In-Kind Transfers and Early Childhood Development: Evidence from Housing Assistance Lotteries*

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Abstract

Governments frequently use in-kind transfers to redistribute resources. In-kind transfers boost the consumption of low-income households, and as a result may also impact child development. This paper examines how a sizeable transfer to low-income families — in the form of housing assistance — affects families' consumption and, in turn, children's early skill development. Using administrative data on applications for housing assistance, randomized offers of housing assistance from lottery-ordered waiting lists, and linked assessments of kindergarten readiness for more than 10,000 children, we estimate the effects of housing assistance on early childhood development. We also explore heterogeneity in effects of housing assistance by family and child characteristics, families' baseline housing consumption, and baseline proximity to early care and education programs. We find that receipt of a housing voucher in particular leads to increases in children's kindergarten readiness and early literacy skills. Effects are concentrated among boys, and appear larger for households that are more likely to realize larger improvements in housing quality.

Keywords: In-Kind Transfers, Children, Child Development, Housing

JEL codes: I24, I38, R23

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1 Introduction

The social safety net in the U.S., and in many other rich countries, redistributes resources to low-income households and families primarily through in-kind transfers. In the U.S., roughly $375 billion of annual safety net spending is directed to children, and more than 92 percent of transfer spending on children is in-kind (Currie and Gahvari, 2008). These in-kind transfers boost low-income households' consumption (Hoynes and Schanzenbach, 2009; Jacob and Ludwig, 2012). We also have mounting evidence of long-term and intergenerational effects of transfer spending directed to low-income families (Hoynes et al., 2016; Jacob et al., 2015).

Studying the impacts of in-kind transfers on child development is complicated by two challenges. The first is the difficulty of linking child-level information on transfer receipt, typically measured as exposure in an eligible or likely-treated group or at the individual adult or household level, to contemporaneous measures of children development. As a result, much of the literature features exposure designs and focuses on long-run outcomes such as adult health and labor market outcomes (Hoynes et al., 2016; Bailey et al., 2023; Pollakowski et al., 2022). The second challenge is the standard identification concern of non-random exposure to, availability of, or receipt of the in-kind transfer, making it difficult to establish a suitable control group. Since much of the safety-net is universally available to household with children, subject to means-test, many studies of in-kind transfers rely on the historical roll-out of programs to estimate the causal effects of in-kind transfers (Hoynes et al., 2016; Barr and Gibbs, 2022; Bailey et al., 2023).

In this paper, we overcome these challenges to provide new experimental evidence on the role of transfers in early childhood development in the context of a large in-kind transfer program in the U.S. We do so by assembling novel data linking children listed on waiting list applications to housing assistance records, and subsequent developmental assessments. This provides a unique setting where we can *directly* observe children who receive assistance and those that do not, and subsequent near-term developmental outcomes drawn from assessments of all children entering public kindergarten in the state of Florida. Using records on more than 10,000 children listed on housing assistance applications linked to early childhood assessments, we estimate the causal effects of housing vouchers and public housing by instrumenting for assistance receipt with randomized initial wait-list position on children's early reading skills, kindergarten readiness, and cognitive and noncognitive skills, as demonstrated in a classroom setting. To our knowledge, we provide the first large-scale experimental evidence of a safety net program on early childhood development in the U.S., a piece that is often missing in studies of the impact of in-kind transfers or resources. To the extent resources and early environments matter for children's early skill development, these are precisely the measures

on which we would expect to observe impact.

We leverage an unusual housing assistance lottery which produced random offers of housing vouchers or public housing to a large population of low-income households in Miami-Dade County, Florida. In 2008, the lead housing authority in the county, Miami-Dade Public Housing and Community Development (PHCD), briefly opened their waiting list for a four-week period to applicants seeking any type of federal housing assistance.[1] At the end of the period, every household that applied was randomly assigned a ranking on a housing voucher waiting list and a separate random ranking on a public housing waiting list. Housing assistance was heavily oversubscribed: more than 70,000 households applied for roughly 3,500 vouchers and 4,500 public housing apartments to be allocated over the ensuing several years. As a result, applicants randomly assigned to the top of the waiting list for vouchers (public housing) were very likely to receive an offer of a housing voucher (public housing), while those randomly assigned to the bottom of the waiting list were not. Our research design compares the outcomes of children in households that were randomly-assigned to the top of an assistance waiting list to children in families outside the top of the list.

We find that receipt of a voucher through the lottery substantially improves children's developmental outcomes. In particular, children whose families lease-up with a voucher score 0.2 standard deviations higher on an assessment of pre-reading skills. We estimate that receipt of a voucher boosts kindergarten readiness by 13 percentage points (22 percent). Relative to control group children at the bottom of the waiting list, children in families that receive vouchers are considerably less likely to be identified as "not demonstrating" appropriate developmental milestones. We find voucher children are 8.8 percentage points (72 percent) less likely to be categorized as "not emerging or demonstrating" key skills during observational classroom evaluations.

The effects of voucher receipt on child development are driven by large positive effects for boys. Boys in families randomized into receiving a voucher score 0.5 standard deviations higher in evaluations of pre-reading skills, and they are 28 percentage points (49 percent) more likely to be deemed kindergarten ready. Moreover, they are much less likely to receive the lowest categorization of skill-development in classroom-based observational assessments. Girls, on the other hand, show no consistent effects (positive or negative) from receipt of housing vouchers. In addition to child and family characteristics, we also explore heterogeneity in program impact by the family's baseline housing situation and early childhood program availability near their prior address, to better understand the mechanisms for these effects.

We contribute to several literatures. Most directly, we contribute to the literature on

[1]PHCD is the seventh largest housing authority in the country in terms of total households assisted at approximately 25,000.

second-generation impacts of transfers. To our knowledge, we provide the first experimental evidence of a large safety net program, in the field, on early childhood skill development in the U.S. Our experimental findings of positive effects on children from housing voucher receipt is consistent with a large literature using quasi-experimental methods to evaluate the effects of in-kind transfers on child outcomes. This study leverages a randomized design, and novel data on both housing assistance and school-entry skills, to enhance our collective understanding of how childhood investments matter for critical early skill development and school readiness, and may have implications in particular for closing family income-based gaps in these areas.

The remainder of the paper is organized as follows: section 2 summarizes the strands of the literature to which this work contributes, section 3 discusses institution details relevant for this study and the data used for the analysis, section 4 outlines the empirical strategy, section 5 reports results and section 6 concludes.

2 Related Literature

The second-generation effects of income and in-kind transfers to families or households have been the subject of much inquiry. A large and growing literature documents the potential for childhood investments, in particular, to generate large returns (Hendren and Sprung-Keyser, 2020). Recent studies have found an important role for financial resources in early childhood in influencing children's developmental and academic outcomes as well as their longer-term wellbeing, including a large randomized study of the impact of cash transfers on infant brain development (Troller-Renfree et al., 2022). Mixed evidence emerges from studies documenting the positive effects of additional tax benefits at birth on medium-run academic outcomes and earnings in young adulthood (Barr et al., 2022) and null effects of increased resources at birth and in childhood from the Supplemental Security Income (SSI) program (Hawkins et al., 2023). Researchers have also studied the impact of in-kind food assistance—the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and the Supplemental Nutrition Assistance Program, known as food stamps—on children using designs that capitalize on program availability across geography over time (Bailey et al., 2023; Hoynes et al., 2011, 2016). In addition, studies have investigated the impact of receipt of housing assistance on children's medium- and long-run outcomes (Chetty et al., 2016; Chyn, 2018; Jacob et al., 2015).

Interest in the long-term effects of income and in-kind transfers derives, in large part, from the conceptual and empirical foundation that investments in early childhood *can have* meaningful effects on children and their trajectories. Economists argue that early-life resources,

including pre-natal exposure to increased resources, may be particularly impactful because of the long time horizon for early investments to realize returns, complementarities in health and human capital investments across the life course, and the malleability of the young brain, making early development particularly susceptible to intervention (Almond and Currie, 2011; Almond et al., 2018; Heckman, 2006; Heckman and Masterov, 2007; Knudsen et al., 2006).

