Home Ownership and School Outcomes of Children

Evidence from the PSID Child Development Supplement

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Abstract. Using the PSID Child Development Supplement (CDS) and the corresponding PSID main data sets, we examine whether home ownership has positive effects on the academic achievement of children after correcting for selectivity bias and controlling for home environment, neighborhood quality, residential stability, and income. While we find no independent effects of home ownership, there are positive significant effects of home environment, neighborhood quality, and residential stability on the reading and math performance of children between the ages of three and twelve. The main policy implication of our study is that improvement of a child's home environment, residential stability, and the quality of the neighborhood is more important than ownership of a home to achieve better child outcomes. Subsidized home ownership can lead to better child outcomes to the extent that it places a child in a better home environment, in a more stable residence, and in a better neighborhood.

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I

Introduction

POLICYMAKERS and academic researchers have argued that owning a home has many social benefits. In the United States, most studies show that among other benefits, children of homeowners perform relatively better in school than children of renters (Haurin et al. 2002; Boehm and Schlottmann 1999; Green and White 1997). There is also a growing consensus that U.S. public schools are not adequate to prepare children from disadvantaged families for higher education. While policymakers and academic researchers are studying the efficacy of public provision of preschool as a policy option (Heckman and Raut 2008; Raut 2003; Heckman 2000), some researchers are exploring whether subsidized home ownership or subsidized housing for the poor could be alternative policy options to alleviate the schooling problem of disadvantaged families (Haurin et al. 2002; Currie and Yelowitz 2000; Newman and Harkness 2000; Green and White 1997).

There are broadly two views on how home ownership can lead to positive school outcomes of children. According to one view, parents acquire do-it-yourself skills, interpersonal skills, and financial skills through home ownership, which they can pass on to their children (Green and White 1997). These skills can help their children achieve better school outcomes and subsequent labor market performance. An alternative view is that communities populated mostly by homeowners provide better neighborhoods, better public schools, and residential stability, all of which are important factors for successful child outcomes (Jencks and Mayer 1990). According to the first view, providing housing for poor families may be one way for disadvantaged children to receive these skills. The second view suggests that a policy priority should be put on improving the quality of public schools, neighborhood, and the home environment of disadvantaged children.

In this article, we examine whether home ownership has positive effects on child outcomes at different stages of their development. While the descriptive statistics in U.S. data sets show a positive relationship between home ownership and child outcomes, this

relationship could be spurious for two reasons. First, the amount of parental resources spent on children could be an important determinant of child outcomes, and home ownership may act as a proxy for unobserved parental resources. Second, parental concern for children is an important factor that influences child outcomes. A more concerned parent may self-select to own a home in a safe neighborhood with a good public school to create a better home environment while interacting with other well-informed parents in the same neighborhood. We estimate the effect of home ownership on child outcomes after controlling for the independent effects of home environment, neighborhood effects, residential stability, and selectivity bias using data available from the Panel Study of Income Dynamics (PSID).

The PSID is a data set of approximately 7,000 representative families living in the United States. Data on economic, health, and social behavior were collected from the core families beginning in 1968. Individuals from families in the core sample were interviewed every year until 1997. The study followed adults as they have grown older, as well as children who formed their own families. After 1997, the PSID switched to biennial data collection. The Child Development Supplement (CDS) contains data from the children of the families in the 1997 PSID main data set.

The CDS is a unique data set that has not been used for the purpose of determining the effects of home ownership on child outcomes. The CDS contains data on parents and their 0–12-year-old children. The data set includes the cognitive, behavioral, and health status of 3,563 children residing in the United States. It includes extensive measures of the children's home environment, family relationships, and children's time diaries in home and at school. We use two measures of child outcomes at various stages of a child's development: cognitive and reading comprehension test scores. The economic and personal characteristics of the parents are matched to the children from the main PSID data set.

The rest of the article is organized as follows. In Section II, we survey the relevant literature. In Section III, we describe the methodology of this study as well as the variables and the data set. In Section IV, we present our empirical estimates. In Section V, we present the concluding remarks.

II

Previous Literature

HOME OWNERSHIP has been found to be positively correlated with child outcomes (Rohe, McCarthy, and Van Zandt 2000). What could be the underlying reasons behind this? It has been argued by some that homeowners acquire certain skills that they can pass on to their children, who then can benefit from such skills in school and the labor market (Green and White 1997). On the other hand, the observed positive relationship between home ownership and school outcomes of the children might be a pure statistical phenomenon for several reasons. First, parents vary in unobservable behaviors that determine how much they care for their children. Parents who care for their children's well-being assiduously may self-select to own a home in a good neighborhood with a good school district and provide a better home environment. These parents would also spend more resources for their children's education. In both cases, we will see a spurious, positive relationship between home ownership and children's educational outcomes, while the underlying factors behind better educational outcomes need not be home ownership. This spurious effect is known in the literature as selectivity bias.

