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Experimentally Estimated Impacts of School Vouchers on Educational Attainments of Moderately and Severely Disadvantaged Students

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Experimentally Estimated Impacts of School Vouchers

on Educational Attainments of Moderately and Severely Disadvantaged Students

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Abstract

Although qualitative research suggests that school choice and other interventions are more beneficial for moderately disadvantaged than severely deprived students, the subject has barely been explored by quantitative studies with either observational or experimental designs. We estimate experimentally the impact of a voucher offer on college attainment of poor minority students by household income and parental education. Estimates are obtained from a 1997 private, lottery-based voucher intervention in New York City. National Student Clearinghouse provided 2017 postsecondary outcomes. Positive impacts on moderately disadvantaged students do not extend to the severely deprived.

Experimentally Estimated Impacts of School Vouchers on Educational Attainment of Moderately and Severely Disadvantaged Students

Qualitative researchers report that school choice programs are more effective at serving the moderately disadvantaged than those from severely disadvantaged backgrounds that are differentiated by both ethnicity and class. Pondiscio (2019), for example, discusses how a charter-school network in New York City is more effective at serving minority students from households with some cultural and financial assets than those less well endowed, and Wells and Scott (2001) provide anecdotal evidence that schools of choice serve the relatively advantaged segment of the low-income population. In his book, *The Truly Disadvantaged*, William Julius Wilson (1991; 2012) discusses ways in which deprivations suffered by those segregated by both ethnicity and socio-economic status (SES) can affect a person's ability to capitalize on new opportunities, including education.

Although these and other qualitative studies have deepened our understanding of the cultural and resource challenges of those who are severely disadvantaged, very few quantitative studies of connections between SES and educational attainment have differentiated between moderately and severely disadvantaged segments of the minority community. Nor have most experimental evaluations of school choice and other programmatic interventions drawn this distinction. Yet potential heterogeneous effects hypothesized by qualitative research have an important bearing on assessments of the efficacy of these interventions.

In this paper we estimate heterogeneous school voucher effects on college enrollment and degree attainment among African American and Hispanic students who attended elementary school in New York City toward the end of the 20th Century. These effects are estimated for a program established by the New York City School Choice Scholarships Foundation (SCSF) in

1997. SCSF specified that, to participate in the lottery, applicants must be public school students entering first through fifth grade who provide documents showing they are eligible for participation in the federal free and reduced-price lunch program, a threshold set at 185 percent of the poverty line (Peterson, Myers & Howell, 1998). Information on the offer of a voucher to those who won the lottery is combined with data on postsecondary enrollment and degree attainment information provided by the National Student Clearinghouse as of the fall of 2017.[1]

We detect no significant voucher effects for severely disadvantaged students, that is, for ethnic minority students living in extremely low-income households and, separately, for those in families where neither parent had an education beyond high school. However, we find significantly and substantively significant increases of 7 percentage points of voucher offers on four-year degree attainments among minority students from moderately disadvantaged households. Given the very low percentage of first-generation college or low-income students who graduate from college, these increments are roughly 50 percent higher than what would otherwise be the case (as estimated by control group rates).

Theoretical Framework and Literature Review

Qualitative research has deepened our understanding of the cultural and resource challenges of those who are truly disadvantaged by both ethnic and class isolation (Bourdieu, 1986; Weninger & Laureau, 2018; Wilson, 1991). But quantitative research, even while carefully documenting the overall effects of SES on student achievement and attainment, has seldom differentiated between moderately and severely disadvantaged segments of the minority community. Nor have experimental evaluations of school choice and other programmatic interventions paid much attention to heterogeneities within disadvantaged groups.

Qualitative Research on Disadvantaged Families

Although school voucher are often designed to serve low-income families, theorists and qualitative researchers have raised concerns about the effectiveness of such interventions at addressing the needs of those isolated by both ethnicity and SES (Ascher, et al., 1996; Brighouse, 2000; Fiske and Ladd, 2000; Fuller, Elmore and Orfield, 1996; Gewirtz et al., 1995; Guttmann, 1985; Henig, 1995). In Bryk et al.'s (1993: 313) study of Catholic schools, the authors say students, to remain, must conform to school expectations:

> Implicit here is the idea that participation in a particular school is not an inalienable right. Catholic school faculty go to great length to help students and work with parents, but reciprocity is also expected. Students who seriously or chronically violate the community's norms must leave. Indeed, students are more likely to exit for this reason than for poor academic performance.

Similarly, Wells and Scott (2001: 252) report that "students who were not trying hard enough, were frequently tardy or absent, wore the wrong clothes, or misbehaved (as defined by the school's conduct code) could be kicked out" of private schools.

These concerns also apply to other school choice programs such as charter schooling. Pondiscio (2019: 242) observes that families who win a lottery held by a New York City charter school network must agree to purchase uniforms, transport their child to school, supervise their child's homework and volunteer at school when asked. He summarizes his findings as follows:

> the common criticism [of charter schools] is that they 'cream students,' attracting bright children, and shedding the poorly behaved and hardest to teach. This misses the mark. [These schools are] *creaming parents.* Parents who are not put off by uniforms, homework, reading logs, and constant demands on their time…. Parents who are not

> upset by tight discipline and suspensions but grateful for it, viewing it as a safe haven from chaotic streets and schools.

These factors may limit the accessibility of charter schools to families from the lowest socioeconomic echelons.

Qualitative scholarship has also drawn sharp distinctions between those within the low SES population earning a modest income and a more extremely deprived group that depends heavily upon episodic employment and government transfers for survival (Miller, 1958; Lewis, 1961, 1966, Anderson, 1999). Hannerz (1969: 46-55), for example, draws a sharp contrast between those in an inner-city neighborhood that he labels "mainstreamers" and "street families." The former, he says, are "stable working-class people" who "conform most closely to mainstream American assumptions about the 'normal' life." The mainstreamers "generally spend much time at home" and, if the parents have school-age children, they "try to see to it that homework gets done." By contrast, the street families "are conspicuous in the open-air life of ghetto street corners and sidewalks." Males "usually hold low-paying, unskilled jobs and are sometimes unemployed." As a consequence, he says, "street families have a lower average income than mainstreamer families."

