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**THE EFFECTS OF HOMEOWNERSHIP ON CHILDREN'S OUTCOMES:
REAL EFFECTS OR SELF-SELECTION?**

C. Scott Holupka, Ph.D.
Sandra J. Newman, Ph.D.
Johns Hopkins University
Institute for Policy Studies

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Policy Context

The empirical literature on the role of homeownership in children's outcomes overwhelmingly reports statistically significant beneficial effects of homeownership *per se*. This apparent consensus has been used by policymakers to argue for the "evidence-based policy" of promoting ever increasing rates of homeownership across the socioeconomic continuum. The policy question we are trying to answer in our research is whether there truly is a "homeownership effect" and, if so, does it apply across demographic and socioeconomic subgroups. For example, homeownership is viewed by some to increase residential stability, which is known to be beneficial for children's development. But no one has clearly disentangled whether homeowners are a self-selected group of stable households or whether homeownership, itself, increases stability. This is a key policy question since it may be possible to evince greater residential stability without the substantial responsibilities and burdens of homeownership (Newman 2008). Given the prominent role of homeownership in housing policy and the billions of taxpayer dollars involved, this research is a high priority for housing policy development. It has also taken on even greater urgency in roughly the last year with the foreclosure crisis.

Homeownership: The State of our Knowledge

Our reading of the homeownership literature reveals something at least as intriguing as the apparent alignment of findings. Seldom acknowledged in reviews of the body of homeownership research is the considerable unease expressed by several authors themselves about their finding statistically significant effects of homeownership on a range of child outcomes (e.g., Green and White 1997). The major focus of their concern is that the findings are the result of self-selection and not the causal effects of homeownership (Rohe, McCarthy and Van Zandt 2000).

Curiously, the handful of articles written from 2000 to the present offers a more mixed

picture of the existence of a homeownership effect.¹ At one end of the spectrum, for example, Haurin, Parcel and Haurin (2002) use the National Longitudinal Survey of Youth (NLSY) and instrumental variables (IV) to address self-selection and report findings that support the homeownership effect. But at the other end of the spectrum, Aaronson (2000) does an IV analysis with the Panel Study of Income Dynamics (PSID) and reports that the effects of homeownership are statistically insignificant.

Determining what accounts for these mixed results is important for taking the next step in knowledge development and, ultimately, designing truly evidence-based policy. Unfortunately, many of these studies are hampered by methodological weaknesses, which make it difficult to assess their results. Further, from a substantive perspective, none of the studies examines subgroup differences by income, race or similar covariates despite plausible arguments supporting such differences in the effects of homeownership.

In the next section, we offer a brief critical review of the four key articles in this more recent literature. We highlight the main approach taken in each study, the main findings, and the methodological questions that arise.

The Recent Homeownership Literature

One of the most often cited papers on the benefits of homeownership to children is the Haurin et al. (2002) paper noted earlier. They conduct time-series analyses over the 1988-1994 period with the NLSY data to examine the effects of homeownership on three childhood outcomes: the Peabody Individual Achievement Test (PIAT)-reading, the PIAT-math, and a standard measure of behavior problems. Their models include controls for child, parent and neighborhood characteristics, and they attempt to correct for selection bias by using an instrumental variable approach. Their instrument is an index of house prices they developed

¹ It is not clear whether the more recent work was inspired by the concerns of earlier researchers.

from both the Freddie Mac-Fannie Mae repeat sales housing price index combined with data from the American Chamber of Commerce Research Association, which provides values for all 50 states and 100 of the largest MSAs. Haurin et al. also test for the effects of the duration of homeownership by substituting the number of years the child lived in an owned home for the variable measuring whether the child was living in an owned home--that is, the homeownership variable. Improvements in reading and math scores are statistically significant at .10, but effects on behavior problems are not significant.² Similar results occur when they substitute their duration variable for the homeownership variable, which they interpret as support for the hypothesis that homeownership improves child outcomes.

The Haurin et al. paper has much to be praised, but we see three legitimate critiques. First, the ever-present challenge of IV analysis is the ability to find a measure that explains the variable of interest but is unrelated to the dependent variable. In this instance, the goal is to find a plausible IV that explains homeownership but is not correlated with child outcomes. We question the independence of the Haurin et al. IV since our recent research on housing affordability suggests that metropolitan area housing prices are, in fact, related to child outcomes (Harkness, Newman and Holupka, to appear). Additionally, it is impossible to judge the adequacy of the IV used in this analysis because the authors do not present findings from statistical tests designed for this purpose.³ Finally, the most common hypothesis for the

² Haurin et al. also examine the two potential mediating effects of Home Observation for Measurement of the Environment (HOME) subscales--the physical environment/cognitive stimulation subscale (HOME-C) and the emotional support subscale (HOME-E). The authors find that homeownership leads to significantly higher scores on both subscales: a 23 percent increase in HOME-C and a 13 percent increase in HOME-E. Although Haurin et al. discuss the direct and indirect effects of homeownership emanating from these models, they don't link the two HOME subscales to their hypotheses about how homeownership affects children. Thus, while they have developed a simple structural model, it doesn't seem to have been designed to test a specific structural hypothesis.

³ Murray (2006) describes a number of strategies that can be used to examine both the validity and strength of IVs, such as examining over-identifying restrictions, testing alternative instruments, and formally testing that the IV's relationship to the dependent variable is consistent with the proposed

supposed homeownership effect is that homeownership is a surrogate for residential stability, and that it is stability that lies at the heart of the beneficial effects on children--not homeownership itself. The Haurin et al. analysis doesn't test this premise directly for two reasons. First, they look only at length of time as a homeowner as a substitute for homeownership--not as a mediator, which would require including both homeownership and stability measures in their model.⁴ Second, because they measure stability among homeowners only, they do not control for any differences in the residential stability of renters (Barker and Miller 2008).

Aaronson's (2000) longitudinal analysis using the PSID extends Green and White's (1997) influential *Journal of Urban Economics* paper analyzing a single outcome of homeownership, staying in school until age 17. One of Aaronson's important extensions is using an IV in an effort to account for self-selection (something that Green and White did not do). Aaronson's IV for his homeownership equations is the average homeownership rates for racial groups and income quintiles (from the March CPS) for each state for each year covered by his analysis. Two other important extensions are his controls for the fraction of years a child moved between ages 7 and 16, along with a second IV--the family's mobility before the child turned 5--to account for possible selection bias in residential mobility. His initial models, which include measures of family composition, family income, and head's work status averaged over the child's lifetime (ages 7-16) produce positive and statistically significant effects of homeownership on the single educational attainment outcome he examines. When he includes a measure of mobility--the fraction of years with a move between ages 7 and 16--the

theoretical relationship. Murray also recommends using the Stock-Yogo test to examine the strength of an IV since a weak IV may not sufficiently reduce bias.

⁴ Note that if a family moved from one owned home to another, it would not be considered by the Haurin et al. measure.

homeownership effect declines by half. Finally, when IVs are included for both selection into homeownership and residential mobility, the effect of homeownership becomes statistically insignificant.

Aaronson's paper is also impressive, but we see three weaknesses. First, as with Haurin et al., Aaronson provides no statistical tests of the quality of his instrumental variables. Further, he examines only a single outcome. And third, even though his results clearly indicate that the significant effects of homeownership are eviscerated by the inclusion of controls for mobility and selection, Aaronson hedges substantially in his conclusions and essentially doesn't address his striking homeownership finding.