Empirically, we know early childhood is a critical period of investment because (1) children arrive at school with pronounced gaps by family income in both their cognitive and social-emotional skills (Bradbury et al., 2019; Burkam and Lee, 2002; Reardon, 2013), and (2) empirical evidence of effects of early childhood investments and preschool programs on important long-run outcomes (Barr and Gibbs, 2022; Gray-Lobe et al., 2022). Research also suggests that school-entry skills are strongly related to measures of later-life wellbeing, and that improving early skills through childhood investments generates subsequent human capital benefits in adolescence and adulthood (Duncan et al., 2007; Chetty et al., 2011). Our paper fills an existing gap in these related literatures by using a rigorous, experimental design to measure the impact of housing assistance on children's early development, the pathway through which safety-net programs could affect long-run outcomes for the children of families exposed.

3 Institutional Details and Data

The Housing Choice Voucher program, formerly Section 8, is the largest rental assistance program administered by the U.S. Department of Housing and Urban Development (HUD). Housing vouchers serve roughly 2.5 million households (5.3 million people) with an annual budget of roughly $20 billion (Collinson et al., 2019). Public housing serves about 1.1 million households (2.3 million people) at annual budget expense of roughly $8 billion. Both programs are typically funded exclusively using federal funds, but they are administered by local quasi-government organizations called Public Housing Authorities (PHA). Families issued housing vouchers use them to lease units on the private rental housing market, while public housing families are offered apartments in public housing developments owned by a PHA.

In Miami-Dade County, Florida, the local PHA is Miami-Dade Public Housing and Community Development (PHCD). PHCD is the seventh largest housing authority in the country in terms of total households assisted at approximately 25,000. It owns and operates 16 large public housing developments, and about 56 scattered-site properties which together total 9,000 units. The tenant-based voucher program operated by PHCD serves approximately 16,000 households per year. PHCD serves the entire county, with voucher families located in

nearly all jurisdictions in Miami-Dade County.

3.1 2008 Waiting List

As a result of a lawsuit filed against PHCD, the agency agreed to open their waiting lists for all their assisted housing: housing vouchers and public housing and separately randomize wait-list positions for vouchers and public housing. In July 2008 Miami-Dade Public Housing and Community Development opened their waiting list for a four week period to applicants seeking any type of federal housing assistance. Households submitting an application were told about the eligibility for the programs and agreed to allow their submitted information to be used in determining eligibility. After four weeks the application period was closed, and in September every household that applied during the open period was randomly assigned a ranking on a housing voucher waiting list and a separate random ranking on a public housing waiting list.[2]

Households were notified about their initial position after randomization, and the initial static ranking on each list was published online. PHCD then began drawing down from each waiting list as vouchers and public housing units became available. When households approached the top of the waiting list, PHCD would attempt to contact the household to undergo a final eligibility determination. If a household wanted to learn about their current position they needed to call the leasing department. Households determined to be eligible in the final eligibility review received offers of assistance in the order that they became available.

For public housing vacancies, PHCD would attempt to try to offer one unit of the appropriate bedroom size within each of three broad geographic zones that divide the county. If households rejected all the available units they would be permanently removed from the public housing waiting list. A household that accepted the offer of a public housing unit could technically remain eligible for a voucher during the first 12 months of their public housing leases, but in practice no one was issued a voucher after leasing up in public housing. And after 12 months in their unit, families accepting public housing were removed from the voucher waiting list. For housing vouchers, households were issued housing vouchers with typically 90 days to find an acceptable unit. When a family was issued a housing voucher they were removed from both waiting lists. Finally, households that could not be contacted at follow-up or who were found ineligible at the follow-up screening were removed from the waiting list as PHCD worked through both lists. Recent work suggests that housing authorities often struggle to contact individuals on their waiting list (Waldinger (2019)).

[2]The randomized orders were created from a random number generating function in a spreadsheet.

3.2 Waiting List Data

The primary sample is drawn from the more than 70,000 applications entered into the the 2008 housing assistance lottery. Importantly, these data contain information on both household heads and all household members at the time of application. For household heads, the data include race, ethnicity, need for an accessible unit, age, whether the household had an email address, and baseline address, as well as first name, last name, date of birth and the last four digits of the social security number. For members, it contains the unique identifiers and gender. The wait-list sample includes more than 70,000 unique households with more than 158,000 unique members. The waist-list file also includes the initial randomized position for both public housing and housing vouchers.

We determine whether a household is at the "top" of a given waiting list by using the lottery position and admission dates for households who receive assistance. Specifically, we identify the lottery position that corresponding to latest admission dates for housing vouchers during our outcome period. [3] We do a similar exercise for public housing, but determine the "top" cutoff separately by needed bedroom size to mirror how public housing units were offered. We show in the appendix that are results are robust to a variety of alternative cut-offs to denote "top" positions.

We make two sample restrictions for our analysis. First, we restrict the sample to applicants living in Miami-Dade County at the time of application. This is because applicants outside of Miami-Dade were typically ineligible to receive assistance. Second, we exclude the 4 percent of applicants living at public housing at baseline, since we are primarily interested in the effects of the transfer relative to counterfactual of no housing assistance.

3.3 Kindergarten Entry Assessment Data

Our primary outcome data comes from the Florida Kindergarten Readiness Screener. The state requires that public schools screen all kindergarten students within the first 30 days they are enrolled.[4] The screener consists of two distinct components: the Florida Assessment for Instruction in Reading (FAIR), and the Early Childhood Observation System (ECHOS).

The FAIR screening is administered by schools and contains two sub-tests a "Broad Screen" which evaluates progress on dimensions such as letter naming and phonemic awareness, and a diagnostic inventory assessing listening comprehension and vocabulary. Performance on the

[3] To avoid the bias described in De Chaisemartin and Behaghel (2018), we use an "initial offer" estimator.

[4] Children enrolled in the state's Voluntary Prekindergarten Education Program (VPK) or kindergarten in non-public schools may also participate in the screening, however, nearly all of our records are from public elementary schools (including charters).

Broad Screen then is used to calculate a "Probability of Reading Success" score. This score ranges from 1 to 100, and a student is judged to be "Kindergarten Ready" if they score a 67 or above. The probability of reading success scores are calibrated to reflect the likelihood of the child scoring at or above proficiency on the reading section of the Stanford Early School Achievement Test (SESET) if taken at the end of the year.

The ECHOS is also administered by schools, but is an "embedded assessment" - meaning that it is intended to take place during natural classroom activities. The ECHOS evaluates progress for 19 benchmark items across seven domains: Language and Literacy, Mathematics, Social and Personal Skills, Science, Social Studies, Physical Development and Fitness, and Creative Arts. Teachers or assessment administrators use a matrix to code student progress along each item. From the ECHOS data, we receive the overall status which falls into one of the three categories: "Demonstrating" – the child clearly demonstrated skills appropriate for beginning kindergarten; "Emerging/Progressing" – the child demonstrated some of the skills appropriate; or "Not Yet Demonstrating" – appropriate skill development was not demonstrated during the screening.

The Florida Department of Education linked children listed on the the housing authority applications to all assessments for the years 2009-2013 using fuzzy matching on first name, last name, and date of birth. Among children listed on housing applications living in Miami-Dade County, who are less than 4 at the time of random assignment, we estimate that approximately 85% match to an assessment.

We focus on two outcome measures from the linked FAIR screening. First, an indicator for whether the child scored as being "Kindergarten Ready." Second, we standardize the raw probability of reading success score to facilitate comparisons with other studies ("Standardized Score"). From the ECHOS assessment, we examine impacts on the assessment's three distinct categories: "Not Yet Demonstrating," "Emerging," and "Demonstrating."

4 Empirical Strategy

The random initial ordering of the waiting lists for vouchers and public housing provides exogenous variation in offers of housing assistance. Since some children are in households randomly placed at the top of the voucher waiting list, while others are randomly sorted to the bottom, a natural strategy is to compare those placed at the top to those at the bottom. This strategy will recover a reduced-form "Intent to Treat" (ITT) parameter. However, because many households on the waiting list do not receive assistance, we are also interested in estimating the effect of leasing up with housing assistance. To do so, we use random waiting list position as an instrument for estimates and estimate a the Local Average Treatment

Effect (LATE): the effects of leasing with assistance for those induced into assistance by their wait-list position.