In a classic study, Wilson (1991: 462) distinguishes between the moderately poor and the truly disadvantaged:

> The ghetto features a population, the underclass, whose primary predicament is joblessness reinforced by growing social isolation. Outmigration has decreased the contact between groups of different class and racial backgrounds and thereby concentrated the adverse effects of living in impoverished neighborhoods. These concentration effects, reflected, for example, in the residents' self-limiting social

dispositions, are created by inadequate access to jobs and job networks, the lack of involvement in quality schools, the unavailability of suitable marriage partners, and the lack of exposure to informal mainstream social networks and conventional role models

In sum, qualitative researchers suggest that students from households suffering severe cultural and resource deprivations may not be able to capitalize on educational opportunities to the same extent as those who are just moderately disadvantaged.

Quantitative Research on Disadvantaged Families

Quantitative research also speaks to several salient issues with respect to school choice and disadvantaged families. As in qualitative work, this literature attempts to identify and characterize disadvantaged families. Much of this literature additionally identifies several factors that explain SES gaps in educational outcomes. But even though program interventions have been implemented to address these gaps, much of this research does not focus on impacts on the severely disadvantaged subgroups identified in the qualitative research. The assessment of the efficacy of these interventions is limited by this research gap.

Quantitative researchers face challenges to obtaining precise and valid measures of disadvantage. Although estimates of the size and composition of the truly disadvantaged population depends on the indicator of disadvantage one employs. Jencks (1991) provides some sense of its magnitude as of 1988, just about the time the students in our own analytic sample were born (about 1986–1991). About 1.7 percent of U.S. white men and 6.9 percent of black men between the ages of 25 and 54 were both poor and jobless that year. The percentage of families with children headed by a woman on welfare was 9.5 percent. High school drop-out rates were 16.5 percent for black students and 35.8 percent for Hispanic ones. Except for this last

figure, these estimations suggest that the truly disadvantaged in 1988 constituted roughly 5 percent to 15 percent of the population.

If these percentages are roughly correct, then most studies of SES disparities in educational attainment and other educational outcomes do not distinguish individuals from severely disadvantaged backgrounds from others who suffer less severe deprivation. For example, numerous studies have evaluated the impact of SES on educational outcomes by estimating differentials between those who are and are not eligible for the federal free and reduced lunch program. Yet this indicator has come under criticism for becoming too inclusive, sometimes identifying over half the school-age population as in poverty. Questions about the validity and reliability of free-lunch status as an SES indicator have been raised (Domina et al., 2018; Harwell & LeBeau, 2010; Michaelmore and Dynarski, 2017). Even research that does not rely on the free-lunch measure tends to group all minority students together and/or define the poor more broadly as the lowest deciles or sometimes even half of the SES distribution (Alon, 2009; Bastedo and Jaquette, 2011; Bowen, Chingos, & McPherson, 2009; Buchmann & DiPrete, 2006; Chetty et al. 2017; Reardon, 2013; Vigdor and Ludwig, 2008). In short, quantitative research has not made distinctions at the same level of granularity as much of the qualitative research we cited earlier.

Despite these limitations, this body of research documents numerous disparities in educational outcomes by SES. Bailey and Dynarski (2011), for example, show that large disparities arise with even moderate increments in household income. Only 29 percent of high school students born between 1979 and 1982 enrolled in college if they lived in households in the lowest quartile of the distribution, but 47 percent of this cohort enrolled in college if they lived in households in the second lowest quartile. Four-year completion rates are also sharply

differentiated. High school graduates rates are only 9 percent among those in the lowest quartile, while the rate is 21 percent among those in the second quartile. Of those who enrolled in college, 32 percent of the lowest quartile persisted to graduation, while 44 percent of those in the second quartile attained the four-year degree. Presumably, the contrasts would be even greater if individuals in the lowest deciles were compared to those somewhat higher in the distribution.

Factors Explaining Gaps in Education Outcomes by SES. A large body of quantitative research has posited several reasons behind gaps in educational outcomes by SES. These factors begin, as Furstenberg (2011, 468) says, "at very early ages, creating a daunting problem for schools as they attempt to compensate for learning differences in the family." College-educated mothers speak more frequently with their infants, use a larger vocabulary when communicating with their toddlers, and are more likely to use parenting practices that respect the autonomy of a growing child (Guryan, Hurst, & Kearney, 2008; Hart & Risley 2003; Hoff, 2003). College-educated and higher-income families have access to more enriched schooling environments (Altonji & Mansfield, 2011) and are less likely to live in extremely impoverished communities burdened with high violent crime rates (Burdick-Will et al. 2011). Children exposed to lower SES environments are at greater risk of traumatic stress and other medical problems that can affect brain development (Nelson & Sheridan 2011). These and other childhood and adolescent experiences contribute to SES disparities in academic achievement (Kao & Tienda, 1998; Goyette 2008; Jacob & Linkow, 2011).

Impacts of Interventions on the Truly Disadvantaged. Many programmatic or policy interventions have attempted to address the resulting inequalities of educational opportunity. Research on these interventions, however, have identified only modest impacts. For instance, high-quality, focused pre-school interventions have been shown to have long-term effects on

educational attainment (Heckman et al., 2010), but it is unclear whether such interventions can be brought to scale (Puma, 2012). Home visits to dysfunctional families, initiatives to enhance family literacy, and adult education programs aimed at changing parental behavior and management practices have little effect on child readiness for school (Barnett 1995; Brooks-Gunn, 2003; Gomby, Culross, & Behrman 1999; Goodson, 2005; Magnuson & Duncan, 2004; Magnuson & Votruba-Drzal, 2008; St. Pierre, Ricciuti, & Rimdzius, 200; Sweet & Appelbaum, 2004). In general, the authors of a systematic review of parent engagement interventions conclude that there is "little empirical support for the widespread claim that parental involvement programs are an effective means of improving student achievement or changing parent, teacher or student behavior" (Mattingly et al., 2002, 549).

