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Does public housing reduce housing cost burden among low-income families with children?

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Abstract

About half of all renter households and over three-quarters of very low-income households in the United States experience a housing cost burden, with higher rates among families with children. Public housing may be an important tool for reducing families' housing cost burdens. The current study uses nearly four decades of data from the Panel Study of Income Dynamics and its Assisted Housing Database to explore the relationship between public housing and housing cost burden among children in low-income families. Results from fixed effects models suggest that public housing is associated with a greatly reduced risk of experiencing housing cost burden when housing assistance receipt is measured a year before housing cost burden. These findings highlight the importance of public housing for reducing low-income families' housing cost burdens.

Keywords

public housing; housing; housing assistance; low-income families; rental cost burden

Introduction

Nearly half of all renter households in the United States experience a housing cost burden, paying more than 30% of their income toward housing (Joint Center for Housing Studies 2017). Housing cost burdens are even higher among low-income families. Nearly all (83%) households with incomes below \$15,000 experience a cost burden, along with about three-quarters (77%) of households earning between \$15,000 and \$30,000 a year (Joint Center for Housing Studies 2017). Housing assistance may be an important tool to alleviate families' housing cost burdens.

Public housing—permanent place-based assistance that is developed, owned, and maintained by Public Housing Authorities—limits families' housing expenditures to 30% of household income¹, effectively boosting the incomes of families with housing cost burdens by reducing the percentage of their resources they must spend on housing. When families are not

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burdened by housing costs, they can allocate their funds toward other expenditures that can benefit children's current and future wellbeing, including healthcare, more or better food, childcare, afterschool enrichment, and education. For example, lower housing cost expenditures are associated with reduced food insecurity (Fletcher, Andreyeva, and Busch 2009). An additional benefit of receiving housing assistance may manifest as children grow older: children in families with lower housing cost burdens may have less incentive or need to drop out of school and enter the workforce (Forget 2011). Housing unaffordability is also associated with worse health, behavioral problems, and material hardship among families with children (Harkness and Newman 2005).

Public housing subsidizes families' rent payments, and the Department of Housing and Urban Development (HUD) allocates utility allowances for public housing residents (Dastrup, McDonnell, and Reina 2011). These utility allowances generally keep families' total housing costs—rent plus utilities—to 30% of their household income (Dastrup, McDonnell, and Reina 2011), by design drastically reducing the likelihood that a family living in public housing will experience a housing cost burden. This anticipated relationship may not be a given, however: research on housing cost burden among households receiving another subsidy (Housing Choice Vouchers) shows that even among voucher recipients, housing cost burden is still common (McClure 2005).

The current study uses four decades of longitudinal data from the Panel Study of Income Dynamics (PSID) and linked Assisted Housing Database (PSID-AHD) to explore the association between living in public housing and housing cost burden among children in low-income families. Advanced quantitative modeling techniques allow for the examination of changes in housing cost burden both between and within children in low-income families, which also addresses concerns about selection bias and endogeneity. All analyses control for a rich set of individual, family, and census tract-level characteristics.

Housing and affordable housing policy overview during the study period

Housing in the United States has become increasingly unaffordable. For example, from 1985 to 2005, average monthly housing costs for renters increased 95 percent (Eggers and Moumen 2008). These increased housing costs have been coupled with an essential stagnation in average wages among renters from the 1960s through today (Joint Center for Housing Studies 2018). In no state can a minimum-wage worker working 40 hours a week afford to rent a two-bedroom home priced at the fair market rate (National Low Income Housing Coalition 2018). Rising housing costs have made housing assistance all the more valuable, especially given its scarcity: less than one of every four eligible families receives it (Rice and Sard 2009).

During the latter half of the 20th century and the beginning of the 21st, there have been several changes to the U.S.'s affordable housing policy, but throughout this period, public housing has been a consistent source of affordable housing. Begun in 1937, the public

¹Rent is calculated as the highest of: 30% of the family's monthly adjusted income (pretax income minus allowable income deductions), 10% of the family's monthly income, welfare rent (in states where applicable), or minimum rent (\$0 to \$50, as set by the public housing authority). For more detail on calculations, see Department of Housing and Urban Development (2002).

housing program has provided permanent place-based assistance, developed, owned, and maintained by Public Housing Authorities (PHAs; United States Congress 1937). Over time, the housing stock provided through this program has varied both in scale and quality. Through 1994, the number of public housing units increased to a high of more than 1.4 million units, but after that time, the public housing stock decreased, and in 2012 it numbered about 1.16 units (Schwartz 2015). The capital budget to maintain public housing has been dramatically underfunded, and it was estimated that repairs would necessitate \$26 billion in spending as of 2010 (Department of Housing and Urban Development 2017). In the past two decades, several steps have been taken to address concerns about substandard units. In the 1990s, nearly 100,000 severely distressed public housing units were demolished through HOPE VI²; 85% of these units were replaced with units intended for low- and moderate-income households (Gress, Cho, and Joseph 2016). Another effort to preserve public housing units was established in 2012, when Congress authorized the Rental Assistance Demonstration program to provide capital improvements to about a quarter-million public housing units by leveraging private funds and converting public housing units to place-based Section 8. These changes to the public housing program reflected concerns about the quality of public housing units but did not lead to changes in rental costs for residents.

Concurrent with these changes to the public housing program, the federal government began funding housing vouchers in the 1970s and incentivizing the development of affordable housing units through Low Income Housing Tax Credits (LIHTC). The number of housing vouchers has increased over that period, from 1.20 million in 1993 to 1.97 million in 2007 and 2.30 million in 2016 (Kingsley 2017). Even more dramatically, from 1993 to 2016, the number of units built through the LIHTC program increased from 400,000 to 2.57 million; the units have been used to provide families moving out of public housing with an option in the private market, often using vouchers (Kingsley 2017).

As federal expenditures on affordable housing have shifted to vouchers and LIHTC projects, research, understandably, has focused on these programs. Public housing, however, still provides critical housing assistance to more than a million households, and the federal government is using tax dollars to incentivize investment in the program (U.S. Department of Housing and Urban Development 2017). As such, this program still warrants research.

The relationship between housing assistance and housing cost burden

Over the past several decades, there has been a movement to provide affordable housing through vouchers and the LIHTC program. While the number of families living in public housing is small when compared to the scale of these programs, more than two million people live in public housing, and nearly 40% of the million households served by public housing include children; additionally, the program has been serving families for more than eight decades (U.S. Department of Housing and Urban Development 2017). One purpose of affordable housing programs is to ensure that housing is, indeed, affordable for low-income

²HOPE VI aimed to address severely distressed public housing and resulted in the demolition of much of the high-rise public housing stock in favor of low-rise, mixed-income redevelopment.

families. Research examining housing cost burden among voucher holders has found that about a third of Housing Choice Voucher (HCV) holders experience a housing cost burden, and about 20% experience a high housing cost burden, spending more than 40% of their income on rent (McClure 2005). We have very limited information, however, about housing cost burden among families living in public housing. Prior literature on housing cost burdens among families receiving housing assistance focuses primarily on voucher holders, with only one study examining housing cost burdens among public housing residents (Mast 2012). Recent descriptive analyses of 2009 Public and Indian Housing Information Center (PIC) data from HUD show that only 3.2% of public housing residents are cost-burdened (Mast 2012).