To estimate the reduced form effect of voucher and public housing wait-list position on child outcomes, we estimate the following equation:

$$y_i = \beta_1 \text{Top Voucher}_i + \beta_2 \text{Top Public Housing}_i + \phi_x + X_i\Gamma + \varepsilon_i \tag{4.1}$$

Where y_i is the test outcome for child i, Top Voucher$_i$ is an indicator for being randomized to the top of of the voucher waiting list, and Top Public Housing$_i$ is an indicator for being randomized to the top of the public housing waiting list. β_1 is the reduced-form effect of being at the top of the voucher list and β_2 is the reduced-form effect of being at the top of the public housing waiting list. We include fixed effects ϕ_x for two pre-lottery factors which affect the mapping of public housing position to unit offers: the predicted number of bedrooms needed and the location in one of three geographic zones delineated by PHCD. Additionally, since some individuals appear multiple times on the waiting list under different household applications, we control for the number of applications. Finally, in all specifications we control for year-quarter of birth to account for cohort differences. Throughout the analysis, we cluster the standard errors at the household level.

To estimate the effects of being admitted to public housing or leasing up with housing vouchers, we instrument for lease-up with the initial randomized position on each waiting list. Specifically, the empirical approach taken has the following form:

$$\begin{aligned} \text{Housing Voucher}_i &= \pi_1 \text{Top Voucher}_i + \pi_2 \text{Top Public Housing}_i + \phi_x + X_i\Gamma + \varepsilon_i \\ \text{Public Housing}_i &= \gamma_1 \text{Top Voucher}_i + \gamma_2 \text{Top Public Housing}_i + \phi_x + X_i\Gamma + \nu_i \end{aligned} \tag{4.2}$$

Where i indexes individuals, the outcome of the second stage is y in equation 4.3. The first stage is estimated simultaneously, jointly predicting lease-up for public housing and housing vouchers. Equation 4.2 is the first stage broken out by type of assistance. For both types of assistance, we instrument for leasing-up with indicators for being randomly assigned to the top of the public housing list (Top Public Housing) and top of the voucher list (Top Voucher). Since public housing offers arrive randomly conditional on bedroom size need, we include μ_x fixed effects for predicted bedroom needs based on household size and member gender mix. we also include a vector of pre-lottery controls including: child and household demographics, neighborhood characteristics ($\boldsymbol{x}$).

$$y_i = \beta_1 \text{Housing Voucher}_i + \beta_2 \text{Public Housing}_i + \phi_x + X_i\Gamma + \varepsilon_i \tag{4.3}$$

In the simple single-treatment case, just-identified IV will recover the Local Average Treatment Effect (Imbens and Angrist (1994)) of the effect of receiving treatment relative to a well-defined counterfactual of "no-treatment." However, with more than one endogenous variable standard IV does not identify the the effect of receiving either treatment relative a well-defined counterfactual. This is because an instrument draws in new households from multiple margins: those that would chose the alternative treatment if they didn't receive the instrumented treatment and those who would choice no-treatment. That is, some households may switch from public housing to vouchers if they get a voucher offer. This "switching" behavior, or substitution bias (Heckman et al., 2000), constitutes a violation of the exclusion restrictions. This issue has been considered recently by Kirkeboen et al. (2016) as well as Kline and Walters (2016) and Hull (2018), and originally by (Heckman et al., 2000). Instead, the parameters estimated in equation 4.3 correspond to the effect of public housing (housing voucher) relative to a mix of "no treatment and housing vouchers (public housing)."

To isolate the effects of assistance relative to a counterfactual of "no assistance," we also report the effects of receive vouchers (public housing) for those *not* at the top public housing (voucher) waiting list, which we refer to as the "No Assistance Alternative". The degree of substitution bias depends directly on how much voucher (public housing) take-up pulls people away from public housing (voucher).[5] By restricting the sample to households who's voucher (public housing) position has little impact on their public housing (voucher) take-up, we can isolate the effects of vouchers (public housing) relative to a counterfactual of no assistance.

5 Results

5.1 Waiting List Positions and Housing Assistance

We start by examining the relationship between randomized initial waiting list position and receipt of housing assistance. Figure 1 provides graphical results that illustrate the

[5] In the context of two treatments, and a binary IV estimate recovers a weighted combination of subLATEs, as in Kline and Walters (2016); Hull (2018) In our context, the estimated LATE for housing vouchers $LATE_v$ is"

$$LATE_v = \beta_v^{IV} = (1-\omega)\, LATE_{n\to v} + \omega LATE_{p\to v}$$

where $LATE_{n\to v}$ is the LATE of receiving a voucher for households who would have otherwise chosen "no treatment" and $LATE_{p\to v}$ is the LATE for households who would have otherwise chosen public housing. The weight $\omega = \frac{P(D(1,z_p)=v, D(0,z_p)=p)}{P(D(1,z_p)=v, D(0,z_p)\neq v)}$ is the degree to which a public housing offer causes households to take-up vouchers.

relationship between randomized waiting list position for housing vouchers and the probability of voucher lease-up. Children in households near the "Top" of the voucher waiting list (those with positions below 9,200) are about 30 percentage points more likely to receive a voucher than children with initial positions below 9,200.

Figure 2 provides an analogous plot for public housing waiting list position and lease-up. Take-up rates for public housing are significantly lower, reflecting the fact that families in Miami Dade appear to prefer housing vouchers. Additional, the relationship is nosier, reflecting the fact that the housing authority would also consider bedrooms need and three geographic zones in making public hosing offers. In both cases, the randomized initial waiting list position generate a strong first stage with F-statistics of 453 for vouchers, and 405 for public housing.

5.2 Effects on Housing and Neighborhood

Before exploring the effects of housing assistance on child outcomes, we examine the effects of housing assistance on the housing and neighborhood conditions experienced by applicants. Prior research has found has little to no effect of voucher receipt on measures such as neighborhood poverty rates for unassisted families living in private housing at baseline (Wood et al., 2008; Jacob and Ludwig, 2012). This contrasts with the effects of a voucher for families residing in public housing at baseline, as in Moving to Opportunity (MTO), where voucher families experienced large reductions in neighborhood poverty and crime exposure (Sanbonmatsu et al., 2011).

Table 3 presents the reduced-form and IV estimates on changes in housing and neighborhood characteristics from pre-lottery and post-lottery locations. Columns (2)-(6) reports results on several neighborhood characteristics, each measured at the census tract level. Receipt of a housing voucher causes a family to move to a neighborhood with roughly 3 percentage points lower poverty rates (relative to baseline poverty rate of 21 percent). This estimated effect is slightly larger than prior experimental estimates of vouchers for families living in private housing (Wood et al., 2008; Jacob and Ludwig, 2012), but only about one-sixth of the effect of relocating from distressed public housing with a voucher from MTO (Sanbonmatsu et al., 2011; Chetty et al., 2016). Vouchers also cause families to move to safer neighborhoods. We estimate that receipt of a voucher leads a family to move to neighborhood with 5.4 fewer violent crimes per one thousand (a 43 percent reduction relative to the baseline mean). We find no dectable effects on neighborhood school quality, the fraction of single-parents in the neighborhood, or predicted income rank in adulthood from the Opportunity Atlas (Chetty et al., 2018).

In contrast to vouchers, participation in public housing, on average, entails moves to neighborhoods that are *more* impoverished. We estimate that moving into public housing increases the neighborhood poverty rates exposure by 8 percentage points (36 percent of the baseline control mean). While it is unsurprising that tracts with public housing will have elevated poverty rates, it is striking that families in our sample are moving *from* pre-lottery neighborhoods with substantially lower poverty. Moving into public housing also increases exposure to violent crime. Families' lease-up in public housing causes them to move to neighborhoods with 8 more violent crimes per one thousand (a 65 percent increase relative to the baseline neighborhood).

5.3 Effects of Assistance on Child Outcomes

Next, we document the effects of housing assistance on the developmental outcomes of children. As described in section 3.3, we draw on an assessment of early literacy skills as part of the Florida Assessment for Instruction in Reading which produces a reading score and a determination of kindergarten readiness.

Table 4 reports the effects of assistance on these measures. Families' receipt of a housing voucher leads to a 14 percentage point increase in their children's kindergarten readiness (relative to mean control mean of 61 percent). The effects appear slightly large when we focus on households that were unlikely to have public housing as an alternative (Column 3). Receipt of a voucher also boosts early literacy skills by 0.22 standard deviations. When compared to families with no housing assistance alternative (column 3), the benefits are even more pronounced for children in voucher lease-up families.

