At least one study found school choice has greater academic returns for girls than for boys (Hastings et al. 2006).

Educational needs. Boys are more likely to be classified with special education needs (Halpern 1997; Jennings and Beveridge 2009), and many charters do not offer a full range of special education services (Wilkens 2011). It may be that boys are less likely to apply to charter schools as a result, that boys are less likely to enroll upon winning an admissions lottery, or that boys are more likely to exit charter schools once enrolled, if needed services are unavailable.

Behavior. Girls have better behavior, on average, than boys (Bertrand and Pan 2013; DiPrete and Jennings 2012), and thus may be less opposed to strict disciplinary standards adopted by some charter schools, including KIPP and others adherent to a "no excuses" philosophy (Angrist et al. 2011; Thernstrom and Thernstrom 2003). Once enrolled, boys may be more likely to exit charters as a result of behavioral infractions, either on their own accord or at the prompting of the school. By the same token, parents may be more likely to initially enroll their boys in a charter school if they believe they will benefit from its disciplinary policies.

Academic achievement. Attrition from charter schools may vary by gender due to variation in educational outcomes. For example, if boys perform worse on average than girls or gain less from attending a charter than girls, they may be more likely to return to a traditional school, whether because of parental preferences or in response to guidance from the school itself. Hanushek et al. (2007) found that families of charter school students in Texas were particularly sensitive to academic performance. That is, charter school students with smaller test score gains were more likely to exit, as were students attending schools with lower overall performance (see also Zimmer and Guarino 2013).

III. EXISTING EVIDENCE

A gender imbalance favoring girls has been reported in a number of charter school studies, although gender was never a focal point of these papers. For example, in their evaluation of Boston charter schools, Abdulkadiroğlu et al. (2011) found that girls made up 53 percent of their elementary charter population as compared to 48 percent of traditional public school students. The gap was two points smaller in middle school but larger in high school, where 60 percent of Boston charter students were female, versus 51 percent of non-charter students. Comparable female shares have been reported in studies of charter schools in Chicago (Booker et al. 2009; Hoxby and Rockoff

2005), Baltimore (Baltimore City Schools 2009), and New York City (Hoxby and Murarka 2007, 2009), and in KIPP middle schools (Tuttle et al., 2013).

Two partially randomized studies of charter schools offer some hints as to the timing of gender enrollment gaps. Hoxby and Murarka's (2007) evaluation of charter schools in New York City found girls were slightly underrepresented among applicants to charter elementaries, but more likely to *attend* conditional on acceptance. Across all years in their study, they found that 49 percent of students who applied and were lotteried-in (mostly in kindergarten and 1st grade) were girls. However, 51.5 percent of those who accepted and enrolled were female. In Boston, charter middle school lotteries had 1.8 percentage points more girls than traditional schools (48.8 versus 47.0), and charter high school lotteries had 8.5 percentage points more girls than traditional schools (59.3 vs. 50.8). There was little difference observed between lottery applicants and enrollees, however (Abdulkadiroğlu et al. 2009).

There has been less analysis of attrition from charter schools, and most of these studies do not specifically examine differential attrition by gender. In some cases, however, scholars have examined exit related to characteristics plausibly associated with gender, such as achievement, for example. In their study of exit patterns from charter schools, Zimmer and Guarino (2013) found no evidence that low-achieving students leave charter schools at higher rates than traditional schools.

At least two studies identified higher attrition for male charter school students. Nichols et al. (2012) examined attrition and replacement of students in 19 KIPP middle schools. Attrition rates from KIPP were similar to those in traditional public schools, but students who replaced leavers were more likely to be female and more academically advantaged in KIPPs than in traditional public schools. Notably, Nichols et al. report that the percent male in these schools is 48 percent in the entering grade (5th) and 40 percent in 8th grade. Another study found boys were slightly more likely to leave charter schools in elementary and middle school (Baltimore Public Schools 2009). In

Baltimore, 52 percent of leavers were male in grades K-5, and 54 percent were male in grades 6-8. In high school, leavers were disproportionately female, with 54 percent of those exiting being girls. It was not clear whether these gaps in attrition rates were different from those in traditional public schools, however.

The gender balance of the school environment matters for overall school performance. Previous studies show that a 10-percentage point change in the female share of one's classroom increases girls' and boys' math achievement by 0.06 and 0.08 standard deviations, respectively (Hoxby 2000). This suggests that exposure to a 2-point difference in the female share can increase math achievement by 0.01 to 0.02 standard deviations for every year of exposure. The cumulative impact would be greater in settings where the gender gap is larger.

Whatever the source, this paper establishes general gender-based patterns of enrollment in charters in the United States – an area that has received insufficient attention in the current literature on school choice and charter schools.

IV. DATA AND METHODS

We rely on two sources of data. The first is a panel of all schools in operation nationwide between 1999-00 and 2010-11, including charter schools, constructed from the Common Core of Data (CCD).[2] We use this panel to estimate the average difference between charter and non-charter schools in female enrollment, and to provide descriptive evidence of how this gender gap varies by grade level, state, and over time. The second is a longitudinal database of all students in grades 3-12 attending North Carolina public and charter schools between 2005-06 and 2010-11. These data follow students across grades and between schools, allowing us to more closely examine rates of attrition.

We begin with the national panel of schools by estimating the average difference in female enrollment shares between charter and non-charter schools, controlling for observed characteristics of the school and their student populations plausibly related to its gender composition. That is, we are interested in the coefficient β_1 in a regression like the following:

$$(1) \qquad pfemale_{it} = \beta_0 + \beta_1(charter)_{it} + \gamma X_{it} + u_{it}$$

where $pfemale_{it}$ is the percent female in school i in year t, $charter_{it}$ is an indicator variable equal to one if school i is a charter school in year t, and X is a vector of time-varying school characteristics, described below. The error term u_{it} includes factors other than X and the school's charter status that are associated with variation in the female enrollment share in year t.

Unlike variation in race or SES, there are few spatial or school variables that reliably predict variation in gender composition. The female share of live births in the U.S. is about 48.8 percent in any given year (Martin et al. 2013) and the vast majority of schools fall within a few percentage points of this average. An obvious exception is single-sex schools, which in practice are rare among public schools (and are excluded from our analysis).[3] That said, there are a few reasons why a public school's female share may deviate from the natural rate. First, girls may be more or less likely to enroll in private or home school. Where private or homeschooled students constitute a meaningful share of the school-aged population, a higher proportion of girls in these schools would result in a correspondingly higher male share in public schools.[4] Second, boys and girls may be retained at different rates, particularly in key transition grades (Hauser 2004). Third, dropout rates vary by gender. Fourth, there is minor variation in sex ratios by race, income, and region. For example, the ratio of girls to boys at birth is slightly higher among black mothers (49.1%) and lower among Asian/Pacific Islander mothers (48.5%) in the U.S. (Chahnazarian 1988; Martin et al. 2013).

We cannot address all of these factors directly in our analysis, but we attempt to account for school and community differences contributing to variation in the female share, in order to contrast the gender composition of similar schools in similar locales. We limit our panel to schools operating in the 41 states with charter laws during this period, including D.C.[5] Vocational and special education schools—which tend to be gender imbalanced—are excluded, as are schools that appear to be single-sex, defined as having greater than 95 percent or fewer than 5 percent girls. We do include schools classified as "other/alternative" along with "regular" public schools. As explained in the online appendix, many charters appear to be miscoded in the CCD as "other/alternative," especially in early years. As a robustness check, we also report results excluding these schools. The number of charter schools that meet the above conditions range from about 1,500 in 1999 to 5,100 in 2010. The panel also includes approximately 80,000 non-charter schools annually that meet these criteria.

Charters are more likely to have non-traditional grade configurations, which may complicate comparisons with traditional schools if the female share varies by grade, due to differential grade retention and dropout behavior. "Start-up" charter schools often build up their schools from successive cohorts such that, for example, the school enrolls 6th grade in year one, 6th and 7th in year two, and so on. We address grade-specific variation in the female share by estimating models with school-by-grade level observations with grade level effects and grade-specific state, county, or school district fixed effects.[6] Thus, for example, if schools serving grade 11 are disproportionately female due to higher dropout rates among 10th grade boys, the main grade level effect will capture these differences. If this imbalance is greater in a particular urban district, the district-grade fixed effect will account for this differential.