Similarly, interventions that seek to increase college enrollments and retain students in college by providing information to parents or students, or reminding students of deadlines, or even the use of mentors and tutors to help induce enrollments have been shown to vary widely in their effectiveness (Carrell & Sacerdote, 2017; Cheng & Peterson, 2018; Deming & Dynarski, 2009; Gurantz, 2019; Hoxby and Turner, 2015; Hyman, 2020; Oreopoulos & Petronijevic, 2013; Oreopoulos & Petronijevic, 2019; Swanson et al., 2018).

Studies of school choice interventions also rely upon broad categories when defining socio-economic disadvantage. Most programs are available to students coming from households with incomes that vary anywhere between 150 percent and 300 percent of the poverty line (Epple et al., 2017, 447). Despite the broad eligibility range, evaluations of programmatic impacts do not draw fine SES distinctions within the eligible population. Instead, estimates are made for the participating population as a whole or for ethnic groups within that population. Epple et al. (2017, 469) summarize their review of the literature on U. S. interventions: "Overall, the

evidence . . . finds not very robust effects on test scores. . . [but] more robust evidence has accumulated regarding positive impacts on graduation probabilities, particularly for black students." Nothing is said in this or other literature reviews about the joint effects of extreme deprivation jointly by ethnicity and SES (Mills, and Wolf, 2015; Shakeel et al., 2016).

The most recent studies of voucher effects on educational attainment take a similarly broad-gauged perspective. For example, Chingos and Kuehn (2017) find that participation in the Florida tax-credit program, which gives private-school scholarships to low-income students, increases college enrollment rates by six percentage points but finds no significant impacts on two-year degree attainment at Florida colleges. Chingos (2018) finds no voucher impact on college enrollment in the Washington, D.C. voucher program. Wolf et al. (2018, 2020) report that voucher students in Milwaukee are more likely to enroll in college and slightly more likely to complete college than a matched comparison group. All these studies illuminate the potential of school choice for attainment, but none conduct a fine-grained analysis that looks at students affected by both ethnic and class deprivations, though one study found positive effects on high school graduation among those who had higher levels of academic performance prior to participation in the program (Wolf et al., 2013).

Many factors might explain the difficulties programmatic interventions encounter, but of critical importance is the economic, social, and cultural capital that disadvantaged subgroups may lack — a point that, as we described earlier, qualitative researchers have long made. As Furstenberg (2011, 469) theorizes, these merely modest impacts may be due to the concentration of interventions on "the most disadvantaged portion" of the low SES population. "Little of what we have learned," he concludes, can "be safely generalized to families of modest to moderate means." Our analysis below supports this conclusion.

In sum, despite the considerable number of studies of the connection between SES and educational outcomes, the quantitative literature, unlike important qualitative studies, has yet to explore in depth the combined effects of social and economic isolation by both ethnicity and class. The SCSF program in New York City studied here provides an opportunity to discern heterogeneous of an intervention by degree of deprivation within a disadvantaged population.

The Intervention

This opportunity arose as the result of an unusual set of political circumstances. In the fall of 1996, when the New York City public schools failed to open on time, the Catholic archdiocese responsible for the city's private schools having this religious affiliation offered to accept—and, presumably, to educate--the public school's one thousand "worst" students (Morkan & Formicola, 1999). The school chancellor rejected the proposal, but the idea was embraced by New York City's mayor, setting off a political firestorm over the proper boundaries between church and state. In the wake of this controversy, SCSF, in the spring of 1997, announced an intervention that would at least partially mimic the archdiocese's offer. Though the vouchers were not directed specifically toward the worst students in the public schools, they were limited to low-income students already in public school or who had not entered first grade. Preference was also given to those of very low income, as three-fourths of the vouchers were reserved for those attending lower-performing schools (defined by average test-score performance). Further, to show a strong popular demand for vouchers, SCSF conducted an energetic promotional campaign in low-income neighborhoods. A surprisingly large number of students—more than 20,000—were said to have applied for scholarships (Peterson, Myers & Howell, 1998). Thus, there is every reason to think that information about the availability of

vouchers for low-income families penetrated deeply into the poorest segments of the black and Hispanic communities.

SCSF offered three-year half-tuition scholarships worth up to $2,380 (2019 dollars) annually[2] to 1,000 low-income families with children who were entering first through fifth grades.[3] Program eligibility was limited to those who came from "families with incomes such that they qualified for the U.S. government's free [and reduced price] school lunch program" (Peterson, Myers & Howell, 1998). A student from a household that was at as much as 185 percent of the poverty line was eligible for participation in the program. Income used to determine eligibility was earned income documented by either a tax return, a wage statement or some other document indicating eligibility status. In-cash or in-kind income via welfare assistance, disability assistance, food stamps, housing subsidies or other government transfers was not considered when establishing eligibility.

A recipient could use the voucher to attend any participating private school in New York City regardless of its religious or secular orientation. Because the number of applications for a voucher exceeded the available number of vouchers being offered, random lotteries were held to determine whether a student received a voucher. Over two-thirds of those receiving an offer initially chose to attend a Catholic school. Additional details of the program and evaluation procedures associated with the program can be found in Peterson, Myers and Howell (1998).

Students from minority background constituted 85 percent of the sample (Table 1). Forty-two percent of the treatment group and 41 percent of the control group were African American, and 42 percent of the treatment group and 47 percent of the control group were Hispanic.