Because of the limited research on housing cost burden among public housing residents, the current study also draws on evidence from prior studies examining housing cost burden among voucher holders to develop an analytic strategy. A descriptive study of nearly the entire population of HCV holders finds that more than a third (38%) of households were cost-burdened, spending more than 30% of their income on housing; while high, this rate had decreased from 47% two years earlier (McClure 2005). More recent descriptive analyses of 2009 Public and Indian Housing Information Center (PIC) data from HUD find similar results: about 31% of voucher holders experience housing cost burden (Mast 2012). These studies show that housing cost burden is common among households with vouchers.

Other analyses using more robust statistical methods have examined housing cost burden among voucher holders. Findings from Markov chain analyses, which are used to predict housing cost burden over time, indicate that housing cost burden among voucher-holders increases for years after admission to the program, though there is significant variation in the severity of cost burden experienced (Mast 2014). The Moving to Opportunity experiment, which randomly assigned households to receive vouchers, also provides insight into the possible causal relationship between vouchers and housing cost burden. Multivariate results from this experiment show that vouchers had no effect on housing cost burden (Comey, Popkin, and Franks 2012).

Several factors appear to exacerbate housing cost burden among voucher-holders. Characteristics such as having children, a minimal income, a large household size, or a single female head of household are associated with having a higher housing cost burden (McClure 2005). For example, the housing cost burden rate among single-female-headed households with a voucher is 43%, compared to 38% overall (McClure 2005). Living in the South is also associated with a high housing cost burden, perhaps because families have less income from other sources due to lower welfare generosity (McClure 2005). Furthermore, regional differences in housing market conditions can influence families' likelihood of experiencing a housing cost burden (Comey, Popkin, and Franks 2012).

In sum, prior literature has established that housing cost burden is common among voucher-holders but only one study examines housing cost burden among public housing recipients (and does so descriptively). This study (Mast 2012) finds that among these recipients, housing cost burden is extremely uncommon, but no studies examine the association between public housing and housing cost burden, particularly among low-income families

with children, a group that may be particularly vulnerable to facing housing cost burden. These families often experience greater discrimination than childless households (e.g., Desmond 2016). Thus, the current study uses longitudinal data to explore the association between public housing and housing cost burden among children in low-income families.

Current study

The current study uses four decades of longitudinal, panel data from the PSID to examine the association between public housing and housing cost burden among low-income families with children.

This study addresses both methodological concerns about using survey data to answer this research question and concerns about selection bias. Accurately measuring the receipt of housing assistance can be challenging, as self-reports are often unreliable (Shroder 2002). For example, there is a tendency for people to over-report living in public housing (Shroder 2002). Misrepresentation of housing assistance receipt, across all types of housing assistance (e.g., vouchers and public housing), is found in multiple datasets, including the Survey of Income and Program Participation, the Current Population Survey, and the American Housing Survey (Shroder 2002). Thus, rather than using respondents' self-reports of housing assistance receipt, the current study uses the PSID's Assisted Housing Database, which provides verified assistance receipt. Additionally, selection bias is a concern when comparing families who receive housing assistance to those who do not, because families who receive housing assistance may be systematically different from those without it. In this study, I utilize conservative, individual fixed-effects models to examine changes in housing cost burden within children as their housing assistance status changes. These methodological choices move closer toward estimating causal effects.

Methods

Data

Panel Study of Income Dynamics (PSID)—This study uses data from the PSID, a large, nationally representative panel survey developed to evaluate programs created as part of the War on Poverty. Data collection began in 1968 and continues today. The initial survey sample included about 18,000 individuals in 5,000 families and has grown to about 24,000 individuals in 10,000 families. Interviews were conducted annually from 1968 through 1997 and biannually thereafter. In the current study, data from every year for the first six years of the child's life and then data from every other year are used in order to ensure the same number of observations per participant, regardless of the year in which the child was born.

PSID-Assisted Housing Database—In addition to the detailed longitudinal data available in the main PSID, the PSID's restricted-use Assisted Housing Database (PSID-AHD) provides information on housing assistance for all family units in the PSID. The PSID-AHD has matched standardized addresses for each family unit from 1968 through 2009 to records of assisted housing (Newman and Schnare 1997). These data are particularly important because they address the possible misreport of housing assistance receipt (Shroder 2002).

Sample

The sample includes 942 children born between 1970 and 1992 in 696 families. The sample is limited to only children in families that would be eligible for housing assistance, based on a measure of “permanent” income over childhood. This permanent measure of childhood availability is established by calculating a household income to metropolitan statistical area (MSA) income ratio at each year and averaging those ratios across childhood. Children whose families have permanent income to MSA ratios at or below 0.50 are included in the sample because this captures the majority of families receiving subsidized housing and is consistent with recent prior literature using these data (e.g., Kucheva 2018, Gold 2018). This permanent measure, rather than a measure calculated for each specific year, is utilized because families experiencing short-term low-income spells are unlikely to receive housing assistance due to long program waiting lists. Additionally, children are included in the sample only if their families rented for at least one wave in childhood (because families receiving public housing are renters). The first set of analyses, with a two-year lag, uses a sample of 942 children with 5,574 observations, pooled from birth to age 15. The second set of analyses lags housing assistance by only one year, allowing for the examination of housing assistance receipt and housing cost burden during early childhood. Due to missing data on housing cost burden and time-varying characteristics in early childhood, 26 children from the original sample are omitted, resulting in a sample of 916 children with 3,371 observations, pooled from birth to age six.

Measures

Housing cost burden—Housing cost burden is calculated using two variables from the PSID core survey: housing cost (rental or mortgage payment) and household income. The housing expense to household income ratio is calculated by dividing the amount spent on housing by household income. A household is coded as having a housing cost burden if its housing costs exceed 30% of household income. This method of calculating housing cost burden follows HUD’s determination of housing cost burden (Belsky, Goodman, and Drew 2005), except that utility costs are not included in the current measure because the PSID collects these data only inconsistently. This calculation accurately measures housing cost burden among public housing recipients because utility costs are included in rent: either PHAs set rent to include utilities, or tenants pay utilities and the amount is subtracted from rent, which is 30% of income (Dastrup, McDonnell, and Reina 2011). However, because families with housing in the private market pay utilities separately, this measure likely understates housing cost burden among families without housing assistance.

Housing assistance—Housing assistance is measured annually from birth to age six and biannually from ages seven to 15 using the PSID-AHD and is coded as a categorical variable (no housing assistance; public housing; all other types of housing assistance). The public housing category includes housing that is developed, owned, and maintained by Public Housing Authorities through the public housing program. It does not include place-based Section 8, housing financed using LIHTC, or other place-based assistance. The other housing assistance category includes housing vouchers and place-based assistance other than public housing (e.g., Section 202, which is targeted toward the elderly; rural housing programs; and Section 8 place-based assistance) to make the comparison group as pure as

possible. Vouchers and other place-based housing are collapsed into one category because voucher receipt was reported only from 1995 on, rather than over the full period of the study. Conclusions about this category are not drawn due to program heterogeneity.