Taken together, our main empirical model for grade *g* in school *i* in year *t* is the following:

$$(2) \qquad pfemale_{igjt} = \beta_0 + \beta_1 (charter)_{it} + \gamma X_{igt} + \alpha_{gj} + \lambda_t + u_{ijt}$$

In equation (2) the α_{gj} are alternately grade-specific state, county, or school district effects, while the λ_t are year dummies. One would not expect the mean female share of schools to vary much systematically across geographic areas or time, but these effects aim to capture the effects of differential public school attendance (versus private or home schools) and dropout incidence across locales, as well as cohort differences. Finally, X_{it} includes observed characteristics of schools, including the share of enrollment by race/ethnicity, and the percent eligible for free lunch (a proxy for family income). While the CCD reports data on race by grade, free lunch eligibility is only reported at the school level. Given multiple observations per school per year, we allow for clustered standard errors by school. All regressions are weighted by student enrollment in grade *g* in school *i* in year *t* such that results generalize to the average student in grade *g*. We experimented with alternative weighting schemes, in addition to estimating all models without weights; the results were not substantively different.

To assess how the gender gap in charter enrollment has evolved over time, we estimate a version of (2) separately for each year, 1999-2010. To produce grade-specific estimates of the gender gap, we estimate models in which *charter* is interacted with *grade*, and we summarize variation in the gender gap across states by estimating models separately by state for the most recent year (2010). Lastly, we use a subset of charters that converted from traditional public schools to examine changes in the female share *within* schools over time as the school changes status.

In the second part of the paper we turn to potential mechanisms explaining gender gaps in charter enrollment. First, using the CCD panel, we examine whether the gender gap is larger in CMO-affiliated schools—and KIPP schools in particular—than in other charter schools. KIPP is known for its "no excuses" philosophy and strict behavioral expectations, and a larger gap in these

schools could indicate that behavior is a relevant factor. As noted earlier, Nichols et al. (2012) found an initial gender gap in KIPP middle schools that grew over time as leavers were more likely to be male and late entrants more likely to be female. As an initial look at attrition within schools, we also use the CCD to examine changes in enrollment shares by gender across grades and years.

While the strength of the CCD is its ability to track patterns over time for the entire country, the data do not permit tracking of individual students over time. We therefore use longitudinal data from North Carolina to estimate rates of attrition by gender from charter and traditional schools. While North Carolina is not necessarily representative of other states with charter schools, we show the gender gap in that state is comparable to the national average.[7] It is also one of the few available data sources for observing mobility within and between charter schools. We use the Masterbuild compiled by the North Carolina Education Data Research Center, which includes all students enrolled in grades 3-12 between 2005-06 and 2010-11. We first estimate the following attrition model, separately by grade, for students in grades 3-11 in charter schools:

$$(3) \qquad \Pr(\textit{non-structural move}_{sigt}) = f(\beta_0 + \beta_1 female_s + \gamma X_{sigt} + \theta S_{it} + \lambda_t)$$

$Pr(\textit{non-structural move}_{sigt})$ is the probability that charter school student s makes a non-structural move from school i between year t and $t+1$, the λ_t are year dummies, X_{sigt} is a vector of student characteristics, and S_{it} is a vector of school locale and type dummies (from CCD data).[8] Following recent literature on student mobility, we define non-structural moves as an exit from school i when the student's grade g is not a terminal grade in that school (Hanushek et al. 2004; Machin et al. 2006; Xu et al. 2009; Schwartz and Stiefel 2013; Zimmer and Guarino 2013). We determine whether grade g is a terminal grade in school i in year t by looking ahead to $t+1$ to see whether grade $g+1$ is offered in that school. As an example, a 4th grader leaving school i after year t would be coded as a non-

structural move if *i* enrolled students through grade 5 in year *t+1*. A 5^{th} grader leaving *i* after year *t*, however, would not be coded as a non-structural move, as this would be a normal transition.[9] We consider a move as any move between schools or an exit from North Carolina public schools altogether.

The coefficient β_1 in (3) can be interpreted as the female-male difference in the probability of a non-structural move, conditional on observed student and school characteristics, for students enrolled in charter schools in grade *g*. In *X* we include controls for student race/ethnicity and eligibility for free or reduced price meals (a proxy for poverty), their interactions, and Limited English Proficiency (LEP), and special education status. Models for grades 3-8 also include controls for reading and math scores (standardized by grade, subject, and year).

While estimates of (3) capture differential attrition *within* the charter school sector, they cannot say whether the gender gap in attrition (if any) is larger or smaller than that observed in traditional public schools serving similar students. To that end, we estimate model (4), separately by grade level (3-5, 6-8, and 9-11), for *all* students in school districts that ever housed a charter school in North Carolina:

$$(4)\ \Pr(\textit{non-structural move}_{sigt}) = f(\beta_0 + \beta_1 \textit{female}_s + \beta_2 \textit{charter}_{it} + \beta_3(\textit{female}_s \times \textit{charter}_{it}) + \gamma X_{sigt} + \theta S_{it} + \varphi_j + \lambda_t)$$

Model (4) adds an indicator variable $\textit{charter}_{it}$ to distinguish enrollment in a charter school, and an interaction between $\textit{female}_s$ and $\textit{charter}_{it}$. In this case, β_1 can be interpreted as the female-male difference in the probability of a non-structural move in *traditional* schools, β_2 is the charter-noncharter difference for boys, and the difference-in-difference coefficient β_3 is the extent to which the gender gap in attrition is larger (or smaller) in charter schools than in traditional public schools.

We explore the possibility of *within-year* attrition by re-estimating models (3) and (4) using within-year moves as the dependent variable. To identify within-year moves, we use variables in the Masterbuild that report enrollment status at multiple points during the school year. We define a within-year move as being enrolled in school *i* in the fall but not in the spring. Finally, we look descriptively at the gender composition of new (incoming) students in North Carolina charter and traditional schools to test for differences at the point of intake. Due to data limitations, however, we are only able to do this for grades 4-12. (For a student to be classified as new, we must be able to determine they were not a student in the school in the prior year).

V. THE GENDER GAP IN ENROLLMENT IN NATIONAL DATA

The National Gender Gap in Charter School Enrollment

We begin our look at the gender gap in charter school enrollment using our national panel of public schools. Descriptive statistics for schools in the panel, weighted by enrollment, are reported in Table 1 for the most recent year of the CCD (2010-11) and for all years of the panel. In 2010-11, the mean female share of enrollment was 48.8 percent overall (exactly the female share of births), and 50.7 percent in charter schools, a gap of 2.0 percentage points. Charter schools were also more likely to enroll black (+12.4 percentage points) and free lunch eligible students (+2.2) than the average school, and were more likely to be located in large cities (+24.5), classified as "other/alternative" schools (+4.0), and serve a "mixed" grade span such as K-8 (+26.8).

A closer look at the full distribution of female enrollment shares for charter and non-charter schools in 1999 and 2010 (Figure 1) shows a shift toward greater female enrollment in charters over time. Charter schools in general exhibit greater variation in the female share than non-charter schools, with a higher proportion of charters serving disproportionately female or disproportionately male populations. For example, in 2010-11, the percent female at the 75th and 90th percentiles of

charter schools was 53.4 and 57.0 percent, respectively; in non-charters, these percentiles were 50.4 and 52.5 percent.

Differences in the gender composition of schools are due in part to differences in grades served. Therefore, Figure 2 shows the (enrollment-weighted) mean female share of enrollment by grade for charter and non-charter schools in 1999-00 and 2010-11. The female share is consistently higher in charters in 2010-11, ranging from 1.1 to 1.7 percentage points higher in elementary school (K-5), 1.5 to 1.9 points in middle school (6-8), and 2.4 to 3.9 points in high school (9-12). The figure also shows the national gender gap in charter school enrollment increased in all grades between 1999 and 2010, particularly in secondary school.

Because charters and the communities they serve differ in a variety of ways, our comparisons of raw means and distributions potentially reflect the role of factors other than a gender-specific gap between charter schools and otherwise similar non-charter schools. In the next section, we provide regression-adjusted estimates of the gender gap in charter school enrollment. We find controls for grade, race and poverty composition, and grade-by-area fixed effects have almost no effect on the raw gender gaps shown in the preceding figures.