While vouchers appear to improve early literacy and kindergarten readiness, we find no similar gains for children in families who lease-up in public housing. The point estimates for public housing are consistently close to zero, and none are statistically significant. The estimates for public housing are somewhat less precisely estimated than for voucher. Still, if public housing produced similar-in-magnitude effects as vouchers, we would be powered to detect them.

Next, Table 5 explore impacts on childrens' likelihood of demonstrating developmental benchmarks during an observational assessment. These measures are described in more detail in section 3.3. Children in families that receive a voucher also perform better in these ECHOS assessments. We find that receipt of a voucher leads to a nearly 9 percentage point reduction in the likelihood of receiving lowest category of performance, "Not Emerging or Demonstrating." At the same time, we find a similar-sized *increase* in the likelihood of receiving the the middle category, "Emerging." Children in voucher-receiving families are

nearly 10 percentage points more likely to be classifies as "emerging" on developmental skills. Again, these positive effects appear even larger when comparing to control group children in families with no alternative housing assistance.

In contrast to the voucher results, public housing does not detectably improve children's developmental outcomes, as recorded in the observational assessment. The results for children in families receiving public housing via the random-order list are small in magnitude and statistically indistinguishable from zero.

5.4 Heterogeneity

To better understand the mechanisms through which housing assistance may or may not improve children's skill development, we explore heterogeneity in the effects of vouchers and public housing by family and child characteristics, families' housing consumption and expenditures, and baseline availability of early care and education options.

5.4.1 Family and Child Characteristics

Importantly, the positive effects of housing vouchers are driven by large, positive effects of housing lease-up on boys (Table 6). Boys in families randomized into receiving a voucher perform nearly 0.6 standard deviations higher on the pre-reading skills assessment, and they are 29 percentage points (49 percent) more likely to reach the kindergarten readiness threshold. "Treated" boys are also much less likely than their control group counterparts to be categorized as "not emerging or demonstrating" on the classroom-based observational assessment of their skill development, a nearly 15 percentage-point reduction (or 100-percent decrease relative to the control group). They are also 19 percentage points more likely to be in the "emerging" category, a 40-percent increase. Girls, on the other hand, show no consistent effects (positive or negative) from receipt of housing vouchers.

In Figure 5, we report the impacts of vouchers (left) and public housing (right) separately by: number of children in the household, number of adults in the household, and race/ethnicity. The positive developmental effects of housing vouchers are significantly larger for children living in multiple-child households. They also appear larger for children in single-adult households compared to children from multiple-adult households, though we cannot formally reject that they're different due to the small number of multi-adult households. Finally, the effects appear larger for Black children than for Hispanic children.

5.4.2 Baseline Proximity to Early Care and Education Options

One potential pathway through which housing assistance may affect child development could be through housing moves to neighborhoods with more early childhood care and education programs, and thus more opportunity for investment in skill development outside the home. Using data on Head Start center locations and availability of slots in the state's VPK program, School Readiness programs in child care and preschool settings, and child care and preschool providers with the state's high-quality "Gold Seal" designation, we explore variation in housing assistance impact for children in households with less exposure prior to the move to ECE opportunities.

5.4.3 Baseline Housing Expenditures

To better understand how housing assistance affects families' consumption of housing and other goods and services, we also explore heterogeneity in impacts by the family's baseline housing situation. In particular, we use rental listing data linked to addresses histories for waiting list families, to estimate baseline housing consumption for lottery families. We then examine whether the effects of housing assistance vary by estimated baseline housing spending. This allows us to probe whether the positive effects of vouchers that we document appear to be driven by increases in housing consumption of increases in non-housing spending. [6]

Figure 8 reports the effects of housing voucher and public housing for the pooled sample, then separately by predicted baseline housing spending. Households with "High Housing Spending" are those who are likely already spending a substantial fraction of their income towards housing, and thus are likely to use the voucher to increase non-housing consumption. While those in the "Low Housing Spending" group are those who are living in lower-quality housing at baseline, and will presumably use the voucher to upgrade their housing and neighborhood quality. The effects of the voucher appear to be driven primarily by children in households that are *not* spending a lot at baseline, suggesting that housing consumption, rather than increase in non-housing consumption, are driving the observed effects.

[6] In figure 6 we illustrate the theoretical changes in housing and non-housing spending from receipt of a voucher for households with different levels of baseline housing consumption. Figure 7 illustrates the same for public housing.

6 Conclusion

In this paper we investigate how in-kind housing transfers affect the developmental outcomes of young children. To do so, we link administrative data from a unique housing assistance lottery in Miami-Dade County, Florida to administrative data on early childhood skill assessments. We find substantial improvements in school readiness and early literacy skills, likely capturing both cognitive and noncognitive skill development, among children whose households received a voucher. These effects are only realized among voucher recipients, not public housing recipients, and are driven by benefits to boys. We find suggestive evidence that these benefits are linked with increases in housing quality/consumption rather than simply increased family resources.

Our paper is in conversation with multiple strands of the literature, particularly studies that explore second-generation effects of social programs and transfers targeted at households or families. We provide experimental evidence on the impact of a sizable income support program on child development outcomes in a large, diverse U.S. metropolitan area. These results are consistent with a large body of evidence using quasi-experimental approaches to study the impact of in-kind transfers on child outcomes, and leverages a randomized design, and novel data on both housing assistance and early childhood development to expand our knowledge of how investments in the early years produce benefits over the short run, and in turn, the long run.

Our findings of positive effects on measures of school-entry cognitive and noncognitive skills help reconcile the literature that finds that in-kind transfers can improve children's long-run outcomes and the literature on the importance of resources and investment in the critical early childhood years for generating effects thereafter. This study helps fill the evidence gap between the time of investment and the longer-term outcomes, providing useful evidence on the role of government transfers in simultaneously facilitating low-income households' consumption and supporting children's healthy development.

