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Housing affordability and investments in children

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ABSTRACT

This paper uses the 2004–2009 Consumer Expenditure Surveys to examine whether housing affordability affects expenditures on children in families with income at or below 200% of the poverty line. After accounting for selection using propensity score matching, estimating effects using nonlinear GLM, and performing sensitivity tests, we find that child enrichment expenditures have an inverted U-shaped relationship with housing cost burden, our measure of housing affordability. This result is similar to the concave pattern of the association between housing cost burden and measures of children's cognitive achievement in reading and math. Thus, child expenditures, particularly for enrichment, may be one mechanism by which housing affordability affects children's cognitive outcomes. The inflection point for enrichment spending occurs at roughly the 30% housing cost-to-income ratio, the longstanding rule-of-thumb for defining housing affordability.

1. Introduction

It is well established that affordability is the main housing problem facing lower-income households and a key rationale for housing policy (e.g., Quigley 2008; Steffen et al., 2011). Deciding what people can afford has been based largely on normative judgment.[1] In the 1920s, banks adopted "a week's wages for a month's rent" rule-of-thumb, equivalent to a 25% housing cost to income ratio (Feins and Lane, 1981). This relative standard was subsequently adopted by each of the successive agencies vested with responsibility for US housing policy for moderate and lower-income households: the Housing and Home Finance Agency in the 1940s, the Department of Housing and Urban Development in the 1960s, and the Federal Housing Administration in the 1970s.[2]

Given this heuristic approach to defining affordability, it is not surprising that the cost burden measure has been debated virtually since its inception. Critics question the reliance on a relative standard, the ratio value designated as "affordable," and the lack of attention to differences in housing quality (e.g., Belsky et al., 2005; Bogdon and Can, 1997; Goodman, 2001; Hulchanski, 1995; Stone, 2006).[3] Nonetheless, the fraction of household income devoted to housing costs, or housing cost burden, remains the standard for defining housing affordability by both government and the private sector. The ratio was increased from 25% to 30% in the early 1980s and has remained there ever since.

Despite the central importance of the housing cost burden measure and of housing affordability more generally to housing policy, research has not examined the effects of affordable housing on residents. The broad policy question is whether affordable housing is welfare improving by moving housing consumption closer to the socially optimal level, given that housing creates externalities and is considered a merit good.

In this paper, we begin to address this question by focusing on the narrower topic of the role of affordable housing in the healthy development of lower-income

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[1] See Pelletiere (2008) for a succinct history of the housing cost burden standard.

[2] Although the FHA was created in 1934, it did not adopt the housing cost burden approach until 1972. (See Feins and Lane (1981) for a discussion of FHA's underwriting practices prior to 1972.)

[3] Concern about the lack of attention to housing standards arises because poor families may achieve a low housing cost burden by living in low-quality units in distressed neighborhoods.

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children. We examine one plausible mechanism through which affordability may convey its effects on children's outcomes by exploring whether housing affordability leads to larger expenditures on children, and particularly child enrichment expenditures. At first glance, it might appear that providing low-income families with affordable housing would solve the problem of material deprivation, which can have deleterious consequences for a child's healthy development including cognitive, social and emotional outcomes (e.g., Gershoff et al., 2007). But this would only be true if parents spend at least some portion of their greater disposable income on the child's needs and enrichment. At present, we do not know if this, in fact, occurs. We use the Consumer Expenditure Surveys (CE) to examine this pathway.

The next section reviews the literature. We then discuss how we measure affordability, and review the data, methods, and results. We summarize the results and explore their implications in the final section.

1.1. Literature review

This research is informed primarily by two bodies of literature: the literature on the role of income in child development, and the literature on the role of affordable housing in child well-being. In both sets of studies, the question of interest for the current paper is whether low income and material hardship (which could be caused by unaffordable housing) have deleterious effects on children's well-being.

1.2. Income and child development

Affordable housing acts as an income supplement, freeing up cash income that can be spent as desired. The most applicable framework in economics is the economic theory of family resources and child development (e.g., Becker, 1991; Foster, 2002). Like other economic actors, families face resource allocation decisions subject to budget constraints, and are assumed to choose the array of expenditures that maximizes their "utility" or satisfaction. According to this economic model, decisions about how much to spend on children depend, in part, on how much parents value their children compared with competing targets for family resources. Because the benefits to be derived from investments in children will not occur until some point in the future, parents who are future-oriented are expected to spend more on their children and less on current consumption for themselves (Foster, 2002).