In a more recent study, Galster, Marcotte, Mandell, Wolman and Augustine (2007) also use the PSID in a longitudinal IV analysis of several young adult outcomes: whether the child graduated from high school, graduated from college, owned their own home, had a child before age 18, and the wage rate earned in young adulthood. Their initial findings parallel those of Green and White as well as Aaronson: even with extensive controls for child, parent and neighborhood characteristics, homeownership during childhood has a statistically significant beneficial effect on educational attainment (in this analysis, both high school and college graduation).⁵ Like Aaronson, after controlling for mobility using a similar measure--the proportion of years during childhood when the child did not move--the homeownership effect is reduced to statistical insignificance. Their IV is complex and incorporates measures of the metropolitan housing market, county homeownership rates and household incomes (e.g., indices of owner-occupied housing prices; index of gross rent; ratio of rental costs to homeownership costs). The IV results are provocative in showing no statistically significant effects of homeownership on high school or college graduation, child bearing before age 18, or wages.

⁵ They also find a significant effect on the likelihood of owning a home as a young adult, but no significant effects on teen births or wages.

However, the authors discount these results because of their very high standard errors, which is typical of IV models (Murray 2006).

As with Haurin et al. (2002) and Aaronson (2000), the Galster et al. paper has several strengths including the attempt to examine multiple outcomes. But their extremely complex IV produces results that the authors themselves do not trust, undermining their attempt to control for self-selection. Ultimately, it is unclear what the reader should conclude about the homeownership effect.

The final paper in the most recent homeownership literature is Barker and Miller's (forthcoming) analysis of multiple datasets: the PSID, NLSY, PUMS and Early Childhood Longitudinal Study (ECLS). Like Aaronson (2000), they also attempt to extend Green and White's PSID analysis (1997), in their case, by including additional covariates, most notably, whether the child had moved within the past two years and the past 10 years, net worth, and household vehicle ownership. Unlike Green and White, their analyses find no statistically significant effect of homeownership on staying in school once mobility and asset measures are included. Unfortunately, neither Green and White in 1997 nor Barker and Miller more than 10 years later take any steps to address self-selection. Green and White ignore this issue because they find no evidence of self-selection in their PSID analysis. Barker and Miller *do* find evidence of self selection, but then do not take the next step and conduct their own PSID analysis *after* taking self-selection into account. In the end, then, we are left with Green and White surmising that self-selection is at work though they see no evidence of it so they don't test for it, while Barker and Miller do a similar analysis, do find evidence of self-selection but then do not address it through IV or some other approach.⁶

⁶ Another concern is that Barker and Miller's PSID result that homeownership has no or negative effects is associated with very large standard errors once mobility measures are included. As a result, the 95 percent confidence interval includes both the point estimate for the beneficial effects of homeownership

Barker and Miller's analysis of the PUMS, NLSY and ECLS further weakens the case that homeownership, *per se*, has a positive effect on childhood outcomes. In their PUMS analysis, they find that homeownership has a weaker effect for those living in apartments and mobile homes than for those living in single-family homes. The PUMS data do not provide any measures of residential stability or net worth, which they acknowledge seriously limits their results. But they argue that the inconsistency of their homeownership findings across housing types calls into question the importance of ownership itself. An additional reason for skepticism about homeownership effects is that their difference-in-differences analysis with the NLSY produces no effect of changes in housing tenure on a similar set of child outcomes examined by Haurin et al. (e.g., cognitive skills, behavior problems, HOME-E). Once again, however, they urge caution in interpreting these results because the number of cases where tenure changed is small and the time span for the analysis is short. Finally, Barker and Miller's analysis of ECLS data shows that any significant differences between children of homeowners and children of renters in reading and math scores in first, third or fifth grades disappears when a set of child and family measures is included in their models.⁷ This absence of effects also applies to changes in cognitive test scores over time.

To sum up, then, while results from the more recent literature begin to undo the uniform support for a homeownership effect on child well-being found in earlier research, methodological issues with each of these new analyses mean the question is still far from being settled. Further, none of these studies conduct subgroup analyses either through split samples or interaction terms. As Rohe, McCarthy and Van Zandt (2000) point out, despite the fact that

and the point estimate for the neutral or negative effects of homeownership. Aaronson (2000) uses the PSID and a different analytic approach and also sees the erosion of the homeownership effect but without any increase in standard errors.

⁷ These variables include child's age and birth weight, family SES, mother's age at first birth, and WIC participation.

homeownership is strongly related to income, race and a range of other covariates, analyses to date generally do nothing to address this. For example, although income is typically included as an independent variable in models of homeownership effects, this assumes that homeownership has the same effect at all income levels despite strong arguments for why this may not be the case. A similar scenario applies to race, with most studies controlling for race under the assumption that the effect of homeownership is uniform across racial groups. Yet, blacks have historically lower homeownership rates than whites even after controlling for income and other factors, suggesting that the factors that predict homeownership among blacks may not be the same as those that apply to whites. Another complicating factor is that, even after controlling for child, parent and family characteristics, black children do not perform as well on various measures of academic achievement as whites. To the extent that blacks are more likely to be renters compared with whites, these differential achievement scores may be incorrectly attributed to homeownership.

Objectives and Approach

As this literature review demonstrates, recent research re-opens the question of whether homeownership, in fact, has beneficial effects on several child outcomes. But while this newer body of work deserves credit for questioning the “homeownership effect” consensus of past work, it suffers from its own set of weaknesses. Since resolving the self-selection question is fundamental to understanding whether there truly is a homeownership effect, it is one key focus of our analysis. Overall, our attempts to address selection leave only one or two marginal effects of homeownership. Although these effects are weak, we conducted a second set of analyses to try to understand *why* homeownership may matter for these child outcomes. While there has been much speculation about why homeownership matters, this question has not been explored in a systematic way. We, therefore, take an initial stab at how this effect operates--that is, the

mechanism(s) by which homeownership influences children's well-being. Our approach to each of these issues follows.

Selection

We attempt to address selection bias with a two-pronged approach: subgroup analysis, and statistical matching.

Subgroup Analysis. Evidence suggests that there are subgroup differences in the effects of homeownership on children, with recent results suggesting dramatic differences by income and race. Harkness and Newman (2003) and Green and White (1997), for example, find only weak effects of homeownership on affluent children compared with lower-income children, while Staub (2008) and Harkness and Newman (2005) find homeownership effects for white children but not black children. This population heterogeneity makes it more difficult to tease out homeownership effects when all subgroups are combined into a single analysis sample, as has been the norm to date. Including income and race among several covariates does not adequately address these subgroup differences. Instead, in this paper we analyze separate subgroups of white low-income children and black low-income children.⁸ We define low income as having an average family income in the lowest 30 percent of the overall 2002 PSID Child Development Supplement (CDS) sample.⁹

Statistical Matching. The few previous attempts to address self-selection rely on an IV approach. While IV estimates ideally avoid selection bias, achieving this ideal requires that the IV be highly correlated with the covariate of interest (in this case, homeownership) but uncorrelated with the outcome (in this case, measures of child well-being). As previously noted,

⁸ The sample includes too few Hispanics or children of other races for subgroup analyses.