Second, residential stability may positively affect child development (Aaronson 2000). Homeowners are often less likely to change residences because of the high transaction costs of moving. As a result, children of homeowners will change schools less frequently than children of renters. Haveman, Wolfe, and Spaulding (1991), using PSID data, conclude that moving one's residence with a child under the age of 7 or during adolescence (ages 12–15) significantly reduces the probability of the child's graduating from high school. Residential mobility accounts for 18 percent and 29 percent of the educational disadvantage of children living in single-parent families or stepfamilies, respectively (Astone and Mclanahan 1994).

Third, a better neighborhood can have a positive effect on child development and school outcomes for several reasons, such as residential stability, peer effects, and many other factors (see Jencks and Mayer 1990 for an extensive survey and a typology of the previous literature; and see (Klebanov et al. 1997) Brooks-Gunn et al. 1993 for

empirical evidence). Homeowners tend to live in better neighborhoods and this may lead to a spurious, positive relationship between home ownership and child outcomes.

Previous studies that found positive effects of home ownership on child outcomes either did not control for some of the important factors such as home environment, neighborhood effects, and selectivity bias or did not control for some of the important attributes associated with homeowners that may lead to a positive relationship between home ownership and child outcomes. Furthermore, very few studies focus on whether home ownership has different effects on the academic achievement of children of different age groups. We briefly review this literature.

Green and White (1997) find that children of homeowners are more likely to stay in school than children of renters, using three different data sets including PSID. They find home ownership in itself has a positive effect on child outcomes even after controlling for the selectivity bias. The authors do not, however, control for home environment or neighborhood effects. Homeowners tend to have more resources to support a stable home environment. In their study, the home ownership variable may be capturing the positive effects of a better home environment.

Boehm and Schlottmann (1999) also use PSID data to find that children of homeowners have higher productivity levels and achieve higher levels of education, and thus also earn higher levels of income. However, this study does not control for selectivity bias of the parent's motivation to own a home. A more recent study by Haurin, Parcel, and Haurin (2002) uses National Longitudinal Survey of Youth (NLSY) data to examine the impact of home ownership on child outcomes after controlling for selectivity bias. The study finds that the home ownership indicator has positive coefficients for math and reading test scores with a *t*-statistic of 1.7. The authors conclude that home ownership affects the quality of the home environment such that a child's cognitive outcomes are up to 9 percent higher in math achievement and 7 percent higher in reading achievement for children residing in owned homes. The limitation of this study is that the neighborhood variables are too broad since they are characteristics of the entire county rather than the actual neighborhood in which the

child resides. The home ownership variable in their study may thus be capturing the positive effects of the neighborhood. Moreover, a *t*-statistic of 1.7 indicates that the home ownership effect is barely significant.

The study by Harkness and Newman (2002) uses the geocoded PSID data to determine whether the benefits to children from home ownership depend on neighborhood characteristics such as poverty rate, home ownership rate, and residential stability. The authors find that home ownership has positive outcomes for children in any neighborhood. The study by Brooks-Gunn et al. (1993) along this line has found that the presence of affluent neighbors can positively influence child outcomes. On the other hand, a recent study by Solon, Page, and Duncan (2000) finds that once family background characteristics are controlled for, the correlation between neighboring children and their educational attainment is minimal.

Some studies have tried to separate family background characteristics and neighborhood effects by comparing the academic achievement between siblings who have changed geographic location (Plotnick and Hoffman 1999; Aaronson 1998). Plotnick and Hoffman (1999) find that neighborhood characteristics such as the percentage of female-headed households, families receiving public assistance, and low-income families in the neighborhood are insignificant once family characteristics are controlled for. On the other hand, Aaronson (1998) finds that the impact of neighborhoods may exist on dropout rates even when family-specific characteristics that may be associated with the choice of neighborhood are controlled for. In a more recent study, Duncan, Boisjoly, and Harris (2001) use data from the National Longitudinal Study of Adolescent Health and find that the largest correlations between height, verbal achievement, and delinquency are among siblings rather than peers, classmates, or neighbors.

Our article differs from the previous studies on several counts. First, we use a unique data set that allows us to control for residential stability, home environment, neighborhood effects, and unobservable characteristics of the caregivers. More specifically, our study uses the proportion of minority residents and the proportion of homeowners that reside in the neighborhood to measure neighborhood effects. These variables are more direct measures of neighborhood

characteristics, as compared to the county-level data that are used in the previous studies by Haurin, Parcel, and Haurin, among a few others. We also introduce another important variable that captures the parental concern for child's well-being, the parent's assessment of the neighborhood as being a good place to raise children. This comes directly from the CDS survey and has not been used in any other study.

Furthermore, unlike the previous studies, we separate the children in our sample into different cohorts based on age to determine whether home ownership has different effects at different stages of child development. For instance, older children may be more affected by their peers or neighborhood characteristics than younger children. We discuss these in more detail in Section III below.