Regression-Adjusted Estimates of the Gender Gap in Charter School Enrollment

Table 2 and Figures 3-4 report regression-adjusted estimates of the national gender gap in charter enrollment for the most recent wave of school data (Table 2), for all years in our panel (Figure 3), and by grade (Figure 4). Following equation (2), the dependent variable in each model is the percent female in grade g within a school i in year t, and observations are weighted by grade-level enrollment. Table 2 reports these results for 2010-11. Each cell provides results from a separate regression, showing only the estimated coefficient on the charter indicator, interpreted as the average gap in the female share between charter and non-charter schools serving the same grades,

similar populations, and in the same locations. The first row comes from the full sample, while the second through fourth rows represent increasingly homogeneous samples of schools (excluding other/alternative schools, limiting to schools in large cities, and both restrictions). The four columns represent model specifications without fixed effects, and with grade-specific state, county, and school district fixed effects, respectively.

Our regression-adjusted estimate of the gender gap in charter school enrollment for 2010-11 is a statistically significant 1.8 to 2.0 percentage points, depending on the model ($p < 0.001$). In most cases, the inclusion of (grade specific) state or county fixed effects has little effect on the point estimate (and making it slightly larger), but including school district effects decreases the gap by 0.1 point. This suggests districts with charter schools differ in systematic ways with respect to gender composition—perhaps due to differences in retention policies or dropout rates—and therefore we only use district fixed effects specifications in models that follow.

In the interest of space, we do not report estimated coefficients for race, income, and grade level, although they are available in the online appendix. While these variables do little to explain variation across schools in the female share, the gender gap in charter enrollment is larger when these covariates are omitted. Some coefficients are statistically significant; for example, grades in schools with a larger share of black and Hispanic students tend to have higher fractions of female students, while schools with a larger share of free or reduced price lunch eligible students have a lower fraction. The effect sizes are modest, however.

Figure 3 shows point estimates of the gender gap from our model estimated separately for each year, 1999 to 2010. A 95-percent confidence interval is shown as a dotted line around each estimate. The trend over time is clear: the gender gap in charter enrollment increased steadily over this 11-year period. In 1999-00 and 2000-01, the gap was statistically indistinguishable from zero, but by 2010 had grown to 1.9 percentage points. These estimates are sufficiently precise such that

one can reject the hypothesis that the gender gap in later years (e.g., 2007-2010) is the same as that in the earlier years (e.g., 1999-2002).

In Figure 4, we present estimates from a model that fully interacts the charter indicator and grade level, allowing us to see how the gender gap varies by grade. We again use district fixed effects, and report estimates for 2010-11 (comparable to Table 2). Figure 4 reports the gender gap, along with a 95-percent confidence interval for each estimate. This figure shows the gender gap exists as early as kindergarten, at 1.65 points. There is no statistically significant difference between this gap and the other elementary/middle grades, although the point estimates suggest a gradual increase into 7th and 8th grades. After 8th grade, the gap is larger, at 2.6 points in 9th and 10th grade, 3.6 points in 11th grade, falling again in 12th (presumably due to selection of students who persist). While point estimates in high school are statistically indistinguishable, we can reject the hypothesis that the gender gap is the same in early (e.g., 1st-5th) versus later grades.

We also estimated model (2) separately by state, including (grade specific) district fixed effects. Results are available in the online appendix. All but two states have positive gender gaps, although not all are statistically distinguishable from zero. There is notable variation in the gap across states. In 2010, Louisiana had the largest gap at 5.7 percentage points, although others including Arkansas, Pennsylvania, Massachusetts, and Texas had gaps of 3.0 points or more. Much of the variation appears to be driven by gender gaps in middle school; there is less variability in grades K-5. Notably, North Carolina has a gap near the national average, at 1.7 percentage points.

Estimates of the Gender Gap in Charter School Enrollment Using Conversion Charters

As an alternative test for whether a school's charter status is associated with its female share, we examined changes in the female share of *conversion* charters—those that originated as traditional public schools but later changed status. While conversions are not representative of the full

population of charter schools, they provide a unique opportunity to observe how student populations change within a school after the rules governing it change and it becomes a school of choice. For this we obtained a complete list of conversion charters from 16 states with the largest number of conversions during this period, including California (76), Ohio (68), Georgia (27), and Texas (25) (listed in the online appendix).

Table 3 reports results from regressions using observations of grades within schools in states where conversions occurred after 1999-00. The first two columns represent a simple difference-in-difference, with one indicator variable equal to one for schools that converted to charter during this period (2000 or later) and a second equal to one for these same schools in years *after* conversion. The model in column (1) includes grade-specific district effects, while the model in column (2) includes *school* fixed effects, where the "post conversion" effect is identified by variation within conversion schools over time. Columns (3)-(4) replace the simple "post" indicator with another indicating the number of years elapsed since conversion, which allows any effect of conversion to vary with time. All models include the full set of grade and school controls in equation (3).

The results in Panel A show that conversion schools have, on average, a higher female enrollment share than comparable schools prior to conversion, a statistically significant difference of about 0.6 percentage points. In the years following conversion, we find the gender gap in enrollment between conversions and other public schools widens by 0.24 points, although the smaller effect in the model with school fixed effects is not statistically significant. The estimated coefficient on "years after conversion" in Panel A columns 3-4 is small and statistically insignificant.

Many of the conversions used to identify effects in Table 3 are relatively recent, however. Roughly a quarter in our sample had been observed three or fewer years after conversion, which may not be sufficient to observe any enrollment change that might occur. Thus, Panel B reports results for the same models, limiting conversion schools to those observed at least three years after

conversion. In these cases, our point estimates for the post-conversion years are larger. To highlight one example, in the model with school effects we find that the gender gap in enrollment between conversion and other public schools rose 0.36 points, on average, after conversion, or 0.07-0.08 points per year. Again, while conversions are not necessarily representative of all charter schools, these results find schools converting to charter status see an increase in their female share following conversion.

VI. POTENTIAL MECHANISMS FOR THE GENDER GAP IN ENROLLMENT

Our analysis of the CCD found charters enroll a higher fraction of girls than observationally similarly traditional public schools, an imbalance that is particularly large in the secondary grades. It is unclear, however, whether this gap is due to differences in the propensity to enroll in charter schools, attrition, or other factors. In this section, we begin by examining whether the gender gap is larger in CMO-affiliated charter schools (such as KIPP), which are more likely to adhere to strict academic and behavioral expectations that may be less appealing to boys. We then use the CCD and longitudinal student-level data from North Carolina to look at differential attrition by gender for charter and traditional public schools.

The Gender Gap in CMO and KIPP Charter Schools

Using data from the National Alliance for Public Charter Schools, we identified all charters in the CCD affiliated with a charter management organization (CMO) and those specifically affiliated with the KIPP network of schools. An advantage of looking at CMOs and KIPP is that they are more often associated with a "no excuses" philosophy and its strict academic and behavioral expectations (Angrist et al. 2011; Thernstrom and Thernstrom 2003). To the extent these are deterrents to boys (or boys are more likely to exit such settings), we might expect to find a larger

gender gap in enrollment between these and other schools. Late entrants to CMO and KIPP schools may also be less likely to be male (Nichols et al. 2012).

Table 4 reports the results of a model analogous to that in Table 2, with grade-specific school district fixed effects, that splits charter schools into CMO (or KIPP) charters and other charter types. In column (1), we see that the estimated gender gap in enrollment is somewhat larger in CMO-affiliated schools than in other charter schools (2.0 vs. 1.9 points), although they are not statistically distinguishable. The gender gap in enrollment in KIPP schools, on the other hand, is substantially larger than that in other charter schools (2.9 vs. 1.9 points), but given the precision of these estimates we cannot reject the hypothesis that the gaps are the same.