Because housing assistance is measured annually, there are changes within children over time (e.g., going from not receiving housing assistance to living in public housing) that allow for the analysis of individual fixed-effects models estimating those changes.

Covariates—Analyses include both time-invariant and time-varying variables that may confound the association between housing assistance receipt and moving.

Time invariant—Time invariant covariates are measured at the child's birth.

Characteristics of the child's family include the mother's age and education and the household head's race and ethnicity. It is critical to control for those characteristics because housing cost burden is more likely among non-white households and households with younger or older household heads (under age 25 and age 65 and older; Joint Center for Housing Studies 2017), and black housing-seekers are more likely to experience housing market discrimination, reducing housing choice (e.g., Massey and Lundy 2001). Analyses also include child-level characteristics: the child's sex and whether the child had a low birth weight (< 2500 grams). The child's sex is included because neighborhoods affect boys and girls differently, perhaps leading families to consider their children's sex in making housing decisions. For example, moving to a less poor neighborhood has improved mental health benefits for girls but not boys (Sanbonmatsu et al. 2011, Ludwig et al. 2013), and living in disadvantaged neighborhoods is associated with greater engagement in delinquent behaviors for both girls and boys, though the effect is larger for boys (Kroneman, Loeber, and Hipwell 2004). Low birth weight is included as a proxy for health; worse health may lead to increased medical costs and, potentially, increased housing cost burden. To account for variation in housing assistance availability and other economic, policy, and contextual changes in the U.S. over time, the year in which the child was born is included as a control.

Time-Varying—A series of time-varying covariates, both at the family and census-tract levels, are included in all analyses. Family-level characteristics include: whether there was an individual with a disability in the household, whether there were both male and female children (where 1 equals children of both sexes), the number of children (to ascertain the number of dependent children in the household), the number of adults (to indicate both potential doubling-up situations and potential wage-earners), whether the mother had formed an independent household (if the mother is head or wife, she has formed her own household, separate from her parents), whether there was a male household head, whether the family received cash welfare assistance (i.e., Aid to Families with Dependent Children and, later, Temporary Assistance to Needy Families, which may reduce families' housing cost burden; this variable is included as an indicator of safety net connectedness and is the safety net program with the most reliably collected data in the PSID), household income to poverty ratio, and the region in which the family lived (Northeast, Midwest, South, or West). Family composition characteristics are associated with families' likelihoods of experiencing housing cost burden: for example, having children or individuals with disabilities in the household are associated with increased housing cost burden (McClure 2005, Joint Center for Housing

Studies 2017). Housing cost burden has been found to vary by geographic characteristics (Joint Center for Housing Studies 2017) so the current study controls for census tract-level characteristics, including the percentage of the population below the poverty line, the percentage of residents who are white, and the median rent. In multivariate analyses, all time-varying characteristics are lagged the same amount of time as housing assistance receipt (two years in the first set of models and one year in the second) to ensure that these characteristics preceded whether or not the child experienced housing cost burden.

Analytic Strategy

First, the sample is pooled across the first 15 years of the children's lives, representing 39 years of data. Next, descriptive statistics of all variables included in the analysis are presented for the full sample and for children in families (1) not receiving housing assistance and (2) living in public housing. Descriptive statistics for families with children who are receiving other housing assistance are not presented due to program heterogeneity in this category.

Next, ordinary least squares (OLS) regression models, known as linear probability models (LPM) when models have a dichotomous outcome, are used to estimate the association between public housing receipt and whether the child's family experienced housing cost burden in the pooled sample. While the outcome variable in these analyses is dichotomous, linear probability models typically provide unbiased estimates of dichotomous outcomes when the probability is between 0.2 and 0.8 (Angrist and Pischke 2008; Hellevik 2009; Von Hippel 2015). Thus, the models are estimated using OLS equations for ease of interpretation, flexibility with interaction effects (Ai and Norton 2003), and to more easily compare coefficients across models (Mood 2010; Breen, Karlson, and Holm 2013).

In the first set of analyses, housing assistance and all time-varying covariates are lagged by two years to establish correct temporal ordering. The two-year lag is utilized to address the switch to biannual data collection in the PSID beginning in 1997 (i.e., for children born later in the sample for the current study, the most recent measurement of housing cost burden is reported two years prior). The two-year lag is likely to satisfactorily cover the period in which families receive housing assistance. On average, between 1995 and 2009, the average length of stay in public housing was 4.8 years; the length of stay is most reliably estimated from 1998 on because households that had long stays in public housing prior to automated systems may not have had an admission date (McClure 2017). There is still the possibility, though, that families moved out of public housing during the two-year lag.

Given that families do transition out of public housing, I conduct a second set of analyses utilizing a one-year lag of both housing assistance and time-varying covariates to minimize the likelihood of families moving out of (or into) public housing during the lag period. For these analyses, I examine the relationship between housing assistance and housing cost burden only in early childhood (from birth to age six), the ages for which these models can be estimated with a one-year lag for the full sample. This one-year lag may more accurately reflect the relationship between housing assistance and housing cost burden because housing assistance may have more of an immediate than prolonged association with housing cost burden. In this second set of analyses, the sample is limited to children born between 1970

and 1992 (as in the first set of analyses) for whom observations of both housing assistance receipt and housing cost burden are available across early childhood.

For both sets of analyses, the following models are presented:

1. OLS (random effects) models that explicitly examine effects within and between children's families by allowing intercepts to vary across children.
2. Fixed effects models (the most conservative estimates) that examine effects only within children's families over time and account for all static characteristics of children by permitting variation in both intercepts and slopes.

Results of each analysis are presented as regression coefficients and *t*-statistics. Regression coefficients can be interpreted as percentage point changes in the probability of having moved.

Results

Descriptive results

Table 1 presents descriptive statistics for the full sample and by housing assistance receipt along with significance tests comparing children whose families received housing assistance to those who did not. The full sample includes 5,574 observations on 942 children in 696 families. Of the full sample, just over three-quarters (76.26%) did not receive housing assistance. Slightly more than 13% (13.20) lived in public housing, and 10.54% received some other type of housing assistance. Housing cost burden (spending at least 30% of household income on housing) was common, experienced by 44.56% of children's families in the sample. There were significant differences in experiencing housing cost burden by housing assistance receipt. Children and their families living in public housing were significantly less likely to experience housing cost burden than children whose families did not have housing assistance (23.10% compared to 49.47%, respectively).

There are significant differences on several covariates between children who lived in public housing and those who received no housing assistance. Compared to children whose families did not have housing assistance, children living in public housing were more likely to be female, have mothers who were slightly older, have more children and fewer adults in the household, to receive cash assistance, to have a lower income to poverty ratio, and to live in more poor census tracts with lower median rents. Children living in public housing, compared to children whose families did not have housing assistance, were less likely to have a low birth weight or an individual with a disability in the household.