III

Methodology

Our sample consists of children ages three and over in the PSID-CDS who were given the Woodcock-Johnson Revised Tests of Achievement. We use the Broad Reading and Broad Math scores in our sample to measure the child's academic achievement. The standard scores are calculated from 0–200. Most students scored between 50 and 180 points. We first use the OLS (ordinary least squares) method to estimate the effect of home ownership on math and reading ability. We then use the two-stage least squares method of estimation to correct the selectivity bias in estimates of the parameters of interest. The OLS estimates are compared to the two-stage least squares estimates in order to determine whether the positive, significant effect of home ownership in OLS continues to have positive effect on academic achievement after correcting for selectivity bias.

Children ages three and older were given two subtests of the Woodcock-Johnson Revised Tests of Achievement: Letter Word and Applied Problems. The Letter Word test measures reading identification skills and symbolic learning. The Applied Problems test measures mathematical skills in solving practical problems. Children between the ages of six and twelve were given two additional exams consisting of passage comprehension and calculation questions that are included

in the Broad Reading and Broad Math scores, respectively. Approximately 1,267 children age six and over took all four tests of cognitive development, while 550 children between ages three and five took two tests.

In Table 1, we report the summary statistics of the sample. It is clear from Table 1 that children in households whose caregivers own their housing units on average scored better on exams than children of renters or children who live in government-subsidized housing. In fact, children of homeowners scored 9.5 percent and 9.7 percent higher than children of nonhomeowners on the Broad Reading and Broad Math exams, respectively.

Homeowners comprise about 60.1 percent of our sample. The majority of homeowners in our sample are white. Approximately, 75 percent of all white households own homes, while only 44 percent of all black households own homes. Moreover, only 15 percent of female-headed households are homeowners. Hispanic households comprise about 1.5 percent of all homeowners.

Homeowners tend to have higher incomes, to be more educated, to have higher scores on the Mother's Passage Comprehension Test, and to change residences less frequently. In this sample of CDS families, homeowners and nonhomeowners have 13.4 and 12.1 average years of schooling, respectively. While this number is quite low, it is consistent with the entire sample mean of 12.61 mean years of school with a standard deviation of 2.59. Only 9 percent of homeowners in our sample moved to another residence since the spring of 1996, the time of the last PSID interview. Moreover, the majority of homeowners live in neighborhoods where more than half the residents are also homeowners. There are also a larger proportion of homeowners than nonhomeowners who have lived in the same residence for more than five years. These statistics indicate that homeowners may have many of the same attributes that contribute to a stable home environment. Therefore, it is necessary to determine which characteristics of homeowners have an independent effect on child outcomes.

Our basic model for child outcomes includes several control variables that previous studies have found to be important factors for a child's academic achievement (Haveman and Wolfe 1995). Specifically, we use family characteristics such as education level, income,

Table 1

Means of Selected Parent and Child Characteristics by Tenure Status

	Homeowners	Nonhomeowners
Income	62,752.06	23,517.14
	(68,661.72)	(19,033.56)
Broad Reading score	107.41	98.1
	(17.00)	(17.64)
Broad Math score	107.28	97.77
	(18.80)	(18.4)
Letter Word test	105.6	98.23
	(17.77)	(17.17)
Applied Problem	107.94	99.98
	(17.77)	(17.12)
White (%)	75.2	21.62
$N = 976$		
Black (%)	44.13	49.44
$N = 886$		
Female-headed household (%)	15.06	58.08
Moved (%) since spring of 1996	8.98	30.35
Length of residence (%)	44.31	19.05
Homeowners in neighborhood (%)	66.81	26.41
Mother's cognitive score	27.3	17.59
	(74.74)	(8.59)
Household head's completed years of education	13.4	12.1
	(2.39)	(2.03)
N	1,169	761
	(60.57%)	(39.43%)

Note: Standard deviations in parentheses.

and household type together with a few new measures for neighborhood and home environment that were not included in most previous studies, as described below.

Home ownership: We include a dummy variable, home ownership, that takes value 1 if the head of the household owns the housing unit

and 0 otherwise. If the household does not own or rent the housing unit, then it is likely the household receives government support and/or lives in a public housing project.

Parent and Child Characteristics: An important household characteristic for our purpose is whether the child lives with one or both parents. We create a dummy variable for female-headed households to indicate whether the child resides in a female-headed household or not. We also include the mother's score on a passage comprehension test to control for cognitive abilities of the parent.

Other characteristics of the head of the household include the labor income, race/ethnicity, and the number of years of education. Dummy variables for black and Hispanic households are included in the model. In this study, we use the number of years of schooling by the head of the household to measure the education level of the household. These data are available from the demographic file of the caregiver in the CDS data set. Values in the range of 1–20 were assigned to the head based on the number of years of schooling. We chose to use the CDS measure of education level since the education variable that is available from the main PSID data set was more limited. For instance, the range in the years of schooling from the main data set is from 1–17, with 17 indicating some postgraduate work.

