The Behavioral Consequences of Pre-kindergarten Participation for Disadvantaged Youth

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This paper investigates the effects of public pre-kindergarten participation on the subsequent behavioral outcomes of disadvantaged youth. We utilize a unique longitudinal dataset that links student birth records to pre-kindergarten participation for every child born in Florida in or after 1994 who subsequently attended public school in Florida. Because pre-kindergarten participation is endogenous, we employ a novel identification strategy to estimate the effects of pre-kindergarten participation by comparing siblings within the same family. We demonstrate that, within a family, the sibling with less costly access to public pre-kindergarten – measured by the fact that his or her locally-zoned elementary school offers a pre-kindergarten program when he or she is four years old – is considerably more likely to attend than the equally-eligible sibling who would have attended pre-kindergarten at a school other than his or her zoned elementary school, and use this differential access within a family as an instrument to predict public pre-kindergarten attendance.

The vast majority of the economics literature on the efficacy of pre-kindergarten has concentrated on academic outcomes. This topic has been studied extensively with regard to school readiness and student cognitive performance, with mixed evidence to date. The most compelling of these studies exploit cross-sibling comparisons (Currie and Thomas, 2000; Garces et al., 2002) and regression-discontinuity designs that take advantage of discontinuities in Head Start funding (Ludwig and Miller, 2007). These studies find general evidence that Head Start participation has long-term benefits in terms of schooling outcomes.

But from the inception of federal support to extend educational opportunity to 3- and 4-year-old low-income children, there has been a consistent dual emphasis on

cognitive and social development. To the planners of Head Start in 1964, preparing disadvantaged youth to succeed in school required a "whole child" approach, one in which not only academic knowledge but also behavioral competence would be emphasized (Zigler and Styfco, 2004). In addition to Head Start, the federal government also began to aid state efforts to provide local community-sponsored preschools through the mechanism of the Child Care and Development Block Grant program. This flow-through program subsidized child care programs whose quality standards were allowed to vary a great deal more than Head Start's. To supporters of Head Start, these state-subsidized early childhood programs "do not pretend to have anything to do with school readiness. They are essentially custodial programs whose only purpose is to enable poor parents to enter the work force" (Zigler and Styfco, 2004, p. 53).

This issue—that preschool separates parents from children during crucial years of their development as a result of either an elective or required return to the workforce — remains at the heart of the debate over its potentially zero-sum benefit/harm ratio: disadvantaged children may receive sufficient academic stimulation to compensate for missing or insufficient parental instruction yet this cognitive benefit may be offset by two negatives: (1) low income children congregate in poor quality child care settings where unfamiliarity with appropriate social interaction is mutually reinforced; and (2) initiation into socially acceptable norms of behavior is conducted not consistently by family members but intermittently by a stranger. The preferred alternative outcome of preschool for disadvantaged youth is that it teaches school acculturation behavior in ways that improve student academic and behavioral outcomes once at school.

Research suggesting the possibly negative impact of preschool participation on children's subsequent elementary school behavior is embedded in the larger debate about the psychological consequences of children of any income level being separated from their parents in the first years of life. In the early 1980s educational psychologists began employing attachment theory (Bowlby, 1973; Ainsworth, 1978) in their study of increasing numbers of infants and toddlers being placed in public or private child care as a result of mothers rapidly returning to the workforce. Attachment theory posited that for humans to become trusting and caring individuals they must, as infants, bond with their mothers in the first year of life. The theory predicted that disruption of this attachment process (primarily to a nurturant female) would result in a child who is unable to develop self control or form stable relationships. Jay Belsky was one of the first educational psychologists to claim to have found evidence confirming this prediction. Starting in the mid 1980s, Belsky issued a series of warnings (1986, 1988, 1990) that "early and extensive nonmaternal care carried risks in terms of increasing the probability of insecure infant-parent attachment relationships and promoting aggression and noncompliance during the toddler, preschool, and early primary school years" (Belsky, 2002). The research that Belsky cited was criticized on the grounds that it did not take into account the quality of the childcare setting or the background characteristics of the children.

The decade of the 1990s saw a two-prong response to anxiety among both poor and non-poor families that leaving their infants and toddlers in a group child care setting might promote adverse behavioral outcomes such as non-compliance and aggression. In the legislative arena, the National School Readiness Task Force issued a report in 1991 affirming that school readiness involved not only academic knowledge but also social

competence. In 1994, Congress set school readiness to be first among the nation's eight education goals. By the year 2000, all children would have access to high-quality, developmentally appropriate preschool programs and would arrive at school able to "to maintain the mental alertness necessary" to learn (P.L. 103-227).

In the research arena, the National Institute of Child Heath and Human Development commissioned a multi-center study of early child care and youth development. Since 1993, the NICHD Early Child Care Research Network has produced over 60 publications, many of which reach conflicting conclusions about the relationship between early childcare and socio-emotional development. Since the early 1990s, a great deal of research has been conducted on short- and long-run effects of children's early preschool experiences. Given that early childhood education represents a nexus of psychological theory, employment exigency, and cultural transmission, it is not surprising that findings in this body of research using nationally representative samples are decidedly mixed:

- The National Institute of Child Health and Development [NICHD] Study of Early Child Care and Youth Development (1998a) found no difference in problem behavior during the first three years among children reared exclusively at home and those who spent more than 30 hours per week in non parental care.
- The NICHD Study of Early Child Care and Youth Development (1998b) found that mothering was a stronger and more consistent predictor of child outcomes than child care. There was little evidence that early, extensive, and continuous care was related to problematic child behavior. Child-care quality was the most consistent predictor of child functioning.

- The NICHD Study of Early Child Care and Youth Development (2001) found that when quality and quantity of child care were controlled, the association between family factors and children's social-emotional development remained significant, thereby affirming that parents continue to have a meaningful effect on children's behavior despite considerable child care experience in the earliest years.
- The NICHD Study of Early Child Care and Youth Development (2003) found that children spending longer hours or more months in center care each year exhibit elevated levels of aggression and less effective impulse control.
- The national evaluation of Early Head Start (Love et al., 2005) found that children randomly assigned to the program (compared to a control group that could access any community service except Early Head Start) showed fewer problem behaviors and lower levels of aggressive behavior at 24 and 36 months. No evidence was found that more time in child care was associated with higher rates of aggressive behavior.
- First year findings from *The Head Start Impact Study* (U.S. Department of Health and Human Services, 2005) reported effect sizes of -0.13 for total behavior problems and -0.16 for hyperactivity as reported by parents whose children were randomly assigned to Head Start. Control group could enroll in available community non-Head Start services.
- A study of subsidized childcare in Quebec found evidence of negative effects on a wide spectrum of child behavioral outcomes: hyperactivity-inattention, general anxiety, separation anxiety, and physical aggressiveness/opposition (Baker, Gruber and Milligan, 2005).

