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

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Abstract

For decades, social theorists have posited—and descriptive accounts have shown—that students isolated by both social class and ethnicity suffer extreme deprivations which limit the effectiveness of equal-opportunity interventions. Even educational programs that yield positive results for moderately disadvantaged students may not prove beneficial for those who possess less of the forms of economic, social, and cultural capital that play a critical role in improving educational outcomes. Yet evaluations of school choice and other educational interventions seldom estimate programmatic effects on severely disadvantaged students who are isolated by both ethnicity and social class. We experimentally estimate differential impacts of a 1997 New York City school voucher intervention on college attainment for minority students by household income and mother’s education. Postsecondary outcomes as of 2017 are obtained from the National Student Clearinghouse. The severely deprived do not benefit from the intervention despite substantial positive impacts on college enrollments and degree attainment for the moderately disadvantaged. School choice programs and other interventions or public policies may need to pay greater attention to ensuring that families possess the requisite forms of capital — human, economic, social, and cultural — to realize their intended benefits.

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

Sociologists and anthropologists studying urban communities have drawn clear distinctions between moderately disadvantaged groups and more severely deprived ones that have less education and depend more heavily upon government transfers and episodic employment for survival (Anderson, 1999; Lewis, 1961, 1966; Mehta & Davies, 2018; Miller, 1958). In a classic study, Wilson (1991: 462) emphasizes the social isolation of those from different class and racial backgrounds who live in impoverished neighborhoods. They lack quality schools, suitable marriage partners, and adequate “exposure to informal mainstream social networks and conventional role models.” He theorizes that programs designed to promote equality of opportunity that have positive impacts on the moderately disadvantaged may have little or no impact on those he refers to as the “truly disadvantaged” (Wilson, 2012).

Educational outcomes are largely dependent on multiple forms of capital – human, social, economic, and cultural. Individuals and their communities possess combinations of these forms of capital to varying degrees. (Bourdieu, 1986; Coleman 1988; Weininger and Lareau, 2018). Consistent with these theories, quantitative research has documented sizeable differentials in educational achievement and attainment gaps between those who are moderately and severely disadvantaged (Bailey and Dynarski, 2011; Duncan and Brooks-Gunn, 1997; Michaelmore and Dynarski, 2017). Meanwhile, qualitative research has deepened our understanding of the challenges of those who are truly disadvantaged by both ethnic and class isolation (Wilson, 1991, 2012).

But evaluations of programs expected to rectify educational disparities, including those involving choice of school, seldom pay attention to these distinctions in degree of deprivation.

For example, using a randomized control trial to evaluate the School Choice Scholarship Foundation (SCSF) program, a school voucher intervention in New York City, Chingos and Peterson (2015) estimate modest positive impacts of the offer of a voucher to low-income minority students in elementary school on college enrollments and four-year degree attainment. Yet this study and others do not explore potential theoretically significant heterogeneities by joint deprivation by ethnicity and socio-economic status (SES) within that population (Mills and Wolf, 2015; Waddington and Berends, 2018; Wells and Scott, 2001; Wilson 1991, 2012; Wolf et al., 2013). As Furstenberg (2011: 469) observes, the modest impacts of many interventions may be due to their concentration 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.”

In this paper we estimate these theoretically significant heterogeneous impacts on college enrollment and degree attainment ignored by Chingos and Peterson (2015) in their study of the long-term effects of the same 1997 New York City voucher intervention. Our postsecondary outcome data are obtained from the National Student Clearinghouse as of 2017, four years later than the time Chingos and Peterson (2015) observed college enrollment and attainment. The additional time span allows for identification of college attainment levels even if a student’s education has been interrupted.

We detect no significant intention-to-treat (ITT) effects for severely disadvantaged students, that is, for ethnic minority students from extremely low-income households or, separately, for first-generation college students. However, we detect effects of 8 percentage points on any college enrollment and 7 percentage point effects on any degree and four-year degree attainment for ethnic minority students whose mother attended college. Treatment-on

treated (TOT) effects, that is, the impact on attainment of the moderately disadvantaged who use the voucher opportunity to attend a private school, are 11 to 15 percentage points for enrollment at any college and about as much as 10 percentage points for degree attainment at any college and at four-year institutions. Given the generally low levels of educational attainment among disadvantaged students, these impacts are quite large. They are approximately 20 to 30 percent higher for enrollment at any college, over 40 percent higher for degree attainment at any college, and 67 percent higher for four-year degree attainment than what would otherwise be the case, as estimated by control group rates. We conclude by discussing possible reasons for and implications of these disparate programmatic impacts for the truly and the moderately disadvantaged.

Theoretical Framework

Sociological theories posit that that individuals from moderately and severely deprived demographic backgrounds respond differentially to programmatic interventions expected to enhance educational opportunity. Empirical accounts provide evidence that supports the theory, but program evaluations seldom estimate heterogeneities by severity of deprivation.

Moderately and severely disadvantaged populations

Wilson's groundbreaking statements (1991; 2012) on the harms suffered by the "truly disadvantaged," summarize and advance well developed theories that draw distinctions between the moderately poor and those suffering extreme isolation by both ethnicity and social class (Anderson, 1999; Lewis, 1961, 1966; Miller, 1958). Hannerz (1969: 46-55), for example, distinguishes between those in an inner-city neighborhood whom 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” while the latter depend upon government transfers and episodic unemployment.