The number of children in the family is important in determining how resources are allocated within the household. Many studies have shown a negative effect of this variable on the academic performance of children because a larger family size may indicate less expenditure per child. While the order of children may have some impact on a child's learning process since younger children can often learn from their older siblings, the age gaps between the children may have more of a direct impact on how household expenditure is allocated among the children. Since this information is not readily available, we include the number of children in the household in our model to control for family size.

Since the gender of a child may influence resource allocation among children, we also include a dummy variable, gender of the child, which takes value 1 if the child is a girl and 0 otherwise.

Residential Mobility: In order to measure the residential mobility of the household, we looked at several variables that were available in

the PSID, including whether the family had moved since the spring of 1996, the likelihood of moving in the next couple of years, and the number of times the child changed schools. In this study, we used a dummy variable to indicate whether the family moved in the previous year (1996). This is an important indicator of a possible disruption in the child's schooling or home environment prior to the child taking the test in 1997. A new school or environment may have a negative affect on the child's academic achievement. A recent move can also create stress for a child. If the family had moved earlier, then the child can eventually adjust to his or her neighborhood over time.

Neighborhood Characteristics: Information on the geographic location such as census tract or zip code is not freely available through the PSID. Therefore, we used the information provided by the primary caregiver to obtain characteristics for the neighborhood. The percentage of Hispanic and black families and the proportion of homeowners in the neighborhood are used to capture neighborhood effects.

The parent's assessment of whether or not the neighborhood is a good place to raise children is also included as the dummy variable rating of neighborhood, which takes value 1 if the neighborhood is assessed as good and 0 otherwise. The primary caregiver's assessment of the neighborhood provides a proxy for the motivation of neighborhood choice and is used as a partial measure to control for self-selection bias.

Home Environment: The Home Observation for Measurement of the Environment, known as the HOME scale, measures the level of cognitive stimulation and emotional support provided to the child by the primary caregiver.[1] This scale is based on a series of questions about the family relationships and time spent with the child. It includes items such as closeness with the parents, frequency of behavioral problems, involvement in household tasks, and interactions with an absent parent.

The HOME scale is often used to measure the overall quality of the child's home environment. We find that home ownership has a significant positive effect on home environment; see also Haurin, Parcel, and Haurin (2002) for an estimate of positive effect. However, in this study, we have revised the HOME scale by statistically purging out the effect of home ownership so that we could examine if, after

controlling for the revised measure of home environment, the variable for home ownership still has an independent positive effect on child outcomes, including its positive effect on home environment. Therefore, we are able to control for an independent measure of home environment in our model of child outcomes.

IV

Results

A. The Basic OLS Model

Reading Achievement—OLS Model

We estimate the effects of home ownership on child outcomes by using the Broad Reading and Broad Math test scores from the Woodcock Johnson exams. Tables 2 and 3 present the empirical results of our basic model of children's reading and math achievement, respectively. The first column shows the empirical results for all children ages six and over. The second, third, and fourth columns report the OLS estimates by age group. We did not control for the unobservable characteristics of the parent in this baseline regression model so that we could compare the estimates with previous studies. We report the two-stage least squares estimates that control for unobserved characteristics of the parents in Tables 4 and 5.

In the overall sample, home ownership and parent's education level all have a statistically significant, positive effect on the child's cognitive development. While the magnitude of the difference in scores is not large, children of homeowners score slightly better on the Broad Reading exams. On average, children of homeowners scored 2.74 points higher than children of nonhomeowners. The tests are scored from 0 to 200. The actual scores for the Broad Reading test range from 42 to 186, while the Broad Math scores range from 18 to 184. Our finding that children of homeowners have better educational outcomes is consistent with previous studies.

In the OLS model, we find that the income variable has statistically insignificant effects. This may be due to the presence of other household characteristics such as the education of the parents. When the

Table 2

The OLS Estimates of the Model of Reading Test Score

Variables	Overall	Ages 3–5	Ages 6–9	Ages 10–12
Constant	64.650**	67.617**	52.993**	78.795**
	(12.64)	(8.17)	(5.88)	(8.79)
Black	−0.102	2.141	−0.063	−2.936
	(0.10)	(1.29)	(0.04)	(1.65)
Hispanic	−7.637*	−6.389	−12.848**	0.960
	(2.44)	(1.27)	(2.57)	(0.15)
Number of children	−1.553**	−1.475**	−2.217**	−1.838**
	(4.62)	(2.65)	(3.77)	(3.11)
Log of income	0.598	0.872	1.007	−0.614
	(1.33)	(1.26)	(1.19)	(0.80)
Gender of the child (girl)	2.743**	1.861	1.937	3.231*
	(3.78)	(1.56)	(1.57)	(2.48)
Moved last year	−0.869	−1.573	−0.717	0.851
	(0.88)	(1.05)	(0.42)	(0.43)
Rating of neighborhood	0.230	−1.737	−1.712	4.226*
	(0.19)	(0.80)	(0.84)	2.09
Proportion of Hispanic residents	0.028	0.331	−0.624	1.078
	(0.02)	(0.10)	(0.21)	(0.31)
Proportion of black residents	0.324	0.819	−0.318	0.436
	(0.30)	(0.44)	(0.17)	(0.23)
Proportion of ownership	2.180**	1.327	2.964*	1.104
	(2.58)	(0.95)	(2.07)	(0.74)
Revised HOME scale	1.014**	1.072**	0.393	0.971**
	(6.76)	(4.10)	(1.47)	(3.58)
Female-headed household	−0.617	−2.287	−2.517	0.660
	(0.60)	(1.41)	(1.40)	(0.35)
Mother's cognitive score	0.629**	0.461**	0.716**	0.841**
	(7.53)	(3.33)	(5.02)	(5.62)
Household head's completed years of education	0.942**	0.773**	1.777**	0.377
	(5.03)	(2.62)	(5.42)	(1.11)
Home ownership	2.735**	0.076	0.101	5.969**
	(2.79)	(0.05)	(0.06)	(3.32)
R^2	0.24	0.202	0.272	0.283
N	1,788	550	689	549