Multivariate results

Table 2 presents results from multivariate OLS regression models examining the association between public housing and housing cost burden with housing assistance. Models 1 and 2 show results from models where housing assistance is measured two years before housing cost burden, and Models 3 and 4 represent analyses with a one-year lag and show the results from the fully controlled OLS model using random effects. In Model 1, living in public housing is associated with a 10 percentage point decrease in housing cost burden compared

to renting without assistance. Several covariates in this model are significantly associated with housing cost burden: having more adults in the household, a male household head, living in the South (compared to the Northeast), and having higher census tract poverty rates are associated with reduced housing cost burden. Having a low birth weight is associated with an increased housing cost burden. Being born in most years is significantly associated with a higher likelihood of experiencing housing cost burden than being born in 1970, likely because of rising housing costs over time (results available in Appendix A).

Model 2 shows results from the fixed-effects model. This model is conservative and reflects changes within individuals. The coefficients can be interpreted as the change in housing cost burden as a child's family moves into or out of public housing. In this model, public housing is not significantly associated with housing cost burden. The coefficient size is greatly attenuated, but the direction of the coefficient remains negative. This finding suggests that unobserved characteristics may be driving the relationship between public housing and housing cost burden in this model. Several covariates are also significant in this model: living in the Midwest or South is associated with an increased housing cost burden as compared to the Northeast (this comparison is *within* children, and regional changes within children are uncommon), while having a higher income to poverty ratio and living in a census tract with a higher poverty rate and median rent are associated with reduced housing cost burden.

Models 3 and 4 are results from multivariate OLS regression models examining the association between public housing and housing cost burden with a one-year lag. In these analyses, the sample is limited to observations in early childhood (birth through age 6) because observations are available annually during this time period. Results from fully controlled OLS models with random effects are presented in Model 3. Children living in public housing, compared to those whose families do not receive any housing assistance, have a 23 percentage point lower likelihood of experiencing housing cost burden. Several covariates in this model are also associated with housing cost burden: having more adults in the household, a male household head, and living in the South (compared to the Northeast) are associated with reduced housing cost burdens, while having a census tract with a higher poverty rate and higher median rent is associated with an increased housing cost burden. The year in which the child is born is not significantly associated with housing cost burden (results presented in Appendix A).

Results from a fixed-effects model are presented in Model 4. In this model, living in public housing (compared to when the child did not live in public housing) is associated with a 21 percentage point decrease in housing cost burden. In this model, additional adults in the household are also associated with reduced housing cost burdens, while having a higher income to poverty ratio; living in the Midwest, South, or West (compared to the Northeast); and having a census tract with a higher poverty rate and higher median rent are associated with an increased housing cost burden.

The findings from these two sets of models taken together suggest that public housing's effect on housing cost burden may be more immediate: families' housing cost burdens are more responsive to housing assistance received in the year directly prior to the measurement

of housing cost burden than to housing assistance received two years prior. As would be expected, variables associated with higher household incomes (e.g., having more adults in the household, a higher income to poverty ratio, and a male household head) are associated with a reduced likelihood of experiencing a housing cost burden.

Sensitivity analyses

A series of sensitivity analyses were conducted to further understanding of the relationship between public housing and housing cost burden. These analyses are particularly important because they may provide insight, when examining changes within children's families' housing assistance status, into those for whom public housing may be effective in reducing housing cost burden. All robustness checks are estimated with both one- and two-year lags and are presented in Table 3.

First, robustness checks examine whether the results may be overstated because the sample includes multiple children in the same families. Therefore, standard errors are clustered at the family level. In these analyses, the magnitude, direction, and significance of the associations between public housing and housing cost burden are consistent with the findings from the models presented in Table 2. Public housing significantly reduces housing cost burden both between and within children's families with a one-year lag and between children's families with a two-year lag. Next, the sample is limited to only one child per household. These findings are again consistent with those in the main models.

Housing assistance may be particularly effective in reducing housing cost burden for children in families that are extremely low-income. Thus, the next set of sensitivity tests limits the sample to children in families with permanent extremely low incomes (where the permanent household income to MSA income ratio is less than or equal to 0.3). These results are also consistent with the results from the main models. In the models in which housing assistance is lagged one year, the effect size in the fixed-effects model is slightly attenuated and is significant at $p < 0.05$, rather than $p < 0.001$ as in other models.

Next, to examine whether this relationship may be more salient among children whose families rent for longer periods of time, the sample is limited based on several parameters for length of renting—at least 3, 5, and 10 years. Results from these models are also consistent with the main models.

Finally, having multiple adults in the household may moderate the relationship between public housing receipt and housing cost burden. To determine whether this is the case, I test moderated models examining whether there is an interaction between housing assistance and the number of adults in the household (measured continuously and dichotomously as more than 1 adult compared to 0 or 1 adults). In the models with a two-year lag and the one-year lagged fixed-effect model, there is no significant interaction effect. In the random-effects models with a one-year lag, while the interaction term is significant, the main effect of the number of adults in the household is not.

Taken together, the results from the robustness checks are consistent with the results from the main models and suggest that public housing is associated with reduced housing cost burden across a variety of model specifications.

Discussion

Descriptively, low-income children who live in public housing are much less likely to experience a housing cost burden than children whose families do not receive housing assistance. In multivariate regression models, I find that (1) when lagging housing assistance receipt by two years, public housing is associated with reduced housing cost burden in random-effects models, examining changes both between and within children's families. However, this relationship is not significant in fixed-effects models, suggesting that selection bias may be at play. (2) When housing assistance is lagged by one year, public housing is associated with reduced housing cost burden in both random and fixed-effects models.

The models in which housing assistance is lagged one year show that receiving public housing is associated with a 21 percentage point reduction in the likelihood of experiencing a housing cost burden compared to when the child's family was not receiving housing assistance. This suggests that the effects of public housing on housing cost burden are immediate. Taken along with the results from the models with a two-year lag, it would appear that this assistance is effective in reducing housing cost burden in the time period directly after receipt but perhaps not as families discontinue receiving such assistance. Thus, families may not be on a more stable financial trajectory when leaving public housing. Researchers should explore families' housing cost burdens in the years after public housing receipt in a manner similar to Mast (2014), to ascertain whether there is a longer-term impact of public housing receipt on housing cost burden. Of additional interest would be understanding whether the longer-term effect of public housing is reflective of differences in selection into assistance, unmeasured family factors, or how families leverage their housing assistance to attain longer-term financial stability.

Over time, housing in the United States has become increasingly unaffordable (Joint Center for Housing Studies 2016). Using data that covers both a contemporary and slightly historical period (1970 through 2009), the findings in this paper suggest that public housing may be an effective tool for reducing housing cost burden. Because the data used in these analyses largely predates the housing crisis, these estimates of the effects of public housing on housing cost burden may be conservative. Future research should explore the relationship between public housing and housing cost burden with data from the Great Recession forward, in order to explore whether housing assistance has become a more effective tool for reducing housing cost burden in this economic climate.