Indirect Evidence on Differential Attrition within Schools from the CCD

In Table 5 we use our national CCD panel to see whether enrollment patterns across grades and years are consistent with differential attrition by gender. Because the data is at the school-by-grade rather than student level, these results are only indirect with respect to attrition. For the models in this table, we identified "pseudo-cohorts" within each school, defined as grade *g* in year *t,* grade *g+1* in year *t+1*, and so forth. Then, for each grade and year, we calculated the change in percent female enrollment within a school from year *t* to *t+1*. A value of 1.5 for 4th grade, for example, would indicate an increase in the percent female between grades 4 and 5 in the same school between year *t* and *t+1*.

Column (1) of Table 5 reports the results of a regression for the within-school between-grade change in the percent female for charter schools. The estimated coefficients are positive for every grade except 2nd, indicating a mean grade-to-grade increase in the female share within charter schools. The coefficients are significant and meaningful in size only in middle and high school, however. (The latter will reflect dropout behavior). For example, from 7th to 8th grade, there is an

increase in the percent female of 0.6 percentage points, on average. To test whether this pattern is different from that observed in traditional schools, the regression in column (2) extends the sample to all schools. The rightmost column reports the estimated difference between charter and traditional schools in their grade-to-grade change in female share. In all grades, the difference is positive and statistically significant, indicating that the change in female share from grade to grade is larger in charter schools than traditional schools. The differences range from 0.2 percentage points in grade 2 to 0.67 points in grade 7 and 9. (The estimate for grade 8 should be interpreted with caution, since a large number of charters terminate in grade 8).

These results suggest that charter schools retain girls at a modestly higher rate than boys, and that this differential is larger than in traditional public schools. The differential retention rate appears lower in the elementary grades, and greater in middle and high school (though the latter is partly due to dropout behavior). Of course, these results are indirect given the aggregate data available in the CCD. We turn to student-level data to investigate this question further.

The Gender Gap in Attrition from Charter and Traditional Schools

As explained in Section IV, we use North Carolina data for students in grades 3 to 11 to estimate gender differences in attrition—the propensity to make a non-structural school move or a within-year move. All models pool data over the five years 2005-06 to 2009-10 and include student covariates and year effects; models with charter and traditional schools add school district effects.

Panel A of Table 6 reports the estimated gender gap by grade level in the propensity to make a non-structural move. Column (1) limits the sample to students enrolled in charter schools (i.e. model (3)). The baseline probability of switching schools or exiting the state system is high in charter schools, roughly 21 percent in grades 3-8 during this period (as compared to 12% in traditional public schools). Girls are less likely to exit charters than boys at every grade level, by about 1-3

percentage points, with the differences larger in the upper grades. (All are statistically significant at conventional levels).[10] Consistent with patterns observed in the CCD, the gender gap in attrition is somewhat larger in charter versus traditional schools. Column (2) of Table 6 reports the results for model (4), which extends the sample to all students. For charter students, the estimated gender gap in the propensity to make a nonstructural move is comparable to that in column (1). The rightmost column shows this gap is larger than that in traditional schools, by about 1 percentage point. The difference is statistically significant in the elementary and middle grades.

The estimates in Panel A do not capture *within-year* attrition, as the data provide the school of record at the time of end-of-grade testing.[11] The Masterbuild, however, includes indicators of enrollment at earlier points in the year: the first day of fall testing, the first day of March testing, and the 20th day of school (the latter for 2006-2008 only). We repeated our analysis in Panel B, re-defining the outcome as the propensity to make a within-year move: enrolled in school *s* in the fall but not during end-of-grade testing. Note that grade 12 can be added to the analysis of within-year movers.

On the whole, within-year attrition is low in North Carolina. For charter students, about 2.6 percent of students in grades 3-8 enrolled in the fall but not in the spring. This percentage is higher in grades 9-12, but would include students who formally dropped out during the year. In all grades, girls in charter schools are less likely to make within-year moves than boys, but the difference is only about 0.5 percentage point. In this case, the gender gap in within-year moves is not significantly different than that in traditional schools, seen in column (2). In fact, in grades 6-8 the gender gap in within-year attrition appears to be larger in traditional schools. These point estimates are small in magnitude but statistically significant. Overall, it does not appear that within-year attrition is an important explanation for the gender gap in charter enrollment in North Carolina.

Finally, as a cursory look at the gender composition of *incoming* students—both new students and transfers—we report the female share of incoming students in charter and traditional schools in North Carolina in Table 7. The Masterbuild is limited for this purpose, as we can only classify students as new to a school in grades 4-12, and therefore cannot observe all points of entry. In the early grades, we find incoming students in charter schools—mostly transfers-in—are more likely to be female than incoming students in traditional schools, a difference of 2 percentage points. The gender gap for incoming students in other grade levels is positive, but not statistically significant.

Taken together, there are notable differences in the gender composition of exiting and entering students in charter and traditional schools in North Carolina. However, on balance, these differences do not appear large enough to explain the full enrollment gap between charter and traditional schools in North Carolina, suggesting gaps also exist upon intake.

VII. DISCUSSION

In this paper we documented a gender gap in charter enrollment using two data sources: a national panel of schools, and student-level data from North Carolina. This gap is comparable to that found in other charter school studies, in which gender was never a primary focus. In our most recent year of data, we found charter schools enroll a larger share of female students, with an average gap of about 1.9 percentage points, after controlling for differences in school characteristics and location. This gap was largest in high school, peaking at 3.1 points in 11th grade. Interestingly, this differential has not shrunk as the sector has expanded. On the contrary, we found the gender gap in enrollment grew steadily over time, and is now more than double its size in 1999-00. There are some obvious limits to this growth, although some states where charters have flourished, such as Louisiana, have particularly large gaps. Variation in educational programs may help illuminate these differences across states. Our look at KIPP, known for their demanding curriculum and strict

behavioral expectations, revealed a gender gap nearly a full percentage point higher than in other charter schools (though not statistically different). This suggests preferences for, or ability to succeed in, particular types of educational environments may be an important driver of gender gaps in enrollment, not only in charters but in all schools of choice.

Longitudinal data from North Carolina allowed us to explore one potential mechanism for the gender imbalance: differential retention and attrition. We found boys are more likely to make non-structural moves from charters than girls, a gap that was larger in charter versus traditional schools. This pattern is consistent with our analysis of grade-to-grade changes in national data, where attrition is observed only indirectly. While boys are more likely to make within-year moves than girls in charter schools, the gap was similar in traditional schools. On balance, the gender gap in enrollment in North Carolina appears to be a function of both differential attrition and selection in.

To conclude, we focus on three sets of implications of our findings: 1) the implications for understanding preferences for, and ability to persist in, particular educational environments; 2) implications for establishing the mechanisms through which charter schools work; and 3) potential distributional consequences.

First, our findings point to the importance of investigating heterogeneous preferences for educational environments across groups such as gender, race/ethnicity, socioeconomic status, or ability. While our study cannot causally identify the mechanisms that produce gender gaps in charter enrollment, that we find larger gaps in middle and secondary grades, as well as in schools known to have strict behavioral climates, suggests preferences for particular types of experiences may play a role. Scholars should consider the independent roles of parents' and students' preferences, particularly in the upper grades, in shaping school choice decisions. Understanding these preferences is especially important in districts where the charter sector is large (or growing), where families have increased opportunities for sorting across schools.

Second, a better understanding of the enrollment, attrition, and replenishment practices of charter schools will increase our knowledge of the mechanisms through which charters impact student performance. While the gender gaps estimated here are not large enough to explain mean differences in charter and traditional school performance, they are only slightly smaller than the gaps in ELL (4 points) and special education status (3 points) that have commanded significant policy attention (CREDO 2013). Given what is known about the positive peer effects of girls for both boys and girls, future studies should estimate these effects more explicitly.

Finally, that higher fractions of girls attend charter schools means that if charter schools are more or less effective than schools these students would have attended, they may influence gender gaps in achievement and attainment. At present, the direction of these impacts is not clear, as charters in some urban areas (i.e., New York, Boston, and Chicago) have been found to be more effective than their counterparts. In studies of other locales, however, charters have a more mixed record, and thus could increase, decrease, or leave unchanged gender differences in performance.

REFERENCES

Abdulkadiroğlu, Atila, Joshua Angrist, Susan Dynarski, Thomas J. Kane, and Parag Pathak. 2011. "Accountability and Flexibility in Public Schools: Evidence from Boston's Charters and Pilots." *The Quarterly Journal of Economics* 126(2): 699–748.