Other sociologists have documented the structural effects of neighborhoods on educational attainment and social mobility (Ainsworth, 2002; Entwisle et al., 2005; Howell, 2019; Lareau and Goyette, 2014; Leventhal and Brooks-Gunn, 2000; Sampson, 2012; Sharkey, 2013; Turley, 2003; Wodtke et al., 2011). Kasarda (1985) shows how the lack of private transport in large cities limits the access of the isolated urban poor to employment and other opportunities distant from the immediate neighborhood. But poor neighborhoods contain diverse populations, and culture is not easily reduced to structural relationships. There is wide variation in how much various forms of capital are possessed by different individuals and communities, even within the same geographic area (Massey and Eggers, 1990; Massey, Gross, and Shibuya, 1994; Newman, 1992; Small and Newman, 2001).

The size and composition of the severely 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 participating in the SCSF evaluation 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, considerably less than the share of the population considered poor in a good deal of educational research (Chingos 2016; Domina et al., 2018; Harwell and LeBeau, 2010; Hanushek et al. 2020). For example, participation in the

federal free and reduced-price lunch (FRL) program is often used as a poverty indicator. To be eligible for FRL, a student must come from a household that is no more than 185 percent of the federally determined poverty line, which varies by size of household. In 1997, the eligibility limit was set at \$16,874 for a family of three and \$20,280 for a family of four (\$27,518 and \$33,072 in 2020 dollars). Since then, Congress has broadened eligibility levels and has allowed entire school districts to participate in the program if the share of FRL students reaches a certain threshold. Between 1999 and 2015 the percentage of students participating in the FRL program increased from 37 to 52 percent (Chingos, 2016). Notably, Michelmore and Dynarski (2017) have recently offered a way of using FRL in panel data to correlate achievement outcomes with intensity of deprivation. They find that students who are persistently FRL-eligible across several years score lower on achievement tests than students who are only episodically eligible. This approach may allow researchers to make more precise distinctions among impoverished students — as long as longitudinal data that repeatedly measure FRL status are available.

Instead of relying on FRL status to measure poverty, other research tends to group all ethnic minority students together or defines the poor broadly so as to include as much as even half of the SES distribution (Alon, 2009; Bastedo and Jaquette, 2011; Bowen, Chingos, and McPherson, 2009; Buchmann and DiPrete, 2006; Chetty et al. 2017; Vigdor and Ludwig, 2008). But Bailey and Dynarski (2011) find striking differences in outcomes, even between the lowest two quartiles of the SES distribution. 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, while 47 percent of this cohort enrolled in college if they lived in households in the second-lowest quartile. College graduation rates are only 9 percent among those in the lowest quartile, while the rate is 21 percent among those in the second quartile. In our own analysis, we similarly

distinguish higher from lower SES students within the disadvantaged population in order to more precisely differentiate varying degrees of disadvantage.

Program Evaluations

When program evaluations fail to consider the joint impact of class and ethnicity, they may discern no impacts when in fact there are heterogeneous ones. Many factors might explain the difficulties programmatic interventions encounter, but the fact that most interventions focus on the severely disadvantaged may understate the potential impact of program interventions on those less disadvantaged.

For example, school choice programs likely have differential impacts on different segments of the disadvantaged population. (Ascher, et al., 1996; Brighthouse, 2000; Fiske and Ladd, 2000; Fuller, Elmore and Orfield, 1996; Gewirtz et al., 1995; Henig, 1995). To be effective, the practice of choice requires forms of capital that are not available to all socio-economic groups. Parents must have the time and energy to select the appropriate setting for their child. The family may be expected to cover the pecuniary costs of school uniforms, educational materials, and potential travel outside their immediate neighborhood of residence. Families also require social networks and social capital to navigate the school selection process and integrating themselves into the school community (Wolf and Stewart, 2014). Moreover, schools may have rules of behavior with which students must comply if they are to remain in the school. Parents lacking the cultural capital and familiarity with particular practices, habits, and norms within a school community face challenges of integrating and belonging (Bourdieu, 1986). For example, Bryk et al. (1993: 313) report that “Catholic school faculty go to great lengths to help students and work with parents, but reciprocity is also expected. Students who

seriously or chronically violate the community's norms must leave." Wells and Scott (2001) make similar observations.

Despite strong theoretical reasons for expecting to observe heterogeneous effects among students from low SES backgrounds, evaluations of school choice interventions typically ignore them. Eligibility for participation is ordinarily quite inclusive, with incomes as high as 300% of the poverty line. Estimates of programmatic impacts are typically made for the entire participating population or for all members of specific ethnic groups (Epple et al., 2017; Mills, and Wolf, 2015; Shakeel et al., 2016). In the case at hand, Chingos and Peterson (2015) estimate only mean effects for the full sample and by ethnicity, but not joint effects of deprivation due to interactions among social characteristics.

Chingos and Peterson (2015), moreover, estimated college enrollment and degree attainment impacts as of 2013, seventeen years after students had received the voucher offer. By tracking attainment at that point, the study could identify degree attainment for students in the evaluation's youngest cohort only if they persisted without interruption through both high school and college. Yet many low-income and minority students pursuing further education take considerably longer to complete their degree programs (Chetty et al., 2017; U.S. Department of Education, 2019). With data on college outcomes as of 2017, we are able to detect enrollment and degree acquisitions even if progress by students is delayed for an additional four years beyond the date observed by Chingos and Peterson (2015). During the intervening period, enrollments at four-year institutions in the study sample increased from 26 percent to 29 percent, and the four-year graduation rate increased from 10 percent to 16 percent, a 60 percent increase over the four-year period.