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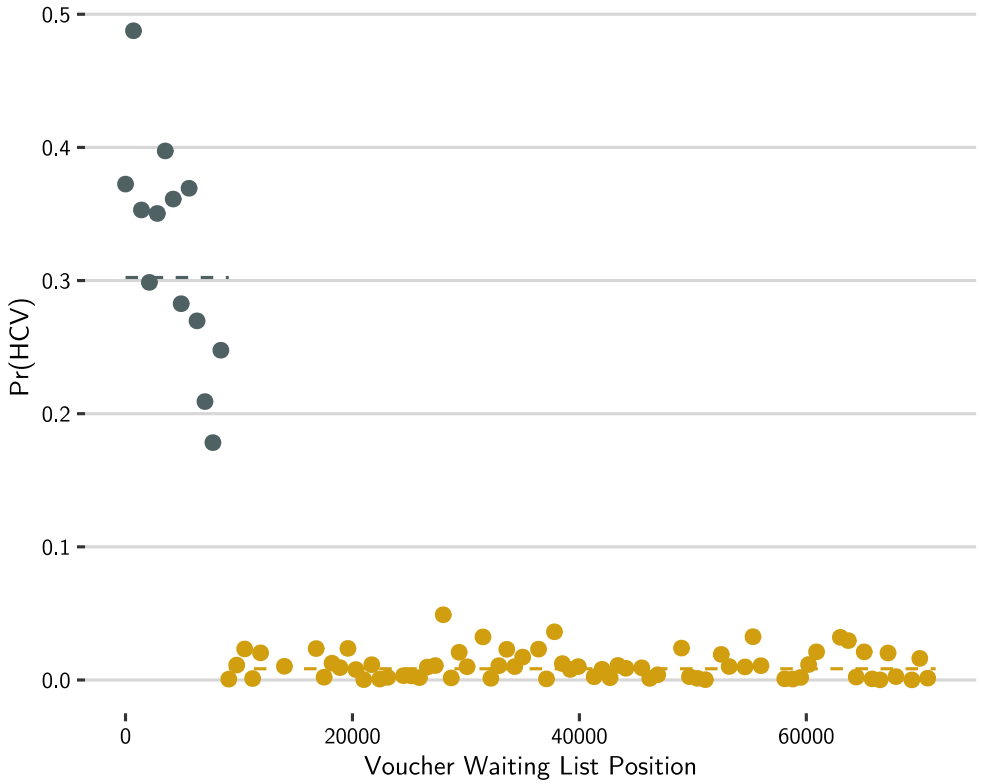
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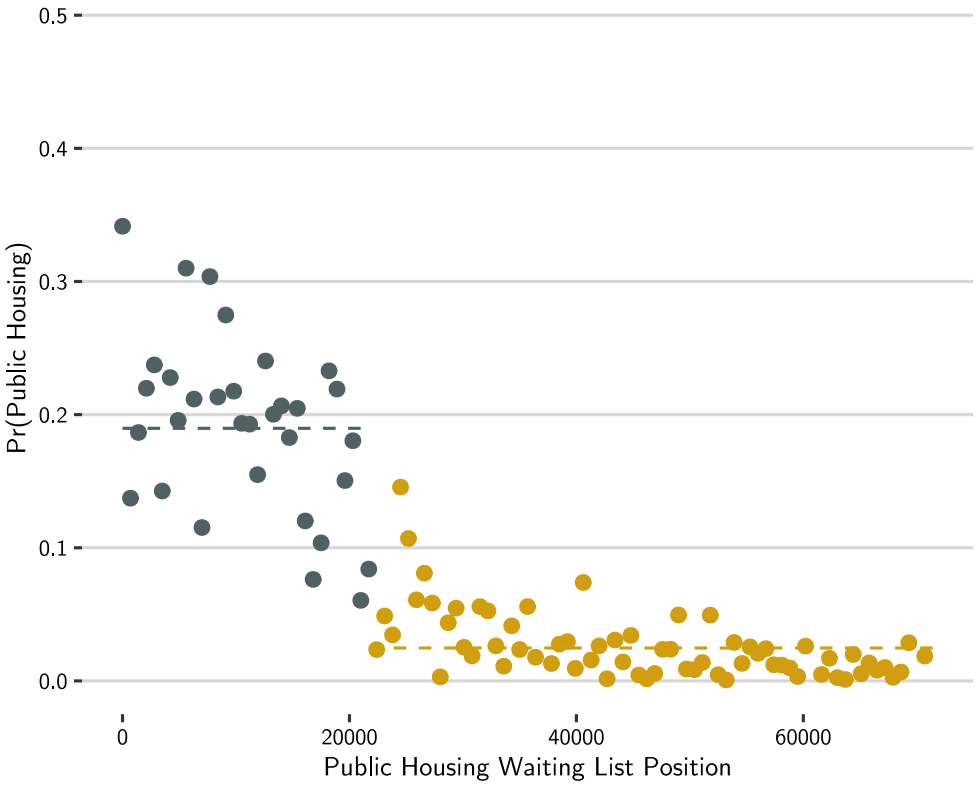
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Figure 1: Housing Voucher Lease-up by Wait-list Position



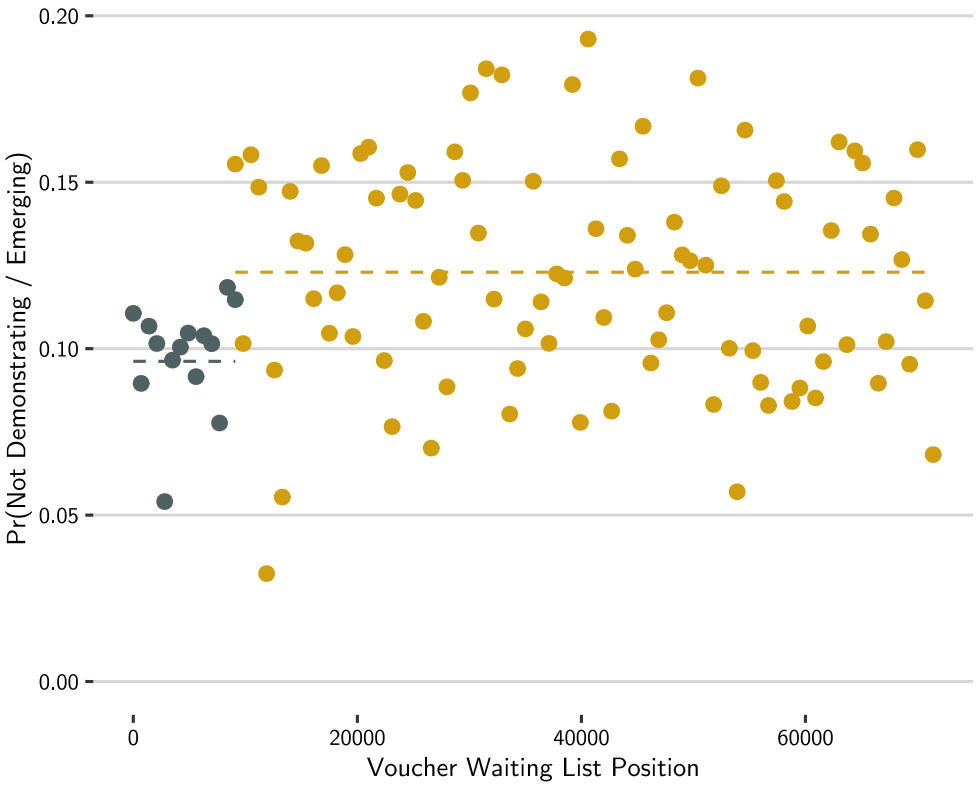
This figure plots the probability of leasing with a voucher by initial position on the 2008 housing voucher waiting list. Each dot is a 700 bin of the analytical sample, or approximately 600 households. The brick color line is the predicted probability of leasing-up with a voucher from a regression of voucher take-up on a dummy for having a wait-list number near the top of the waiting list

Figure 2: Public Housing Take-up by Wait-list Position



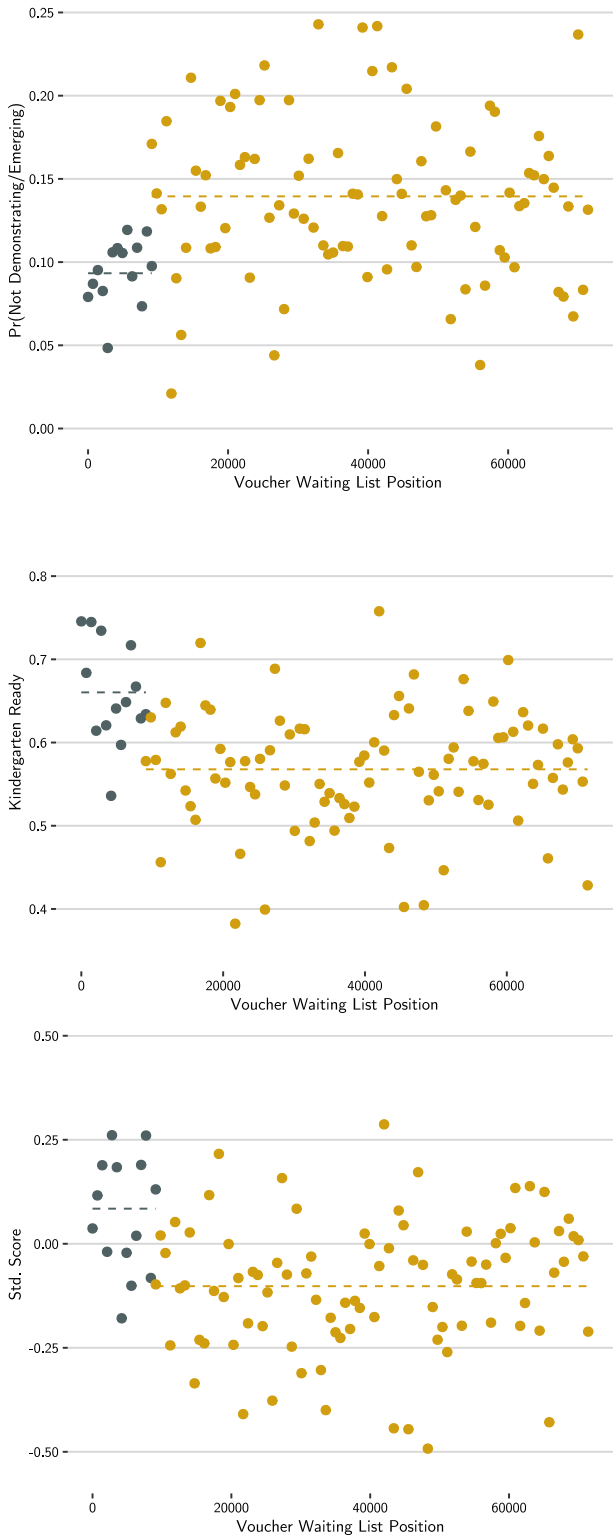
This figure plots the probability of leasing with in public housing by initial position on the 2008 public housing waiting list. Each dot is a 1-percent bin of the analytical sample, or approximately 600 households. The brick color line is the predicted probability of leasing-up in public housing from a regression of public housing lease-up on the rank position on the public housing list and the public housing rank position squared.