≪Table 1 Here≫

All applicants were required to provide documentation of their earned income at the time parents were surveyed. The measure of income used here is from a survey administered to the caretaker who accompanied the child to the testing program, but we assume that the applicant felt constrained to report a level of income in the survey consistent with the documentation used to establish lottery eligibility. In any case, the earned income of many voucher applicants was very low. No less than 29 percent of the treatment group reported earned incomes of less than $8,048 a year in 2019 dollars, and another 22 percent reported an earned income between that number and $12,876. These percentages do not differ significantly for students in the control group. Altogether, 51 percent of the evaluation sample consisted of students from households with earned incomes of less than $12,876 a year (see Table 1). Although we do not know the amount of unreported income and income from government transfers available to these households, this portion of the sample seems to consist mainly of those whom Wilson (1991) would regard as truly disadvantaged. The remainder of the sample — the moderately disadvantaged — had earned incomes that ranged between $12,900 and the maximum allowed, which was 185 percent of the poverty line.

The adults accompanying their children to the testing session reported that their parents had a wide range of educational backgrounds (Table 1). Sixteen percent of both the treatment and control group students had parents without a high school diploma, while another 28 percent of the treatment group and 24 percent of the control group said neither parent had any education beyond a high school diploma or its equivalent. The remainder claimed that at least one parent had some college or even a college degree. Those from families where neither parent had more than a high school diploma or its equivalent are classified as the truly disadvantaged, while the

balance — 53 percent of the sample — consisted of children who had at least one parent who had enrolled in college.

In sum, the SCSF intervention was designed in such a way as to generate a set of applicants participating in the evaluation who were overwhelmingly of minority group status and who divided almost evenly into two contrasting segments of the low-SES community.

Data

To estimate voucher impacts on educational attainment as of Fall 2017, we link individual-level lottery data from SCSF to college enrollment and completion data provided by the National Student Clearinghouse (NSC). The NSC contains information on the enrollment status for every academic term and postsecondary institution that a student attends as well as whether the student earned a degree. Among the 2,666 students in the study population, the original study had for 2,634 students the requisite information (name and date of birth) needed to attempt a match to the NSC data.[4] In the analytic sample, 1,356 students were assigned to the treatment group and 1,278 students were assigned to the control group. As mentioned, those attending low-performing public schools were given a better chance of winning the lottery, increasing the number of observations of those from extremely disadvantaged ethnic and class backgrounds. We employ weights to adjust for imbalances in the sampling frame, so the sample is representative of the applicant pool.

As is shown in Table 1, the characteristics of the treatment and control groups are similar, as is expected given the random assignment of students to receive a voucher. Treatment students are less likely to be of Hispanic descent and less likely to have parents who only complete high school or earn a GED. With nearly 20 different statistical tests, these two differences may have occurred at random, and a joint significant test of the variables listed in Table 1 in a regression of

treatment status on these variables and randomization group dummies yields a p-value of 0.20. These results provide evidence of the fidelity of the random assignment; we also control for the full set of observed covariates.

We estimate the effects of a 1997 SCSF offer of a voucher to low-income elementary school students in New York City on college enrollment and graduation rates as of the fall of 2017, four years after a prior evaluation of SCSF's impact on educational attainment (Chingos & Peterson, 2015). That interval provided students with an additional four years to enroll in college and to finish their post-secondary degree program. By the fall of 2017, even the youngest cohort of participants in the SCSF program had three years to graduate from a four-year institution over and beyond an expected graduate date that assumes no educational interruptions. The oldest cohort had seven years beyond the expected graduation date. Given this increased length of time, it is not surprising that the percentage of students enrolled and the percentage attaining a four-year degree increased substantially during the intervening four-year interval between the previous evaluation and this one. Enrollment increased by 3 percentage points (from 26 percent to 29 percent) in a two-year college and by 13 percentage points (from 26 percent to 39 percent) in a four-year institution. Similarly, degree attainment rates shifted upward by 6 percentage points (10 percent to 16 percent). Bachelor's degree attainment rates increased from 10 percent to 16 percent over this time period (see Table 3). Interestingly, the graduation rate as of 2017 resembles the graduation rate of 15 percent for students in the bottom two quartiles reported by Bailey and Dynarski (2011) for cohorts born between 1979 and 1982.[5]

Methodology

The substantial increase in both enrollment and graduation rates of the participants in the evaluation suggest that is worth replicating the previously reported findings to see if they are

robust to outcomes after students have had four more years to pursue their further education. We report these results below, but the main purpose of this paper is to report for the first time, heterogeneous voucher impacts with interaction terms that differentiate minority, low-income students who are moderately disadvantaged from those who are severely disadvantaged.

Estimation procedure

We estimate the following linear probability model of the effect of the offer of a voucher or the intent-to-treat (ITT) effect.[6] That is, we estimate the impact on college enrollment and degree attainment of being offered a scholarship:

$$Y_i = \beta_0 + \beta_1 Treat_i + \beta_2 X_i + \delta_i + \epsilon_i. \quad (1)$$

In equation (1) Y_i is an indicator for either whether student *i* enrolled in postsecondary education or completed a postsecondary degree. $Treat_i$ is a dummy variable identifying students assigned to the treatment group (i.e., offered a scholarship), and X_i is the vector of student demographic characteristics shown in Table 1. Students were randomized in blocks that were formed based upon family size, the verification and testing session, and whether their baseline school had an average test score above or below the city median. To capture the experimental design in our model, we include δ_g, a vector of randomization block indicators. Finally, ϵ_i is the error term. We use weights in the regressions to make the sample representative of those who originally applied for a scholarship and cluster standard errors by randomization block. This model replicates the models in Chingos and Peterson (2015), except that our data spans through the fall of 2017 instead of ending in the fall of 2013. Also following Chingos and Peterson (2015), we present estimates of this regression model for the full sample as well as for samples restricted to segments of the population — by ethnicity, household income, and parent's educational attainment.

Estimating Impacts for the Severely Disadvantaged

To estimate the impacts for students from severely disadvantaged subgroups, we follow the prior research suggesting that it is the intersection of ethnicity and class that places segments of the population at a greater disadvantage (Bourdieu 1986; Lubienski, 2002; Weninger & Laureau, 2018; Wilson, 1991). Following prior research that has also explored these dynamics (Buchmann and DiPrete, 2006; Cheng & Peterson, 2018; Park & Hossler, 2014; Perna & Titus, 2005; Rowan-Kenyon, 2007), we test for treatment effects by first identifying students from disadvantaged minority backgrounds. We then include a term that interacts receipt of a voucher with indicators for either household income or parental education. Operationally, we dichotomize students into high-income and low-income categories, depending on whether earned income was reported to be than $12,877 in 2019 dollars, which is also the approximate median income for our sample. For the education interaction term, we dichotomize education between those who do and those who do not have a parent with at least some college, as reported by the adult accompanying the child to the initial testing session.