⁹ The poorest 30 percent includes families with an average income over the life of the child of less than \$25,900 in 2001 dollars.

none of the recent research presents tests of the quality of the IVs used, and house price indices--the basis for the IVs used by all analysts except Aaronson (2000)--may, in fact, be related to child outcomes (Harkness, Newman and Holupka, forthcoming).

Instead of searching for a valid IV, we take a different approach. We statistically match cases within race and income subgroups using propensity score methods to create better balance between homeownership and renters. This method adjusts the weighting of cases, possibly even removing cases, so that the two groups look as similar as possible (i.e., minimizing differences in means) on all observed variables included in the construction of the propensity score. By contrast to an IV approach, matching does not assume that the measures used to create the propensity score are uncorrelated with the outcomes (Heckman & Navarro-Lozano 2004). On the other hand, matching methods correct for observed biases only, while a valid IV accounts for both unobserved and observed biases (Schneider et al. 2007).

Since matching is done before analyzing outcomes, multiple matching procedures can be examined to find the procedure that produces the best balance for a specific sample.¹⁰ After testing a variety of matching procedures available in a program developed by Ho, Imai, King and Stuart (2008), we found that the “full matching method” provided the best balance for the low-income white sample, and the “genetic matching procedure” provided the best balance for the black sample.¹¹ For the white sample, the full matching procedure yields 186 cases (51 homeowners and 135 renters). For the black sample, the genetic matching procedure yields 218 cases (117 homeowners and 101 renters).

¹⁰ By contrast, using multiple models to examine an outcome increases the likelihood of chance findings, and therefore some sort of correction procedure (e.g., Bonferroni correction) should be used to determine significance.

¹¹ The program developed by Ho, Imai, King and Stuart is called "MatchIt" and is designed to run using the R programming language. It can be downloaded at <http://gking.harvard.edu> See the technical appendix for more details on how the matching was done.

Mediators of Homeownership

Among the hypotheses that have been offered for why homeownership conveys benefits to children are that it increases residential stability, has positive psychological effects on parents that improve their parenting skills, and improves the quality and desirability of the child's neighborhood. We test each of these prominent hypotheses but caution that neighborhood measures are probably endogenous since the same factors that affect child outcomes may also affect the type of neighborhood the family lives in.

This analysis involves OLS tests of three relationships for the black and white low-income subgroups: (1) between homeownership and each child outcome; (2) between homeownership and each mediator; and (3) between each mediator and each child outcome controlling for homeownership.¹²

Data

The PSID and its 2002 CDS are the primary sources of data for this analysis. The PSID is an ongoing longitudinal survey of American households begun in 1968 by the University of Michigan Survey Research Center. Interviews were conducted annually until 1997 and biennially thereafter. The original sample of about 5,000 families grew over time as new families that split off from the original families were added to the survey. Low-income families were originally oversampled and, despite their greater attrition, they are still overrepresented in more recent waves of the data. The PSID is the source of two groups of measures used in this analysis: demographic and socioeconomic characteristics, a measure of neighborhood poverty, and a measure of house prices, as described below. The 2002 CDS is the source of the child outcome measures and the following hypothesized mediators: the parent's psychological status,

¹² See Baron & Kenny (1986).

the parent's assessment of neighborhood quality, and the parent's assessment of the home learning environment.

Dependent Variables

We examine three childhood outcomes: cognitive achievement, behavior problems, and health. Cognitive achievement is measured with scores from three tests in the battery of the Woodcock-Johnson Revised Tests of Achievement: Letter-Word, Passage Comprehension, and Applied Problems (Woodcock and Johnson 1990). The first two tests measure verbal ability and reading comprehension, and the third measures math ability.¹³ Higher scores indicate greater achievement.

Behavior is assessed using the Behavioral Problems Index (BPI), an abbreviated (30 item) version of the Child Behavior Check List appropriate for large-scale surveys (Peterson and Zill 1986). Questions are asked of parents or caregivers and include such items as how often the child is disobedient, is too fearful or anxious, or has trouble getting along with other children. Higher scores indicate more behavior problems.

The child's health status is measured by a five-category "poor to excellent" rating asked of the primary caregiver, typically the mother. Higher scores indicate better health.

The home learning environment is measured with a subset of questions from the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell & Bradley 1984). Parents were asked to assess the educational and cultural environment within the home (e.g., Does the child have access to a musical instrument? What learning materials are available

¹³ The Woodcock-Johnson tests are normed like IQ tests to have a mean of 100 and a standard deviation of 15. The Letter-Word and Applied Problems tests can be given to children three years of age or older, while children must be at least six years old to complete the Passage Comprehension test. Since only children who participated in the 1997 CDS were eligible for the 2002 CDS, our analysis sample includes no children less than five. Children less than six were given the letter-word and applied problems tests only, while children six and older also completed the passage comprehension test.

in the home?) and outside the home (e.g., How often is the child taken on educational or cultural outings?)

Independent Variables

Homeownership is defined as the fraction of the child's life spent in an owned home. Other independent variables include the child's age, mother's age and education, the percentage of the child's life in a two-parent family, whether the child always lived in a one-parent family, the average number of siblings, the percentage of the child's life that the family received welfare, whether the child's family always received welfare, the average family income over the child's lifetime,¹⁴ whether the child was ever breastfed,¹⁵ and a measure of house prices. We include socioeconomic attributes from the child's birth through 2001 to account for possible cumulative effects (Todd and Wolpin 2003). Limiting the sample to low-income families reduces the variance of many of these variables (e.g., family income, mother's education), affecting both the direction and strength of the relationship between these variables and outcomes. Also note that mother's age, education and whether the child was breastfed was missing on 1-2 percent of the total sample. These missing values were imputed using a multivariate imputation procedure.

The PSID geocode allows us to include a control for house prices, which affect the likelihood of homeownership and which our work on housing affordability suggests have an effect on child outcomes (Harkness, Newman and Holupka, forthcoming). We rely on HUD's Fair Market Rents (FMRs)¹⁶ as our house price measure.^{17,18} The geocode is also the source of

¹⁴ Income was specified as the annual family income in 2001 dollars averaged over the life of the child.

¹⁵ Breastfeeding has been demonstrated in previous research to have positive effects on child development (e.g., Perez-Escamilla 2005; Woodward and Liberty 2005; Lawrence 2005; Kramer 2005).

¹⁶ FMR values were adjusted by the CPI and then averaged over the life of the child.

¹⁷ HUD sets the FMR annually for every housing market in the country. According to the Federal Register, "the FMR for an area is the amount that would be needed to pay the gross rent (shelter rent plus utilities) of privately-owned, decent, and safe rental housing of a modest (non-luxury) nature with suitable

the neighborhood poverty variable, which comes from 1980, 1990 and 2000 census tract data.¹⁹ The neighborhood quality measure is based on a 5-point ordinal scale (1=poor, 5=excellent) asking parents or caregivers how they rate the neighborhood as a place to raise children.²⁰

Sample Characteristics

Univariate statistics for the low-income black and white samples (black N=712; white N=86) are shown in Appendix Table 1. Woodcock-Johnson test scores are missing for one-quarter of the black sample and one-third of the white sample, and measures of parent's psychological status are missing for 15 percent of the black sample and one-quarter of the white sample. The primary reason for most of the missing data is that both the achievement tests and psychological status measures require in-person administration and 15 percent of the black sample and 25 percent of the white sample were interviewed by phone in an effort to conserve costs. Tests for possible nonresponse bias on homeownership and multiple background characteristics reveal no consistent patterns.²¹

amenities" (Federal Register 2006). It is generally set at the 40th percentile of the rent distribution for standard quality units.