The Intervention

The SCSF voucher intervention occurred in the aftermath of a concatenation of unusual political events. When New York City public schools did not open on time in the fall of 1996, the archdiocese responsible for the city's Catholic schools offered to accept the public school's one thousand neediest students (Morkan and 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 midst of this controversy, SCSF, a non-profit foundation, was formed solely for the purpose of providing private-school scholarships to eligible applicants to be used at any participating secular or religious private school in New York City. The foundation announced in February of 1997 that it would provide three-year, half-tuition private-school scholarships annually of up to \$1,400 per child in 1997 dollars (\$2,283 in 2020 dollars) beginning the coming school year to 1,000 eligible families who had children entering first grade or, if they had a child in public school, would be entering second through fifth grade (Peterson et al., 1997). Over two-thirds of those receiving an offer initially chose to attend a Catholic school.

Program eligibility was limited to those eligible for FRL, which at the time was limited to those coming from a household with an income of no more than 185 percent of the poverty line, Eight-five percent of the vouchers were reserved for students attending schools that had average scores below the citywide median on the state proficiency examination.

SCSF announced that the scholarship winners would be selected by a lottery if applications exceeded the number available. SCSF received more than 20,000 initial mail-in application reforms, due in part to a major promotional undertaking mounted in low-income, ethnic minority neighborhoods. Mathematica Policy Research (MPR), the firm contracted to conduct an evaluation of the intervention, determined that it was not feasible to verify the income

eligibility of such a large number applicants. To ensure that all applicants were treated equally, it invited a representative sample of applicants chosen by lot to bring their child to a verification session at which income eligibility would be ascertained, the child would be given a baseline test, and the accompanying adult would fill out a short questionnaire while the child was taking the test (Peterson et al., 1997).

A lottery was also used to select the scholarship winners from among those who attended verification sessions. Randomization was stratified in order to ensure that 85 percent of the scholarships were offered to students who had attended low-performing schools. A representative sample of those who did not win the lottery was chosen to form the control group of students. Weights are applied so results reported here are representative of all applicants.

SCSF offered scholarships to 1,000 families who had children eligible for participation in the program. The number of offers exceeds the number of families that won the lottery, because some families had more than one child eligible for participation in the program (Peterson et al., 1997). Although the initial voucher offer was limited to three years, SCSF subsequently extended scholarships to the end of eighth grade to for those students who remained continuously in participating private schools. All subjects included in the analysis were randomly assigned to treatment and control groups prior to the beginning of the 1997-1998 school year, when the voucher intervention began.

Data Collection and Classification

In this section we discuss sample attrition, covariate balance across treatment and control groups, the operational definitions of ethnicity used here, and our parameterization of education and income differentials.

Attrition

Attrition occurred when participating students were not found in the administrative data available from the National Student Clearinghouse (NSC). Fortunately, that attrition was very small. Information (i.e., name and date of birth) needed to attempt a match to the NSC data base was available for 2,634 students or 98.8 percent of the 2,666 students in the analytic sample. If a match was not made, we assumed the student was never enrolled in a further education institution. This assumption under-estimates the number of college enrollments and degree attainments, because names cannot be matched for three reasons, with the latter two accounting for most of the attrition: (1) mis-spellings and nicknames, (2) a few colleges do not provide the requisite information to NSC and some institutions, and (3) parents block access to student records (Dynarski et al., 2015).

Most participants in the SCSF program probably enrolled in postsecondary educational institutions within the State of New York or elsewhere in the Northeast region. The NSC coverage rate in New York for the academic year 2010-11 is estimated by Dynarski et al. (2015) to be 93.9 percent for public four-year institutions, 98.6 percent for public two-year institutions, 89.3 percent at private four-year institutions, but only 43.4 percent for all for-profit institutions. Less than 10 percent of all students attended for-profit institutions that year. Given the high coverage rate of the NSC data for all but the small number of for-profit institutions, the attrition rate appears quite low. Even if attrition occurred systematically, say, because members of the control group were more likely to attend for-profit colleges than members of the treatment group, the small for-profit share of total enrollments makes it unlikely this source of potential bias could have any more than a minimal impact on our results. And since for-profit institutions mainly award two-year degrees, attrition would be exceptionally low for estimates of four-year enrollments and degree attainments.

Covariate balance

Among those for whom a college enrollment match is attempted, 1,356 students had been assigned to the treatment group and 1,278 students to the control group. The characteristics of the treatment and control groups are similar (see Table 1). However, 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 significance 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. Treatment and control groups do not differ significantly by any characteristic even when the analytic sample is limited to those who are disadvantaged minorities or other key subgroups, lending confidence to a causal interpretation of estimates of a voucher on educational attainment outcomes for both the full sample and those limited to subgroups. In what follows, we discuss how we parameterize a variety of indicator variables for these subgroups.

<<Table 1 about here>>

Ethnicity

Ethnic minority students constitute 85 percent of the sample (see Table 1). Forty-two percent of the treatment group and 41 percent of the control group are African American, and 42 percent of the treatment group and 47 percent of the control group are Hispanic students. A child is identified as a member of a disadvantaged minority group if the accompanying adult at the information verification session says that the ethnicity of the mother is either African American or Hispanic. Ethnicity is estimated to be that of the mother, because a third of the respondents say the father is absent from the home. Results are robust to estimates when children are

identified as minority if either the mother or father is reported to be of an African American or Hispanic background. (See Online Appendix, Table A1 and Table A2).