Results

In Columns 1 through 3 of Table 2, we display the ITT impact estimates on all college enrollments, two-year enrollments and four-year enrollments as of Fall, 2017. Among the full sample of students, those who receive a voucher are 1.2 percentage points more likely to enroll in a two-year college and are 1.5 percentage points less likely to enroll in a four-year college. Neither effect is statistically distinguishable from zero. Similarly, a voucher offer shifted upward the percentage of students who obtained a four-year degree by only 1.4 percentage points, and it had an even smaller impact on two-year degree attainment. These results confirm those reported in the prior study using attainment data as of 2013 (Chingos & Peterson, 2015). Even though

enrollment and degree attainment rates rose between 2013 and 2017, voucher impacts on these outcomes did not change materially.

Heterogeneity by Ethnicity, Household Income, and Parental Education

We now turn to heterogeneous effects by ethnicity and SES reported in Panels B through D in Table 2. As indicated by the interaction term, effects of an offer on college enrollment are 11.9 percentage points higher among minority students than on other students. Similarly, offer effects on four-year degree attainment are 11.2 percentage points higher for disadvantaged minority students than on other students.

We also observe enrollment heterogeneities by household income. Relative to students from higher-income backgrounds, impacts on attending any college are 11.5 percentage points lower for students from households with very low income. Impacts on attending a four-year college for these students are 9.3 percentage points lower. Effects on degree attainment are also lower for these students, but the estimate is not statistically significant.

Treatment heterogeneities by parental education are also observed. The effects of a voucher offer on enrollment at any college is 9 percentage points lower for first-generation students than for those from families with a parent who has more education. The interaction term in the degree attainment estimations are consistently negative, with a statistically significant 6.7 percentage point negative impact for four-year degree attainment.

In short, we routinely observe heterogeneities by both ethnicity and SES. But to isolate the truly disadvantaged, it is important to consider the intersection of ethnicity and class. We now consider this intersection and turn to results for the truly disadvantaged that estimate SES heterogeneities separately for just the minority student population to model. (The numbers in the non-minority sample are too small to invite further exploration.)

≪Table 3 Here>>

Effects on The Truly Disadvantaged: Income and Education Interactions for Minorities

Panel A of Table 3 displays voucher impacts on minority postsecondary enrollment by SES. Considering the interaction term, the impact of the offer of a voucher on two-year college enrollments is 7.0 and 7.6 percentage points lower for minority students from lower income households or without college educated parents, respectively, than for the moderately disadvantaged minority students. The interaction term for first-generation college students is marginally significant. The effects on enrollment in four-year institutions are 11.5 percentage points and 6.3 percentage points lower for minority students from lower income households or without college educated parents, respectively. The interaction term for lower-income minority students is statistically significant. In sum, the voucher offer seems to have had a noticeably larger impact on college enrollments of the moderately disadvantaged than the truly disadvantaged.

<<Table 4 Here>>

The differences between the two segments of the minority community are even clearer when it comes to degree completion, as shown in Panel B of Table 3. Although we observe no significant effects of an offer on the attainment of a two-year college degree regardless of family background, we detect sharp differences in the effect of a voucher offer on four-year degree attainment, depending on the parental education and household income of the student. Among minority students from household with moderately low incomes, the impact of a voucher offer on four-year degree attainment is 5.8 percentage points; among those who have at least one parent with some college, the impact is 6.9 percent. In other words, considering the degree completion rates for the control group (17 percent and 14 percent, respectively), the offer of a

voucher increased the likelihood of four-year degree attainment by one-third to one-half. But for those who are truly disadvantaged, the offer of a voucher has no significant effect on college graduation rates. Whether the estimate is by household income or parental education, the interaction term is negative and the voucher impacts hover around zero.[7]

In sum, our experimental findings of school-choice effects resemble the conclusions reached by Pondiscio (2019) in his qualitative study of a New York City charter-school network: Schools of choice can have substantial college attainment benefits for those low-income families with some cultural and material resources. If those resources are lacking, such benefits are not apparent.

Discussion

In sum, SCSF program impacts on enrollment and degree attainment as of the fall of 2017 do not differ substantially from those observed in 2013 (Chingos & Peterson, 2015). The offer of a voucher has no significant average impact on college enrollment and degree attainment.[8] However, these average effects mask important heterogeneities by ethnicity and SES. If a minority family lacks financial, social, and cultural resources, the opportunity created by the voucher yields no detectable benefit. Impacts of the voucher opportunity are not significantly different from zero both for minority students who would be first-generation college students and for those from very low-income households. But among minority students with some educational and financial resources, voucher usage can yield important long-term educational benefits. If these students also come from households with somewhat higher incomes or with at least one parent with some college education, being offered a voucher to attend a private school increases enrollment rates and also yield an increase in four-year degree completion by up to 7 percentage points. Considering that the four-year degree completion rate

among the moderately disadvantaged in control group ranges between 14 percentage points and 17 percentage points, depending on the specific estimation. These gains are no less than 35 to 50 percent, though, admittedly, from a low initial level. The gains are especially impressive given the fact that the SCSF program initially promised only half-tuition, three-year scholarships.

The results raise policy questions about the size of a school voucher that is necessary for a program targeted to the most disadvantaged families to be effective. The SCSF scholarship covered only half the costs of tuition up to $2,340. Minority families with minimal resources may not have been able to have paid the balance. Indeed, our first-stage estimates for our TOT analysis (see Appendix Table A1) show the average number of years in attendance at a private school was substantially greater among students from higher income families than lower income ones. The latter group seldom attended private school at all, while those of higher income went to a private school for well over two years.