Figure 3: Child Development Outcomes by Voucher Lottery Position



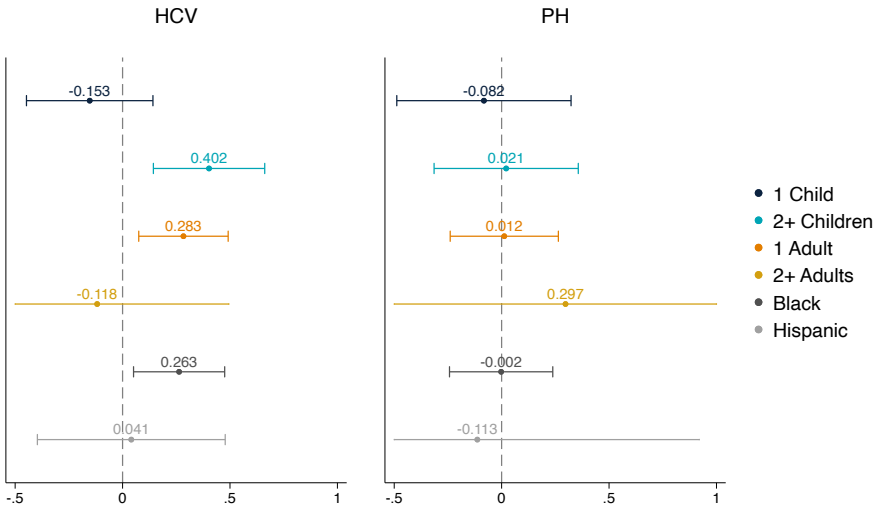
Notes: This figure plots the mean probability of that a child is determined to be "Not Emerging or Demonstrating" in the ECHOS assessment by bins of the randomized initial positions on the voucher list for the full sample of children. Each dot represents 700 slots of voucher positions. The dashed blue line is the average of the y-variable for children below position 9,200 on the voucher list, the dashed gold line is the average y-variable for children in positions above 9,200.

Figure 4: Child Development Outcomes by Voucher Lottery Position (Boys)



Notes: This figure plots mean child development outcomes by bins of the randomized initial positions on the voucher list for the sample of boys. Each dot represents 700 slots of voucher positions. The dashed blue line is the average of the y-variable for children below position 9,200 on the voucher list, the dashed gold line is the average y-variable for children in positions above 9,200.

Figure 5: Heterogeneity in Child Development Impacts



Notes: This figure plots the IV estimates for the effects of housing vouchers ("HCV") and public housing ("PH") on children's early literacy skills for several subgroups in baseline characteristics. Whiskers are 95% confidence intervals

Table 1: Summary Statistics and Randomization Check

	(1) Top Vouchers	(2) Top Public Housing	(3) Control (Bottom)	(4) P-value from joint test
Child Age	2.433	2.426	2.449	0.628
Boy	0.492	0.515	0.498	0.179
Girl	0.508	0.485	0.502	0.179
Age, Head	27.690	28.039	27.947	0.373
Disabled, Head	0.054	0.064	0.064	0.386
Elderly, Head	0.003	0.006	0.005	0.565
White (Not Hispanic)	0.016	0.013	0.015	0.782
Hispanic	0.312	0.345	0.334	0.179
Black	0.704	0.680	0.686	0.377
Asian	0.002	0.001	0.002	0.703
Female, Head	0.919	0.913	0.920	0.538
Ever Homeless	0.081	0.085	0.076	0.461
Tract Poverty	0.227	0.221	0.217	0.019
Has Email	0.710	0.700	0.718	0.253
Total Adults	1.231	1.217	1.228	0.594
Total Children	2.295	2.304	2.231	0.042
Has FAIR-K	0.726	0.725	0.725	0.995
Has ECHOS	0.739	0.740	0.743	0.891
N	1439	3598	9874	

This table reports the mean characteristics for the children in the analytical sample by voucher and public housing wait-list positions. Column (1) reports the mean baseline characteristics for children who's household was randomly assigned to the top of the voucher list. Column (2) reports the means for children who's household was randomly assigned to the top of the public housing waiting list. Column (3) for children from households at the bottom of both waiting lists. Column (4) reports p-values from a joint test of the significance of difference between columns (1) -(2) and column (3), clustering standard errors at the household level.

Table 2: First Stage

	HCV (1)	PH (2)
Top HCV	0.304***	−0.048***
	(0.014)	(0.006)
Top PH	−0.002	0.160***
	(0.005)	(0.008)
Control Mean	0.007	0.021
N	10,864	10,864

Notes: This table reports the first stage results. Column 1 reports the impact of being at the top of the housing voucher waiting-list ("Top HCV") and being at the top of the public housing waiting-list ("Top PH") on lease-up with a housing vouchers. Column 2 reports the impact of being at the top of the housing voucher waiting-list ("Top HCV") and being at the top of the public housing waiting-list ("Top PH") on admissions to public housing. The sample consists of children less than 5 on the waiting list for housing assistance, who link to a developmental outcome described in section 3. Robust standard errors are reported in parenthesis, clustered at the household-level. Statistical significance is denoted by: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$.

Table 3: Impact on Housing and Neighborhood Quality

	Housing Quality	Neighborhood Quality				Opportunity Atlas
	$\Delta \ln(\hat{Rent})$	Δ Poverty Rate	Δ School Quality	Δ Crime	Δ Single Parent	Δ Income Rank
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Reduced Form						
Top Voucher	0.037***	−0.016***	0.017	−2.461***	−0.004	0.002
	(0.014)	(0.004)	(0.026)	(0.483)	(0.004)	(0.002)
Top Public Housing	−0.012	0.016***	−0.005	1.614***	0.008***	−0.002*
	(0.010)	(0.003)	(0.019)	(0.357)	(0.003)	(0.001)
Panel B: IV (LATE)						
Voucher	0.088**	−0.029***	0.042	−5.416***	−0.004	0.004
	(0.036)	(0.010)	(0.073)	(1.354)	(0.010)	(0.005)
Public Housing	−0.063	0.080***	−0.023	8.003***	0.038***	−0.011*
	(0.052)	(0.014)	(0.097)	(1.725)	(0.014)	(0.006)
Control Mean	7.146	0.218	−0.650	12.370	0.266	0.360
Controls	Y	Y	Y	Y	Y	Y
N	7,996	12,301	12,302	12,286	12,301	12,284

Notes: This table reports the effects of wait-list position (reduced form) and housing assistance (IV) on housing consumption and neighborhood quality. All outcomes are changes between post-lottery and pre-lottery addresses. All neighborhood quality outcomes are measured at the census tract-level. Column 1 reports impacts on housing quality, defined as hedonic rent, described in section 3. Column 6 impacts on neighborhood predicted income rank in adulthood from the Opportunity Atlas from Chetty et al. (2018). Panel A reports the ITT estimates from estimating equation **??** and Panel B reports the LATE estimates. "HCV" reports the coefficient on voucher wait-list position (reduced form) or voucher lease-up (IV). "PH" reports the coefficient on public housing wait-list position (reduced form) or public housing lease-up (IV). Robust standard errors are reported in parenthesis, clustered at the household-level. Statistical significance is denoted by: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$.