Notes: T-statistics in parentheses.
**$p < 0.01$ level; *$p < 0.05$ level.

Table 3

The OLS Estimates of the Model of Math Test Score

Variables	Overall	Ages 3–5	Ages 6–9	Ages 10–12
Constant	63.044**	62.586**	64.914**	62.275**
	(11.07)	(6.16)	(6.70)	(6.33)
Black	−3.201**	−5.631**	1.092	−5.521**
	(2.83)	(2.77)	(0.57)	(2.83)
Hispanic	−6.951*	−2.924	−8.820	−5.316
	(2.00)	(0.48)	(1.64)	(0.77)
Number of children	−0.890*	−1.563*	−0.994	−0.697
	(2.38)	(2.28)	(1.57)	(1.07)
Log of income	0.618	1.017	0.383	0.261
	(1.23)	(1.20)	(0.42)	(0.31)
Gender of the child (girl)	−0.643	0.482	−2.515	−0.568
	(0.79)	(0.33)	(1.90)	(0.40)
Moved last year	−0.062	2.080	−2.913	0.262
	(0.06)	(1.13)	(1.60)	(0.12)
Rating of neighborhood	0.703	1.544	−4.671*	6.123**
	(0.52)	(0.58)	(2.14)	(2.76)
Proportion of Hispanic residents	−3.075	−4.321	−5.122	0.953
	(1.49)	(1.12)	(1.60)	(0.25)
Proportion of black residents	0.219	3.251	−2.053	−0.903
	(0.18)	(1.42)	(1.02)	(0.43)
Proportion of ownership	2.507**	0.623	4.770**	1.449
	(2.67)	(0.36)	(3.11)	(0.89)
Revised HOME scale	1.150**	1.202**	0.843**	0.982**
	(6.89)	(3.75)	(2.94)	(3.31)
Female-headed household	1.603	1.046	−1.393	4.192**
	(1.41)	(0.53)	(0.72)	(2.05)
Mother's cognitive score	0.665**	0.820**	0.460**	0.798**
	(7.15)	(4.83)	(3.00)	(4.86)
Household head's completed years of education	1.020**	0.4938	1.781**	0.906*
	(4.89)	(1.37)	(5.05)	(2.44)
Home ownership	3.318**	1.164	1.850	6.239**
	(3.04)	(0.62)	(0.99)	(3.16)
R^2	0.242	0.267	0.23	0.302
N	1,788	550	689	549

Notes: See notes for Table 2.

Table 4

The IV Estimates of the Model of Reading Test Score

Variables	Overall	Ages 3–5	Ages 6–9	Ages 10–12
Constant	63.838**	67.835**	54.516**	75.261**
	(9.67)	(6.36)	5.38	(7.89)
Black	0.3546	2.146	0.111	−3.336
	(0.32)	(1.31)	(0.06)	(1.82)
Hispanic	−6.905*	−6.401	−12.932**	−1.354
	(2.09)	(1.29)	(2.61)	(0.20)
Number of children	−1.358**	−1.475**	−2.172**	−1.845**
	(3.82)	(2.69)	(3.63)	(3.07)
Log of income	0.656	0.853	0.733	−0.046
	(0.95)	(0.93)	(0.61)	(0.05)
Gender of the child (girl)	2.602**	1.852	1.886	3.355*
	(3.32)	(1.53)	(1.53)	(2.53)
Moved last year	−0.701	−1.531	−0.125	−1.114
	(0.43)	(0.77)	(0.05)	(0.44)
Rating of neighborhood	0.672	−1.717	−1.384	3.356
	(0.47)	(0.77)	(0.61)	(1.54)
Proportion of Hispanic residents	0.9265	0.341	−0.219	0.316
	(0.45)	(0.11)	(0.07)	(0.09)
Proportion of black residents	0.168	0.837	0.0188	−0.7417
	(0.13)	(0.43)	(0.01)	(0.34)
Proportion of ownership	2.411	1.275	2.401	3.270
	(1.47)	(0.60)	(1.06)	(1.42)
Revised HOME scale	1.055**	1.084*	0.533	0.483
	(3.43)	(2.41)	(1.03)	(1.01)
Female-headed household	−0.647	−2.248	−1.614	−2.604
	(0.34)	(1.11)	(0.48)	(0.81)
Mother's cognitive score	0.634**	0.459**	0.714**	0.938**
	(6.73)	(2.97)	(5.04)	(5.49)
Household head's completed years of education	0.947**	0.770*	1.726**	0.558
	(4.31)	(2.46)	(4.76)	(1.49)
Home ownership	2.104	0.272	2.774	−4.433
	(0.37)	(0.04)	(0.32)	(0.52)