In addition to pecuniary factors, the significant moderating effects of parental education suggest that cultural factors may be at work. As other studies have shown, social and cultural capital are crucial elements for improving educational attainment outcomes (Bourdieu, 1986; Cheng & Peterson, 2018; R; Perna & Titus, 2005; Rowan-Kenyon, 2007; Weninger & Laureau, 2018). Nurturing social networks and institutions that enable parents to more fully participate in voucher programs may be necessary (Wolf and Stewart, 2014). Otherwise, in the presence of these gaps in social and cultural capital, school choice may sustain inequalities as the most disadvantaged families are left behind in lower-resourced schools (Wells and Scott, 2001; Weninger & Laraeu, 2018). This has evoked criticism from those who caution that schools of choice "will leave regular public schools with the most difficult students to educate, thus creating a two-tier system of widening inequality" (Ravitch, 2010: 145). But other researchers say there is

little reason “why low-income families of color should not have the ability to send their children to school with the children of other parents who are equally engaged, committed or ambitious for their children, [as that] is what affluent parents do” (Pondiscio, 2019, p.301).

Whatever the merits of these alternative judgments, the results reported here suggest that opportunities for low-income minority families to attend private schools are largely beneficial for those who have some economic and cultural resources. Private schools, like public schools, seem to have found it difficult to address the educational needs of the truly disadvantaged. The SCSF voucher program may have enhanced the educational opportunities of the moderately disadvantaged segment of the low-income community, but the tools, policies, and institutions needed to assist the truly disadvantaged remain elusive.

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Table 1: Summary Statistics

	Treatment (N= 1,356)	Control (N = 1,278)	p-value
Baseline Math Test Score	17.1	17.1	0.914
Baseline Reading Test Score	24.6	22.9	0.247
Parents' Highest Education			
No College Education			
Some High School	0.16	0.16	0.943
High School Diploma/GED	0.28	0.24	0.063
Some College Education			
No BA degree	0.40	0.41	0.732
BA degree or more	0.13	0.15	0.220
Family Income (2019 dollars)			
Extremely Low Income			
Less than $8,048	0.29	0.27	0.359
$8,049-12,876	0.22	0.24	0.382
Moderately Low Income			
$12,877-17,705	0.15	0.13	0.242
$17,706-24,144	0.14	0.14	0.791
$24,145-32,760	0.11	0.11	0.901
$32,760 or more	0.10	0.11	0.396
Mother born in U.S.	0.61	0.58	0.157
Racial/Ethnic Background			
African American	0.42	0.41	0.659
Hispanic	0.42	0.47	0.017
Other Race	0.16	0.12	0.011
Mother Works	0.34	0.35	0.825
Father Absent	0.35	0.36	0.680
English main language	0.71	0.72	0.903
Female	0.50	0.49	0.422

Notes: Weighted averages shown. P-values for a test that there are no differences in demographic characteristics between control and treatment groups are shown. A joint significance test also fails to reject the null hypothesis that variables are not jointly different across treatment and control conditions (p=0.200).

Table 2: Intent-to-Treat Estimates

	Postsecondary Enrollment			Degree Attainment		
	(1) Any College	(2) Two Year	(3) Four Year	(4) Any Degree	(5) Two Year	(6) Four Year
Panel A: Overall Effect						
Treat	0.016	0.012	-0.015	0.014	0.001	0.014
	(0.021)	(0.020)	(0.021)	(0.019)	(0.013)	(0.016)
Control Group Mean	0.520	0.288	0.388	0.234	0.093	0.157
Panel B: By Ethnicity						
Treat	-0.070	0.020	-0.117*	-0.087	0.021	-0.081
	(0.063)	(0.062)	(0.067)	(0.057)	(0.037)	(0.050)
Treat*Minority	0.100	-0.009	0.119*	0.119*	-0.023	0.112**, [a]
	(0.067)	(0.066)	(0.070)	(0.061)	(0.040)	(0.053)
Minority	-0.024	0.066	-0.049	-0.080	0.056	-0.121
	(0.087)	(0.080)	(0.091)	(0.076)	(0.038)	(0.075)
Control Group Mean for Non-Minorities	0.582	0.276	0.489	0.349	0.097	0.253
Panel C: By Income						
Treat	0.078**	0.049	0.034	0.052*	0.016	0.032
	(0.033)	(0.031)	(0.033)	(0.029)	(0.020)	(0.025)
Treat* Lower Income	-0.115**	-0.071	-0.093**, [a]	-0.062	-0.021	-0.030
	(0.045)	(0.044)	(0.045)	(0.041)	(0.029)	(0.034)
Lower Income	-0.015	-0.031	-0.035	0.003	-0.016	-0.002
	(0.061)	(0.059)	(0.063)	(0.057)	(0.039)	(0.045)
Control Group Mean for Higher Income Students	0.529	0.283	0.399	0.252	0.090	0.187
Panel D: By First Generation College Student						
Treat	0.055*	0.022	0.010	0.040	0.005	0.044*
	(0.030)	(0.030)	(0.031)	(0.027)	(0.017)	(0.024)
Treat* First Generation	-0.090**	-0.021	-0.056	-0.058	-0.010	-0.067**
	(0.043)	(0.041)	(0.043)	(0.038)	(0.026)	(0.032)
First Generation	0.033	0.031	0.022	0.008	0.037	-0.005
	(0.059)	(0.054)	(0.057)	(0.049)	(0.032)	(0.045)
Control Group Mean for Non First Generation Students	0.546	0.306	0.413	0.243	0.085	0.162

Notes: N = 2,634. Each panel displays coefficients estimated from separate models. All models control for baseline test scores in math and reading, parent's education, household income, ethnicity, student's gender, whether the student was an immigrant or not, presence of father at home, mother's employment status, and whether English is spoken at home. Estimates based on linear probability models. Sample weights included. Standard errors clustered by randomization block. *** p<0.01, ** p<0.05, * p<0.1. Superscripts a, b, and c indicate overall treatment effects for the specified subgroup at the 0.01, 0.05, and 0.1 levels, respectively.