Mother's education

For education, our choice of indicator is the educational attainment of the mother. The accompanying adult was asked whether the child's mother (1) does not have a high school degree, (2) has only a high school degree, (3) received some further education after high school, or (4) has a college degree. As shown in Table 1, 16 percent of both the treatment and control group students have mothers without a high school diploma; the mothers of another 28 percent of the treatment group and 24 percent of the control group do not have any education beyond a high school diploma or its equivalent. The remainder say the mother has some postsecondary education or a college degree. To distinguish the severely from the moderately disadvantaged, we dichotomize the educational attainment level of the mother at a cut point that distinguishes those with or without at least some college education. The cut point is selected, because it distinguishes between students with mothers who have college experience from those who are first-generation students, who are less likely to complete a degree program (Lareau, 2011; Warburton et al., 2001; Wilbur and Roscigno, 2016). The cut point also preserves sample size for both those defined as moderately and severely disadvantaged by splitting the sample near the median. Results are robust to other cut points, such as one that distinguishes students with mothers who do not complete high school from other students (See Online Appendix Table A3).

Income

Accompanying adults were asked to select one of six earned income categories shown in Table 1. Fifty-one percent of the analytic sample consists of students from households with annual earned incomes of at most \$13,067 a year. Among those in the treatment group, 29

percent come from households with less than \$8,169 annually, and another 22 percent report an earned income between that number and \$13,067. The percentages are similar for students assigned to the control group (see Table 1). We do not know the amount received from government transfers and unreported income. The remainder of the sample report earned income levels greater than \$13,067. Ten percent of the treatment group and 8 percent of the control group report an income level of \$32,670 or higher. Students are classified as severely disadvantaged if households are reported to have earned incomes of less than \$13,067 in 2020 dollars, which is about half the poverty line of \$26,200 for a family of four, the level the U.S. Department of Agriculture (which has the responsibility for estimating the poverty line) uses to indicate severe poverty (Beale and Gibbs, 2006). This cutpoint also preserves sample size for both the severely and moderately disadvantaged by dividing the sample close to the median. We obtain similar results when using other income cut points as the operational definition of severe disadvantage (see Online Appendix, Table A3).

Empirical Strategy

We first estimate the following linear probability model of the effect of the offer of a voucher or the intent-to-treat (ITT) effect.¹ That is, we estimate the impact on college enrollment and degree attainment of being offered a scholarship:

$$Y_i = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 X_i + \delta_j + \epsilon_i. \quad (1)$$

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. As a way to address missing data, X_i also includes dummy variables that indicate missing data for each variable. 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_j , a vector of indicator variables identifying the randomization block j within which the student was randomly assigned. Finally, ϵ_i is the error term. All regressions incorporate sampling weights to make the sample representative of those who originally applied for a scholarship, and we cluster standard errors by randomization block. We use this model to replicate results in Chingos and Peterson (2015) before estimating heterogeneous treatment effects by degree of disadvantage, which were previously not considered.

We then turn to the main focus of the analysis and estimate treatment effects for moderately and severely disadvantaged students. After identifying students in these two subgroups per the operationalization of disadvantage described earlier, we add to equation (1) a term that indicates degree of disadvantage and a term that interacts the treatment indicator with the indicator for degree of disadvantage. Specifically, we estimate

$$Y_i = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 D_i + \beta_3 \text{Treat}_i \times D_i + \beta_4 X_i + \delta_j + \epsilon_i, \quad (2)$$

where all the variables are as they are described in equation (1), except for D_i which is an indicator that equals 1 if the student is identified as severely disadvantaged and 0 otherwise. The coefficient on the interaction term estimates the difference in treatment impacts on educational attainment for students who are severely disadvantaged and moderately disadvantaged. We also provide TOT estimates for equation 2 by using a two-stage least squares instrumental variables framework that uses the offer of a voucher as an instrument for private school attendance.

Results

In Panel A of Table 2, we display the ITT impact estimates on college enrollments and degree attainment as of Fall 2017 for the full sample. No statistically significant mean impact of a voucher offer is detected, reproducing the findings reported by Chingos and Peterson (2015), even with data collected four years later. However, heterogeneous effects are observed by ethnicity, mother's education, and household income as shown in the subsequent panels in Table 2. Notably, minority students, if offered a voucher, are more likely to obtain a degree from any college as well as from a four-year college. Students of mothers with some college education also more likely to obtain a four-year degree, if they receive a voucher offer. Also, effects on enrollment at any college are positive for those from higher-income households. However, these impacts do not take into account heterogeneities of programmatic effects that may occur in the presence of joint deprivation by both ethnicity and other indicators of SES, the topic of our next section.

<<Table 2 about here>>

ITT Impacts on Moderately and Severely Disadvantaged

To explore such heterogeneities, we estimate differential effects among disadvantaged minority students by mothers' education and household income. Results based on the ITT models are shown in Table 3. The impact of the offer of a voucher on enrollment at any college is 8 percentage points if minority students have mothers with some college education, but it is 12 percentage points less if they have no more than a high school diploma. The effect of a voucher on attainment of a degree from any college is 7 percentages points if a voucher has been offered to the child of a more educated African or Hispanic American mother. A similar 7 percentage point impact is observed for four-year degree attainment. But if the child is a first-generation college and minority student, the impacts for obtaining any degree and a four-year degree are 9

percentage points less than it is for students whose mothers have had some college experience. In other words, the treatment effect for first-generation students from minority backgrounds is not significantly different from zero.

We also observe heterogeneities by SES when we estimate impacts by household income. Enrollment at any college is boosted by 8 percentage points if a minority student from a higher-income household receives a voucher offer, but the treatment effect is 11 percentage points less if made to a minority student from a lower-income than a higher-income household. The voucher impact on enrollment in a four-year college is also 9 percentage points less for lower-income minority students compared to the voucher impact for higher-income minority students. Similarly, degree attainment at a two- or four-year college is 5 percentage points higher if a voucher offer is made to a minority student from a higher-income household but the offer has no significant effect on a lower-income minority student. Much the same is true specifically for four-year degree attainment. In short, the voucher offer seems to have had a noticeable, positive impact on college enrollments and degree attainments of those only moderately disadvantaged by income, but the same cannot be concluded regarding minority students with severe income constraints.