¹⁸ We did not include an additional price measure for owned housing because the correlation between the FMR and the National Association of Realtors (NAR) metropolitan house price index was .82, thus raising concerns about multicollinearity. We used the NAR index because it has the longest time series and the most inclusive geographic coverage of existing house price indices, though it is not available over time for all metropolitan areas in the PSID.

¹⁹ Decennial tract data are interpolated linearly to create a neighborhood poverty measure for each PSID interview over the life of the child.

²⁰ Because owner-occupied housing is more likely to be located in non-metropolitan areas than renter-occupied housing, not controlling for the urbanicity of the location could produce spurious results if this locational effect were attributed to homeownership. Therefore, we tested models with two alternative measures of urbanicity: population density, and proportion of urban housing units in the region. Neither variable changed the effects of homeownership on outcomes, nor was there a change in explanatory power.

²¹ For example, in the white sample, those interviewed by telephone had somewhat lower family incomes (about \$19,000 versus about \$21,000) and reported relatively more moves (.4 versus about .2) compared with those interviewed in person. In the black sample, those interviewed by phone had somewhat higher

Although both samples are limited to children in low-income families, black children are generally much more disadvantaged. Average annual family income is \$15,190 compared with \$19,710 for white children. Welfare rates are also substantially higher, with black children spending an average of 60 percent of their lives in families receiving welfare compared with 38 percent for white children. And the percentage of children living their entire lives in families receiving welfare is more than twice as large: 21 percent versus 10 percent, respectively.

Much of the difference in income may be attributable to family structure. Black children spend less than one-quarter of their lives, on average, living in a two-parent family compared with almost two-thirds for white children (23 percent versus 64 percent, respectively). On average, black children also have more siblings: 1.59 compared with 1.21 for whites. The mothers of black children are also more likely to report having less than a high school education (44 percent versus 37 percent, respectively), and less likely to have any college exposure. Overall, black children spend less of their childhood living in an owned home, on average (21 percent versus 33 percent, respectively), and fewer black children have ever lived in an owned home (43 percent versus 61 percent, respectively).

Black children in the sample perform appreciably worse than white children on the three Woodcock-Johnson achievement tests, with black children scoring about one-half of a standard deviation lower, on average. There are no appreciable differences between black and white children on either the behavior problems index or the health measure, however.

There are also few, if any, differences between black and white families in their likelihood of moving, various measures of the psychological well-being of parents, or in the HOME scale. Black parents, however, report somewhat lower neighborhood quality than white

incomes (roughly \$15,000 versus \$14,000) and children had fewer siblings (approximately 1.5 versus 1.8) than those interviewed in person.

parents (on a 5-point scale, 3.08 versus 3.53, respectively), and the rate of neighborhood poverty is a higher for blacks (29 percent versus 16 percent, respectively).

Appendix Table 1 also provides sample characteristics for the matched samples. Since matching is designed to reduce differences between homeowners and renters in each sample, it is not surprising that, for the black sample, matching produces a higher average family income (\$17,060 post-match compared with \$15,190 pre-match); more time spent on average in a two-parent family (31 percent versus 23 percent); less time spent on welfare (49 percent of the child's life versus 60 percent), and fewer years during which the child experienced a move (33 percent to 23 percent). There are no appreciable differences in the matched black sample in achievement, behavior or health measures, little change in parent psychological status, and no differences in the HOME scale or the neighborhood measures. There are fewer differences between the pre- and post-match white samples.

Results

Does Homeownership Affect Child Outcomes?

We estimate two sets of regression models on the black and white subsamples: the first before statistical matching, and the second after matching. These results are listed in the first two columns of Table 1.²²

For white children before matching, the effects of homeownership are positive and statistically significant at conventional levels on two of the three achievement measures (and at the .10 level on a third). Neither health nor behavior problems are significant. For black children before matching, there are no statistically significant relationships between homeownership and any of the child outcomes. Although the coefficients have the same sign for both whites and blacks, the size of the effects is roughly 5-10 times smaller for blacks. These

²² Appendix Tables 2-7 provide complete regression results.

results are generally consistent with Harkness & Newman (2005) and Staub (2008), who suggest that homeownership does not operate in the same way for black and white low-income children.

After matching, these results change dramatically. For white children, the effects of homeownership remain statistically significant for only one achievement measure, though at a reduced level. For black children, although matching increases the size of the coefficients, none are statistically significant at conventional levels.²³

These results suggest that the alternative approach of statistical matching to address selection yields the same conclusion as the IV approach adopted by recent studies: once selection is addressed, there is essentially no evidence of homeownership effects on child outcomes.

Why Might Homeownership Affect Child Outcomes?

Having reached this general conclusion, there is little point in pursuing the analysis of possible mediators for the large majority of child outcomes in our study since their relationship to homeownership is statistically insignificant. However, in the spirit of the exploratory nature of this paper, we take this next analytic step for the one childhood outcome measure for white children and black children that either reached, or nearly reached, the conventional .05 level of statistical significance. In each subsample, this single measure pertained to achievement, though the measure for white children (letter-word) is different from the measure for black children (passage comprehension). As shown in Table 1, letter-word reaches the .05 level for white children, while passage comprehension reaches the .10 level for black children.

The results of the second part of the mediator analysis, testing the relationship between homeownership and each mediator, are shown in Table 2. Residential stability, measured by the percentage of years with a move during a child's lifetime, is the only mediator with a statistically

²³ After matching, the measure of achievement that remains statistically significant for white children (letter-word) and the different measure of achievement that reaches the .10 level of significance for black children (passage comprehension) do not follow a consistent or understandable pattern and may be the result of unobserved selection.

significant relationship to homeownership among both white and black children. As expected, homeownership is associated with greater residential stability: the more of a child's lifetime spent in an owned home, the fewer the residential moves. Among white children, when homeownership and residential stability are both included in the child outcome (letter-word) model, the effect of homeownership on the letter-word measure of achievement declines and its statistical significance falls to the .10 level. This likely occurs because residential stability itself has some effect (.10 level) on this achievement measure, with children moving more having lower letter-word scores. Thus, to the extent that homeownership has an effect on this measure of achievement, it appears to operate by increasing residential stability.

For black children, when homeownership and residential stability are included in the child outcome (passage comprehension) model, the direct effect of homeownership increases somewhat, though it still remains statistically significant at only the .10 level. There is no evidence that homeownership influences this outcome by affecting the child's residential stability.

Discussion

Although the analysis presented here uses a different approach from recent research to address selection bias, the results are essentially the same: there is little evidence that homeownership has an effect on child well-being as measured by cognitive achievement, behavior problems and health. Like other recent studies, then, this paper suggests that the earlier findings, which overwhelmingly point to beneficial effects of homeownership on children, may have mistaken selection differences in who becomes a homeowner with the effect of homeownership itself.