Table 3: Intent-to-Treat Estimates for the Truly Disadvantaged

	Two-Year Degree		Four-Year Degree	
	(1)	(2)	(3)	(4)
Panel A: Postsecondary Enrollment				
Treat	0.047	0.042	0.070**	0.029
	(0.033)	(0.031)	(0.033)	(0.031)
Lower Income*Treat	-0.070		-0.115**	
	(0.046)		(0.046)	
First-Generation College*Treat		-0.076*		-0.063
		(0.043)		(0.045)
Control Group Mean for Higher Income Minorities	0.286		0.369	
Control Group Mean for Lower Income Minorities	0.293		0.372	
Control Group Mean Non-First-Generation Minorities	0.294		0.402	
Control Group Mean for First-Generation Minorities	0.285		0.345	
Panel B: Degree Completion				
Treat	0.006	0.009	0.058**	0.069***
	(0.021)	(0.018)	(0.027)	(0.025)
Lower Income*Treat	-0.005		-0.047	
	(0.030)		(0.035)	
First-Generation College*Treat		-0.028		-0.086**
		(0.027)		(0.035)
Control Group Mean for Higher Income Minorities	0.088		0.165	
Control Group Mean for Lower Income Minorities	0.091		0.123	
Control Group Mean Non-First-Generation Minorities	0.082		0.144	
Control Group Mean for First-Generation Minorities	0.103		0.144	
Sample Size	2,157	2,313	2,157	2,313

Notes: Samples restricted to minority students. Panel A displays treatment impacts on postsecondary enrollment. Panel B displays treatment impacts on degree completion. Lower income parents have household incomes less than $12,877 in 2019 dollars. Control variables and sampling weights included. Estimates based on linear probability models. Standard errors clustered by randomization block. ***p<0.01, **p<0.05, *p<0.1

Appendix A
Treatment-on-the Treated Estimates

Treatment-on-the-Treated Estimation Procedure

We then run treatment-on-the-treated (TOT) models to estimate the impacts of scholarship use, rather than merely a scholarship offer. We then provide a treatment-on-the treated (TOT) estimate of effects of attendance at a private school. We use a two-stage least squares framework where the offer of a voucher serves as an instrument for whether or not the student attended private school. We estimate

$$\text{Private}_i = \alpha_0 + \alpha_1\text{Treat}_i + \alpha_2 X_i + \delta_i + \nu_i \quad (2)$$

$$\text{Attain}_i = \gamma_0 + \gamma_1\text{Private}_i + \gamma_2 X_i + \delta_i + \mu_i, \quad (3)$$

where private_i is an indicator equal to 1 if student i ever attended private school throughout the three-year duration of SCSF. The other variables are as they are in equation (1), and ν_i and μ_i are the error terms. Again, we use sampling weights and cluster standard errors by randomization block.

First-stage results are displayed in Table A1. Receiving a voucher through the lottery clearly influences private-school attendance. Students who win a lottery are about 66 percentage points more likely to attend a private school. As another check for a strong first stage, we use the receipt of a voucher to predict whether or not a student uses the voucher to attend a private school. As shown in column 2 of Appendix Table A1, students who are awarded a lottery spend 1.7 additional years in private school.

TOT estimates are presented in Tables A2 through A3. The coefficients in these tables are properly interpreted as changes in the percentages of degree attainment and postsecondary enrollment that occur if students ever attended a private school during the three years of its existence. No distinction is drawn as the length of time a student was in a private school. It may

be for as little as a day or as long as nine years, because the initial promise of three years was extended through eighth grade for all those who continuously used the voucher. Since TOT estimates are statistically significant only if ITT estimates presented in the prior tables are significant, the overall pattern results are the same as discussed in the main text, except for the fact that the size of the estimated TOT effects are substantially larger than the ITT effects.

Table A1: First Stage Regression Estimates

	(1) Ever Attended	(2) Years Attended
Lottery Winner	0.655***	1.74***
	(0.018)	(0.048)
Baseline Math Test Score	-0.000	0.000
	(0.001)	(0.001)
Baseline English Test Score	0.000	0.001
	(0.000)	(0.001)
Parent Educational Attainment		
High School Diploma/GED	0.011	0.047
	(0.033)	(0.068)
Some College	0.051	0.101
	(0.033)	(0.069)
BA degree or more	0.065	0.133*
	(0.041)	(0.080)
Family Income (2019 dollars)		
$8,049-12,876	0.027	0.020
	(0.026)	(0.051)
$12,877-17,705	-0.018	0.003
	(0.033)	(0.067)
$17,706-24,144	0.095***	0.260***
	(0.036)	(0.072)
$24,145-32,760	0.103**	0.266***
	(0.046)	(0.094)
$32,760 or more	0.136***	0.347***
	(0.041)	(0.086)
Mother born in U.S.	-0.047*	-0.075
	(0.027)	(0.054)
Racial/Ethnic Background		
African American	-0.021	0.073
	(0.065)	-0.118
Hispanic	-0.001	0.140
	(0.069)	(0.130)
Mother Works	0.007	-0.032
	(0.025)	(0.048)
Father Absent	0.008	0.021
	(0.021)	(0.043)
English main language	-0.011	-0.053
	(0.033)	(0.068)
Female	0.015	0.035
	(0.017)	(0.035)

Notes: Model includes controls for randomization blocks. Omitted category for parent education consists of parents who did not complete high school. Omitted category for family income consists of families who make less than $8,049. Sampling weights included. Standard errors clustered by randomization block. *** p<0.01, ** p<0.05, * p<0.1