Angrist, Joshua, Susan Dynarski, Thomas J Kane, Parag Pathak, and Christopher Walters. 2010. "Inputs and Impacts in Charter Schools: KIPP Lynn." *American Economic Review* 100(2): 239–43.

Angrist, Joshua, Parag Pathak, and Christopher Walters. 2013. "Explaining Charter School Effectiveness." *American Economic Journal: Applied Economics* 5(4): 1–27.

Baltimore City Public Schools. 2009. "Charter School Report: 2005-06 to 2007-08 School Years."

Bertrand, Marianne, and Jessica Pan. 2013. "The Trouble with Boys: Social Influences and the Gender Gap in Disruptive Behavior." *American Economic Journal: Applied Economics* 5(1): 32–64.

Betts, Julian, and Y. Emily Tang. 2008. *Value-Added and Experimental Studies of the Effect of Charter Schools on Student Achievement: A Literature Review*. Seattle, WA: Center for Reinventing Public Education.

Bifulco, Robert, and Helen F Ladd. 2006. "The Impacts of Charter Schools on Student Achievement: Evidence from North Carolina." *Education Finance and Policy* 1(1): 50–90.

Bifulco, Robert, Helen F Ladd, and Stephen L Ross. 2009. "The Effects of Public School Choice on Those Left Behind: Evidence from Durham, North Carolina." *Peabody Journal of Education* 84(2): 130–49.

Black, Sandra, Paul Devereux, and Kjell Salvanes. 2013. "Under Pressure? The Effect of Peers on Outcomes of Young Adults." *Journal of Labor Economics* 31(1), 119–53.

Booker, Kevin, Brian Gill, Ron Zimmer, and Tim R Sass. 2009. "Achievement and Attainment in Chicago Charter Schools." Santa Monica: RAND Education.

Booker, Kevin, Scott Gilpatric, Timothy Gronberg, and Dennis Jansen. 2005. *The Effect of Charter Schools on Traditional Public School Students in Texas: Are Children Who Stay Behind Left Behind?* New York: National Center for the Study of Privatization in Education.

Buchmann, Claudia, Thomas DiPrete, and Anne McDaniel. 2008. "Gender Inequalities in Education." *Annual Review of Sociology* 34(1): 319–37.

Buckley, Jack, and Mark Schneider. 2005. "Are Charter School Students Harder to Educate? Evidence from Washington, D.C." *Educational Evaluation and Policy Analysis* 27(4): 365–80.

Chahnazarian, Anouch. 1988. "Determinants of the Sex Ratio at Birth: Review of Recent Literature." *Social Biology* 35(3-4): 214–35.

Conger, Dylan, and Mark Long. 2013. "Gender Gaps in College Enrollment: The Role of Gender Sorting Across Public High Schools." *Educational Researcher* 42(7): 371–80.

Dee, Thomas and Helen Fu. 2004. "Do Charter Schools Skim Students or Drain Resources?" *Economics of Education Review* 23(3): 259–71.

DiPrete, Thomas and Claudia Buchmann. 2013. *The Rise of Women: The Growing Gender Gap in Education and What it means for America's Schools.* New York: Russell Sage Foundation.

DiPrete, Thomas, and Jennifer Jennings. 2012. "Social and Behavioral Skills and the Gender Gap in Early Educational Achievement." *Social Science Research* 41(1): 1–15.

Dobbie, Will, and Roland Fryer. 2011. "Are High-Quality Schools Enough to Increase Achievement among the Poor? Evidence from the Harlem Children's Zone." *American Economic Journal: Applied Economics* 3(3): 158–87.

Halpern, Diane. 1997. "Sex Differences in Intelligence: Implications for Education." *American Psychologist* 52(10): 1091–1102.

Hanushek, Eric, John Kain, and Steven Rivkin. 2004. "Disruption versus Tiebout Improvement: The Costs and Benefits of Switching Schools." *Journal of Public Economics* 88(9-10): 1721–46.

Hanushek, Eric, John Kain, Steven Rivkin, and Gregory Branch. 2007. "Charter School Quality and Parental Decision Making with School Choice." *Journal of Public Economics* 91(5-6): 823–48.

Hastings, Justine, Thomas J Kane, and Douglas Staiger. 2006. "Gender and Performance: Evidence from School Assignment by Randomized Lottery." *The American Economic Review* 96(2): 232–36.

Hauser, Robert. 2004. "Progress in Schooling." In *Social Inequality,* K.M. Neckerman. New York: Russell Sage Foundation.

Hoxby, Caroline. 2000. *Peer Effects in the Classroom: Learning from Gender and Race Variation*. National Bureau of Economic Research Working Paper #7867.

Hoxby, Caroline, and Sonali Murarka. 2007. "New York City's Charter Schools Overall Report". Cambridge, MA: New York City Charter Schools Evaluation Project.

———. 2009. *Charter Schools in New York City: Who Enrolls and How They Affect Their Students' Achievement*. National Bureau of Economic Research Working Paper #14852.

Hoxby, Caroline, and Jonah Rockoff. 2005. *The Impact of Charter Schools on Student Achievement*. Working Paper, Harvard University.

Imberman, Scott. 2007. *Achievement and Behavior in Charter Schools: Drawing a More Complete Picture. Working Paper*. New York: National Center for the Study of Privatization in Education.

Jennings, Jennifer, and Andrew Beveridge. 2009. "How Does Test Exemption Affect Schools' and Students' Academic Performance?" *Educational Evaluation and Policy Analysis* 31(2): 153–75.

Lavy, Victor, and Analía Schlosser. 2011. "Mechanisms and Impacts of Gender Peer Effects at School." *American Economic Journal: Applied Economics* 3(2): 1–33.

Long, Mark, and Dylan Conger. 2013. "Gender Sorting across K–12 Schools in the United States." *American Journal of Education* 119(3): 349–72.

Machin, Stephen, Shqiponja Telhaj, and Joan Wilson. 2006. "The Mobility of English School Children." *Fiscal Studies* 27(3): 253–80.

Martin, Joyce et al. 2013. *Births: Final Data for 2011.* Hyattsville, MD: National Center for Health Statistics.

Nichols-Barrer, Ira, Brian Gill, Philip Gleason, and Christina Clark Tuttle. 2012. *Student Selection, Attrition, and Replacement in KIPP Middle Schools*. Princeton, NJ: Mathematica Policy Research.

Noblit, George, and Dickson Corbett. 2001. "North Carolina Charter School Evaluation Report". Evaluation Section, Division of Accountability Services, Instructional and Accountability Services.

Raymond, Margaret. 2009. "Multiple Choice: Charter School Performance in 16 States". Stanford University: Center for Research on Education Outcomes (CREDO).

Schwartz, Amy Ellen, and Leanna Stiefel. 2013. *Moving Matters: The Causal Effect of School Mobility on Student Performance*. Working Paper, New York University

Thernstrom, Abigail, and Stephan Thernstrom. 2003. *No Excuses: Closing the Racial Gap in Learning.* New York: Simon and Schuster.

Tuttle, Christina Clark, Brian Gill, Philip Gleason, Virginia Knechtel, Ira Nichols-Barrer, and Alexandra Resch. 2013. *KIPP Middle Schools: Impacts on Achievement and Other Outcomes*. Princeton, NJ: Mathematica Policy Research.

Weiher, Gregory, and Kent Tedin. 2002. "Does Choice Lead to Racially Distinctive Schools? Charter Schools and Household Preferences." *Journal of Policy Analysis and Management* 21(1): 79–92.

Whitmore, Diane. 2005. "Resource and Peer Impacts on Girls' Academic Achievement: Evidence from a Randomized Experiment." *American Economic Review* 95(2): 199–203.