<<Table 3 About Here>>

For the most part, we do not observe differential effects by either mothers' education or household income on either two-year college enrollments and or two-year degree attainment.² Apparently, the effects of the voucher offer on moderately advantaged students is to increase overall educational attainment and especially the pursuit of a four-year degree.³

TOT Effects on the Moderately Disadvantaged

To estimate treatment effects on those students treated by the voucher offer, that is, on those who actually used the offer to attend a private school, we use the lottery indicator as an instrument to predict usage no matter how brief the period of time. These first stage results are shown in Table 4. According to these results, those offered a voucher were about 66 percentage points more likely to make use of the opportunity to attend a private school. For students from ethnic minority backgrounds with a mother who has not attended college or come from low-income backgrounds, the difference in private school attendance rates does not differ significantly between the treatment and control groups.

<<Table 4 About here>>

Consistent with social theory that posits the importance of minimum levels of cultural, social and material capital for seizing programmatic opportunities, private school attendance is positively correlated with indicators of socioeconomic status. For instance, as shown in column 1 of Table 4, children who come from families in the upper three income categories are about 10 percentage points more likely to attend a private school than children from families in the lower income categories. Children whose mother has a college degree are about 7 percentage points more likely to attend a private school than children whose mother did not complete high school.

In Table 5, we present TOT estimates of SCSF program impacts. For students from moderately disadvantaged households who use the voucher to attend private school, enrollment rates at any college as measured by the education are 11 percentage points higher. Impacts on attainment of any degree for these students are 10 percentage points regardless of SES indicator. Impacts on attainment of a degree from a four-year institution range between 8 to 10 percentage points, depending on the SES indicator.

<<Table 5 About here>>

These impacts are large when one considers the relatively low levels of college enrollment and degree attainment by disadvantaged students (Table 5). The 10 percentage-point increase in four-year degree attainment for students from minority background with mothers who have some experience in college jumps represents an increase of about 67 percent. Increments are 21 percent higher for enrollments at any college.

Despite these substantial impacts on the moderately disadvantaged, we were unable to detect any positive benefits of the offer of a voucher on the educational attainments of severely disadvantaged students. Our experimental findings resemble conclusions drawn by case study research, which suggest that students and families find it difficult to take advantage of school choice opportunities unless their cultural and material resources have reached a certain minimum.

Discussion and Conclusion

Sociology of education has long examined the distinctions not only between traditionally disadvantaged and advantaged students but also between students of varying levels of disadvantage (Mehta & Davies, 2018; Wilson 2012). Still the former topic has received much more empirical attention than the latter, particularly within the program and policy evaluation literature. This literature's relative inattentiveness to studying heterogeneous treatment effects of equal-opportunity interventions leaves much to be learned about the efficacy of these interventions for individuals and communities who are more severely deprived of human, economic, social, and cultural capital. A wide body of sociological literature suggests that these forms of capital play for educational success and other indicators of longer-term wellbeing (Bourdieu, 1986; Coleman 1988; Weininger and Lareau, 2018). Thus, though interventions may be beneficial for some individuals from disadvantaged backgrounds, they may fail to benefit

those who lack these forms of capital to a greater extent. Indeed, this is what our analysis of the SCSF program suggest.

We initially confirm the earlier finding reported by Chingos and Peterson (2015) that no mean impacts on college attainment of an offer of a SCSF voucher can be detected. But with data from four additional years post-treatment, we find previously unobserved disparities in voucher impacts between the moderately disadvantaged and the more severely disadvantaged who are jointly deprived by SES and minority status. If a family from ethnic minority backgrounds lacks financial, social, and cultural capital, as indicated by mother's education or household income, the opportunity created by the voucher yields no detectable benefit. But among students from ethnic minority backgrounds with some educational and financial resources, voucher usage can yield important long-term educational returns. For the students from these moderately disadvantaged backgrounds, being offered a voucher to attend a private school increases enrollment rates at any college by 8 percentage points and increases both overall and four-year college degree attainment by about 5 to 7 percentage points. These are large effects. Based on TOT estimates, enrollment at any college for the moderately disadvantaged increases from 21 percent to 29 percent, depending on SES indicator. Degree attainment at any college increases by 45 percent, and four-year degree attainment increases by 67 percent above what would otherwise be the case. Yet, impacts of a voucher opportunity for truly disadvantaged minority students are nil with some coefficient estimates even pointing in the negative direction, though they are statistically insignificant due to limitations in study power.

The results raise policy questions about the size of a school voucher 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 \$2,283. Minority families with minimal resources

may not have been able to have paid the balance. Our first-stage estimates for our TOT analysis (see Appendix Table A4) demonstrate that private school attendance was greater among students from higher-income families than lower-income ones by approximately 10 percentage points.

Apart from pecuniary factors, the significant moderating effects of parental education suggest that other factors may be at work. As numerous studies have demonstrated, social and cultural capital are crucial for educational attainment (Bourdieu, 1986; Cheng and Peterson, 2019; Lareau, 2011; Perna and Titus, 2005; Rowan-Kenyon, 2007; Weininger and Lareau, 2018; Wilbur and Roscigno, 2016). Nurturing social networks and institutions that enable parents to more fully participate in voucher programs may be necessary to reap the benefits they provide (Wolf and Stewart, 2014). Schools too need to tend to these cultural and material needs of these families if they wish to serve them effectively. In the presence of gaps in social and cultural capital, school choice may sustain inequalities as the most disadvantaged families remain in less effective educational institutions (Wells and Scott, 2001; Weininger and Lareau, 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: 301).