Table 4: Impacts on Early Literacy and Kindergarten Readiness

	Control Mean (1)	Full Sample (2)	No Assistance Alternative (3)
Panel A: Reduced Form			
Kindergarten Readiness			
Top HCV	0.608	0.040***	0.046***
	(0.488)	(0.014)	(0.017)
Top PH	0.612	0.002	0.004
	(0.487)	(0.010)	(0.011)
Std. Reading Score			
Top HCV	−0.005	0.066**	0.082**
	(1.004)	(0.029)	(0.034)
Top PH	0.004	−0.001	0.004
	(0.999)	(0.021)	(0.023)
Panel B: IV (LATE)			
Kindergarten Readiness			
HCV	0.608	0.135***	0.150***
	(0.488)	(0.048)	(0.056)
PH	0.612	0.017	0.026
	(0.487)	(0.064)	(0.064)
Std. Reading Score			
HCV	−0.005	0.218**	0.269**
	(1.004)	(0.100)	(0.115)
PH	0.004	−0.006	0.025
	(0.999)	(0.134)	(0.134)
Controls	N	Y	Y
N	9,456	10,863	9,454

Notes: This table reports the effects of wait-list position (reduced form) and housing assistance (IV) on early child outcomes. "Kindergarten Readiness" is an indicator for having scored at or above the threshold to be determined ready for kindergarten. "Std. Reading Score" is a standardized score from evaluation of reading success. Column 1 reports the mean among those randomized to the bottom of the waiting list ("Control Mean"). Column 2 reports the ITT estimates from equation **??** in Panel A and LATE estimates in Panel B. "HCV" reports the coefficient on voucher wait-list position (reduced form) or voucher lease-up (IV). "PH" reports the coefficient on public housing wait-list position (reduced form) or public housing lease-up (IV). Column 3 reports the effects of voucher (public housing) waiting list position and voucher (public housing) lease-up, but restricts the sample to households with bottom public housing (voucher) waiting list positions. This restrictions limits the degree to which voucher (public housing) control group families are receiving public housing (vouchers). Robust standard errors are reported in parenthesis, clustered at the household-level. Statistical significance is denoted by: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$.

Table 5: Impacts on Children's Observed Developmental Benchmarks

	Control Mean (1)	Full Sample (2)	No Assistance Alternative (3)
Panel A: Reduced Form			
Not Emerging or Demonstrating			
Top HCV	0.122	−0.024***	−0.029***
	(0.307)	(0.008)	(0.010)
Top PH	0.121	−0.007	−0.008
	(0.305)	(0.006)	(0.007)
Emerging			
Top HCV	0.472	0.031**	0.063***
	(0.471)	(0.013)	(0.016)
Top PH	0.477	−0.006	0.007
	(0.471)	(0.010)	(0.010)
Demonstrating			
Top HCV	0.312	0.004	−0.011
	(0.438)	(0.012)	(0.015)
Top PH	0.308	0.014	0.008
	(0.437)	(0.009)	(0.010)
Panel B: IV (LATE)			
Not Emerging or Demonstrating			
HCV	0.122	−0.088***	−0.094***
	(0.307)	(0.028)	(0.032)
PH	0.121	−0.044	−0.048
	(0.305)	(0.039)	(0.039)
Emerging			
HCV	0.472	0.097**	0.208***
	(0.471)	(0.045)	(0.053)
PH	0.477	−0.034	0.040
	(0.471)	(0.060)	(0.061)
Demonstrating			
HCV	0.312	0.029	−0.037
	(0.438)	(0.043)	(0.049)
PH	0.308	0.088	0.049
	(0.437)	(0.057)	(0.057)
Controls	N	Y	Y
N	9,697	11,131	9,694

*Notes:*This table reports the effects of wait-list position (reduced form) and housing assistance (IV) on developmental assessments from embedded classroom observations. "Not Emerging or Demonstrating" is an indicator for the lowest categorization of development during classroom observations, taking the value zero otherwise. "Emerging" is an indicator if the child is coded as showing some indication of the necessary skill development. "Demonstrating" is an indicator which takes the value 1 if the child shows the highest level of skill-development, and zero otherwise. Column 1 reports the mean among those randomized to the bottom of the waiting list. Column 2 reports the ITT estimates from estimating equation **??** in Panel A and

Table 6: Impacts on Early Literacy and Kindergarten Readiness by Gender

	Boys		Girls	
	Control Mean (1)	Full Sample (2)	Control Mean (3)	Full Sample (4)
Panel A: Reduced Form				
Kindergarten Readiness				
Top HCV	0.571	0.083***	0.645	−0.005
	(0.495)	(0.020)	(0.479)	(0.019)
Top PH	0.581	−0.002	0.641	0.008
	(0.493)	(0.015)	(0.480)	(0.014)
Std. Reading Score				
Top HCV	−0.093	0.156***	0.080	−0.026
	(1.038)	(0.040)	(0.962)	(0.041)
Top PH	−0.078	0.015	0.082	−0.017
	(1.033)	(0.030)	(0.959)	(0.029)
Panel B: IV (LATE)				
Kindergarten Readiness				
HCV	0.571	0.285***	0.645	−0.008
	(0.495)	(0.074)	(0.479)	(0.063)
PH	0.581	−0.016	0.641	0.049
	(0.493)	(0.089)	(0.480)	(0.090)
Std. Reading Score				
HCV	−0.093	0.554***	0.080	−0.098
	(1.038)	(0.152)	(0.962)	(0.132)
PH	−0.078	0.083	0.082	−0.111
	(1.033)	(0.186)	(0.959)	(0.185)
Controls	N	Y	N	Y
N	4,671	5,351	4,785	5,510

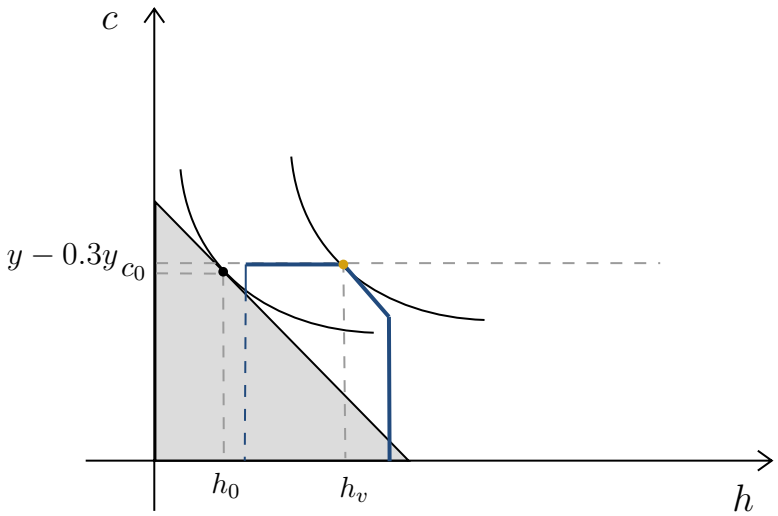
*Notes:*This table reports the effects of wait-list position (reduced form) and housing assistance (IV) on the same outcomes considered in Table 4, separately by child gender. Column 1 reports the mean among those randomized to the bottom of the waiting list ("Control Mean"). Column 2 reports the ITT estimates from estimating equation **??** in Panel A and LATE estimates in Panel B. "HCV" reports the coefficient on voucher wait-list position (reduced form) or voucher lease-up (IV). "PH" reports the coefficient on public housing wait-list position (reduced form) or public housing lease-up (IV). Robust standard errors are reported in parenthesis, clustered at the household-level. Statistical significance is denoted by: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$.