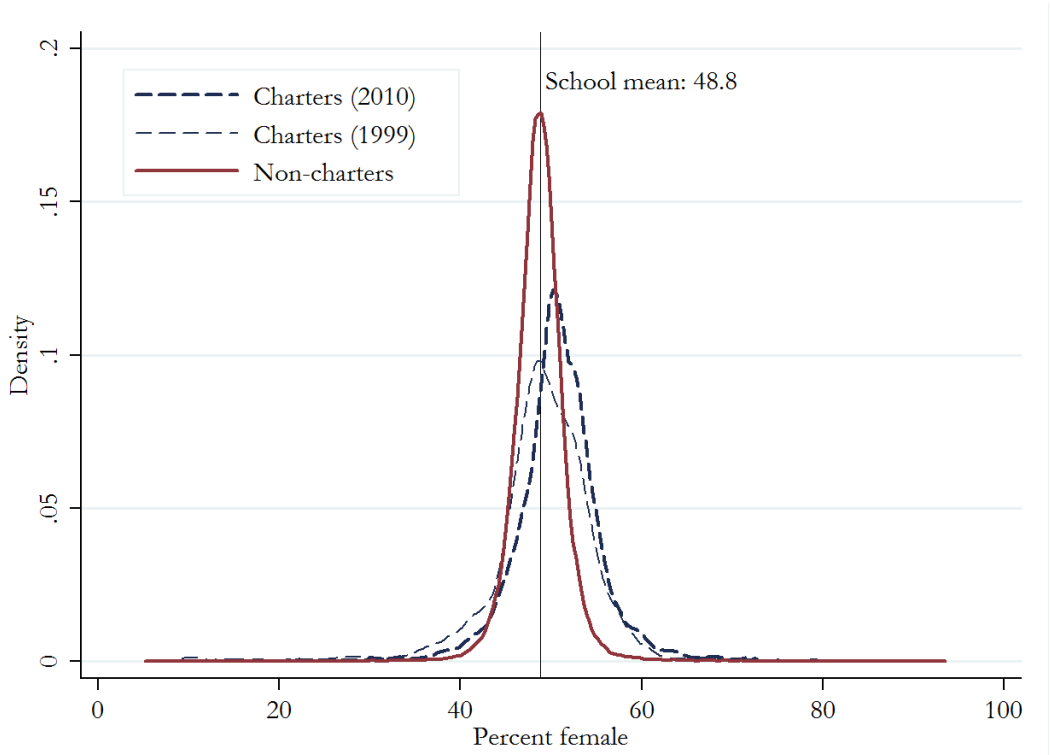
Wilkens, Christian. 2011. "Students with Disabilities in Urban Massachusetts Charter Schools." *Teachers College Record.*

Xu, Zeyu, Jane Hannaway, and Stephanie D'Souza. 2009. *Student Transience in North Carolina: The Effect of School Mobility on Student Outcomes Using Longitudinal Data*. Washington, D.C.: Urban Institute CALDER Center.

Zimmer, Ron, Brian Gill, Kevin Booker, Stephane Lavertu, Tim R Sass, and John Witte. 2009. *Charter Schools in Eight States: Effects on Achievement, Attainment, Integration, and Competition*. Santa Monica: RAND Corporation.

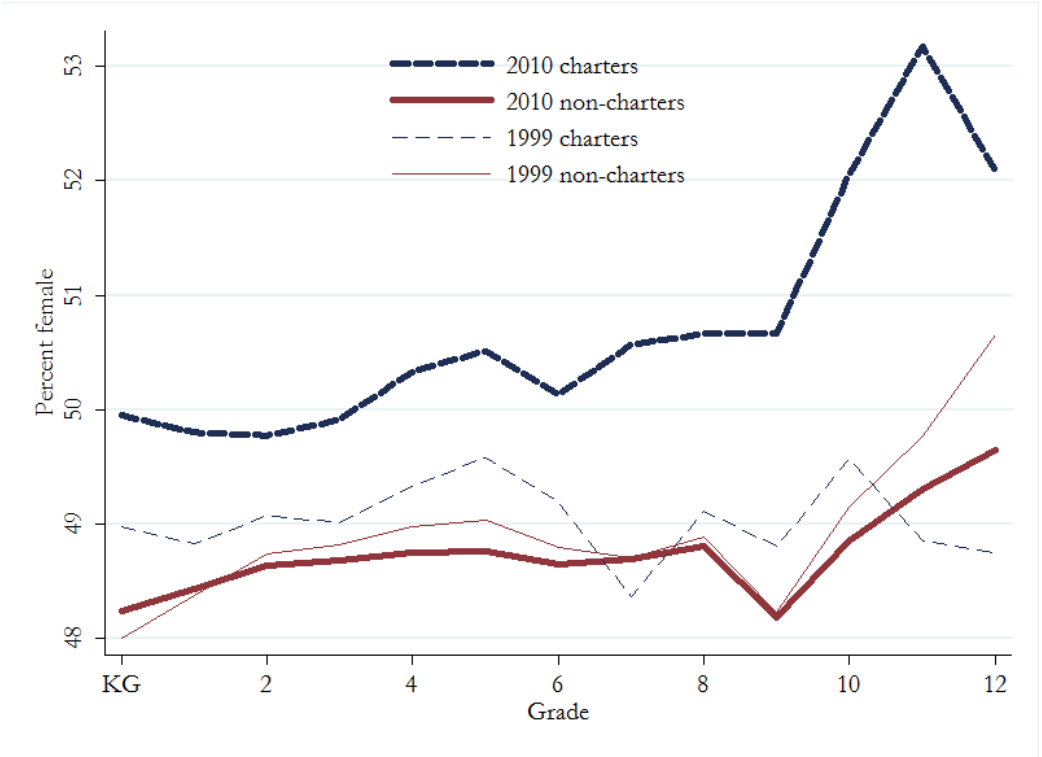
Zimmer, Ron, and Cassandra Guarino. 2013. "Is There Empirical Evidence That Charter Schools 'Push Out' Low-Performing Students?" *Educational Evaluation and Policy Analysis* 35(4): 461–80.

Figure 1: Distribution of female enrollment share, charter and non-charter schools



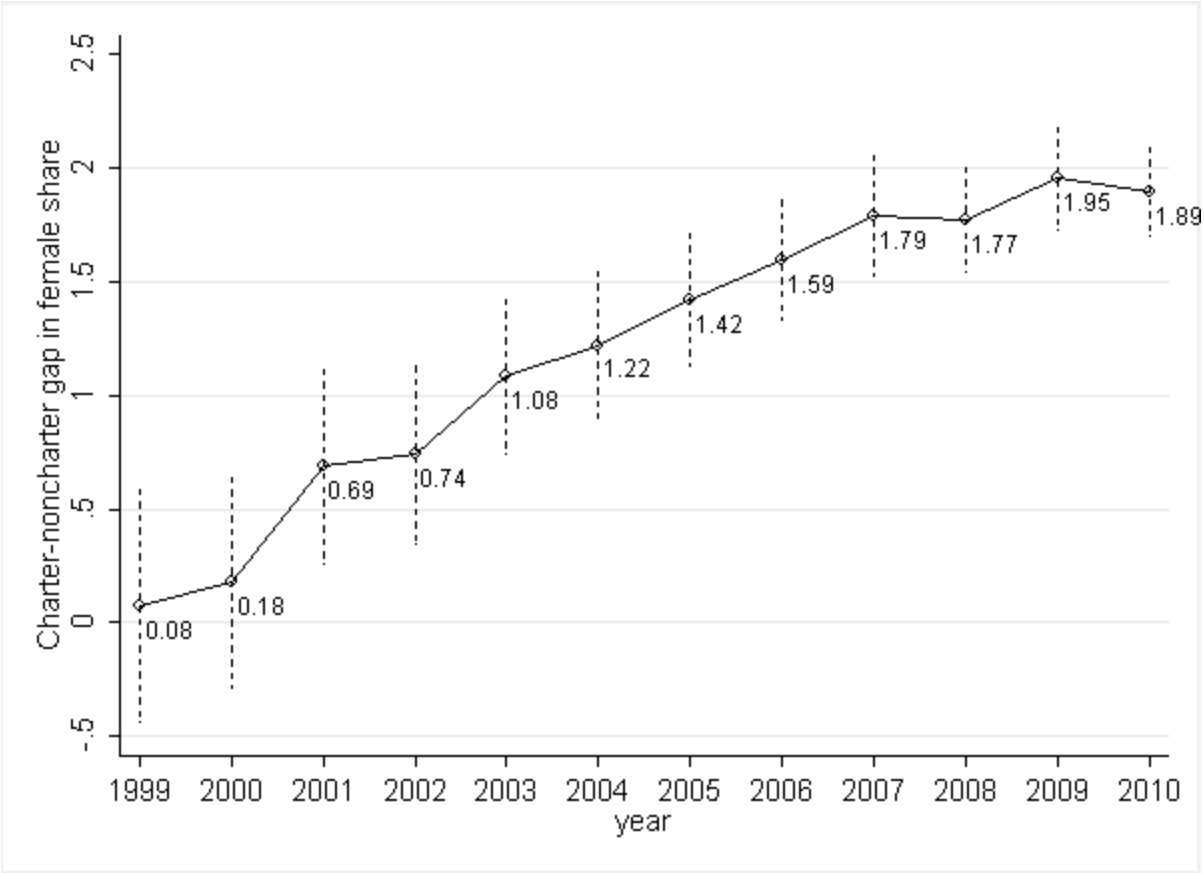
Note: authors' calculations using the Common Core of Data. Distribution for non-charters in 1999 is virtually identical to that in 2010, and thus is not shown for clarity of presentation.