Notes: See notes for Table 2.

Table 5

The IV Estimates of the Model of Math Test Score

Variables	Overall	Ages 3–5	Ages 6–9	Ages 10–12
Constant	69.741**	75.616**	60.191**	59.673**
	(10.95)	(5.58)	(5.46)	(5.80)
Black	−4.909**	−5.364**	0.554	−5.816**
	(4.63)	(2.58)	(0.28)	(2.94)
Hispanic	−9.228**	−3.618	−8.559	−7.019
	(2.89)	(0.57)	(1.58)	(0.98)
Number of children	−0.517	−1.553*	−1.133	−0.702
	(1.51)	(2.22)	(1.74)	(1.08)
Log of income	0.604	−0.135	1.231	0.680
	(0.91)	(0.12)	(0.94)	(0.70)
Gender of the child (girl)	−1.161	−0.069	−2.357	−0.476
	(1.54)	(0.04)	(1.76)	(0.33)
Moved last year	0.460	4.618	−4.749	−1.185
	(0.29)	(1.82)	(1.74)	(0.43)
Rating of neighborhood	0.076	2.737	−5.689*	5.482*
	(0.06)	(0.96)	(2.31)	(2.34)
Proportion of Hispanic residents	−3.541	−3.674	−6.379	0.392
	(1.80)	(0.92)	(1.83)	(0.10)
Proportion of black residents	0.842	4.344	−3.096	−1.770
	(0.67)	(1.77)	(1.33)	(0.75)
Proportion of ownership	2.012	−2.473	6.513**	3.043
	(1.27)	(0.91)	(2.64)	(1.22)
Revised HOME scale	1.257**	1.901**	0.407	0.624
	(4.24)	(3.33)	(0.73)	(1.21)
Female-headed household	2.944	3.406	−4.195	1.789
	(1.62)	(1.32)	(1.15)	(0.51)
Mother's cognitive score	0.581**	0.682**	0.468**	0.870**
	(6.40)	(3.47)	(3.04)	(4.72)
Household head's completed years of education	0.803**	0.275	1.939**	1.039**
	(3.79)	(0.69)	(4.91)	(2.58)
Home ownership	4.477	12.894	−6.441	−1.420
	(0.81)	(1.59)	(0.69)	(0.15)

Notes: See notes for Table 2.

education variables are removed, the income variable becomes significant.

Our results indicate that families with a larger number of children may not be able to devote as much time and resources to each individual child and thus may lead to lower levels of their children's school outcomes. Table 2 shows that a larger family size has a negative and significant effect on the child's reading score for all three age groups, and on math scores for the age group 3–5. It appears that math skills may be more like an innate ability or IQ level, which does not improve by spending more parental time or resources except at an early age. This is consistent with the findings in other studies on early childhood development literature; for references, see Raut (2003) and Heckman and Raut (2008).

Hispanic children are more likely to have lower test scores. English may be a second language for children in Hispanic households. It is also important to note that girls are found to have higher scores on the reading exam, while the sex of the child is insignificant for the Broad Math score (see Table 3).

Although several of the variables shown in Table 2 were also used in previous studies to control for the personal and economic characteristics of the household, we have included a few unique measures in our study. First, we find that the home environment has a positive effect on child outcomes. While Haurin, Parcel, and Haurin (2002) studied the determinants of this variable, we have used it as a regressor to proxy for the stability of the household, capturing the daily interactions between the child and the primary caregiver. Moreover, it is acceptable to include both this variable and the home ownership variable as regressors since we have statistically purged out the effects of home ownership on the HOME variable.

Second, the rating of the neighborhood is also an important indicator of parental concerns. This variable is only found in the CDS data set and has not been used in previous studies. Our estimate shows that the effect of this variable is insignificant in the overall sample, but has some positive effect for older children.

Other studies have included proxies for neighborhood effects, including county-level statistics on race, unemployment rate, crime rate, poverty rate, and education level (Haurin et al. 2002).

However, information on these variables is not available at the neighborhood level. We instead use the proportion of black and Hispanic residents as well as the proportion of home ownership as assessed by the respondent.