- Summarizing effect sizes, The NICHD Study of Early Child Care and Youth Development (2006) concluded that more child-care hours predicted more behavior problems and conflict, according to care providers.
- Using Early Childhood Longitudinal Study data, Loeb et al. (2007) found that center-based care had a negative effect on socio-behavioral measures (with the exception of English proficient Hispanic children). Across the family income distribution, the younger the start age, the larger the negative effect. Intensity effects (more hours per day lead to more kindergarten teacher-report behavioral effects—measures of self control, interpersonal skills, and externalizing behavior) are moderated by family income and race.
- Also using Early Childhood Longitudinal Study, Magnuson et al. (2007) found that participation in pre-kindergarten was associated with higher levels of behavior problems noted in the spring of first grade. This adverse relationship was somewhat attenuated for public school-located pre-kindergarten, particularly for students who continued to kindergarten in the same public school where they attended pre-kindergarten.

Parallel to the legislative and research activity at the national level, the decade of the 90s saw states acting to extend pre-kindergarten into their K-20 educational framework. In Florida as in other states, this downward extension of public schooling to include three and four year olds was partly to accommodate provisions of the Individuals with Disabilities Education Act (PL 99-457). Since disproportionate numbers of incoming low-income children were classified early in elementary school with special education exceptionalities such as speech and language impairment or emotional

handicap, it was considered a worthwhile investment to provide these services in the context of a pre-kindergarten early invention program (PKEI).

In funding the program, the Florida Legislature stipulated that priority be given to economically disadvantaged 3 and 4 year old children whose family's income—up to 135% of federal poverty level--made them free lunch eligible. Additional targets were children of migrant workers, children who had been abused, in foster care, prenatally exposed to drugs, and 3 and 4 year olds not economically eligible who could participate with a fee adjusted for family income. Minimum operational parameters were set at six hours per day, five days per week during the school year with an option of extending services to 10 hours per day year round. Public school PKEI teachers had to be certified in early childhood education; however, school districts could also choose to subcontract with community-based non profits such as Head Start or child care agencies to provide services to 3 and 4 year olds. Staff qualifications at non-public school providers were not as rigorous: a 12-credit Child Development Associate credential (plus 120 hours of fieldwork) was acceptable to be a lead teacher. In either setting, the student-staff ratio was set at 10:1.

Throughout the nineties, annual funding for PKEI hovered just under $100 million with enrollment averaging between 25,000 to 35,000 children per year. By the time our data collection period ended (2003), the program had been transferred out of the Department of Education to the quasi public-quasi private Partnership for School Readiness housed directly inside the Governor's Office. It has since been transferred to the Agency for Workforce Innovation, lending partial support to Zigler and Styfco's

contention that the mission of many state-supported preschool programs is primarily to serve as daycare for mothers on welfare who are required to enter the workforce.[1]

So far we have been focusing on potentially negative behavioral consequences of preschool participation. To look at the glass half-full, considerable evidence has been accumulated that "emotional development and academic learning are far more closely intertwined in the early years. . . . Across a range of studies, the emotional, social, and behavioral competence of young children (such as higher levels of self-control and lower levels of acting out) predict their academic performance in first grade, over and above their cognitive skills and family backgrounds" (Raver and Knitzer, 2002, p. 3). The collocation of academic knowledge and self regulation in the brain is the basis for both conceptual and empirical support in favor of preschool education. To life-span economists such as James Heckman, estimated rates of return to investment in preschool programs far exceed their opportunity costs. These returns to investment would be due in part because younger persons have a longer horizon over which to recoup the fruits of their investments. In Heckman's human capital model (2000), non-cognitive skills and informal learning play important roles in lifetime earnings (see also Heckman, 2006; Heckman and Rubinstein, 2001; Heckman, Stixrud and Urzua, 2006). Most long-run studies that find support for investment in high quality early childhood programs (e.g., High/Scope Perry Preschool, Carolina Abecedarian Project, Chicago Child-Parent Centers) do not make the economic case that disadvantaged program participants caught up to earning levels of more advantaged age peers but rather that society saved money through lower rates of anti-social, cost-positive behavior such as juvenile arrest, welfare

[1] Cascio (2006) shows that mothers entered the workforce as a result of increased availability of state subsidized kindergarten.

dependency, and adult incarceration (Schweinhart et al. 2005; Campbell et al. 2002; Reynolds et al, 2002). Indeed, Belfield et al. (2006) argue that the long-term effects on crime account for a very large share of the dollar-value benefits of the Perry Preschool treatment. On the other hand, Duncan et al. (2006), utilizing data from six longitudinal data sets in the United States, Canada and the United Kingdom, found very limited evidence that self-regulation skills at kindergarten had lasting import for long-term academic and behavioral success.

In the opening years of the present accountability-driven decade, early childhood programs were not spared the press to quantify effects of participation. Head Start adopted a Child Outcomes Framework, and commissioned an impact study as did Early Head Start, both involving random assignment. Some state pre-kindergarten programs were evaluated on the basis of their graduates' performance in elementary school. It has become commonplace to find multilevel and growth curve models being used to investigate the relationship between treatment and proficiency. Calls for "analytical strategies aimed at explaining interindividual differences in intraindividual change" proliferate (Granger and Kivilighan, 2003; Kaplan, 2002). Adding to the need to be able to demonstrate value added results, the lingering controversy over possible detrimental behavioral effects of early non-maternal, collective care has galvanized efforts to better measure and treat mental illness in children (Currie and Stabile, this volume).

In the forty years since the US launched a nationwide program to extend equal opportunity to disadvantaged 3- and 4- year-olds, the mandate to provide instruction in both the cognitive and socio-emotional domains has become subject to increased specificity. In Head Start's performance appraisal goals for 2007, "identifying behavioral

problems in pre-school children" is listed as a specific performance measure (DHHS/ACF/OHS, 2007). A history of difficulty in adhering to the behavioral norms expected by schools is frequently used to explain students' poor academic performance (sometimes culminating in their exclusion from the testing pool). Thus, the burden on public pre-kindergarten programs to initiate students into socially acceptable forms of interaction has never been higher. Our study examines whether children who attended public school pre-kindergarten in Florida acquired a better grasp of socially acceptable behavior than their 4-year-old peers who attended either a non-public preschool or no preschool at all.

Contributions

This analysis makes several key advances over the existing literature. First, this is the first large-scale study to utilize administrative data on pre-kindergarten participation. This has the advantage of size: We observe the entire population of income-eligible students in the state of Florida born in or after 1989. Using administrative data also eliminates the potential for recall bias in measuring program participation; any student who participated in a public Head Start or school-based pre-kindergarten program in the state of Florida is observed in our data. Also, because we have matched child birth records, school-based pre-kindergarten participation records, and subsequent school behavior records for the entire state of Florida, we can rely on administratively-observed background factors and behavioral problems. (We measure behavioral problems by whether the child is referred for disciplinary action by their teachers.) Furthermore, our

matching of birth vital records with school records allows us to compare within families, a strategy shared by Garces et al. (2002).

Second, the use of population-based data allow us to stratify the estimated effects of pre-kindergarten participation in a number of different ways. With tens of thousands of income-eligible families with multiple children, we can estimate with confidence the differential effects of pre-kindergarten participation within families along a variety of dimensions, including birth conditions, maternal age and education.