Table A2: Treatment on the Treated Estimates

	Postsecondary Enrollment			Degree Attainment		
	(1) Any College	(2) Two Year	(3) Four Year	(4) Any Degree	(5) Two Year	(6) Four Year
Panel A: Overall Effect	0.024	0.016	-0.022	0.023	0.001	0.022
Ever Private School	(0.032)	(0.031)	(0.032)	(0.028)	(0.019)	(0.024)
Control Group Mean	0.520	0.288	0.388	0.234	0.093	0.157
Panel B: By Ethnicity						
Ever Private School	-0.156	0.040	-0.258*	-0.192	0.046	-0.181
	(0.144)	(0.136)	(0.154)	(0.129)	(0.082)	(0.116)
Ever Private*Minority	0.200	-0.026	0.263*	0.239*,[a]	-0.049	0.225*,[a]
	(0.147)	(0.140)	(0.157)	(0.133)	(0.085)	(0.119)
Minority	-0.060	0.051	-0.074	-0.108	0.058	-0.150*
	(0.096)	(0.090)	(0.104)	(0.087)	(0.044)	(0.084)
Control Group Mean for Non-Minorities	0.582	0.276	0.489	0.349	0.097	0.253
Panel C: By Income						
Ever Private School	0.118**	0.073	0.053	0.080*	0.024	0.050
	(0.049)	(0.046)	(0.048)	(0.042)	(0.029)	(0.038)
Ever Private*Lower Income	-0.176***	-0.108	-0.141**,[a]	-0.095	-0.032	-0.047
	(0.068)	(0.066)	(0.068)	(0.061)	(0.043)	(0.051)
Lower Income	0.012	-0.014	-0.020	0.019	-0.011	0.008
	(0.065)	(0.062)	(0.067)	(0.060)	(0.041)	(0.048)
Control Group Mean for Higher Income Students	0.529	0.283	0.399	0.252	0.090	0.187
Panel D: By First Generation College Student						
Ever Private School	0.085*	0.032	0.015	0.062	0.008	0.068*
	(0.045)	(0.044)	(0.046)	(0.040)	(0.026)	(0.035)
Ever Private*First Generation	-0.138**	-0.035	-0.084	-0.088	-0.015	-0.102**
	(0.065)	(0.062)	(0.064)	(0.057)	(0.039)	(0.048)
First Generation	0.050	0.051	0.021	0.010	0.046	-0.006
	(0.060)	(0.056)	(0.061)	(0.051)	(0.032)	(0.047)
Control Group Mean for Non First Generation Students	0.546	0.306	0.413	0.243	0.085	0.162

Notes: N = 2,634. Each panel displays coefficients estimated from separate models. All models control for baseline test scores in math and reading, parent's education, household income, ethnicity, student's gender, whether the student was an immigrant or not, presence of father at home, mother's employment status, and whether English is spoken at home. Estimates based on linear probability models. Sample weights included. Standard errors clustered by randomization block. *** p<0.01, ** p<0.05, * p<0.1. Superscripts a, b, and c indicate overall treatment effects for the specified subgroup at the 0.01, 0.05, and 0.1 levels, respectively.

Table A3: Treatment on the Treated Estimates for the Truly Disadvantaged

	Two-Year Degree		Four-Year Degree	
	(1)	(2)	(3)	(4)
Panel A: Postsecondary Enrollment				
Treat	0.066	0.059	0.097**	0.041
	(0.045)	(0.043)	(0.045)	(0.043)
Lower Income*Treat	-0.100		-0.165**	
	(0.066)		(0.066)	
First-Generation College*Treat		-0.110*		-0.093
		(0.063)		(0.064)
Control Group Mean for Higher Income Minorities	0.286		0.369	
Control Group Mean for Lower Income Minorities	0.293		0.372	
Control Group Mean Non-First-Generation Minorities	0.294		0.402	
Control Group Mean for First-Generation Minorities	0.285		0.345	
Panel B: Degree Completion				
Treat	0.009	0.014	0.080**	0.097***
	(0.029)	(0.026)	(0.037)	(0.035)
Lower Income*Treat	-0.007		-0.064	
	(0.043)		(0.050)	
First-Generation College*Treat		-0.042		-0.124**
		(0.040)		(0.050)
Control Group Mean for Higher Income Minorities	0.088		0.165	
Control Group Mean for Lower Income Minorities	0.091		0.123	
Control Group Mean Non-First-Generation Minorities	0.082		0.144	
Control Group Mean for First-Generation Minorities	0.103		0.144	
Sample Size	2,157	2,313	2,157	2,313

Notes: Samples restricted to minority students. Panel A displays treatment impacts on postsecondary enrollment. Panel B displays treatment impacts on degree completion. Lower income parents have household incomes less than $12,877 in 2019 dollars. Control variables and sampling weights included. Estimates based on linear probability models. Standard errors clustered by randomization block. **p<0.01, *p<0.05, + p<0.1

[1] Students entering first grade were exempt from the public-school requirement. Our data on college enrollments and completion was gathered four years after the collection of outcome data reported in Chingos and Peterson

(2015). During the intervening period, many students who had experienced interruptions in their education persisted to graduation, and the bachelor's degree attainment rate for students in the control group increased by six percentage points from 10 to 16 percent.

[2] $1,500 in current dollars. Unless otherwise indicated, all dollar amounts are given in 2019 dollars.

[3] Although the initial voucher offer was for three years, scholarships continued through the end of eighth grade to students who remained continuously in the private sector.

[4] The 99 percent match rate makes differential attrition bias highly unlikely.

[5] They report 9 percent for the bottom quartile, 21 percent for the second quartile.

[6] Results are robust to probit models which are available upon request. We also report Treatment-on-the-Treated (TOT) results that estimate the impact of a use of a voucher. Results are substantively similar to the ITT results and are shown in the Appendix.

[7] The offer of a voucher also increased degree attainment rates for students from non-immigrant households if they also come from higher-income or college-educated backgrounds. The category overlaps those who identify themselves as African American. Among non-immigrants 56 percent are African American, 37 percent are Hispanic, and 8 per cent are otherwise identified. Among immigrants, these percentages are 20%, 61% and 19% respectively.

[8] However, some scholars have argued that a zero effect may imply higher productivity in the private sector than in the public sector, given the higher costs in the public sector (Wolf and McShane, 2013).