Table 7: Impacts on Children's Observed Developmental Benchmarks by Gender

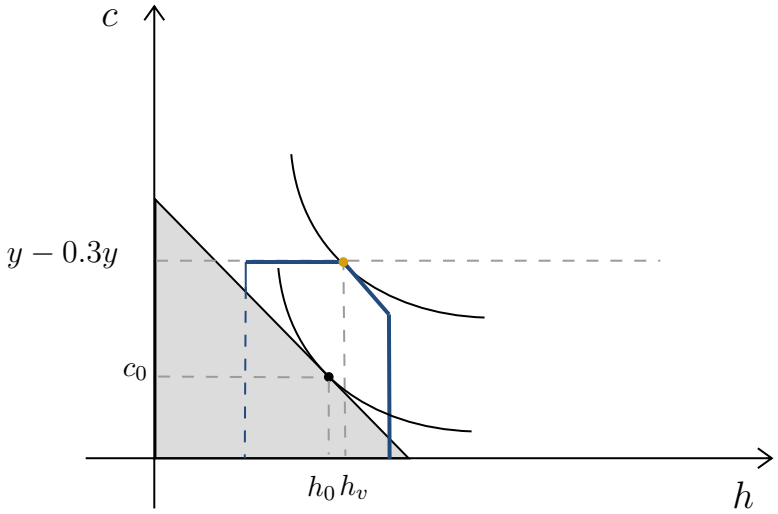
	Boys		Girls	
	Control Mean (1)	Full Sample (2)	Control Mean (3)	Full Sample (4)
Panel A: Reduced Form				
Not Emerging or Demonstrating				
Top HCV	0.139	−0.041***	0.105	−0.009
	(0.325)	(0.012)	(0.287)	(0.011)
Top PH	0.136	−0.005	0.106	−0.010
	(0.322)	(0.009)	(0.288)	(0.008)
Emerging				
Top HCV	0.470	0.059***	0.474	0.005
	(0.472)	(0.019)	(0.470)	(0.018)
Top PH	0.480	−0.011	0.474	−0.000
	(0.472)	(0.014)	(0.470)	(0.014)
Demonstrating				
Top HCV	0.282	0.014	0.340	−0.004
	(0.425)	(0.018)	(0.449)	(0.018)
Top PH	0.279	0.016	0.336	0.013
	(0.422)	(0.013)	(0.448)	(0.013)
Panel B: IV (LATE)				
Not Emerging or Demonstrating				
HCV	0.139	−0.147***	0.105	−0.039
	(0.325)	(0.044)	(0.287)	(0.036)
PH	0.136	−0.032	0.106	−0.068
	(0.322)	(0.056)	(0.288)	(0.053)
Emerging				
HCV	0.470	0.190***	0.474	0.015
	(0.472)	(0.069)	(0.470)	(0.060)
PH	0.480	−0.066	0.474	0.000
	(0.472)	(0.084)	(0.470)	(0.087)
Demonstrating				
HCV	0.282	0.066	0.340	−0.002
	(0.425)	(0.063)	(0.449)	(0.058)
PH	0.279	0.095	0.336	0.081
	(0.422)	(0.077)	(0.448)	(0.084)
Controls	N	Y	N	Y
N	4,810	5,506	4,887	5,623

Notes: :This table reports the effects of wait-list position (reduced form) and housing assistance (IV) on the same outcomes considered in Table 5, separately by child gender. Column 1 reports the mean among those randomized to the bottom of the waiting list ("Control Mean"). Column 2 reports the ITT estimates from estimating equation **??** in Panel A and LATE estimates in Panel B. "HCV" reports the coefficient on voucher wait-list position (reduced form) or voucher lease-up (IV). "PH" reports the coefficient on public housing wait-list position (reduced form) or public housing lease-up (IV). Robust standard errors are reported in parenthesis, clustered at the household-level. Statistical significance is denoted by: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$.

Figure 6: Theoretical Impacts of Voucher on Consumption



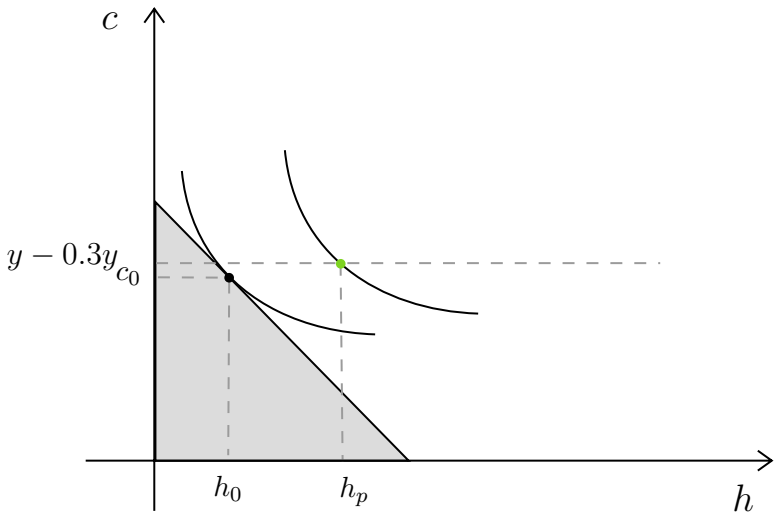
(a) Low Baseline Housing Consumption



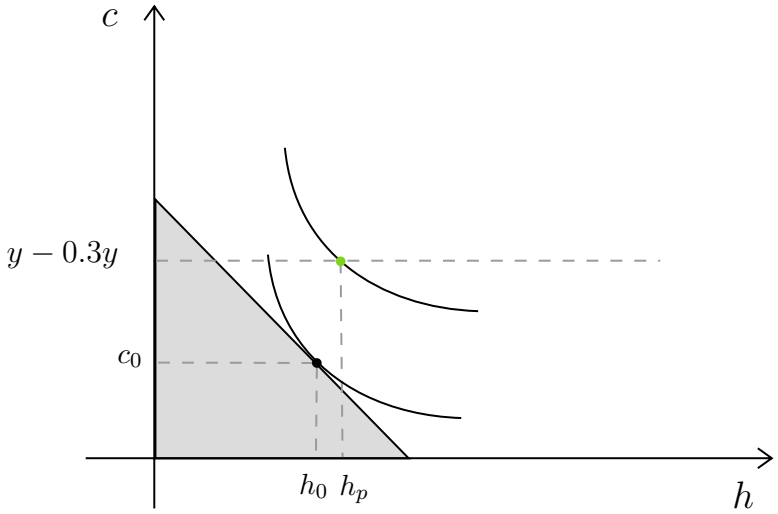
(b) High Baseline Housing Consumption

Notes: This figure characterizes the theoretical consumption trade-off facing a household with and without a housing voucher. The grey shaded area is the budget region. The top panel illustrates the changes in housing and non-housing consumption for a household with low spending on housing before voucher receipt. The bottom illustrates the changes in non-housing spending for a household with high initial spending on housing.

Figure 7: Theoretical Impacts of Public Housing on Consumption



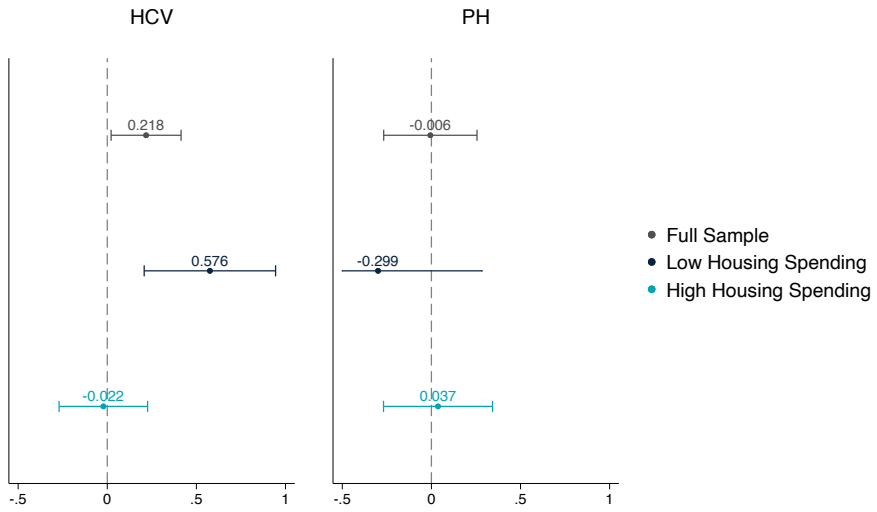
(a) Low Baseline Housing Consumption



(b) High Baseline Housing Consumption

Notes: This figure characterizes the theoretical consumption trade-off facing a household with and without public housing. The grey shaded area is the budget region. The top panel illustrates the changes in housing and non-housing consumption for a household with low spending on housing before public housing admission. The bottom illustrates the changes in non-housing spending for a household with high initial spending on housing.

Figure 8: Heterogeneity in Child Development Impacts by Estimated *Baseline* Housing Spending



Notes: This figure plots the IV estimates for the effects of housing vouchers ("HCV") and public housing ("PH") on children's early literacy skills for households who spend little on housing at baseline, and those that spend more. Whiskers are 95% confidence intervals