Third, and most importantly, this analysis introduces a novel identification strategy. In addition to within-family comparisons, we exploit the fact that local policy conditions outside of the control of specific families generate different effective prices of attending public pre-kindergarten for different siblings. Whereas all students who meet certain family income or health criteria are eligible for public pre-kindergarten participation, not all students have the same ease of access. For around 60 percent of income-eligible Florida students, the student's local zoned elementary school does not offer a public pre-kindergarten program. These students must in turn attend a pre-kindergarten site farther from their home, and perhaps without public transportation.

We argue that the presence of a pre-kindergarten program in the zoned elementary school should promote public pre-kindergarten participation for several reasons. One major reason is informational: Parents are more likely to be aware of pre-kindergarten options when they have a child who attends a school that offers such a program, or when their neighbors have children who attend such a school. But transportation costs may also be a factor, even in cases when transportation to preschool is provided. This may be true for several reasons. Parents may not wish for their young children to be bused long

distances, especially if they are alone. And it may be easier for parents to send their young children on a bus if they are accompanied by an older sibling or older neighbor whom the child knows; these are more likely to be the case if the pre-kindergarten is attached to the local zoned school. (In fact, the informational and neighbor-transportation factors are probably the strongest reasons for this increased likelihood of attending public pre-kindergarten when the locally zoned school offers the program, as first children attend pre-kindergarten at nearly the same rate as their younger siblings.) For all of these reasons, we suspect that it is the public school zone, rather than travel time and mileage, matters most in determining whether children attend public pre-kindergarten programs.

We demonstrate that income-eligible students are highly responsive to the presence of a pre-kindergarten program at their zoned elementary school. Families with a pre-kindergarten program at their zoned elementary school are more than 60 percent more likely to send their children to a public pre-kindergarten program than are families without a pre-kindergarten program at their zoned school. And this pattern holds up within families as well: Around 40 percent of families live in elementary school zones with a public pre-kindergarten program when one sibling is four but not when another sibling is four. This happens either because the family changes residence, because the zoning lines are redrawn, because a school with a pre-kindergarten program dropped it, or because a school without a pre-kindergarten program added it. Regardless, within the same family, the sibling whose zoned elementary school has a pre-kindergarten program is 60 percent more likely to attend than the sibling without such a program at the zoned school. This is true when we exclude families who move, and look only at families with different access to public pre-kindergarten because of exogenous changes in local school

policy. Using these differences in access within a family, we find that public pre-kindergarten participation apparently reduces behavioral problems in elementary school, especially when the child grows up in a particularly disadvantaged neighborhood.

Raw unadjusted relationship between pre-kindergarten and disciplinary problems

Table 1 presents some basic facts about the rates of disciplinary problems in the first three years of school. Here and throughout the analysis, we restrict our attention to students who are income-eligible at the time of potential enrollment in pre-kindergarten. We do not actually measure income eligibility with certainty; to be income-eligible; a family must have income below 100 percent of the poverty line. However, we only observe free lunch eligibility – less than 130 percent of the federal poverty level. We therefore restrict our analysis to the set of families where all students are consistently observed being eligible for free lunch in every potential time period – about 60 percent of the students who are free lunch eligible at any given time. We hope that this more restrictive measure of income eligibility will nearly approximate the true eligible population. Our analysis sample consists of 59,418 children in 29,087 families where all students in the family are consistently observed to be free lunch eligible.

Note also that we cannot observe private pre-kindergarten (or community-based Head Start) participation, and therefore are comparing public pre-kindergarten attendees with all other income-eligible students. Later in this paper, we attempt to draw some potential inferences from the fact that some communities have community-based Head Start programs and others do not.

One observes in Table 1 that students who attended public pre-kindergarten have slightly higher rates of disciplinary problems than students who did not attend public pre-kindergarten in their early years of school. One further observes that the same patterns hold up within families. The finding in the raw data that public pre-kindergarten attendees are slightly more likely than non-attendees to have later discipline problems in the early grades could indicate that public pre-kindergarten is either ineffective in terms of engendering positive behavior or perhaps promotes non-compliant, acting-out behavior. But it could also indicate that students, even within a family, are negatively selected into public pre-kindergarten programs: The siblings most in need of socialization may be the ones that families choose to send to pre-kindergarten, while those who are reasonably well-socialized might not be sent. It could also be the case that families are transitioning in a manner that is unobservable to the researcher. The potential presence of endogeneity bias indicates the necessity of conducting instrumental variables regression.

Evidence of instrument relevance

As mentioned above, our instrumental variable is the presence of a public pre-kindergarten program in the public elementary school for which the student would be zoned at the time that he or she is four years old. Table 2 demonstrates that, in cross section, income-eligible children are much more likely to attend public pre-kindergarten when they have more direct access to it. Even though all students in our data set are eligible for public pre-kindergarten, typically with free transportation, the presence of a public pre-kindergarten program housed locally, in the same elementary school where

older siblings and neighbors already attend, appears to have a powerful effect on public pre-kindergarten take-up. Comparing zip codes without community-based Head Start options, nearly 55 percent of income-eligible students attend public pre-kindergarten when the local zoned school offers pre-kindergarten, while only 26 percent attend public pre-kindergarten when this is not the case. Note also that while the presence of a community-based Head Start program in the zip code area slightly reduces the likelihood that a child will attend a public pre-kindergarten program (53 percent when the zoned school offers pre-kindergarten, and 22 percent when it does not), it is clear that the overwhelming determinant of public pre-kindergarten entry is not the community-based Head Start option, but easier public pre-kindergarten access.

But Table 2 also makes clear that a cross-sectional analysis of participation, using geographic location as an instrument, is not appropriate. This table provides basic descriptive information, culled from the full set of students whose birth records and school records are matched in Florida, on the family attributes of students across geographic locations with differing levels of access to public pre-kindergarten and community-based Head Start programs. Comparing across the columns, one observes that the school zones where public pre-kindergarten is locally offered tend to be poorer (in terms of a higher percentage "eligible" for publicly-funded pre-kindergarten[2]), with larger fractions black and Hispanic, more mothers who are not high school graduates, and fewer married parents than are the school zones where public pre-kindergarten is not locally offered. Community-based Head Start programs tend to operate in zip code areas

[2] We put the word "eligible" in quotation marks because we do not observe eligibility per se. We estimate eligibility based on the student's family's history with free lunch eligibility in the school. We are likely understating the true rate of eligibility in Florida, but this understatement does not seem important for this comparison or for the empirical analysis that follows.

that are poorer still, with even higher eligibility rates, more black families (though not Hispanic families) and lower rates of parental marriage and maternal high school graduation. The same patterns hold whether one looks at the attributes of the entire population of families in the school zone or whether one looks only at the attributes of income-eligible families in the school zone.

Clearly, families residing in these different types of geographical locations differ in many measured and unmeasured aspects that are independent of whether they attend public pre-kindergarten, and in fact, it makes sense that public pre-kindergarten programs (and community-based Head Start programs) would tend to locate in communities where the need for these programs is greatest. This cross-sectional heterogeneity necessitates the use of a fixed effects model that compares outcomes across students who are considerably more similar in terms of unmeasured characteristics. For that, we turn to a within-family comparison.[3]

In order to compare within-families, it must be the case that siblings' public pre-kindergarten take-up varies within a family based on differences in local access to pre-kindergarten. Table 3 shows that many students without a public pre-kindergarten program immediately available still go to pre-kindergarten, but the probability of attending increases dramatically if the zoned school has a program.[4] Among families where the zoned school offered a pre-kindergarten program to all siblings observed in the

[3] Due to potential concerns that sibling spillovers may undermine the credibility of within-family identification strategies in this context, we also estimate models that exploit this cross-sectional variation over time in the neighborhoods whose zoned schools offer public pre-kindergarten programs. The results of these models turn out to be comparable to our favored models that utilize the within-family comparisons.