Though the current paper suggests that public housing may prevent housing cost burden, given the recent research finding that demand-side housing programs (such as vouchers) may be particularly useful in the United States because of high vacancy rates (McClure 2019) and that public housing is often located in more disadvantaged neighborhoods (McClure and Johnson 2014, Newman and Schnare 1997), it is worth discussing the value of housing vouchers. Vouchers offer the promise of access to more advantageous

neighborhoods with better schools, more employment opportunities, and lower crime rates. However, evidence suggests that while more families with vouchers access neighborhoods that are less disadvantaged than do families with public housing, the neighborhoods into which families with vouchers move are not that different from the neighborhoods low-income families without housing assistance access (see review by Owens 2017). Furthermore, families with vouchers also tend to live near lower performing schools compared to both families in public housing and low-income families without housing assistance (Horn, Ellen, and Schwartz 2014). Still, evidence from demonstration programs such as the Baltimore Housing Mobility Program, Moving to Opportunity, and Gautreaux, indicates that housing vouchers, if utilized with the goal of moving families to more advantaged neighborhoods, can succeed in doing so (Owens 2017).

There are several limitations in this study. First, as indicated in the second set of analyses, the effect of public housing on housing cost burden appears to be most salient when measured with a one-year lag (measured during early childhood due to data availability). Though lagging the independent variable allows for proper temporal ordering, it does introduce the possibility that families move into or out of housing assistance receipt during the lag period. Additionally, while the current study finds that public housing seems to be a useful tool in reducing housing cost burden, due to the age of the data, families in the sample analyzed were less likely to experience this burden than more contemporary families (e.g., Joint Center for Housing Studies 2016). Because housing cost burden is now more prevalent among low-income and renter families than in the past, public housing could now be an even stronger tool to reduce housing cost burden.

Another limitation of the current study is measurement of housing cost burden. This study likely underestimates the prevalence of housing cost burden in the portion of the sample not receiving public housing, because utility costs are not routinely collected in the PSID. Therefore, the results of the multivariate analyses are likely conservative estimates of the effects of public housing on housing cost burden.

Additional economic trends may also have impacted the relationship between housing assistance and housing cost burden. During the study period, a series of economic and demographic shifts occurred. The social safety net was radically altered through the 1996 welfare reform, which drastically reduced cash assistance, but the introduction of the Earned Income Tax Credit served to boost the wages of low-income workers. Meanwhile, decreased unionization (Mishel 2012) and the declining value of the minimum wage (Desilver 2017) meant reduced income for working families. These economic changes occurred as the cost of housing increased. Additionally, increased cohabitation rates and births to unmarried women (Cherlin 2004) as well as the rise of dual-income households (Pew Research Center 2015) changed household economics. All these factors likely altered the relationship between housing assistance and housing cost burden. The current paper addresses these changing factors by controlling for cash assistance receipt and family-level characteristics.

Criminal justice trends, particularly mass incarceration, have also shaped individuals' and families' access to housing assistance and, by extension, possible reductions in housing cost burden (National Housing Law Project 2018). Beginning in 1975, federal guidelines to

PHAs specified that applicants' criminal histories should be considered. In 1996, public housing tenants could be evicted if a member of their household was connected to criminal activity. It was not until 2011 that the federal government encouraged PHAs to permit ex-offenders in public housing units. Unfortunately, the PSID has not regularly collected information on household members' criminal justice involvement (with one exception: in 1995, respondents were asked whether individuals in the household aged 14–49 had been charged with breaking the law). Because I cannot identify individuals with these backgrounds, it is possible that the reference category in the present analyses includes children whose families may not have been eligible for public housing because of a household member's criminal history.

Future research with more contemporary data reflecting the prevalence and severity of housing cost burden in the United States would provide important contributions to the understanding of the association between public housing and housing cost burden. Such analyses could ensure that policy proposals, such as the recent proposal to increase public housing residents' rent payments (Booker 2018), would be informed by empirical evidence. This research could also simulate proposed policy changes to evaluate their potential impacts on families' financial wellbeing.

In conclusion, public housing reduces families' housing cost burdens. By reducing housing cost burdens, cash-strapped families gain income to spend on things that benefit parents and children, such as food, clothing, and school- and job-related expenses. With reduced housing costs, parents may also be able to spend additional time with their children, rather than working more hours to make ends meet. Due to limited funds, housing subsidy programs for low-income households assist only a fraction of eligible families. Additionally, lack of political support makes increasing public housing stock unlikely, even though results from the current paper indicate that public housing may be a powerful and fast-acting tool to reduce families' housing cost burdens. The most promising investments to preserve public housing stock seem to be through the existing Rental Assistance Demonstration program, which has been used to leverage private funds to make capital investments in public housing stock. Another, larger, policy proposal that would help cost-burdened renters would be a universal housing voucher program to subsidize families' housing costs (Desmond 2016). Such a broad-reaching policy is appropriate given the increasing unaffordability of housing in the United States across the economic spectrum. In sum, public housing is a valuable tool for reducing housing cost burden but, given the magnitude of the housing affordability crisis and policy barriers to investments in such housing, researchers and policymakers should continue to strongly consider housing assistance that would reach a greater proportion of families burdened by unaffordable housing costs.

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Appendix A:: Multivariate analyses showing results for year in which the child was born

	Housing assistance and time-varying covariates lagged 2 years (n=5,574 observations on 942 children)			Housing assistance and time-varying covariates lagged 1 year (n=3,371 observations on 916 children)		
	Model 1: Random effects	Model 2: Fixed effects	Model 3: Random effects	Model 4: Fixed effects		
Independent variables						
Housing assistance (comparison group: no housing assistance)						
Public housing	-0.10 *** (-4.21)	-0.02 (-0.71)	-0.23 *** (-7.90)	-0.21 *** (-4.54)		
Other assistance	-0.07 ** (-2.93)	-0.03 (-1.11)	-0.09 * (-2.52)	-0.02 (-0.36)		
Baseline covariates						
Female	-0.01 (-0.38)		0.00 (0.21)			
Low birth weight	0.10 * (2.13)		0.07 (1.28)			
Mom's education (comparison group: less than HS)						
High school or GED	-0.03 (-1.46)		-0.02 (-0.89)			
Some college or higher	-0.03 (-1.29)		-0.04 (-1.23)			
Race (comparison group: white, non-Hispanic)						
Black, non-Hispanic	0.01 (0.34)		-0.01 (-0.19)			
Other	-0.01 (-0.16)		0.07 (-1.12)			
Mom's age (years)	0.00 (0.00)		0.00 (-0.03)			
Year born (comparison group: born in 1970)						
1971	0.06 (0.40)		-0.22 (-1.32)			
1972	0.25 (1.76)		0.03 (0.20)			
1973	0.25 * (1.96)		0.08 (0.58)			
1974	0.23 (1.60)		0.05 (0.30)			
1975	0.23 (1.81)		0.06 (0.40)			
1976	0.23 (1.80)		0.03 (0.22)			
1977	0.21 (1.67)		0.05 (0.36)			