Whatever the merits of these alternative judgments, the results reported here suggest that opportunities for socioeconomically disadvantaged families to attend private schools are largely beneficial for those who have some economic and cultural resources. 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. Private schools, public schools, and many other programs outside education seem to have found it difficult to address the educational needs of the truly disadvantaged. It appears that greater attentiveness to ensuring that these families possess the diverse forms of capital — human, economic, social, and cultural — is necessary to reap the intended benefits.

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Table 1: Summary Statistics

	Full Sample			Ethnic Minority Students		
	Treat	Control	p-value	Treat	Control	p-value
Baseline Math Test Score	17.1	17.1	0.914	16.03	16.10	0.924
Baseline Reading Test Score	24.6	22.9	0.247	22.20	24.16	0.174
Parents' Highest Education						
No College Education						
Some High School	0.16	0.16	0.943	0.17	0.17	0.902
High School Diploma/GED	0.28	0.24	0.063	0.26	0.28	0.335
Some College Education						
No BA degree	0.40	0.41	0.732	0.42	0.41	0.677
BA degree or more	0.13	0.15	0.220	0.13	0.12	0.433
Family Income (2020\$)						
Extremely Low Income						
Less than \$8168	0.29	0.27	0.359	0.26	0.28	0.315
\$8169-13067	0.22	0.24	0.382	0.23	0.21	0.303
Moderately Low Income						
\$13068-17967	0.15	0.13	0.242	0.13	0.14	0.445
\$17968-24501	0.14	0.14	0.791	0.12	0.12	0.661
\$24502-32669	0.11	0.11	0.901	0.11	0.10	0.649
\$32670 or more	0.10	0.11	0.396	0.10	0.08	0.196
Mother born in U.S.	0.61	0.58	0.157	0.62	0.64	0.256
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	0.36	0.34	0.326
Father Absent	0.35	0.36	0.680	0.38	0.36	0.460
English main language	0.71	0.72	0.903	0.74	0.72	0.588
Female	0.50	0.49	0.422	0.50	0.51	0.928
Observations	1,356	1,278		1,162	1,151	

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 fails to reject the null hypothesis that variables are not jointly different across treatment and control conditions for the full sample ($p=0.200$). A joint significance test also fails to reject the null hypothesis that variables are not jointly different across treatment and control conditions among ethnic minorities ($p=0.478$). In results not shown, additionally we find no significant covariate imbalance among low-income students and first-generation college students as well as, per our specification of severely disadvantaged students, low-income and first-generation college students from ethnic minority backgrounds.

Table 2: Intent-to-Treat Estimates of Mean Effects for Full Sample and by Ethnicity, Mother's Education, and Household Income

	Postsecondary Enrollment			Degree Attainment		
	(1) Any College	(2) Two Year	(3) Four Year	(4) Any Degree	(5) Two Year	(6) Four Year
Panel A: Full-Sample Effect						
Treat	0.016 (0.021)	0.012 (0.020)	-0.015 (0.021)	0.014 (0.019)	0.001 (0.013)	0.014 (0.016)
Control Group Mean	0.519	0.288	0.388	0.235	0.093	0.157
Panel B: By Ethnicity						
Treat	-0.070 (0.063)	0.020 (0.062)	-0.117* (0.067)	-0.087 (0.057)	0.021 (0.037)	-0.081 (0.050)
Treat*Minority	0.100 (0.067)	-0.009 (0.066)	0.119* (0.070)	0.119* (0.061)	-0.023 (0.040)	0.112** (0.053)
Control Group Mean for Minorities	0.511	0.290	0.375	0.220	0.092	0.144
Control Group Mean for Non-Minorities	0.582	0.276	0.489	0.349	0.097	0.253
Panel C: By Mother's Education						
Treat	0.056* (0.030)	0.022 (0.030)	0.010 (0.031)	0.040 (0.027)	0.005 (0.017)	0.044* (0.024)
Treat* First Generation College	-0.090** (0.043)	-0.021 (0.041)	-0.057 (0.043)	-0.058 (0.038)	-0.010 (0.026)	-0.067** (0.032)
Control Group Mean of First Generation College Students	0.488	0.268	0.360	0.225	0.102	0.151
Control Group Mean of Non First Generation Students	0.546	0.306	0.413	0.243	0.085	0.162
Panel D: By Household Income						
Treat	0.065** (0.030)	0.042 (0.028)	0.024 (0.030)	0.038 (0.026)	0.007 (0.018)	0.026 (0.023)
Treat* Lower Income	-0.104** (0.043)	-0.064 (0.042)	-0.083* (0.043)	-0.050 (0.039)	-0.012 (0.027)	-0.025 (0.033)
Control Group Mean of Lower-Income Students	0.524	0.304	0.383	0.220	0.094	0.130
Control Group Mean of Higher-Income Students	0.515	0.274	0.393	0.248	0.092	0.181

Notes: N = 2,634. Each panel displays estimates from separate models. Low income students have household incomes less than \$13067 in 2020 dollars. Estimates based on linear probability models that include covariates listed in Table 1 and indicators that identify missing data on each variable. Sample weights included. Standard errors clustered by randomization block. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Intent-to-Treat Estimates of Mean Effects for the Moderately and Severely Disadvantaged Minority Students