[4] Note that the public pre-kindergarten attendance rate is somewhat higher in the first row of Table 3 than in the last two columns of Table 2. This is due to differences in sample between the two tables. In Table 2, all families, including those with just one child observed, are included, while in Table 3, only families with two or more children observed are included. In addition, these sibling comparisons tend to be for more disadvantaged families (or families who are more consistently disadvantaged) than the potentially eligible population as a whole.

data, 56 percent of income-eligible students attended public pre-kindergarten. On the other hand, among families for whom the zoned elementary school never offered pre-kindergarten just 35 percent of income-eligible students attended pre-kindergarten. Table 4 shows again that families in the three groups presented in Table 3 are very different, further underscoring the importance of conducting within-family comparisons.

Table 5 presents within-family information on public pre-kindergarten take-up, by access levels. For the 12,107 "mixed" families, the sibling with the easier access to public pre-kindergarten attended these programs 52 percent of the time, while the sibling without such access attended these programs 33 percent of the time. These same differences are apparent when we compare within families of different types, stratified by maternal education, maternal age, and race. This evidence indicates that our instrumental variables strategy has a very strong and consistent (across subgroups) first stage.

One potential disadvantage of a within-family identification strategy involves the potential for cross-sibling spillovers. As mentioned in the introduction, we suspect that the reasons that families are more likely to send their children to public pre-kindergarten programs when their local zoned elementary school offers such a program include both transportation and informational factors. In both of these cases, it may be the case that older siblings attending a public school could contribute to a younger sibling attending a public pre-kindergarten program at that same school. The potential presence of strong cross-sibling spillovers could undermine the credibility of this instrumental variable strategy. It turns out, however, that the comparisons in Table 5 appear to be nearly independent of birth order: For instance, 51 percent of eligible first siblings attend pre-kindergarten when offered at their locally zoned elementary school, as compared with 53

percent of subsequent siblings. Therefore, the non-sibling-related factors associated with public pre-kindergarten participation at locally zoned elementary schools appear to be the dominant reasons for children's attendance. This fact increases the veracity of the within-family comparison as an identification strategy.

Regression estimates

Table 6 presents regression analysis of the estimated effects of attending public pre-kindergarten on the probability of being disciplined. Each cell in the table represents a different regression specification; the columns reflect different years in school. (Typically a student in "year 2" would be in first grade, but we chose to treat kindergarten repeaters and "natural" first graders the same way.) The regression results presented in Table 6 include controls for school fixed effects, as well as for student race, sex, free/reduced price lunch status (though in practice, all students will show up as free lunch eligible), maternal age at birth, maternal education at birth, maternal marital status, Medicaid status at birth, adequacy of prenatal care, complications of labor and delivery, birth order, and indicators for whether the student's birth weight is less than 1000g, 1000-1500g, 1500-2500g, or >2500 g (extremely low, very low, moderately low, or normal birth weight) . The school fixed effect controls are important because schools may vary systematically in how they dispense and report discipline. As can be seen in the first row of Table 6, one observes no apparent cross-sectional relationship between public pre-kindergarten participation and disciplinary problems in the first three years of school. The second row of the table presents the same analysis but with family fixed effects. The

(non-)results remain robust; while there exist some sign changes between years, the magnitudes of the point estimates are trivial.

The third row of Table 6 presents the instrumental variables regression results. As can be seen, there exists a negative and sizeable estimated effect of pre-kindergarten participation and behavioral problems in the first two years of school, and the estimated effect is no longer statistically significant in the third year of school. This evidence suggests that students who participated in public pre-kindergarten programs are less likely to be referred for disciplinary problems later than are non-participants. This result is at odds with much of the existing cross-sectional literature that demonstrates a positive relationship between pre-kindergarten participation and subsequent misbehavior.

However, there is reason to be skeptical of this finding. Our sample of within-family access changers consists of families who moved, families who did not move but who were rezoned from one school to another, where one school offers a pre-kindergarten program and the other does not, and families who did not move and were not rezoned, but the zoned school changed its pre-kindergarten offerings between siblings. The second source of variation – rezonings – is arguably the most exogenous source of variation, but fewer than one percent of these families changed access status as a consequence of rezoning. However, 45 percent of families did not move and were not rezoned, but had their access status change when their zoned elementary school either added or dropped its pre-kindergarten program. These students provide more plausible variation, and the fourth row of Table 6 restricts the analysis to this set of students. We observe similar findings when we exclude students who changed access status because they changed residences, suggesting that endogenous location choice is not driving our

within-family estimates. The fifth and sixth rows of Table 6 stratify these findings by student sex: Unsurprisingly, the results are concentrated exclusively in the male students, who are by far more likely to commit disciplinary infractions in the elementary grades.

While we believe that the within-family identification strategy is more credible than an identification strategy that exploits school changes in public pre-kindergarten offerings over time, because of the non-randomness inherent in schools' and school districts' decisions to initiate or disband school-based pre-kindergarten programs, we are sensitive to the potential that cross-sibling spillovers may still undermine our within-family identification strategy. Therefore, in the last row of Table 6 we repeat the same basic empirical strategy without the family fixed effects – in essence, exploiting cross-time changes in locally zoned schools' pre-kindergarten program offerings. When we do this analysis, the results are slightly smaller but broadly consistent with those found using family fixed effects, suggesting that the findings are not being driven by our decision to compare sibling pairs. In the remainder of this paper, we will therefore continue to utilize our preferred within-family identification strategy.

Are these results evidence of a short-term benefit only of public pre-kindergarten participation? It may be the case that the absence of behavioral problems in the first two years of schooling puts a child on a different trajectory. Table 7 shows that students who had behavioral problems in kindergarten were much more likely to be classified as emotionally disabled or severely emotionally disturbed later on. And Table 8 also presents instrumental variables regression analysis to show that public pre-kindergarten participation reduces the likelihood that a student, all else equal, will be classified as emotionally disabled in year 2 or year 3 of school. And in fact, we observe this reduction

even when we control also for a student's actual observed behavior. This finding suggests that public pre-kindergarten participation not only appears to reduce the degree of problem behavior, relative to the alternative of private preschool or no preschool for disadvantaged youth, but it also seems to further reduce the likelihood of later classification into special education classes for students with serious social-emotional handicaps – above and beyond the degree of behavioral problems observed.