This study also finds little evidence that homeownership conveys effects through the hypothesized (but rarely tested) mediators of the psychological status of the parent,

neighborhood attributes, and the home environment. But we find that homeownership is associated with greater residential stability--the most commonly hypothesized mediator--for both black and white low-income children. For white children, the results suggest that the positive effects of homeownership on one measure of achievement (letter-word) should partly be attributed to a reduction in children's residential mobility. Interestingly, the same mechanism does not operate for low-income black children. This general lack of mediator effects further confirms the absence of homeownership effects on children's outcomes.

It is worth noting that although the sample sizes in this analysis are modest, statistical power tests indicate that they are large enough to detect moderate effect sizes (Cohen's d of $\sim .5$). In fact, there is a greater chance of detecting an effect in the black sample--where we see no effects at conventional levels of statistical significance--than in the white sample.

The prominent role assigned to homeownership in U.S. housing policy and the sea change implied by our findings, and those of other recent studies, call for a series of future research steps. First, these analyses should be replicated and stress tested with different databases. Additionally, given the apparent importance of selection, further methodological and conceptual work is warranted, including developing better IVs, stronger matching methods, and a better understanding of how families become homeowners and the unmeasured characteristics of parents that undoubtedly play a role in this determination. Finally, the possible differences in the ways in which homeownership operates for black and white children merits attention.

References

- Aaronson, Daniel (2000). "A Note on the Benefits of Homeownership," *Journal of Urban Economics*, Vol. 47, pp. 356-369.
- Barker, David and Eric Miller (2008). "Homeownership and Child Welfare," *Real Estate Economics* (to appear).
- Baron, Reuben M. and David A. Kenny (1986). "The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations." *Journal of Personality and Psychology*, Vol. 51, pp. 1173-1182.
- Caldwell, Bettye and Robert Bradley (1984). *Home Observation for Measurement of the Environment*. Little Rock, AR: University of Arkansas at Little Rock.
- Federal Register (2006). "Fair Market Rents for Fiscal Year 2006 for Housing Choice Voucher, Moderate Rehabilitation, Single Room Occupancy, and Certain Other HUD Programs," Vol. 71, No. 30, pp. 7831-7841, February 14.
- Galster, George, Dave E. Marcotte, Marvin B. Mandell, Hal Wolman, and Nancy Augustine (2007). "The Impact of Parental Homeownership on Children's Outcomes during Early Adulthood," *Housing Policy Debate*, Vol. 18, No. 4, pp. 785-827.
- Green, Richard and Michelle J. White (1997). "Measuring the Benefits of Homeowning: Effects on Children," *Journal of Urban Economics*, Vol. 41, pp. 441-461.
- Harkness, Joseph and Sandra Newman (2003). "Differential Effects of Homeownership on children from Higher- and Lower-Income Families," *Journal of Housing Research*, Vol. 14, No. 1, pp. 1-19.
- Harkness, Joseph and Sandra Newman (2005). "Housing Affordability and Children's Well-Being: Evidence from the National Survey of America's Families," *Housing Policy Debate*, Vol. 16, No. 2, pp. 223-255.
- Harkness, Joseph, Sandra Newman and Scott Holupka. "Poverty, Housing Prices and the Well-Being of Children and Parents," *Journal of Urban Affairs*, to appear.
- Heckman, James and Salvador Navarro-Lozano (2004). "Using Matching, Instrumental Variables, and Control Functions to Estimate Economic Choice Models," *The Review of Economics and Statistics*, Vol. 86, No. 1, pp. 30-57.
- Haurin, Donald R., Toby L. Parcel and R. Jean Haurin (2002). "Does Homeownership Affect Child Outcomes?" *Real Estate Economics*, Vol. 30, No. 4, pp. 635-666.
- Ho, Daniel, Kosuke Imai, Gary King and Elizabeth Stuart. (2008). "MatchIt: Nonparametric Preprocessing for Parametric Causal Inference," *Journal of Statistical Software*, Vol. 171, pp. 481-502.

- Kramer, Michael S. (2005). "Breastfeeding Promotion and Early Child Development: Comments on Woodward and Liberty, Pere-Escamilla, Lawrence, and Greiner." *Encyclopedia on Early Childhood Development*. Published online at <http://www.excellence-earlychildhood.ca/documents/KramerANGxp.pdf>.
- Lawrence, Ruth A. (2005). "Supporting Breastfeeding/Early Childhood Social and Emotion Development," *Encyclopedia on Childhood Development*. Published online at <http://www.excellence-earlychildhood.ca/documents/LawrenceANGxp.pdf>.
- Murray, Michael P. (2006). "Avoiding Invalid Instruments and Coping with Weak Instruments," *Journal of Economic Perspectives*, Vol. 20, No. 4, pp. 111-132.
- Newman, Sandra (2008). "Does Housing Matter for Poor Families? A Critical Summary of Research and Issues Still to be Resolved," *Journal of Policy Analysis and Management, Policy Retrospectives Section*, Vol. 27, No. 4, pp. 895–925.
- Pérez-Escamilla, Rafael (2005). "Influence of Breastfeeding on Psychosocial Development," *Encyclopedia on Early Childhood Development*. Published online at <http://www.excellence-earlychildhood.ca/documents/Perez-EscamillaANGxp.pdf>.
- Peterson, James L. and Nicholas Zill (1986). "Marital Disruption, Parent-Child Relationships, and Behavior Problems in Children," *Journal of Marriage and the Family*, Vol. 48, pp. 295-307.
- Rohe, William M. et al. (2000). "The Social Benefits and Costs of Homeownership: A Critical Assessment of the Research," *Working Paper No. 00-01*, Research Institute of America: Washington, DC.
- Schneider, Barbara, Martin Carnoy, Jeremy Kilpatrick, William H. Schmidt and Richard J. Shavelson (2007). "Estimating Causal Effects Using Experimental and Observational Designs." Think Tank White Paper, American Educational Research Association.
- Staub, Leah (2008). *The Relationship between Homeownership and the Outcomes of Black and White Children*. Johns Hopkins University Institute for Policy Studies, Graduate Program in Public Policy thesis, April.
- Todd, Petra and Kenneth I. Wolpin (2003). "On the Specification and Estimation of the Production Function for Cognitive Achievement," *Economic Journal*, Vol. 113, No. 485, pp. F3-F33.
- Woodcock, Richard and M. Bonner Johnson (1990). *Woodcock-Johnson Psycho-Educational Battery-Revised*. New York: Riverside Publishing Company.
- Woodward, Kianne J. and Kathleen A. Liberty (2005). "Breastfeeding and Child Psychological Development," *Encyclopedia on Early Childhood Development*. Published online at <http://www.excellence-earlychildhood.ca/documents/Woodward-LibertyANGxp.pdf>.

Technical Appendix: Statistical Matching

Statistical matching “preprocesses” the data so that subgroups of interest--in this case homeowners and renters--are as much alike as possible on all covariates before conducting analyses. The “MatchIt” program (Ho et al. 2008) implements a variety of matching procedures, allowing us to select the one that maximizes the balance between homeowners and renters.²⁴

To conduct a match, we created a dichotomous variable based on the percentage of years a child was living in owner-occupied housing. The distribution of the original ownership variable is bi-modal in both the low-income black and white samples, with most children spending either very little, or almost all, of their lives in owner-occupied housing. We, therefore, defined the variable dichotomously: either children spent 50 percent or more of their lives in owner-occupied housing, or not. In this analysis sample, 16 percent of low-income black children are classified as being in homeownership families and 27 percent of low-income white children meet this definition.