Among the neighborhood characteristics, the proportion of homeowners in the neighborhood is the only statistically significant variable that is associated with higher test scores. It is difficult to distinguish whether the child's performance on cognitive achievement tests is affected by the quality of the school, which is positively associated the proportion of homeowners, or if neighborhoods with more homeowners create a more stable home environment. The OLS estimates also show that the racial compositions of the neighborhood have no effect on child outcomes.

Finally, we have included a control for a recent move in the household. If the family moved within the last year, it may disrupt the child's schooling and subsequent academic progress. Our empirical results for the Broad Reading scores find that the variable for a recent move is insignificant. It may be that the stability of the household has a larger effect on child outcomes than a change of residence.

In order to determine the effect of home ownership on different stages of cognitive development, we estimate our model for different age groups: ages 3–5, ages 6–9, and ages 10–12. Children between the ages of three and five were only given the Letter-Word and Applied Problem tests. A stable home environment is likely to have a greater impact on younger children who do not attend school. The type of neighborhood can often influence school quality and the child's peers. This is particularly important on outcomes for older children.

The empirical results for the effect of home ownership on Broad Reading scores are not consistent across all three age groups. The second column of Table 2 illustrates the empirical results for children between the ages of three and five. We find home ownership is no longer significant for children in this age group. The home environment has a slightly larger effect on children between the ages of three and five compared to the other age groups. The coefficient is 1.07 for younger children, compared to 0.97 for the older age group. This finding suggests that academic achievement by younger children is

probably more affected by parental involvement and resources at home rather than neighborhood or school effects.

In the third column of Table 2, we observe that the variables for home ownership and home environment become insignificant for children between the ages of six and nine. School quality and neighborhood effects may influence the child's academic ability in this age group. We find the proportion of homeowners in the neighborhood is significant during this stage of childhood. A larger proportion of homeowners may create residential stability and better school quality. It is important to note that Hispanic children in this age group are more likely to have lower test scores than any other age group.

The last column of Table 2 shows that home ownership is positive and significant only for children in the 10–12 age group. Moreover, the rating of the neighborhood by the parents also has a statistically significant and positive impact only on the academic achievement of children between the ages of 10 and 12. This suggests that children may be more influenced by their neighborhood, school quality, or peers during their older stages of childhood. Since homeowners are more likely to live in more stable or higher-income neighborhoods, school quality may be better for children of homeowners.

In a separate regression, we found that the variable for home ownership becomes insignificant after controlling for school quality. We measured school quality using variables such as per pupil expenditure, average salary of all teachers, and student to teacher ratio. These results are not reported here, since school quality cannot be used in all regressions as members of the youngest cohort do not attend school.[2] Therefore, it is likely that home ownership can capture school quality effects for older children, while home environment may have a larger impact on the test scores for non–schoolgoing children.

The results for our model of child outcomes suggest that home environment is an important factor for reading achievement. The home environment has a positive effect on the child's reading achievement during ages 3–5 and ages 10–12. The characteristics of the neighborhood and home ownership are more important for older children than younger children. We find that neighborhood characteristics such as the proportion of homeowners are important for children between the ages of six and nine, while the rating of the

neighborhood is statistically significant for children between the ages of 10 and 12. This supports the view that older children are more likely to be influenced by their peers than younger children.

Math Achievement—OLS Model

The OLS results for math scores are presented in Table 3. The results for the math scores are very similar to estimates for the reading scores. In Table 3, we again observe that the home environment, education level of the parents, proportion of homeowners in the neighborhood, and home ownership variables all have a statistically significant positive effect on math scores for the overall sample. Moreover, the number of children in the household has a statistically significant negative impact on math scores. Black and Hispanic children also tend to have lower math scores.

The effects of the neighborhood on math scores are again important for the older children. The empirical results show that the rating of the neighborhood and the proportion of homeowners in the neighborhood are important for children between the ages of 10 and 12 and children between the ages of six and nine, respectively. Older children are more likely to be influenced by their peers than younger children.

In summary, we find that home ownership is significant only for children between the ages of 10 and 12 among the three age cohorts for both math and reading scores. The home environment is statistically significant for all age groups, with the largest impact on younger children. Younger children in larger households are negatively affected. In the next section, we will determine whether home ownership is still significant after controlling for sample selection bias.

B. Selectivity Bias and Instrumental Variable (IV) Method

The decision to own a home may be motivated by a parent's concern for his or her children's well-being. In that case, the unobserved parental concern, which is in the error term in our previous specifications, will be correlated with the regressors and thus will make the OLS estimates biased and inconsistent. In this section, we correct this problem by using the two-stage regression or instrumental variable (IV) method. In the first step of this two-stage regression, we get the

predicted value of home ownership by regressing it on race, number of children in the household, measure of the home environment, education level, household income, and poverty level. In the second stage, we use the OLS specifications of the previous section with the home ownership variable replaced by its predicted values.

Tables 4 and 5 present the estimates for reading and math scores, respectively. In the two-stage regression model, we find that the effect of home ownership is statistically insignificant in our overall sample for both subjects. Unlike previous studies, we do not find statistically significant positive effect of home ownership on child outcomes once we control for the unobservable traits of the parent.