Falsification exercise

Especially given the fact that the estimated effects of public pre-kindergarten are considerably different depending on whether or not we instrument for pre-kindergarten participation, one might be concerned that our instrumental variables findings are being driven by the identification strategy employed. We therefore propose a falsification exercise, in which we utilize an indicator for low birth weight (i.e., less than 2500 grams at birth) as our replacement dependent variable. Pre-kindergarten participation cannot influence low birth weight, but an unmeasured third variable (e.g., exposure to an environmental toxin) could be associated with birth weight, pre-kindergarten participation and behavioral outcomes. Medical research indicates that low birth weight infants have a higher incidence of behavioral problems, so this association could be seen as a strong falsification test in the event of a finding of zero effect. Therefore, in Table 9 we conduct this falsification test. Because birth weight is a covariate in our regular regression models, we estimate this model without any covariates except for school and family fixed effects. In order to compare apples to apples, we also repeat our instrumental variables regression with discipline as a dependent variable to make certain

that differential treatment of covariates is not responsible for the differences in results. We conduct these tests both for the full sample of families and for the set of families where all observed children were zoned for the same school.

We observe that the results are quite similar with regard to discipline as a dependent variable, regardless of whether or not we include the covariates in the model. There remains the general pattern of a negative relationship between pre-kindergarten participation and discipline in the first two years of school, with less evidence of a relationship in the third year. In the falsification exercise, however, there is no evidence of a relationship between low birth weight and pre-kindergarten participation in our instrumental variables models, providing further support for our instrumental variables identification strategy. Indeed, given the positive correlation between low birth weight and behavioral problems, the positive insignificant coefficient in the low birth weight specification is reassuring.

Availability of community-based Head Start options

Our administrative data set observes only children who participate in pre-kindergarten and Head Start programs located in public schools, but as mentioned above, income-eligible students have community-based Head Start options as well. Ideally, we would have administrative data on all Head Start and pre-kindergarten participants, regardless of whether they attended public or private facilities, but these data are unavailable in a form that can be matched to birth records and subsequent school records. Therefore, we are limited in our analysis to compare public pre-kindergarten participants to all other income-eligible children – both those who did not participate in preschool and

those who attended a community-based Head Start facility. Evidence of a negative relationship between public pre-kindergarten participation and behavioral problems, therefore, could be either upward or downward-biased, depending on the quality of community-based Head Start facilities.

While we cannot directly observe community-based Head Start participation, we can stratify communities on the basis of differential ease of participating in community-based Head Start. We matched all community-based Head Start facilities to students at the zip code level, and found that 52 percent of students whose zoned elementary school has a public pre-kindergarten program also have a community-based Head Start facility in their zip code, while 45 percent of students whose zoned elementary school does not have a public pre-kindergarten program also have a community-based Head Start facility in their zip code. Twenty-three percent of income eligible students have a community-based Head Start facility in their zip code as well as have a zoned elementary school with a public pre-kindergarten program, while 32 percent of income eligible students have neither a local private facility nor a public program in their zoned elementary school.

In Table 10 we stratify our estimated effects of public pre-kindergarten programs into those for students in zip codes with and without community-based Head Start facilities. We observe a striking pattern: The estimated effect of public pre-kindergarten participation in neighborhoods without a local community-based Head Start option (where, presumably, students are less likely to be participating in community-based Head Start programs) is consistently less negative (and is actually positive and statistically significant in the third year of school) than is the case when a community-based Head Start facility is available nearby. These results indicate that in the situations where

students are relatively unlikely to attend community-based Head Start (and therefore, that the estimated effect of public pre-kindergarten can more comfortably be viewed as a comparison with no preschool) there is little evidence of a reduction in disciplinary problems, and if anything, by the third year of school, there is evidence of an increase in disciplinary problems associated with public pre-kindergarten participation.

However, when the comparison group is more likely to be a hybrid of no preschool and community-based Head Start facilities, the negative, significant (and consistent through year three) estimated effect of public pre-kindergarten returns. There are a number of potential explanations for this finding: One is that community-based Head Start participation is strongly associated with later behavior problems in school, while another explanation is that the presence of community-based Head Start programs puts competitive pressure on public pre-kindergarten programs to be higher quality. A third possibility is that community-based Head Start programs may be uptaking worse-behaving children as well, which could be the case if public pre-kindergarten programs enforce higher behavior standards. It is impossible to know which, if any, of these explanations might be at play here.

Of course, another possible explanation is that zip codes with community-based Head Start facilities are simply different. There exists strong evidence to suggest that this is the case: Recall from Table 2 that community-based Head Start programs tend to locate in zip codes with more eligible students, and where students in general tend to be more disadvantaged – coming from households with unmarried mothers or with mothers who did not graduate from high school. Even the eligible students in these neighborhoods tend to be more disadvantaged on average along measurable dimensions. So it might be

the case that the differences observed between locales where community-based Head Start is an option and those where it is less of an option could merely reflect these neighborhood differences.

In an attempt to gauge the degree to which these neighborhood differences might be at play, we repeat the same analysis but compare the estimated effects of public pre-kindergarten participation for students in relatively advantaged neighborhoods to those for students in relatively disadvantaged neighborhoods. We define neighborhood advantage in two different ways -- one based on the percentage of children in the neighborhood who are eligible for public pre-kindergarten and one based on the percentage of children in the neighborhood whose mothers are not high school graduates. These results, reported in the second two panels of Table 10, indicate that the estimated effects of public pre-kindergarten in these different settings are very highly related to measures of neighborhood disadvantage. Neighborhoods with fewer disadvantaged families tend to have small (or opposite-signed) estimated effects of public pre-kindergarten programs, while neighborhoods with more disadvantaged families tend to have large, significant estimated effects of public pre-kindergarten programs.[5] These results strongly suggest that the differences in findings between the estimated efficacy of public pre-kindergarten when community-based options are available and that when community-based options are less available are due not to competitive pressure coming from community-based Head Start programs but rather to the likelihood that public pre-kindergarten programs are most helpful in the most disadvantaged neighborhoods – precisely the neighborhoods where community-based Head Start programs are most likely to locate.

[5] We have also stratified these neighborhoods by fraction eligible and found very similar results.

In an attempt to further investigate this interpretation of the findings, we conduct the same analysis in Table 11, in which we limit the sample to the set of zip codes where community-based Head Start programs are located. This sampling restriction necessarily increases standard errors, but we find strong evidence that, conditioning on the existence of community-based Head Start programs, public pre-kindergarten programs are dramatically more successful with students residing in more disadvantaged neighborhoods than with those residing in less disadvantaged neighborhoods.

We next stratify the estimated effects of public pre-kindergarten based on a series of family attributes – the mother's age, mother's education level, the child's birth weight and the mother's race. The results of this exercise are presented in Table 12. We further differentiate these estimated effects on the basis of measured neighborhood disadvantage, proxied using the rate of free-lunch eligibility in the neighborhood. We have also used the presence of a community-based Head Start program as a proxy of neighborhood disadvantage, and find similar results. We observe relative consistency across the various strata by Year 2 along a series of dimensions: We find that public pre-kindergarten is associated with increased estimated rates of behavioral problems in relatively advantaged neighborhoods and decreased estimated rates of behavioral problems in relatively disadvantaged communities. The differences between these two rates tend to be statistically significant in Year 2. While the results are rather noisy, nonetheless the general pattern of findings remains consistent with those presented above: the estimated beneficial effects of public pre-kindergarten programs are present in the relatively disadvantaged communities and not in the relatively advantaged communities.