	Postsecondary Enrollment			Degree Attainment		
	Any College (1)	Two Year (2)	Four Year (3)	Any College (4)	Two Year (5)	Four Year (6)
<i>Panel A: Minority by Education</i>						
Treat	0.079** (0.030)	0.042 (0.029)	0.029 (0.031)	0.068** (0.027)	0.009 (0.018)	0.069*** (0.023)
First-Generation*Treat	-0.116*** (0.044)	-0.076* (0.041)	-0.063 (0.043)	-0.086** (0.038)	-0.028 (0.026)	-0.086** (0.033)
Control Group Mean Non-First-Generation Minorities	0.534	0.294	0.402	0.222	0.082	0.144
Control Group Mean for First-Generation Minorities	0.485	0.285	0.345	0.217	0.103	0.144
<i>Panel B: Minority by Income</i>						
Treat	0.082** (0.030)	0.037 (0.030)	0.045 (0.030)	0.054** (0.026)	0.008 (0.019)	0.048** (0.023)
Lower Income*Treat	-0.113*** (0.044)	-0.061 (0.042)	-0.091** (0.044)	-0.052 (0.039)	0.008 (0.028)	-0.039 (0.032)
Control Group Mean for Higher-Income Minorities	0.512	0.286	0.378	0.229	0.094	0.164
Control Group Mean for Lower-Income Minorities	0.510	0.293	0.372	0.210	0.091	0.123

Notes: N = 2,313. Samples restricted to minority students. Panel A displays results for models that estimate treatment first-generation, ethnic minority individuals. Panel B displays results for models that estimate treatment low-income, ethnic minority individuals. Lower income parents have household incomes less \$13068 in 2020 dollars. Covariates listed in Table 1 as well as indicators that identify missing data on each variable are included as controls. Sampling weights included. Estimates based on linear probability models. Standard errors clustered by randomization block. ***p<0.01, ** p<0.05, * p<0.1

Table 4: First Stage Results for TOT Analysis

	Dependent Variable: Ever Attended Private School		
	(1) Full Sample	(2) Minority, First Generation	(3) Minority, Lower Income
Lottery Winner	0.655*** (0.018)	0.676*** (0.027)	0.660*** (0.026)
Baseline Math Test Score	-0.000 (0.001)	-0.002** (0.001)	-0.001* (0.001)
Baseline English Test Score	0.000 (0.000)	0.002** (0.001)	0.001* (0.001)
Parent Educational Attainment			
High School Diploma/GED	0.011 (0.033)	0.023 (0.029)	0.085*** (0.032)
Some College	0.051 (0.033)		0.112*** (0.031)
BA degree or more	0.065 (0.041)		0.174*** (0.049)
Family Income (2020 dollars)			
\$8168 -13067	0.027 (0.026)	0.044 (0.037)	0.014 (0.025)
\$13068-17967	-0.018 (0.033)	0.023 (0.046)	
\$17967-24501	0.095*** (0.036)	0.133*** (0.046)	
\$24502 -32669	0.103** (0.046)	0.155** (0.073)	
\$32670 or more	0.136*** (0.041)	0.114* (0.062)	
Mother born in U.S.	-0.047* (0.027)	0.019 (0.044)	0.027 (0.039)
Racial/Ethnic Background			
African American	-0.021 (0.065)	0.014 (0.036)	-0.018 (0.033)
Hispanic	-0.001 (0.069)		
Mother Works	0.007 (0.025)	0.022 (0.032)	0.019 (0.034)
Father Absent	0.008 (0.021)	0.025 (0.030)	0.020 (0.026)
English main language	-0.011 (0.033)	-0.041 (0.051)	-0.047 (0.047)
Female	0.015 (0.017)	0.014 (0.026)	0.053** (0.023)

Notes: Model includes controls for randomization blocks. Low-income students in the results displayed in column 3 had household incomes less than \$13068 in 2020 dollars. Sampling weights included. Standard errors clustered by randomization block. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Treatment on the Treated Estimates for Moderately and Severely Disadvantaged Minority Students

	Postsecondary Enrollment			Degree Attainment		
	Any College (1)	Two Year (2)	Four Year (3)	Any College (4)	Two Year (5)	Four Year (6)
<i>Panel A: Minority by Education</i>						
Treat	0.112** (0.043)	0.058 (0.043)	0.062 (0.042)	0.097** (0.039)	0.013 (0.026)	0.097*** (0.034)
First-Generation*Treat	-0.167** (0.065)	-0.112* (0.062)	-0.132** (0.064)	-0.122** (0.057)	-0.042 (0.039)	-0.124** (0.048)
Control Group Mean Non-First-Generation Minorities	0.534	0.294	0.402	0.222	0.082	0.144
Control Group Mean for First-Generation Minorities	0.485	0.285	0.345	0.217	0.103	0.144
<i>Panel B: Minority by Income</i>						
Treat	0.148*** (0.046)	0.066 (0.045)	0.096** (0.043)	0.104** (0.042)	0.009 (0.029)	0.080** (0.037)
Lower Income*Treat	-0.191*** (0.067)	-0.101 (0.066)	-0.163** (0.066)	-0.097 (0.060)	-0.007 (0.040)	-0.064 (0.050)
Control Group Mean for Higher-Income Minorities	0.512	0.286	0.378	0.229	0.094	0.164
Control Group Mean for Lower-Income Minorities	0.510	0.293	0.372	0.210	0.091	0.123

Notes: N = 2,313. Samples restricted to minority students. Panel A displays results for models that estimate treatment first-generation, ethnic minority individuals. Panel B displays results for models that estimate treatment low-income, ethnic minority individuals. Lower income parents have household incomes less \$13068 in 2020 dollars. Covariates listed in Table 1 as well as indicators that identify missing data on each variable are included as controls. Sampling weights included. Estimates based on linear probability models. Standard errors clustered by randomization block. ***p<0.01, ** p<0.05, * p<0.1