An important consideration in developing a matching model is to include exogenous covariates only. Including endogenous, or potentially endogenous, covariates would create a tautology in the proposed selection model. Since the key variable here, homeownership, is measured over the life of the child, we excluded from the matching model a number of variables that are plausibly a consequence of homeownership. Examples include family characteristics that are also measured over the life of the child such as average family income, the percentage of the child’s life the family received welfare, and the average number of siblings. The model includes background characteristics such as the child’s and mother’s age, the mother’s

²⁴ The program is freeware designed to run using the R programming language. It can be downloaded at <http://gking.harvard.edu>

educational level, and whether the child was breastfed as an infant. Since housing and labor markets vary across the country, region of the country is also included.²⁵

Because outcome differences are not used to determine the matching procedure that produces the best balance, there is no reason not to try all six procedures available in MatchIt. The various matching procedures--exact matching, subclassification, nearest neighbor matching, optimal matching, full matching and genetic matching--differ on several dimensions, including whether the matching is done with or without replacement, whether specific matches are assigned to each "treatment" versus assigning both treatment and comparisons to similar subgroups, and whether the algorithm attempts to minimize differences one unit at a time versus trying to minimize an overall average distance score.

To test how well each procedure balances the two groups, we ran t-tests to assess the differences between homeowners and renters on all of the background and geographic variables before and after matching. The matching procedure that eliminates as many statistically significant differences between the two groups after matching can be said to provide the best balance. Full matching provided the best balance for the low-income white sample. Full matching computes a propensity score for each case and then matches one or more control (renter) cases to each treated (homeowner) case to minimize the weighted average of the propensity scores between them. Genetic matching worked best for the low-income black sample. Genetic matching uses a search algorithm to test weights for each covariate in the propensity model and then uses matching with replacement to match a control case to a treatment case. Both procedures essentially create weights for each case that are then used to run weighted OLS models.

²⁵ Ideally matches would be done using cases from the same metropolitan area, but there are too few cases per metropolitan area in the PSID to do matching at this fine-grained a level of geography.

Table 1: Effect of homeownership on childhood outcomes for low-income white and black samples

	Pre-match models	Post-match models	Post-match models with stability mediator	
			Ownership	Percent years moved
White				
Cognitive achievement				
Letter-word	21.51** (5.46)	20.08* (7.87)	14.55+ (8.42)	-17.61+ (9.75)
Passage comprehension	10.95* (5.01)	9.06 (6.60)		
Applied problems	9.42+ (4.71)	5.54 (5.23)		
Behavior problems				
BPI	-1.94 (3.37)	.36 (3.72)		
Health				
1-5 Scale	-.22 (.26)	-.37 (.31)		
Black				
Cognitive achievement				
Letter-word	2.47 (2.54)	5.09 (3.17)		
Passage comprehension	2.20 (2.12)	4.46+ (2.34)	5.82+ (3.12)	4.99 (5.77)
Applied problems	1.79 (2.17)	3.56 (2.82)		
Behavior problems				
BPI	-.08 (1.60)	-1.02 (2.59)		
Health				
1-5 Scale	-.03 (.13)	-.03 (.17)		

Notes:

1. Standard error in parentheses.

2. + $p \leq .10$; * $p \leq .05$; ** $p \leq .01$

3. See Appendix Tables 2-7 for complete model results.

4. Model with stability mediator only estimated if homeownership was significant at $p \leq .10$ in the Post-Match model.

Table 2: Effect of homeownership on potential mediators for low-income white and black matched samples

	White sample	Black sample
Residential stability		
Percent years moved	-.28*** (.07)	-.29*** (.04)
Parent's psychological status		
Self-esteem	.05 (.17)	-.16+ (.08)
Self-efficacy	.06 (.23)	-.05 (.13)
Parental Aggravation	-.34 (.47)	-.31 (.27)
Parental Depression	-.34 (.25)	-.11 (.15)
Home environment		
HOME	-.05 (.06)	.04 (.04)
Neighborhood attributes		
Neighborhood quality	-.13 (.45)	.23 (.25)
Neighborhood poverty	-4.46 (3.49)	-3.90+ (2.26)

Notes:

1. Standard error in parentheses.
2. + $p \leq .10$; *** $p \leq .001$

Appendix Table 1: Means and standard deviations for black and white children, pre- and post-matched samples

	Black				White			
	Pre-Match Mean	SD	Post-Matched Mean	SD	Pre-Match Mean	SD	Post-Matched Mean	SD
Female	.49	.50	.46	.50	.51	.50	.46	.50
Child's age	10.97	3.58	11.59	3.59	10.01	3.67	10.85	3.74
Mother's age	30.39	7.02	31.94	7.55	29.16	6.67	31.48	6.15
Mother's education								
< High School	.31	.47	.32	.47	.32	.47	.12	.32
High school	.44	.50	.45	.50	.37	.48	.46	.50
Some college	.21	.41	.21	.41	.21	.41	.35	.48
College graduate	.01	.12	.02	.13	.09	.28	.06	.25
Average family income	15.19	6.21	17.06	5.97	19.71	4.71	19.85	4.82
% years living with 2 parents	.23	.32	.31	.37	.64	.33	.64	.33
Always lived with 1 parent	.50	.50	.41	.49	.05	.23	.06	.23
% years on welfare	.60	.32	.49	.33	.38	.34	.33	.33
Always on welfare	.21	.41	.10	.30	.10	.30	.05	.21
Average # of siblings	1.59	1.11	1.53	1.09	1.21	.78	1.03	.72
Breastfed (1,0)	.16	.36	.16	.36	.45	.50	.39	.49
Average FMR	5.86	1.35	5.26	1.04	5.29	1.42	5.10	1.11
Letter word	94.47	16.92	95.00	14.89	101.96	18.51	103.80	19.7
Passage comp.	96.01	14.76	96.31	11.64	102.95	15.53	102.21	15.76
Applied problem	92.69	14.17	92.64	13.05	101.29	14.86	104.89	15.09
Behavior problem	45.25	10.91	44.87	11.07	46.93	11.22	47.27	12.11
Health	4.10	.91	3.94	.89	4.19	.83	4.10	.87
% years moved	.33	.25	.23	.22	.38	.28	.33	.25
Mothers:								
Self-esteem	3.42	.41	3.43	.39	3.32	.50	3.35	.45
Self-efficacy	3.04	.63	2.98	.63	2.91	.61	2.92	.60
Aggravation	2.47	1.11	2.57	1.17	2.44	1.05	2.62	1.16
Depression	.83	.70	.82	.67	.95	.79	.95	.75
HOME	1.02	.20	1.01	.18	1.10	.19	1.08	.19
Neighborhood								
Quality (1-5)	3.08	1.23	3.26	1.19	3.53	1.15	3.14	1.33
Poverty	.29	.13	.29	.12	.16	.08	.16	.08
% years in owned home	.21	.31	.50	.38	.33	.36	.38	.37

Notes:

1. SD = standard deviation.
2. See text for description of variables.

Appendix Table 2: Pre-match models, low-income white sample

	Cognitive Achievement			Behavior problems	Health
	Letter-word	Passage comprehension	Applied problem	BPI	1-5 scale
Homeownership	21.48 (5.44)	10.95 (5.01)	9.28 (4.69)	-2.02 (3.32)	-.24 (.25)
Child's age	.37 (.54)	-.60 (.50)	.08 (.47)	.15 (.33)	-.00 (.03)
Mother's age	.06 (.32)	-.19 (.30)	-.12 (.28)	-.35 (.20)	-.01 (.01)
Breastfed	-3.14 (3.23)	2.48 (2.94)	1.06 (2.79)	-4.28 (2.00)	.27 (.15)
Mom's education:					
< High school	1.35 (3.88)	.69 (3.48)	-6.00 (3.34)	.77 (2.44)	-.27 (.19)
Some college	7.34 (4.04)	4.94 (3.70)	.14 (3.48)	.97 (2.50)	-.10 (.19)
College graduate	21.59 (6.01)	7.87 (5.31)	8.15 (5.18)	.42 (3.77)	.15 (.29)
Percent of life w/ 2 parents	-5.74 (5.36)	.86 (4.86)	-3.28 (4.62)	.51 (3.36)	-.29 (.26)
Always live with 1 parent	2.58 (7.75)	-11.33 (6.91)	1.09 (6.69)	2.38 (5.01)	-.13 (.38)
Percent of life on welfare	1.41 (6.18)	2.34 (5.60)	-.97 (5.33)	8.95 (3.94)	.10 (.30)
Always on welfare	-6.46 (6.15)	-6.40 (5.52)	.92 (5.31)	-2.20 (4.01)	-.34 (.31)
Average # of siblings	-3.88 (2.31)	-3.72 (2.14)	-2.28 (2.00)	1.63 (1.47)	-.01 (.11)
Average family income	-.35 (.43)	-.29 (.38)	-.00 (.37)	.23 (.27)	.02 (.02)
Average FMR	2.98 (1.12)	2.06 (1.01)	2.25 (.97)	-.05 (.72)	-.05 (.05)
Intercept	86.02 (12.79)	106.09 (11.54)	94.61 (11.03)	48.27 (8.15)	4.52 (.62)
R ²	0.31	0.23	0.21	0.18	0.13

Notes:

1. Standard error in parentheses.
2. See text for description of variables.

Appendix Table 3: Post-match models, low-income white sample

	Cognitive Achievement			Behavior problems	Health
	Letter-word	Passage comprehension	Applied problem	BPI	1-5 scale
Homeownership	20.13 (7.86)	9.06 (6.60)	5.42 (5.14)	.38 (3.67)	-.38 (.31)
Child's age	-.61 (.93)	-1.52 (.75)	-1.04 (.46)	1.37 (.61)	-.05 (.04)
Mother's age	.25 (.50)	.24 (.43)	.38 (.33)	-.97 (.28)	.01 (.02)
Breastfed	-4.28 (3.96)	2.05 (3.45)	-4.80 (2.93)	-5.31 (3.41)	.54 (.23)
Mom's education:					
< High school	.71 (4.35)	.46 (3.64)	-4.49 (3.68)	-2.16 (3.75)	.03 (.26)
Some college	6.65 (4.37)	3.14 (3.69)	4.65 (3.58)	1.67 (3.02)	.25 (.21)
College graduate	7.79 (10.64)	-5.47 (6.88)	7.81 (4.50)	8.28 (3.34)	.17 (.29)
Percent of life w/ 2 parents	-3.29 (7.29)	.06 (5.99)	3.91 (6.81)	2.21 (5.40)	-.16 (.37)
Always live with 1 parent	2.46 (12.09)	-11.17 (9.35)	4.98 (10.15)	3.17 (5.98)	.20 (.40)
Percent of life on welfare	4.30 (9.33)	3.52 (7.06)	4.72 (6.57)	10.41 (4.99)	-.37 (.38)
Always on welfare	-19.64 (10.03)	-13.81 (7.16)	-9.62 (7.31)	1.50 (6.28)	-.19 (.45)
Average # of siblings	-3.47 (3.12)	-4.69 (2.46)	-2.24 (2.27)	4.03 (2.36)	-.06 (.15)
Average family income	-.75 (.65)	-.29 (.50)	-.20 (.62)	.32 (.33)	.02 (.02)
Average FMR	3.35 (1.84)	2.26 (1.72)	2.49 (1.27)	1.15 (.83)	-.08 (.07)
Intercept	95.55 (19.89)	105.25 (18.66)	91.77 (22.17)	42.47 (9.67)	4.51 (.78)
R ²	0.33	0.31	0.31	0.32	0.23

Notes:

1. Standard error in parentheses.
2. See text for description of variables.

Appendix Table 4: Post-match model with stability mediator, low-income white sample

	Cognitive achievement			Behavior problems	Health
	Letter-word	Passage comprehension	Applied problem	BPI	1-5 scale
Homeownership	14.53 (8.40)	5.43 (6.63)	3.52 (5.06)	2.50 (4.21)	-.45 (.34)
Child's age	-.56 (.92)	-1.50 (.74)	-1.03 (.48)	1.40 (.61)	-.05 (.04)
Mother's age	-.02 (.49)	.08 (.45)	.29 (.37)	-.90 (.31)	.01 (.02)
Breastfed	-3.91 (3.99)	2.30 (3.50)	-4.68 (2.94)	-5.57 (3.44)	.55 (.24)
Mom's education:					
< High school	1.29 (4.56)	.83 (3.75)	-4.29 (3.77)	-2.33 (3.75)	.04 (.25)
Some college	7.95 (4.29)	3.95 (3.68)	5.08 (3.45)	1.21 (3.01)	.27 (.21)
College graduate	6.12 (11.23)	-7.29 (7.45)	7.24 (4.70)	9.48 (3.69)	.13 (.30)
Percent of life w/ 2 parents	-4.91 (7.21)	-1.06 (6.13)	3.36 (6.45)	2.30 (5.49)	-.19 (.38)
Always live with 1 parent	3.86 (11.04)	-10.39 (8.58)	5.46 (10.18)	3.09 (5.80)	.20 (.40)
Percent of life on welfare	4.75 (9.28)	3.53 (7.20)	4.87 (6.70)	10.47 (4.98)	-.37 (.38)
Always on welfare	-18.01 (8.77)	-12.64 (6.27)	-9.07 (7.03)	1.07 (6.13)	-.17 (.44)
Average # of siblings	-2.93 (3.07)	-4.31 (2.37)	-2.06 (2.30)	3.80 (2.41)	-.05 (.15)
Average family income	-.61 (.62)	-.23 (.50)	-.15 (.64)	.29 (.32)	.02 (.02)
Average FMR	3.41 (1.80)	2.33 (1.71)	2.51 (1.25)	1.15 (.85)	-.08 (.07)
Residential stability	-17.78 (9.69)	-11.60 (7.65)	-6.02 (8.41)	5.79 (4.65)	-.19 (.38)
Intercept	108.82 (19.40)	113.89 (17.39)	96.26 (19.91)	37.64 (11.03)	4.67 (.83)
R²	0.35	0.33	0.31	0.33	0.23

Notes:

1. Standard error in parentheses.
2. See text for description of variables.

Appendix Table 5: Pre-match models, low-income black sample

	Cognitive achievement			Behavior problems	Health
	Letter-word	Passage comprehension	Applied problem	BPI	1-5 scale
Homeownership	2.35 (2.53)	2.09 (2.10)	1.59 (2.15)	-.26 (1.59)	-.02 (.13)
Child's age	-.86 (.26)	-1.52 (.22)	-.18 (.22)	.04 (.16)	.02 (.01)
Mother's age	-.03 (.13)	.02 (.10)	-.17 (.11)	-.09 (.08)	-.03 (.01)
Breastfed	.92 (2.00)	3.75 (1.68)	1.71 (1.70)	.94 (1.24)	.05 (.10)
Mom's education:					
< High school	-1.82 (1.67)	-2.07 (1.39)	.39 (1.42)	.55 (1.03)	-.10 (.09)
Some college	.67 (1.89)	-.18 (1.56)	2.33 (1.61)	-.03 (1.17)	-.04 (.10)
College graduate	-.10 (6.42)	2.59 (5.21)	5.46 (5.45)	-2.33 (3.92)	.21 (.32)
Percent of life w/ 2 parents	1.10 (3.46)	6.67 (2.89)	-.80 (2.94)	-.24 (2.11)	-.19 (.17)
Always live with 1 parent	2.05 (2.19)	3.04 (1.80)	1.63 (1.87)	.30 (1.35)	.05 (.11)
Percent of life on welfare	-4.03 (3.30)	-5.45 (2.77)	-3.71 (2.81)	9.49 (2.08)	-.37 (.17)
Always on welfare	-1.36 (2.37)	1.18 (1.96)	1.35 (2.02)	-3.23 (1.48)	.26 (.12)
Average # of siblings	-.84 (.70)	-1.24 (.58)	-.96 (.60)	-.93 (.43)	.03 (.04)
Average family income	.13 (.15)	-.01 (.13)	.10 (.13)	.05 (.09)	.01 (.01)
Average FMR	.71 (.58)	.13 (.49)	.06 (.49)	.05 (.35)	.06 (.03)
Intercept	101.06 (5.67)	113.23 (4.80)	99.58 (4.83)	42.58 (3.51)	4.34 (.30)
R ²	0.08	0.20	0.05	0.05	0.06

Notes:

1. Standard error in parentheses.
2. See text for description of variables.

Appendix Table 6: Post-match models, low-income black sample

	Cognitive achievement			Behavior problems	Health
	Letter-word	Passage comprehension	Applied problem	BPI	1-5 scale
Homeownership	4.86 (3.16)	4.23 (2.30)	3.53 (2.79)	-1.43 (2.57)	-.01 (.17)
Child's age	-.37 (.60)	-.94 (.34)	.21 (.47)	-.11 (.27)	.03 (.02)
Mother's age	-.08 (.19)	-.03 (.15)	-.20 (.19)	.04 (.16)	-.02 (.01)
Breastfed	-3.20 (3.72)	-4.05 (2.09)	-4.43 (3.15)	1.72 (3.12)	-.24 (.24)
Mom's education:					
< High school	3.79 (2.83)	1.01 (2.37)	.68 (2.26)	-1.52 (1.89)	.09 (.15)
Some college	5.53 (2.80)	3.01 (1.83)	3.43 (2.86)	-3.25 (1.79)	.05 (.16)
College graduate	-4.91 (4.96)	1.95 (3.77)	-7.80 (8.44)	1.52 (3.03)	1.25 (.24)
Percent of life w/ 2 parents	-.88 (5.18)	7.76 (3.28)	3.81 (4.77)	5.19 (4.74)	-.54 (.27)
Always live with 1 parent	1.51 (3.53)	5.10 (2.54)	4.71 (2.79)	.59 (2.58)	.10 (.18)
Percent of life on welfare	-6.39 (4.36)	-4.23 (3.19)	-1.14 (3.97)	7.50 (3.18)	-.43 (.24)
Always on welfare	-1.52 (4.20)	4.50 (3.91)	6.05 (4.58)	1.23 (3.78)	-.63 (.30)
Average # of siblings	-2.55 (1.14)	-2.64 (.98)	-1.24 (1.14)	-.81 (.78)	.20 (.07)
Average family income	-.05 (.22)	.03 (.18)	.41 (.22)	.00 (.22)	.02 (.02)
Average FMR	.98 (1.07)	.48 (.83)	.65 (.99)	1.01 (.80)	-.07 (.06)
Intercept	100.11 (8.40)	103.62 (8.44)	82.61 (7.84)	36.44 (6.56)	4.42 (.55)
R ²	0.14	0.26	0.09	0.09	0.18

Notes:

1. Standard error in parentheses.
2. See text for description of variables.

Appendix Table 7: Post-match model with stability mediator, low-income black sample

	Cognitive achievement			Behavior problems	Health
	Letter-word	Passage comprehension	Applied problem	BPI	1-5 scale
Homeownership	5.38 (3.55)	5.77 (3.08)	2.65 (3.37)	-2.98 (2.97)	.04 (.21)
Child's age	-.38 (.57)	-.99 (.34)	.23 (.47)	-.09 (.27)	.03 (.02)
Mother's age	-.06 (.20)	.04 (.17)	-.23 (.20)	-.01 (.16)	-.02 (.01)
Breastfed	-3.22 (3.73)	-4.23 (2.09)	-4.41 (3.18)	1.75 (3.12)	-.24 (.24)
Mom's education:					
< High school	3.79 (2.84)	.99 (2.37)	.67 (2.26)	-1.45 (1.85)	.08 (.15)
Some college	5.52 (2.82)	2.94 (1.84)	3.45 (2.86)	-3.23 (1.82)	.04 (.16)
College graduate	-4.46 (5.41)	3.28 (4.62)	-8.56 (8.81)	.23 (2.97)	1.29 (.25)
Percent of life w/ 2 parents	-.85 (5.19)	7.86 (3.25)	3.78 (4.79)	5.02 (4.71)	-.53 (.27)
Always live with 1 parent	1.56 (3.57)	5.21 (2.58)	4.62 (2.80)	.29 (2.55)	.11 (.19)
Percent of life on welfare	-6.60 (4.49)	-4.75 (3.12)	-.79 (3.93)	7.93 (3.18)	-.45 (.24)
Always on welfare	-1.55 (4.21)	4.63 (3.96)	6.12 (4.53)	1.29 (3.80)	-.64 (.30)
Average # of siblings	-2.53 (1.16)	-2.64 (1.00)	-1.28 (1.15)	-.90 (.79)	.21 (.07)
Average family income	-.05 (.23)	.04 (.18)	.41 (.22)	-.00 (.22)	.02 (.02)
Average FMR	.98 (1.07)	.44 (.85)	.66 (1.00)	1.01 (.80)	-.07 (.06)
Residential stability	1.86 (6.46)	5.63 (5.60)	-3.17 (6.00)	-5.35 (4.74)	.18 (.34)
Intercept	98.99 (9.70)	100.30 (9.39)	84.53 (8.57)	39.97 (6.88)	4.30 (.59)
R ²	0.14	0.27	0.10	0.09	0.18

Notes:

1. SD = standard deviation.
2. See text for description of variables.