Housing assistance and time-varying covariates lagged 2 years (n=5,574 observations on 942 children)					Housing assistance and time-varying covariates lagged 1 year (n=3,371 observations on 916 children)							
	Model 1: Random effects			Model 2: Fixed effects		Model 3: Random effects		Model 4: Fixed effects				
Time-varying characteristics (lagged 2 years)	1978	0.25	*	(2.03)		0.03	(0.20)					
	1979	0.23		(1.86)		0.03	(0.21)					
	1980	0.26	*	(2.12)		−0.03	(−0.22)					
	1981	0.25	*	(2.12)		0.07	(0.52)					
	1982	0.24	*	(1.99)		−0.03	(−0.21)					
	1983	0.22		(1.83)		0.06	(0.45)					
	1984	0.33	**	(2.80)		0.08	(0.64)					
	1985	0.30	*	(2.54)		0.13	(0.97)					
	1986	0.30	*	(2.43)		0.10	(0.77)					
	1987	0.32	**	(2.71)		0.09	(0.69)					
	1988	0.33	**	(2.74)		0.10	(0.78)					
	1989	0.31	**	(2.58)		0.03	(0.23)					
	1990	0.35	**	(2.95)		0.13	(0.97)					
	1991	0.31	*	(2.55)		−0.02	(−0.18)					
1992	0.29	*	(2.42)		0.03	(0.25)						
Individual w/ disability in HH	−0.02		(−0.69)	−0.01	(−0.17)	−0.04	(−1.07)	−0.04	(−0.73)			
Both male and female children in HH	−0.02		(−0.79)	−0.03	(−0.90)	−0.03	(−1.04)	−0.08	(−1.67)			
Number of children in HH	−0.01		(−0.96)	0.00	(0.29)	0.00	(−0.53)	0.01	(0.76)			
Number of adults in HH	−0.03	**	(−3.01)	−0.02	(−1.52)	−0.05	***	(−3.25)	−0.04	*	(−2.14)	
Mom has formed household separate from parents	−0.04		(−1.51)	0.05	(1.53)	−0.02	(−0.66)	0.06	(1.09)			
Male household head	−0.09	***	(−3.86)	−0.01	(−0.51)	−0.09	**	(−3.14)	0.00	(0.00)		
Received cash assistance	0.01		(0.58)	0.02	(0.98)	0.02	(1.00)	0.02	(0.97)			
Income to poverty ratio	−0.03		(−1.84)	−0.03	*	(−1.96)	0.02	(1.25)	0.05	*	(2.40)	
Region												
Midwest	−0.03		(−0.75)	0.47	**	(2.82)	−0.08	(−1.92)	0.64	**	(2.64)	
South	−0.15	***	(−4.35)	0.30	*	(2.18)	−0.19	***	(−4.60)	0.38	*	(1.99)
West	0.03		(0.69)	0.12		(0.56)	−0.06	(−1.02)	0.86	**	(2.80)	
Poverty rate (census tract)	0.00	*	(−2.15)	0.00	*	(−2.44)	0.00	**	(2.63)	0.00	**	(3.16)

	Housing assistance and time-varying covariates lagged 2 years (n=5,574 observations on 942 children)				Housing assistance and time-varying covariates lagged 1 year (n=3,371 observations on 916 children)			
	Model 1: Random effects		Model 2: Fixed effects		Model 3: Random effects		Model 4: Fixed effects	
Percent white (census tract)	0.00	(-1.89)	0.00	(-1.09)	0.00	(-1.62)	0.00	(-0.43)
Median rent (census tract)	0.00	(-1.67)	0.00	*** (-3.75)	0.00	*** (3.77)	0.00	** (3.23)

Note: Numbers presented are regression coefficients and t-statistics in parentheses. Models also control for year of birth (1970–1992).

* p<0.05,

** p<0.01,

*** p<0.001

References

- Ai Chunrong, and Norton Edward C. 2003 “Interaction terms in logit and probit models.” *Economics Letters* 80 (1):123–129. doi: 10.1016/S0165-1765(03)00032-6.
- Angrist Joshua D., and Pischke Jörn-Steffen. 2008 *Mostly harmless econometrics: An empiricist’s companion*. Princeton: Princeton University Press.
- Belsky ES, Goodman J, and Drew R 2005 *Measuring the nation’s rental housing affordability problem*. Harvard Joint Center for Housing Studies.
- Booker Brakkton. 2018 “HUD Unveils Plan To Increase Rent On Millions Receiving Federal Housing Assistance.” *National Public Radio*. <https://www.npr.org/2018/04/25/605900171/hud-unveils-plan-to-increase-rent-on-millions-receiving-federal-housing-assistan>.
- Breen R, Karlson KB, and Holm A 2013 “Total, direct, and indirect effects in logit and probit models.” *Sociological Methods & Research* 42 (2):164–191. doi: 10.1177/0049124113494572.
- Cherlin Andrew J. 2004 “The Deinstitutionalization of American Marriage.” *Journal of Marriage and Family* 66 (4):848–861. doi: 10.1111/j.0022-2445.2004.00058.x.
- Comey Jennifer, Popkin Susan J., and Franks Kaitlin. 2012 “MTO: A Successful Housing Intervention.” 87.
- Dastrup S, McDonnell S, and Reina V 2011 “Household energy bills and subsidized housing” *American Housing Survey User Conference*, Washington, D.C.
- Department of Housing and Urban Development. 2002 *FACT SHEET: “How Your Rent Is Determined” For Public Housing and Housing Choice Voucher Programs*. edited by Department of Housing and Urban Development Washington, D.C.
- Department of Housing and Urban Development. 2017 *Public and Indian Housing: Public Housing Capital Fund, 2017 Summary Statement and Initiatives*.
- Desilver Drew. 2017 *5 facts about the minimum wage*. Pew Research Center.
- Desmond Matthew. 2016 *Evicted: Poverty and Profit in the American City*. New York, NY: Broadway Books.
- Eggers Frederick J., and Moumen Fouad. 2008 *Trends in Housing Costs: 1985 – 2005 and the 30-Percent-of-Income Standard*. Department of Housing and Urban Development.
- Fletcher Jason M., Andreyeva Tatiana, and Busch Susan H. 2009 “Assessing the effect of changes in housing costs on food insecurity.” *Journal of Children & Poverty* 15 (2):79–93.
- Forget EL 2011 “The Town with No Poverty: The Health Effects of a Canadian Guaranteed Annual Income Field Experiment.” *Canadian Public Policy* 37 (3):283–305.
- Gold Sarah. 2018 “Housing Assistance and Residential Stability among Low-Income Children.” *Social Service Review* 92 (2):171–201. doi: 10.1086/697372.