**Online Appendix:
Supplemental Tables**

Table A1: Intent-to-Treat Estimates by Ethnicity Using Alternative Definition of Minority Status

	Postsecondary Enrollment			Degree Attainment		
	(1) Any College	(2) Two Year	(3) Four Year	(4) Any Degree	(5) Two Year	(6) Four Year
Treat	-0.103 (0.076)	-0.025 (0.071)	-0.119 (0.081)	-0.102 (0.068)	0.040 (0.043)	-0.112* (0.061)
Treat*Minority	0.130 (0.079)	0.036 (0.074)	0.118 (0.084)	0.130* (0.071)	-0.044 (0.046)	0.141** ^a (0.064)
Minority	-0.056 (0.074)	0.015 (0.070)	0.021 (0.077)	-0.076 (0.063)	0.040 (0.034)	-0.107* (0.059)
Control Group Mean for Minorities	0.509	0.289	0.376	0.219	0.092	0.144
Control Group Mean for Non-Minorities	0.626	0.308	0.502	0.389	0.096	0.294

Notes: N = 2,591. Each panel displays coefficients estimated from separate models. Covariates listed in Table 1 as well as indicators that identify missing data on each variable are included as controls. Students are classified as African American if their mother or father was identified as African American. 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 A2: Intent-to-Treat Estimates for the Moderately or Severely Disadvantaged Using Alternative Definition of Minority Status

	Any College		Two-Year Degree		Four Year Degree	
	Enrollment (1)	Completion (2)	Enrollment (3)	Completion (4)	Enrollment (5)	Completion (6)
<i>Panel A: Minority by Education</i>						
Treat	0.076** (0.030)	0.066** (0.026)	0.039 (0.029)	0.009 (0.017)	0.025 (0.030)	0.065*** (0.023)
First-Generation*Treat	-0.113*** (0.043)	-0.085** (0.037)	-0.071* (0.041)	-0.029 (0.026)	-0.063 (0.043)	-0.082** (0.032)
Control Group Mean Non-First-Generation Minorities	0.535	0.221	0.297	0.081	0.405	0.144
Control Group Mean for First-Generation Minorities	0.480	0.217	0.281	0.104	0.344	0.143
<i>Panel B: Minority by Income</i>						
Treat	0.077** (0.030)	0.050* (0.026)	0.036 (0.029)	-0.010 (0.018)	0.037 (0.029)	0.046** (0.023)
Lower Income*Treat	-0.109** (0.044)	-0.047 (0.038)	-0.061 (0.042)	0.011 (0.027)	-0.085* (0.043)	-0.038 (0.032)
Control Group Mean for Higher-Income Minorities	0.511	0.228	0.287	0.093	0.380	0.165
Control Group Mean for Lower-Income Minorities	0.507	0.210	0.291	0.091	0.372	0.123

Notes: N = 2,354. Samples restricted to minority students. Panel A displays results for models that estimate treatment first-generation, ethnic minority individuals. Panel B displays results for models that estimate treatment low-income, ethnic minority individuals. Lower income parents have household incomes less than \$12,877 in 2019 dollars. Control variables and sampling weights included. Students are classified as African American if their mother or father was identified as African American. Estimates based on linear probability models. Standard errors clustered by randomization block. ***p<0.01, **p<0.05, *p<0.1

Table A3: Intent to Treat Results for Low-Income, Ethnic Minority Students Using Alternative Specifications for Low-Income and Mother's Education

	Any College		Two-Year Degree		Four Year Degree	
	Enrollment (1)	Completion (2)	Enrollment (3)	Completion (4)	Enrollment (5)	Completion (6)
<i>Panel A: Mothers with and without a High School Diploma (N= 2,313)</i>						
Treat	0.046*	0.040*	0.019	-0.013	0.003	0.042**
	(0.024)	(0.022)	(0.023)	(0.015)	(0.024)	(0.020)
No Diploma*Treat	-0.116**	-0.041	-0.069	0.035	-0.014	-0.049
	(0.056)	(0.041)	(0.051)	(0.030)	(0.055)	(0.034)
<i>Panel B: Household Income Higher or Lower than \$8168 (N= 2,313)</i>						
Treat	0.049*	0.040*	0.000	-0.013	0.028	0.042**
	(0.026)	(0.022)	(0.024)	(0.015)	(0.025)	(0.020)
Lower Income*Treat	-0.086*	-0.041	0.026	0.035	-0.107**	-0.049
	(0.049)	(0.041)	(0.047)	(0.030)	(0.049)	(0.034)
<i>Panel C: Household Income less than \$8168 vs. greater than \$17967 (N= 1,331)</i>						
Treat	0.111***	0.076**	0.044	-0.001	0.079**	0.072**
	(0.039)	(0.034)	(0.039)	(0.024)	(0.039)	(0.030)
Lower Income*Treat	-0.146**	-0.072	-0.022	0.028	-0.165***	-0.079*
	(0.058)	(0.048)	(0.057)	(0.036)	(0.057)	(0.041)

Notes: Samples restricted to minority students. Panel A displays results for models using different specifications of mother's education to identify severely disadvantaged students. Panels B and C displays results for models using different specifications of income to identify severely disadvantaged students. Control variables and sampling weights included. ***p<0.01, **p<0.05, *p<0.1

¹ Results are robust to probit models.

² The one exception is a marginally significant downward shift in enrollment by students with less educated mothers.

³ 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. We do not interpret these findings, because the non-immigrant category overlaps those identified as a member of a disadvantaged minority group. 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.