Reading Achievement—IV Model

In the first column of Table 4, we do observe positive effects from the home environment and education level of the parents for the overall sample. The coefficient of the variable for home environment slightly increases from 1.01 in the OLS model to 1.06 after controlling for sample selection bias. This result suggests that the home environment and family background are important factors for academic achievement, even after the unobservable characteristics of the parents are controlled for.

In both the OLS model and the instrumental variable model, we find girls have higher reading scores. The variable for black children remains insignificant, while Hispanic children have lower reading scores. Racial composition of the neighborhood also does not matter in child outcomes. Moreover, the number of children in the household has negative impact on academic achievement in the instrumental variable model. The consistent results between both models suggest that these variables are important in themselves, since we have already controlled for the unobservable characteristics of the parents.

In our model for reading scores, we find that home ownership is insignificant for all three age groups after correcting for sample selection bias. The rating of the neighborhood and proportion of homeowners in the neighborhood are both statistically insignificant, while the number of children in the family is statistically significant and negative for all age groups. We also find that the home environment is only significant for children between the ages of three and

five. The mother's cognitive test score and years of education of the head of household are the only other significant variables in both the instrumental variables model and the OLS model.

For the older age groups, we find that the effects of neighborhood characteristics disappear when we correct for the selectivity bias. More specifically, we find that the rating of the neighborhood is insignificant for children between the ages of 10 and 12 in the IV model, whereas it is statistically significant in our OLS model. The proportion of homeowners in the neighborhood has a positive effect on the reading scores of children between the ages of six and nine in the OLS model, but becomes insignificant in the IV model. This implies that the neighborhood effects may be capturing the unobservable characteristics of the parents.

Math Achievement—IV Model

There are several similarities between the empirical results for reading and math scores. In the overall sample, the home environment and education level of the parents are significant factors for cognitive development in both subjects. Home ownership is no longer significant after correcting the sample selection bias.

We find some differences between reading and math scores when we estimated the models by age group. Some neighborhood characteristics, such as the rating of the neighborhood and the proportion of homeowners in the neighborhood, have a positive impact on math scores for children in the older age groups. This is not surprising, since older children are more likely to be influenced by peers as well as the quality of schools in the neighborhood. On the other hand, the reading scores were not affected by neighborhood characteristics. Reading aptitude may depend on parent-child activities, such as reading to the child, which are captured by the home environment and family size variables. Home environment has a positive impact on both math and reading achievement only for children in the youngest age group.

Our results suggest that home ownership does not have an independent effect on child outcomes once we correct the selectivity bias. In light of our results, it appears that some studies that have documented positive benefits of home ownership may be capturing

unobserved parental concerns for children's well-being or the effects of the neighborhood. Very few studies in this area of research have used the PSID-CDS to control for neighborhood characteristics such as the proportion of homeowners or the parent's assessment of the neighborhood. We find that once we control for income, residential stability, neighborhood characteristics, and home environment and correct for selectivity bias, home ownership is no longer a significant determinant of math and reading achievement.

We also find that home environment is an important factor for cognitive development in younger children; that is, parent-child activities and resources spent on children at home contribute significantly to better child outcomes. Moreover, neighborhood characteristics such as rating of the neighborhood and the proportion of homeowners in the neighborhood affect math achievement for older children but have a limited impact on reading achievement once we correct the selectivity bias in the estimates.

V

Conclusion

THE MAIN FINDING of this study is that the positive impact of home ownership on child educational outcomes disappears when the unobservable characteristics of the parents are controlled for. The use of the Child Development Supplement of the PSID data set allows us to use variables that are more detailed proxies of the household and neighborhood characteristics than previous studies, including the proportion of homeowners and minority residents as well as whether the parent believes the neighborhood is a good place to raise children. We find that even after controlling for neighborhood effects, residential stability, income, and the independent measures of home environment, the OLS estimates without correction for selectivity bias show that home ownership has a positive and significant effect on math and reading achievement of children. This is consistent with most of the previous studies.

Unlike previous studies, however, we find that home ownership becomes insignificant when we control for the unobservable behavioral traits of the parent using the two-stage instrumental variable

method. We also find that home environment has a positive effect on the math and reading achievement of young children, while the characteristics of the neighborhood have a more significant effect on older children.

The main policy implication of our study is that home ownership creates a better home environment, which has a positive effect on child outcomes. A subsidy for home ownership may lead to positive effects on academic achievement by placing children in a better home environment, better neighborhood, and more stable residences. However, such a policy can have a marginal effect, since it will affect only those marginal families that can own a home after the subsidy. Our study suggest that a better way to improve child outcomes may be to devise policies that can enable parents to create a stable home environment or facilitate community building through tax incentives and improving public schools.

Notes

1. For a more detailed description of the HOME scale, please see Chapter 6: 1997 Child Supplement of the PSID User Guide.
2. The regression results are available from the authors.

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