Other outcomes

We next turn to other outcomes besides basic discipline and behavioral disability classification. Specifically, in Table 13 we consider the likelihood that a student will, by the end of his or her third year, either have been suspended out of school or repeated a grade.[6] These arguably represent more serious behavioral outcomes than referral to the principal's office for a rule infraction.

As can be seen in Table 13, patterns similar to disciplinary problems emerge with regard to suspension and grade repetition: Students participating in public pre-kindergarten programs are estimated to be significantly more likely to be suspended than are non-participants in relatively advantaged communities, and are significantly less likely to be suspended than are non-participants in relatively disadvantaged neighborhoods. The difference between the two is statistically significantly different from zero as well. The patterns of signs are the same for grade repetition, but neither point estimate is statistically significant; the difference between the two, however, is statistically significant at the seven percent level. These results, while suggestive, provide further evidence that there exist substantial differences in results between communities with community-based Head Start options and those that have less access to community-based Head Start, most likely suggesting that the potential socializing benefits of public pre-kindergarten programs are strongest in the disadvantaged communities where less socialization may have previously taken place – the neighborhoods where community-based Head Start programs are more likely to locate. It is also possible that community-based Head Start programs enroll less socialized students

[6] We present outcomes at the end of year 3 because grade repetition and suspension are low-probability events, particularly in the first year or two of school.

and/or are less successful in teaching appropriate school behavior. With the available data it is impossible to know for certain the degree to which these various explanations are valid, but these results suggest future directions for research.

Conclusion

We utilize a unique matched administrative data set and a novel identification strategy to study the effects of public pre-kindergarten participation on student behavioral outcomes. A first pass at the data would indicate that public pre-kindergarten leads to reduced student disciplinary problems and reduced rates of being classified emotional disabled or severely emotionally disturbed.

However, the comparison group in question includes both community-based Head Start participants and income eligible students who did not participate in preschool. While we lack the ability to identify which members of our comparison group are community-based Head Start participants, we can stratify neighborhoods based on whether there exists a community-based Head Start facility in the zip code. While this is a crude stratification, it provides some evidence on the performance of public pre-kindergarten programs as we can make an attempt to tease out the estimated effects of community-based Head Start participation. We find that the favorable estimated effects of public pre-kindergarten programs are concentrated in the communities where there exist community-based Head Start programs. There exist both favorable and unfavorable explanations for this result: It could be the case that community-based Head Start programs recruit more non compliant children and therefore the overall public pre-kindergarten results are biased in favor of positive behavioral outcomes. But it could also

be the case that community-based Head Start programs provide a competitive spur for public pre-kindergarten programs. We cannot disentangle these two candidate explanations for the results found in the presence of a community-based Head Start program.

However, our further investigation strongly indicates that the findings of relative benefits of public pre-kindergarten programs in communities with community-based Head Start programs in operation are due not to the community-based Head Start programs themselves but rather to differences in the communities in which these programs operate. We find that the behavioral benefits of public pre-kindergarten programs are concentrated in the least advantaged neighborhoods – the communities where community-based Head Start programs tend to operate. In relatively advantaged neighborhoods, on the other hand, we do not find evidence that public pre-kindergarten programs have appreciable behavioral benefits. This may be due to differences in community institutions, neighborhood effects, or private pre-kindergarten alternatives in these more advantaged neighborhoods, or it may be that the families eligible for public pre-kindergarten who live in more advantaged neighborhoods tend to be more advantaged themselves than do their income-eligible counterparts in less advantaged neighborhoods. We will continue to investigate these differences in our future work.

References

Ainsworth, M. D. S., Blehar, M. C., Waters, E. and Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation.* Hillsdale, N.J.: Erlbaum.

Baker M., Gruber, J. and Milligan, K. (2005). Universal childcare, maternal labor supply and family well-being. NBER Working Paper No. 11832.

Belfield, C., Nores, M., Barnett, S., and Schweinhart, L. (2006). The High/Scope Perry Preschool Program: Cost-benefit analysis using data from the age-40 followup. *Journal of Human Resources, 41,* 162-190.

Belsky, J. (1986). Infant day care: A cause for concern? *Zero to Three, 6,* 1-9.

Belsky, J. (1988). The effects of infant day care reconsidered. *Early Childhood Research Quarterly, 3,* 235-272.

Belsky J. and Rovine, M. (1988). Nonmaternal care in the first year of life and the security of infant-parent attachment. *Child Development, 59,* 157-167.

Belsky, J. (1990). Developmental risks associated with infant day care: Attachment insecurity, noncompliance, and aggression? In Chehrazi S. (Ed.). *Psychosocial issues in day care*. Washington, DC: American Psychiatric Press.

Belsky, J. (2002). Quantity counts: Amount of child care and children's socioemotional development. *Developmental and Behavioral Pediatrics, 23,* 167-170.

Bowlby, J. (1973) *Attachment and Loss.* New York: Basic Books.

Currie, J. and Thomas, D. (2000). School quality and the longer-term effects of Head Start. *Journal of Human Resources, 35*(4), 755-774.

Duncan, G. J., Claessens, A., Huston, A. C., Pagani L. S., Engel, M., Dowsett, C. J., et al. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428-1446.

Garces, E., Thomas, D. and Currie, J. (2002). Longer term effects of Head Start. *American Economic Review, American Economic Review, 92*(4), 999-1012.

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science, 312,* 1900-1902.

Heckman, J. and Rubinstein, Y. (2001). The importance of noncognitive skills: Lessons from the GED testing program. *American Economic Review,91*(2), 145-149.

Heckman, J., Stixrud, J. and Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics, 24*(3), 411-482.

Love, J. Kisker, E.E., Ross, C., et al (2005). The effectiveness of Early Head Start for 3-year-old children and their parents: Lessons for policy and programs. *Developmental Psychology, 4,* 885-901.

Ludwig, J. and Miller, D. (2007). Does Head Start improve children's life chances? Evidence from a regression-discontinuity approach. *Quarterly Journal of Economics, 122*(1), 158-208.

NICHD Early Child Care Network. (1998a). Early child care and self-control, compliance, and problem behavior at twenty-four and thirty-six months. *Child Development*, 69, 1145-1170.

NICHD Early Child Care Network. (1998b). Relations between family predictors and child outcomes: are they weaker for children in child care? *Developmental Psychology, 34,* 1119-1128.

NICHD Early Child Care Network. (2001). Nonmaternal care and family factors in early development: An overview of the NICHD study of early child care. *Journal of Applied Developmental Psychology, 22*, 457-492.

NICHD Early Child Care Network. (2002). Early child care and children's development prior to school entry. *American Educational Research Journal, 39*, 133-164.

NICHD Early Child Care Network. (2003). Does amount of time in child care predict socioemotional adjustment during the transition to kindergarten*? Child Development 74,* 976-1005.

NICHD Early Child Care Research Network. (2006). Child-care effect sizes for the NICHD Study of Early Child Care and Youth Development. *American Psychologist* 61(2):99-116.

Loeb, S, Bridges, M., Bassok, D., Fuller, B and Rumberger, R. (2007). How much is too much? The influence of preschool centers on children's social and cognitive development. *Economics of Education Review, 26,* 52-66.