Figure 2: Mean percent female by grade, charter and non-charter schools, 1999-00 and 2010-11



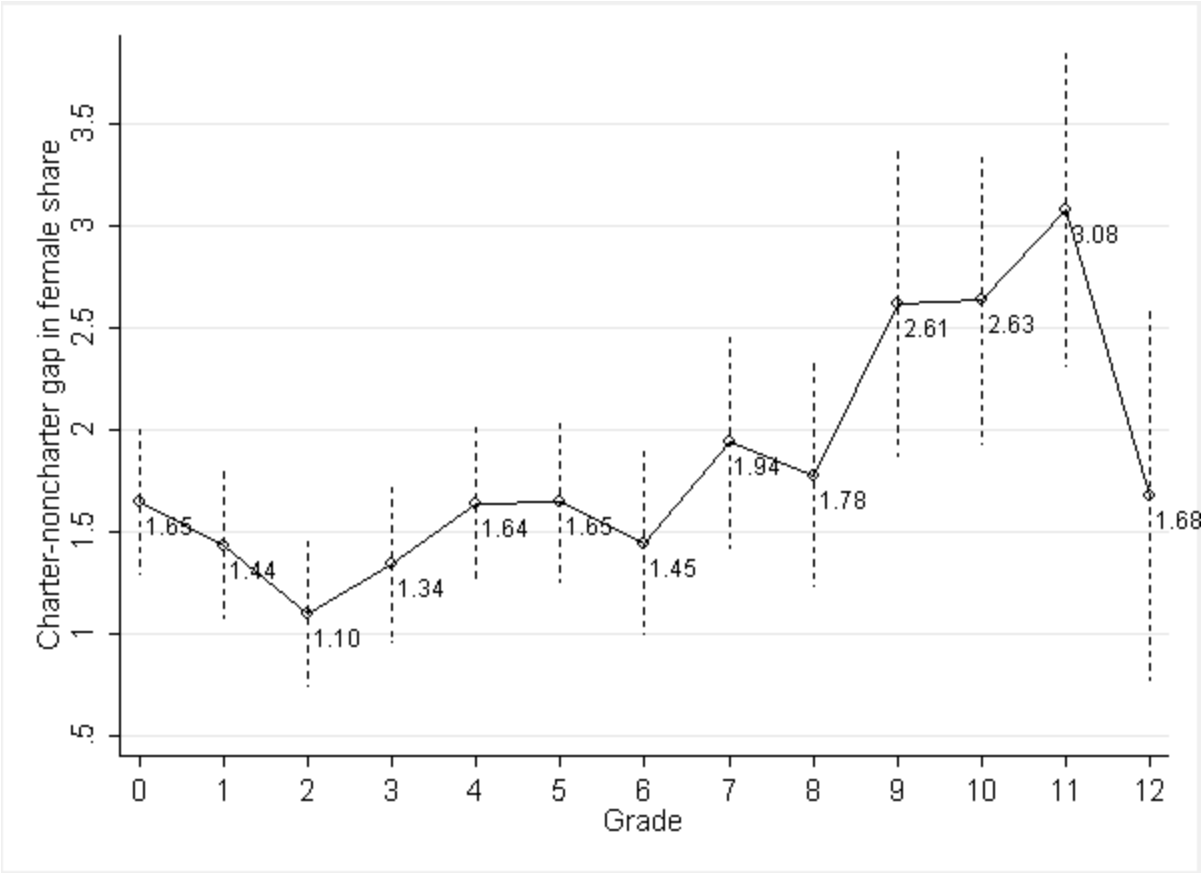
Note: authors' calculations using the Common Core of Data. All of the above are enrollment-weighted averages across schools.

Figure 3: Regression-adjusted estimates of the gender gap in charter school enrollment, by year, 1999-00 through 2010-11



Note: dotted lines indicate a 95-percent confidence interval estimate. Results are from annual regression models for the percent female using school-by-grade observations. The regressions include grade-specific school district effects and controls for enrollment shares by race/ethnicity and grade, the percent eligible for free lunch at the school level, and an indicator for "other/alternative" schools. Regressions are weighted using school-by-grade enrollment.

Figure 4: Regression-adjusted estimates of the gender gap in charter school enrollment, by grade level, 2010-11



Note: dotted lines indicate a 95-percent confidence interval estimate. Results are from regression models for the percent female using school-by-grade observations. The regressions include grade-specific school district effects and controls for enrollment shares by race/ethnicity and grade, the percent eligible for free lunch at the school level, and an indicator for "other/alternative" schools. Regressions are weighted using school-by-grade enrollment.

Table 1: Mean characteristics of all public and all charter schools, national CCD panel

	All years			2010-11		
	All Schools	Charter Schools	Δ	All Schools	Charter schools	Δ
Percent female	48.8	50.3	1.4	48.8	50.7	2.0
Percent black	17.3	30.5	13.3	16.2	28.6	12.4
Percent Hispanic	21.3	23.8	2.5	24.3	27.5	3.2
Percent Asian/Pacific Islander	4.8	3.6	-1.2	5.1	3.8	-1.4
Percent American Indian/Alaska Native	1.2	1.3	0.1	1.2	1.0	-0.2
Percent free lunch eligible	35.2	39.4	4.2	41.2	43.4	2.2
Percent elementary	48.7	46.1	-2.7	48.8	44.3	-4.5
Percent middle	20.4	8.2	-12.1	19.6	8.1	-11.5
Percent high	28.1	18.2	-9.9	28.2	17.4	-10.8
Percent mixed grade span	2.8	27.5	24.8	3.4	30.2	26.8
Enrollment	929.9	770.1	-159.8	905.5	926.2	20.7
Other/alternative school	1.1	7.0	5.9	1.1	5.0	4.0
Large or midsize city (or urban fringe)	72.6	85.6	13.0	72.2	86.5	14.3
Large city	16.4	39.2	22.9	15.6	40.1	24.5
Mid-size city	14.5	17.2	2.7	14.6	16.9	2.2
Urban fringe of large city	30.3	22.7	-7.6	30.0	22.4	-7.6
Urban fringe of mid-size city	11.4	6.5	-4.9	11.9	7.2	-4.8
Large town	1.0	0.5	-0.4	0.9	0.7	-0.2
Small town	6.8	2.7	-4.1	6.4	2.5	-3.9
N	906,772	39,186		82,516	5,018	

Notes: authors' calculations using the Common Core of Data. All of the above are enrollment-weighted averages over schools.

Table 2: Regression estimates of the gender gap in charter school enrollment, 2010-11

Dependent variable: percent of enrollment that is female

	Fixed effect:				
	None	State x grade	County x grade	District x grade	N
Full sample:					
Charter school	1.950***	1.993***	1.989***	1.888***	449,566
	(0.083)	(0.084)	(0.086)	(0.100)	
Full sample excluding other/alternative:					
Charter school	1.809***	1.830***	1.847***	1.797***	432,542
	(0.083)	(0.083)	(0.085)	(0.098)	
Large cities:					
Charter school	1.903***	1.999***	1.971***	1.805***	70,078
	(0.151)	(0.146)	(0.146)	(0.152)	
Large cities excluding other/alternative:					
Charter school	1.787***	1.894***	1.861***	1.758***	66,680
	(0.151)	(0.143)	(0.143)	(0.150)	

Note: standard errors in parentheses with clustering at the school level (* $p<0.05$, ** $p<0.01$, *** $p<0.001$). Each cell is the result from a separate regression model, and reports the estimated coefficient on the charter school indicator. The regressions in columns (2) – (4) include grade-specific location effects and controls for enrollment shares by race/ethnicity and grade, the percent eligible for free lunch at the school level, and an indicator for "other/alternative" schools. Regressions are weighted using school-by-grade enrollment.