- Gress Taryn, Cho Seungjong, and Joseph Mark. 2016 HOPE VI Data Compilation and Analysis In National Initiative on Mixed-Income Communities: Case Western Reserve University.
- Harkness J, and Newman SJ 2005 "Housing affordability and children's well-being: Evidence from the National Survey of America's Families." *Housing Policy Debate* 16 (2):223–255. doi: 10.1080/10511482.2005.9521542.
- Hellevik Ottar. 2009 "Linear versus logistic regression when the dependent variable is a dichotomy." *Quality & Quantity* 43 (1):59–74. doi: 10.1007/s11135-007-9077-3.
- Horn KM, Ellen IG, and Schwartz AE 2014 "Do Housing Choice Voucher holders live near good schools?" *Journal of Housing Economics* 23:28–40.
- Joint Center for Housing Studies. 2016 *The State of the Nation's Housing 2016*. Cambridge, MA: Harvard.
- Joint Center for Housing Studies. 2017 *America's Rental Housing 2017*. Cambridge, MA: Harvard Kennedy School.
- Joint Center for Housing Studies. 2018 *America's Rental Housing 2018*. Cambridge, MA: Harvard Kennedy School.
- Kingsley Thomas G. 2017 Trends in housing problems and federal housing assistance. Urban Institute.
- Kroneman Leoniek, Loeber Rolf, and Hipwell Alison E. 2004 "Is Neighborhood Context Differently Related to Externalizing Problems and Delinquency for Girls Compared with Boys?" *Clinical Child and Family Psychology Review* 7 (2):109–122. [PubMed: 15255175]
- Kucheva Yana. 2018 "Subsidized Housing and the Transition to Adulthood." *Demography* 55 (2):617–642. doi: 10.1007/s13524-018-0656-9. [PubMed: 29542072]
- Ludwig Jens, Duncan Greg J., Gennetian Lisa A., Katz Lawrence F., Kessler Ronald C., Kling Jeffrey R., and Sanbonmatsu Lisa. 2013 "Long-Term Neighborhood Effects on Low-Income Families: Evidence from Moving to Opportunity." *American Economic Review* 103 (3):226–31. doi: 10.1257/aer.103.3.226.
- Massey Douglas, and Lundy Garvey. 2001 "Use of Black English and Racial Discrimination in Urban Housing Markets." *Urban affairs review* (Thousand Oaks, Calif.) 36 (4):452–469.
- Mast Brent D. 2012 "Comparing Public Housing and Housing Voucher Tenants With Bayesian Propensity Scores." *Cityscape* (1):55.
- Mast Brent D. 2014 "Markov Chain Model of Rent Burden in the Housing Choice Voucher Program." *Journal of Housing Research* 23 (2):177–202.
- McClure K 2005 "Rent Burden in the Housing Choice Voucher Program." *Cityscape* 8 (2):5.
- McClure K 2017 *Length of Stay in Assisted Housing*. U.S. Department of Housing and Urban Development.
- McClure K, and Johnson B 2014 "Housing Programs Fail to Deliver on Neighborhood Quality, Reexamined." *Housing Policy Debate*. doi: 10.1080/10511482.2014.944201.
- McClure Kirk. 2019 "The allocation of rental assistance resources: the paradox of high housing costs and high vacancy rates." *International Journal of Housing Policy* 19 (1):69–94. doi: 10.1080/19491247.2017.1362756.
- Mishel Lawrence. 2012 *Unions, inequality, and faltering middle-class wages*. Economic Policy Institute.
- Mood Carina. 2010 "Logistic regression: Why we cannot do what We think we can do, and what we can do about it." *European Sociological Review* 26 (1):67–82. doi: 10.1093/esr/jcp006.
- National Housing Law Project. 2018 *An Affordable Home on Re-entry: Federally Assisted Housing and Previously Incarcerated Individuals*. San Francisco, CA.
- Newman Sandra, and Schnare AB 1997 "“... And a suitable living environment”: The failure of housing programs to deliver on neighborhood quality." *Housing Policy Debate* 8 (4).
- Owens A 2017 "How Do People-Based Housing Policies Affect People (and Place)?" *Housing Policy Debate* 27 (2):266–281. doi: 10.1080/10511482.2016.1169208.
- Pew Research Center. 2015 *The Rise in Dual Income Households*.
- Rice D, and Sard B 2009 *Decade of neglect has weakened federal low-income housing programs: New resources required to meet growing needs*. Center of Budget and Policy Priorities.

- Sanbonmatsu L, Ludwig J, Katz LF, Gennetian LA, Duncan GJ, Kessler RC, and Lindau ST 2011 Moving to Opportunity for Fair Housing Demonstration Program: Final Impacts Evaluation.
- Schwartz AF 2015 Housing Policy in the United States. 3 ed. New York, NY: Routledge.
- Shroder Mark. 2002 “Does housing assistance perversely affect self-sufficiency? A review essay.” *Journal of Housing Economics* 11:381–417. doi: 10.1016/S1051-1377(02)00128-6.
- The National Low Income Housing Coalition. 2018 Out of reach: The high cost of housing.
- U.S. Department of Housing and Urban Development. 2017 Picture of Subsidized Housing.
- United States Congress. 1937 The Housing Act of 1937.
- Von Hippel P 2015 “Linear vs. Logistic Probability Models: Which is Better, and When?”. *Statistical Horizons*. <http://statisticalhorizons.com/linear-vs-logistic>.

Table 1:

Housing assistance and housing cost burden: Descriptive statistics and significance tests (N=5,574, with observations on 942 children)

	Entire sample (n=5,574)		No housing assistance (n=4,251)		Public housing (n=736)		Sig. test (comp. public housing to none)
<i>Independent variables</i>	% or Mean	SD	% or Mean	SD	% or Mean	SD	
No housing assistance	76.26						
Public housing	13.20						
Other housing assistance [^]	10.53						
Housing cost burden							
Experienced housing cost burden	44.56		49.47		23.10		***
Baseline covariates							
Female (%)	52.26		51.26		57.88		**
Low birthweight (%)	4.65		4.78		2.04		**
Mom's education at birth (%)							***
Less than HS	60.53		59.73		75.82		
HS or GED	24.36		24.77		14.40		
Some college or higher	15.11		15.50		9.78		
Race (%)							
White	9.31		10.84		4.35		
Black	87.03		85.04		95.24		
Other	3.66		4.12		[^]		
Mom's age at birth (years)	29.94	11.04	29.65	10.75	31.17	12.52	**
Time-varying covariates							
<i>Household characteristics</i>							
Individual w/ disability in HH	6.67		6.98		4.00		*
Both male and female children in HH	64.62		64.06		69.02		**
Number of children in HH	3.05	1.59	3.04	1.59	3.22	1.62	*
Number of adults in HH	1.36	0.73	1.38	0.75	1.28	0.69	**
Mom has formed household separate from parents	89.45		89.23		88.45		
Male household head	15.72		16.77		13.91		
Received cash assistance	52.94		52.84		61.02		***
Income to poverty ratio	0.61	0.50	0.63	0.51	0.52	0.39	***

Region	Entire sample (n=5,574)	No housing assistance (n=4,251)	Public housing (n=736)	Sig. test (comp. public housing to none)
	SD	SD	SD	
Northeast	7.74	7.15	8.29	
Midwest	34.33	37.49	25.54	
South	50.61	47.31	63.99	
West	7.32	8.05	2.17	
<i>Census tract characteristics</i>				
Below the poverty line (%)	28.69	26.84	39.74	***
White (%)	30.20	30.55	28.08	
Median rent (\$)	234.56	241.59	163.19	***

Notes:

[^] Other HA are not included in significance tests because this category is heterogeneous (comprises many different programs). Abbreviations: high school (HS), household (HH).