Magnuson, K. A., Ruhm, C. and Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review, 26,* 33-51.

Rumberger, R. and Tran, L. (2006). Preschool participation and the cognitive and social development of language-minority students. Technical Report, Center for the Study of Evaluation and the University of California-Linguistic Minority Research Institute.

U.S. Department of Health and Human Services, Administration for Children and Families. (2005). *Head Start Impact Study: First year findings*. Washington, DC.

Zigler, E. and Styfco, S. (2004). *The Head Start Debates*. Baltimore, MD: P. H. Brookes.

Table 1: Rates of disciplinary problems, by pre-kindergarten participation

	Year in school		
	first (kindergarten)	second	third
Non-participants	0.036	0.050	0.073
Pre-kindergarten participants	0.037	0.058	0.075
Within-family comparisons			
Non-participants	0.035	0.052	0.075
Pre-kindergarten participants	0.035	0.054	0.077

Note: Disciplinary problems are defined as having been referred to the principal's office for disciplinary reasons at least once during the year. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school. Families are defined as two or more children who share the same birth mother. Analysis sample: 59,418 children in 29,087 families.

Table 2: Attributes of families with different local pre-kindergarten options

	Families whose local zoned school **offers** a pre-kindergarten program and whose zip code **has** a community-based Head Start program	Families whose local zoned school **offers** a pre-kindergarten program and whose zip code **does not have** a community-based Head Start program	Families whose local zoned school **does not offer** a pre-kindergarten program and whose zip code **has** a community-based Head Start program	Families whose local zoned school **does not offer** a pre-kindergarten program and whose zip code **does not have** a community-based Head Start program
Probability of eligible student attending public pre-kindergarten	0.534	0.547	0.221	0.260
Percent "eligible" in school zone	0.293	0.183	0.256	0.167
Percent black in school zone	0.441	0.250	0.324	0.179
Percent Hispanic in school zone	0.180	0.198	0.154	0.149
Percent mothers in school zone without high school degree	0.377	0.285	0.302	0.216
Percent married parents in school zone	0.494	0.641	0.569	0.690
Percent **eligible** black in school zone	0.635	0.488	0.563	0.433
Percent **eligible** mothers in school zone without high school degree	0.534	0.513	0.469	0.460
Percent **eligible** married parents in school zone	0.297	0.381	0.336	0.390

Table 3: Between-family differences in pre-kindergarten attendance probabilities, by availability at zoned school

Family type	Number of families	Probability of attending pre-kindergarten
No siblings' local zoned school at age 4 offers pre-kindergarten	11458	0.346
Some, but not all, siblings' local zoned school at age 4 offers pre-kindergarten	12107	0.425
All siblings' local zoned school at age 4 offers pre-kindergarten	5522	0.562

Table 4: Differences in family attributes, by differences in availability at zoned school

Family attributes	No siblings zoned for a school offering pre-kindergarten at age 4	Some, but not all, siblings zoned for a school offering pre-kindergarten at age 4	All siblings zoned for a school offering pre-kindergarten at age 4
Teen mother	0.274	0.259	0.231
Mother with less than high school education	0.470	0.514	0.501
Black mother	0.544	0.658	0.671
Mother unmarried	0.649	0.714	0.685
Inadequate prenatal care for child	0.083	0.108	0.137

Note: The attributes reported above are those in place when the youngest observed child in the family was born.

Table 5: Within-family differences in pre-kindergarten attendance probabilities, by availability at zoned school

Family type	Sibling(s) whose local zoned school at age 4 offers pre-kindergarten	Sibling(s) whose local zoned school at age 4 does not offer pre-kindergarten
All eligible families	0.523	0.327
Mother teenaged at birth	0.537	0.345
Mother has less than high school education	0.515	0.320
Mother is black	0.562	0.355
Mother is non-black	0.445	0.270

Table 6: Estimated effects of attending pre-kindergarten on probability of being disciplined

Specification	Year 1 (kindergarten)	Year 2	Year 3
School fixed effects	-0.000 (0.002)	0.003 (0.002)	-0.004 (0.003)
School and family fixed effects	0.000 (0.002)	0.001 (0.002)	0.003 (0.003)
School and family fixed effects with instrumental variable	-0.025 (0.009)	-0.032 (0.011)	-0.003 (0.015)
School and family fixed effects with instrumental variable – **families with children all zoned for the same school**	-0.020 (0.012)	-0.043 (0.015)	-0.009 (0.018)
Male students	-0.041 (0.011)	-0.060 (0.015)	-0.022 (0.021)
Female students	-0.003 (0.007)	0.009 (0.010)	0.001 (0.016)
School fixed effects with instrumental variable	-0.018 (0.006)	-0.028 (0.010)	-0.002 (0.015)

Note: Standard errors adjusted for clustering at the school level are in parentheses beneath point estimates. Each cell represents a different regression specification. Regressions also include controls for race, sex, free/reduced price lunch status, maternal age at birth, maternal marital status, maternal education levels, Medicaid status at birth, prenatal care complications of labor and delivery, indicators for birth weight <1000g, 1000-1500g, 1500-2500g, >2500 g, birth order and school fixed effects. The instrumental variable is an indicator for whether pre-kindergarten programs are offered at the student's zoned elementary school at age 4. Disciplinary problems are defined as having been referred to the principal's office for disobeying school rules at least once during the year. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school. Families are defined as two or more children who share the same birth mother. Analysis sample: 59,418 children in 29,087 families. Analysis sample for last row in table: 31,149 children in 15,248 families.

Table 7: Relationship between disciplinary problems and subsequent classification of emotional disability

	Year 1 (kindergarten)	Year 2	Year 3
Probability of being classified as emotionally disabled or severely emotionally disturbed			
Students who were referred in kindergarten	0.016	0.025	0.026
Students not referred in kindergarten	0.001	0.001	0.002
Probability of being classified with any disability			
Students who were referred in kindergarten	0.049	0.064	0.056
Students not referred in kindergarten	0.025	0.028	0.031

Table 8: Estimated effects of attending pre-kindergarten on probability of being classified as emotionally disabled or severely emotionally disturbed: Instrumental variables regression with family fixed effects

Specification	Year 1 (kindergarten)	Year 2	Year 3
Probability of being classified as emotionally disabled or severely emotionally disturbed	-0.003 (0.001)	-0.020 (0.003)	-0.011 (0.004)
Probability of being classified, conditional on actual observed behavior	-0.002 (0.001)	-0.019 (0.003)	-0.013 (0.005)

Note: Standard errors adjusted for clustering at the school level are in parentheses beneath point estimates. Each cell represents a different regression specification. Regressions also include controls for race, sex, free/reduced price lunch status, maternal age at birth, maternal marital status, maternal education levels, Medicaid status at birth, prenatal care complications of labor and delivery, indicators for birth weight <1000g, 1000-1500g 1500-2500g, >2500 g, birth order and school and family fixed effects. The instrumental variable is an indicator for whether pre-kindergarten programs are offered at the student's zoned elementary school at age 4. Disciplinary problems are defined as having been referred to the principal's office for disobeying school rules at least once during the year. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school. Families are defined as two or more children who share the same birth mother. Analysis sample: 59,418 children in 29,087 families.