Table 3: Regression estimates of the gender gap in charter school enrollment, pre- and post-conversion

	(1)	(2)	(3)	(4)
	Fixed effect:		Fixed effect:	
	District	School	District	School
A. Full sample:				
Conversion school	0.553***	-	0.608***	-
	(0.054)		(0.062)	
Post conversion	0.235**	0.125	-	-
	(0.080)	(0.124)		
Years after conversion	-	-	0.008	0.008
			(0.009)	(0.012)
B. Observed 3+ years post:				
Conversion school	0.314**	-	0.454***	
	(0.117)		(0.088)	
Post conversion	0.534***	0.362**	-	-
	(0.133)	(0.140)		
Years after conversion	-	-	0.088***	0.070**
			(0.021)	(0.023)

Note: standard errors in parentheses (* $p<0.05$, ** $p<0.01$, *** $p<0.001$). Each panel (A/B) and column (1-4) set is the result of a separate regression model. The regressions include grade-specific location (or school) effects and controls for enrollment shares by race/ethnicity and grade, the percent eligible for free lunch at the school level, and an indicator for "other/alternative" schools. Regressions are weighted using school-by-grade enrollment. Only schools in states where charter conversions have occurred are included, and only conversion charters observed for at least 3 years after conversion are identified as conversions in panel B.

Table 4: Regression estimates of the gender gap in CMO and KIPP school enrollment, 2010-11

Dependent variable: percent of enrollment that is female

	(1) CMO	(2) KIPP
CMO or KIPP charter	1.999***	2.883***
	(0.199)	(0.592)
Other charter	1.871***	1.874***
	(0.109)	(0.101)

Note: standard errors in parentheses with clustering at the school level (* $p<0.05$, ** $p<0.01$, *** $p<0.001$). See notes to Table 2 for further details about model specification.

Table 5: Change in female enrollment share within schools, across grades and over time

	(1)	(2)	
	Charter schools only	Charter schools	Charter-noncharter difference
Grade 2	-0.002	-0.005	0.230**
	(0.081)	(0.077)	(0.078)
Grade 3	0.101	0.097	0.321***
	(0.082)	(0.078)	(0.079)
Grade 4	0.046	0.043	0.316***
	(0.083)	(0.079)	(0.080)
Grade 5	0.055	0.078	0.470***
	(0.088)	(0.083)	(0.085)
Grade 6	0.129	0.125	0.324***
	(0.083)	(0.078)	(0.079)
Grade 7	0.626***	0.618***	0.665***
	(0.083)	(0.078)	(0.078)
Grade 8	0.839***	0.904***	2.311***
	(0.110)	(0.103)	(0.106)
Grade 9	1.225***	1.326***	0.662***
	(0.084)	(0.077)	(0.078)
Grade 10	0.722***	0.824***	0.408***
	(0.087)	(0.080)	(0.081)
Grade 11	0.067	0.164*	-0.196*
	(0.091)	(0.082)	(0.083)

Note: columns (1) and (2) represent two separate regression models using grade-year observations in the CCD between 1999 and 2009. Column (1) includes only charter schools, while column (2) includes both charter and traditional schools. The dependent variable is the change in percent female enrollment from grade *g* to grade *g+1* in years *t* and *t+1*, within the same school. All models include year and school district effects. Standard errors reported in parentheses (* $p<0.05$, ** $p<0.01$, *** $p<0.001$).

Table 6: Gender gap in the probability of a non-structural or within-year move, North Carolina schools

	(1) Charter schools		(2) Charter and traditional public schools	
	Female-male gap	Baseline probability:	Female-male gap in charters	Charter-noncharter difference in gap
A. Outcome: non-structural move				
Grades 3-5	-0.012**	0.242	-0.014***	-0.010**
	(0.004)		(0.004)	(0.004)
Grades 6-8	-0.020***	0.218	-0.018***	-0.009*
	(0.004)		(0.004)	(0.004)
Grades 9-11	-0.026***	0.262	-0.028***	-0.006
	(0.006)		(0.006)	(0.006)
B. Outcome: within-year move				
Grades 3-5	-0.004**	0.026	-0.004**	-0.001
	(0.001)		(0.001)	(0.001)
Grades 6-8	-0.006***	0.028	-0.006***	0.004**
	(0.001)		(0.002)	(0.002)
Grades 9-12	-0.013***	0.080	-0.014***	0.001
	(0.003)		(0.003)	(0.003)

Note: in each column (1) and (2), the rows (grade levels) represent separate regression models for the probability of making a non-structural (year-to-year) or within-year move. In column (1) the sample consists of students in grades 3-11 in charter schools in 2006-2010, while in column (2) the sample is all students in grades 3-11 in any North Carolina district that ever housed a charter school. (Panel B regressions also include grade 12). All models include controls for race/ethnicity and free or reduced price lunch status (and their interaction), LEP and special education status, locale, year, and school type dummies. Models for grades 3-8 in panel A also include reading and math scores, and the models in column (2) include school district fixed effects. Standard errors reported in parentheses (* $p<0.05$, ** $p<0.01$, *** $p<0.001$).

Table 7: Gender composition of new students, North Carolina schools

	Percent female, charter schools	Percent female, traditional public schools	Difference
Grades 4-5	50.3	48.4	1.97***
			(0.05)
Grades 6-8	49.0	48.5	0.6
			(0.5)
Grades 9-12	50.3	49.1	1.2
			(0.6)

Note: data consists of all students in grades 4-12 who were new to their school in 2006-2010 (i.e., data was available for their school and grade in the prior year, but they were not observed in that school). Column (3) shows the difference in the percent female, along with the standard error from a t-test for differences in means. (*** $p<0.001$).

[1] Long and Conger (2013) investigate gender sorting across schools of all types in 2008 and find male students are underrepresented in charter and private schools, and over-represented in irregular public schools. Using data from Florida, the same authors link gender sorting in high school to the gender gap in college enrollment (Conger and Long 2013).

[2] Although charter schools have existed since 1992, the CCD has only reliably identified these schools since 1998. Moreover, there appear to be a number of miscoded schools in the CCD. See the online appendix for details, and a description of how we identified likely miscodes.

[3] In the CCD data, we estimate that 1.3% of schools are single sex (less than 5% or more than 95% female) and that these schools are disproportionately vocational and alternative schools. Among regular schools, less than 0.4% are single sex. Regardless of school type, male single sex schools are more common than female.

[4] Nationally, the female share in private schools is comparable to that in public schools (49.0 percent), although the share is slightly higher (49.3 percent) in urban areas (NCES 2008). Estimates of the female share of homeschooled students vary over time from 51% in 1999 to 58% in 2007 (Digest of Education Statistics 2012), though the overall percent of students homeschooled is small (1.3 percent) and more prevalent in rural areas.

[5] The ten states that did not have a charter law during this period are Alabama, Kentucky, Maine, Montana, North Dakota, Nebraska, South Dakota, Vermont, Washington, and West Virginia.

[6] Not all charter schools in the CCD are administratively linked to a local school district. As explained in the online appendix, we linked schools to geographic school districts using their spatial coordinates and GIS.

[7] The most notable difference is that North Carolina charters are historically less concentrated in urban areas than those in other states.

[8] For model (3) we do not include school district fixed effects, as many school districts in North Carolina house only one charter school. Model (4)—which is estimated using charter and traditional schools—incorporates district fixed effects.

[9] A 4th grader repeating 4th grade in a different school would be a non-structural move in this example.

[10] The complete set of regression results is provided in the online appendix.

[11] A state report in 2001 found a higher rate of within-year attrition overall among charter versus traditional schools in North Carolina (Noblit and Corbett 2001).