* p<.05,

** p<.01,

*** p<.001

Table 2:

Housing assistance and housing cost burden: Multivariate regression analyses

	Housing assistance and time-varying covariates Lagged 1 year (n=3,371 observations on 916 children)			
	Model 1: Random effects	Model 2: Fixed effects	Model 3: Random effects	Model 4: Fixed effects
Independent variables				
Housing assistance (comparison group: no housing assistance)				
Public housing	-0.10 *** (-4.21)	-0.02 (-0.71)	-0.23 *** (-7.90)	-0.21 *** (-4.54)
Other assistance	-0.07 ** (-2.93)	-0.03 (-1.11)	-0.09 * (-2.52)	-0.02 (-0.36)
Baseline covariates				
Female	-0.01 (-0.38)		0.00 (0.21)	
Low birth weight	0.10 * (2.13)		0.07 (1.28)	
Mom's education (comparison group: less than HS)				
High school or GED	-0.03 (-1.46)		-0.02 (-0.89)	
Some college or higher	-0.03 (-1.29)		-0.04 (-1.23)	
Race (comparison group: white, non-Hispanic)				
Black, non-Hispanic	0.01 (0.34)		-0.01 (-0.19)	
Other	-0.01 (-0.16)		0.07 (1.12)	
Mom's age (years)	0.00 (0.00)		0.00 (-0.03)	
Time-varying characteristics (lagged 2 years)				
Individual w/ disability in HH	-0.02 (-0.69)	-0.01 (-0.17)	-0.04 (-1.07)	-0.04 (-0.73)
Both male and female children in HH	-0.02 (-0.79)	-0.03 (-0.90)	-0.03 (-1.04)	-0.08 (-1.67)
Number of children in HH	-0.01 (-0.96)	0.00 (0.29)	0.00 (-0.53)	0.01 (0.76)
Number of adults in HH	-0.03 ** (-3.01)	-0.02 (-1.52)	-0.05 *** (-3.25)	-0.04 * (-2.14)
Mom has formed household separate from parents	-0.04 (-1.51)	0.05 (1.53)	-0.02 (-0.66)	0.06 (1.09)
Male household head	-0.09 *** (-3.86)	-0.01 (-0.51)	-0.09 ** (-3.14)	0.00 (0.00)
Received cash assistance	0.01 (0.58)	0.02 (0.98)	0.02 (1.00)	0.02 (0.97)
Income to poverty ratio	-0.03 (-1.84)	-0.03 * (-1.96)	0.02 (1.25)	0.05 * (2.40)
Region				

		Housing assistance and time-varying covariates Lagged 2 years (n=5,574 observations on 942 children)				Housing assistance and time-varying covariates Lagged 1 year (n=3,371 observations on 916 children)			
		Model 1: Random effects		Model 2: Fixed effects		Model 3: Random effects		Model 4: Fixed effects	
Midwest		-0.03	(-0.75)	0.47	**	-0.08	(-1.92)	0.64	**
South		-0.15	(-4.35)	0.30	*	-0.19	(-4.60)	0.38	*
West		0.03	(0.69)	0.12		-0.06	(-1.02)	0.86	**
Poverty rate (census tract)		0.00	(-2.15)	0.00	*	0.00	(2.63)	0.00	**
Percent white (census tract)		0.00	(-1.89)	0.00		0.00	(-1.62)	0.00	
Median rent (census tract)		0.00	(-1.67)	0.00	**	0.00	(3.77)	0.00	**

Note: Numbers presented are regression coefficients and t-statistics in parentheses. Models also control for year of birth (1970–1992).

* p<0.05,
** p<0.01,
*** p<0.001

Table 3:

Robustness checks with one- and two-year lags

	Housing assistance lagged two years				Housing assistance lagged one year	
	Model 1: Random Effects	Model 2: Fixed Effects	Model 3: Random Effects	Model 4: Fixed Effects	Model 3: Random Effects	Model 4: Fixed Effects
Standard errors clustered at family level						
Public housing (ref=no housing assistance)	-0.10 **	(-3.08)	-0.02	(-0.60)	-0.21 ***	(-6.83) -0.21 *** (-4.38)
Only one child per household						
Public housing (ref=no housing assistance)	-0.11 **	(-3.44)	-0.03	(-0.82)	-0.20 ***	(-5.44) -0.20 *** (-3.67)
Permanent income 30% of AMI						
Public housing (ref=no housing assistance)	-0.12 **	(-3.18)	-0.04	(-0.79)	-0.20 ***	(-4.79) -0.15 * (-2.53)
Renting for at least three years						
Public housing (ref=no housing assistance)	-0.10 ***	(-4.38)	-0.02	(-0.68)	-0.22 ***	(-8.34) -0.21 *** (-5.28)
Renting for at least five years						
Public housing (ref=no housing assistance)	-0.11 ***	(-4.55)	-0.02	(-0.68)	-0.22 ***	(-8.53) -0.21 *** (-5.27)
Renting for at least 10 years						
Public housing (ref=no housing assistance)	-0.13 ***	(-5.23)	-0.02	(-0.81)	-0.24 ***	(-8.81) -0.21 *** (-5.16)
Number of adults as a moderator						
Public housing (ref=no housing assistance)	-0.16 ***	(-3.63)	-0.01	(-0.25)	-0.34 ***	(-6.48) -0.27 *** (-3.65)
Adults in the household	-0.04 ***	(-3.63)	-0.02	(-1.92)	-0.02	(-1.74) 0.00 (-0.16)
Public housing ## adults in the household	0.04	(1.58)	0.00	(0.15)	0.07 *	(2.42) 0.04 (0.94)
More than one adult as a moderator						
Public housing (ref=no housing assistance)	0.12 ***	(-4.54)	-0.02	(-0.46)	-0.29 ***	(-8.34) -0.24 *** (-4.70)
More than one adult in the household (ref= less than one adult in the household)	-0.11 ***	(-4.97)	-0.07 **	(-2.85)	-0.06 *	(-2.49) -0.02 (-0.86)
Public housing ## >1 adult in the HH	0.07	(1.54)	-0.01	(-0.21)	0.16 **	(2.90) 0.09 (1.29)

Note: Numbers presented are regression coefficients and t-statistics in parentheses. All models control for full set of covariates included in main analyses presented in Table 2. Abbreviations: reference category (ref) and area median income (AMI).

* p<0.05,

** p<0.01,

*** p<0.001