Table 9: Falsification exercise: Instrumental variables evidence on low birth weight

	Discipline in year 1 (kindergarten)	Discipline in year 2	Discipline in year 3	Low birth weight
School and family fixed effects with instrumental variable	-0.033 (0.009)	-0.026 (0.011)	-0.002 (0.014)	0.005 (0.012)
School and family fixed effects with instrumental variable – **families with children all zoned for the same school**	-0.020 (0.012)	-0.048 (0.016)	-0.028 (0.018)	0.007 (0.018)

Note: Standard errors adjusted for clustering at the school level are in parentheses beneath point estimates. Each cell represents a different regression specification. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school. Families are defined as two or more children who share the same birth mother. Analysis sample: 59,418 children in 29,087 families. Analysis sample for last row in table: 31,149 children in 15,248 families.

Table 10: Estimated effects of attending pre-kindergarten on probability of being disciplined, by availability of local community-based Head Start option: Instrumental variables estimates

	Year 1 (kindergarten)	Year 2	Year 3
No community-based Head Start in zip code	-0.013 (0.014)	-0.011 (0.019)	0.064 (0.025)
Community-based Head Start in zip code	-0.039 (0.011)	-0.065 (0.013)	-0.026 (0.016)
p-value of difference	0.12	0.00	0.00
Differences by percent in neighborhood who are eligible for public pre-kindergarten			
10th percentile of percentage eligible	0.018 (0.021)	0.005 (0.025)	0.068 (0.031)
90th percentile of percentage eligible	-0.076 (0.016)	-0.090 (0.021)	-0.055 (0.026)
p-value of difference	0.00	0.00	0.00
Differences by percent of mothers in neighborhood who are not high school graduates			
10th percentile of percentage non-graduate mothers	-0.004 (0.014)	-0.022 (0.017)	0.041 (0.022)
90th percentile of percentage non-graduate mothers	-0.052 (0.014)	-0.064 (0.017)	-0.045 (0.024)
p-value of difference	0.00	0.00	0.00

Note: Standard errors adjusted for clustering at the school level are in parentheses beneath point estimates. Each cell represents a different regression specification. Regressions also include controls for race, sex, free/reduced price lunch status, maternal age at birth, maternal marital status, maternal education levels, Medicaid status at birth, prenatal care complications of labor and delivery, indicators for birth weight <1000g, 1000-1500g, 1500-2500g, >2500 g, birth order and school fixed effects. The instrumental variable is an indicator for whether pre-kindergarten programs are offered at the student's zoned elementary school at age 4. Disciplinary problems are defined as having been referred to the principal's office for disobeying school rules at least once during the year. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school. Families are defined as two or more children who share the same birth mother. Neighborhoods are designed by public school zones.

Table 11: Estimated effects of attending pre-kindergarten on probability of being disciplined, by percentage eligible in the neighborhood, conditional on community-based Head Start availability:
Instrumental variables estimates

	Year 1 (kindergarten)	Year 2	Year 3
Families residing in zip codes with community-based Head Start availability			
10th percentile of percentage eligible	0.025 (0.034)	-0.004 (0.043)	0.021 (0.053)
90th percentile of percentage eligible	-0.085 (0.021)	-0.118 (0.026)	-0.056 (0.031)
p-value of difference	0.00	0.00	0.00

Note: Standard errors adjusted for clustering at the school level are in parentheses beneath point estimates. Each cell represents a different regression specification. Regressions also include controls for race, sex, free/reduced price lunch status, maternal age at birth, maternal marital status, maternal education levels, Medicaid status at birth, prenatal care complications of labor and delivery, indicators for birth weight <1000g, 1000-1500g, 1500-2500g, >2500 g, birth order and school fixed effects. The instrumental variable is an indicator for whether pre-kindergarten programs are offered at the student's zoned elementary school at age 4. Disciplinary problems are defined as having been referred to the principal's office for disobeying school rules at least once during the year. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school. Families are defined as two or more children who share the same birth mother. Neighborhoods are designed by public school zones.

Table 12: Estimated differential effects of attending pre-kindergarten on probability of being disciplined: Instrumental variables regression with school and family fixed effects

Family/student attribute	Year 1 (kindergarten)			Year 2		
	Below-median rate of free-lunch eligibility	Above-median rate of free-lunch eligibility	p-value of differ-ence	Below-median rate of free-lunch eligibility	Above-median rate of free-lunch eligibility	p-value of differ-ence
Teenage mother	-0.007 (0.035)	-0.044 (0.024)	0.17	0.007 (0.043)	-0.089 (0.030)	0.04
Mother's education less than high school	-0.034 (0.021)	-0.047 (0.016)	0.49	0.015 (0.026)	-0.096 (0.020)	0.00
Low birth weight	-0.015 (0.045)	-0.025 (0.026)	0.80	0.056 (0.069)	-0.035 (0.032)	0.16
Black mother	-0.004 (0.018)	-0.046 (0.011)	0.08	0.018 (0.025)	-0.087 (0.015)	0.00

Note: Standard errors adjusted for clustering at the school level are in parentheses beneath point estimates. Each cell represents a different regression specification. Regressions also include controls for race, sex, free/reduced price lunch status, maternal age at birth, maternal marital status, maternal education levels, Medicaid status at birth, prenatal care complications of labor and delivery, indicators for birth weight <1000g, 1000-1500g, 1500-2500g, >2500 g, birth order and school and family fixed effects. The instrumental variable is an indicator for whether pre-kindergarten programs are offered at the student's local elementary school. Disciplinary problems are defined as having been referred to the principal's office for disobeying school rules at least once during the year. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school. Families are defined as two or more children who share the same birth mother. Analysis sample: 59,418 children in 29,087 families.

Table 13: Estimated effects of attending pre-kindergarten on probability of being suspended or repeating a grade by year 3, by differing degrees of community disadvantage: Instrumental variables estimates

	Probability of being suspended by year 3	Probability of repeating a grade by year 3
Relatively advantaged neighborhoods: below-median rate of free lunch eligibility	0.055 (0.034)	0.031 (0.042)
Relatively disadvantaged neighborhoods: above-median rate of free lunch eligibility	-0.052 (0.019)	-0.036 (0.027)
p-value of difference	0.00	0.06

Note: Standard errors adjusted for clustering at the school level are in parentheses beneath point estimates. Each cell represents a different regression specification. Regressions also include controls for race, sex, free/reduced price lunch status, maternal age at birth, maternal marital status, maternal education levels, Medicaid status at birth, prenatal care complications of labor and delivery, indicators for birth weight <1000g, 1000-1500g, 1500-2500g, > 2500 g, birth order and school fixed effects. The instrumental variable is an indicator for whether pre-kindergarten programs are offered at the student's zoned elementary school at age 4. To be included in the analysis, students must be in families with at least two children who were born after 1989 and enrolled in school before 2002, and where all children in the family are recorded as being eligible to receive free lunch (i.e., self-reported income less than 130 percent of the poverty line) in every observed period in school, and where all included students are observed through year 3 of school. Families are defined as two or more children who share the same birth mother.