The parent investment or material hardship model proposed by the child development field complements the economic model. The parent investment model states that income allows parents to purchase goods, services and experiences that benefit child development (Smith et al., 1997; Yeung et al., 2002). These expenditures include child care, learning materials, enriching activities, and health and dental care. Children in low-income families are assumed to fare worse because they are less likely to benefit from these expenditures and investments by their parents. Because housing affordability directly affects disposable income, parents in unaffordable housing have less to spend on their children, with potentially adverse consequences for those at the low end of the income distribution.

Consistent with the heterogeneity of preferences and future orientation of families, empirical tests of the economic theory of family resources and child development reveal considerable variation in expenditures on children even among families with similar incomes (e.g., Foster, 2002; Lino, 2008; Omori, 2010). Thus, similarly budget-constrained families make different choices about how to spend their limited funds. This insight has also been reported in considerable detail by scholars from other disciplines and methodological traditions, most prominently sociologists using qualitative and mixed-methods approaches (e.g., Edin and Lein, 1997; Mistry and Lowe, 2006; Mistry et al., 2008).

Several tests of the parent investment model find that material resources are more beneficial for cognitive outcomes than for behavior and emotional outcomes (Linver et al., 2002; Yeung et al., 2002). The effects of income appear to be nonlinear, being more important for poor children than the near-poor or non-poor (e.g., Dearing et al., 2001). Mayer (1997), however, reports very small effect sizes for income, leading her to conclude that the role of family income is mostly spurious. But Mayer's analysis excludes early childhood, which evidence increasingly suggests is a critical developmental period (e.g., Cunha and Heckman, 2007; Duncan et al., forthcoming).

1.3. Affordable housing and child development

Only one study we are aware of attempts to examine the causal effects of housing affordability on child outcomes (Newman and Holupka, 2013). This paper tests three hypotheses about the role of housing affordability in child well-being among lower-income families: that devoting too great a share of income to housing has deleterious effects on children; that spending too little on housing jeopardizes child well-being; or that unaffordable housing has positive effects on children because house prices capitalize such beneficial community features as school quality and low crime rates. Child outcomes include cognitive achievement, behavior, and health. The analysis relies on data from the Panel Study of Income Dynamics and its 1997 and 2002 Child Development Supplements, applies two quasi-experimental analytic approaches – propensity score matching and instrumental variable modeling – to address endogeneity and to support causal inference, and tests the sensitivity of results to omitted variable bias. Results reveal an inverted U-shaped relationship between the fraction of income devoted to housing and cognitive achievement,[4] with the best performance in the middle of the housing cost burden distribution and the worst performance at both high and low levels of affordability. The inflection point of approximately 30% supports the longstanding rule-of-thumb definition of affordable housing. There is no evidence that housing affordability affects behavior problems or health, however.

[4] Cognitive achievement is measured by tests of reading and math ability from the Woodcock-Johnson Revised Tests of Achievement (Woodcock and Johnson 1990).

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Three additional studies examine the related topic of the effects of housing prices on child outcomes. Blau and Haurin (2012) use data from the National Longitudinal Surveys of Youth to estimate fixed effects instrumental variable models (see Arellano and Bond, 1991). They find "small or negligible" effects of housing prices on child and young adult outcomes. A longitudinal analysis of the PSID-CDS finds that low-income children growing up in higher-priced housing markets fared no worse than those in lower-priced markets on academic achievement, behavior or health outcomes (Harkness et al., 2009). An earlier study, using the 1997 cross-section of the National Survey of America's Families, reports that living in higher-priced housing markets was associated with poorer health among children ages 6–11 and with poorer health and behavior for children ages 12–17 compared with lower-priced markets (Harkness and Newman, 2005). Although housing prices are correlated with housing affordability, they are not equivalent. Therefore, the results of these three housing price studies pertain most directly to outcomes in higher-versus lower-priced markets, not affordability *per se.*

1.4. Defining housing affordability

Traditionally, affordable housing has been defined as spending no more than 30% of income on housing. Adoption of this rule-of-thumb as the conventional wisdom is based on substantial external validity because it is the standard set by government regulations guiding assisted housing programs and by the private financial sector including mortgage lenders.[5] Despite its widespread acceptance, simplicity, and intuitive appeal, the housing cost burden measure has several weaknesses. Arguably, the most important is the analytic problem that the same factors that influence parents' decision to spend a particular fraction of family income on housing may also be associated with both their children's healthy development and how much they spend on their children to ensure their healthy development, the research question at the heart of this paper. As discussed below under Methods, we use propensity score matching in an effort to address this selection problem. The propensity method attempts to approximate an experimental design in which individual, household and community characteristics are fixed but housing affordability varies.

1.5. Hypotheses

Our recent work on the effects of housing affordability on child outcomes produced consistent results across both propensity and IV approaches of a U-shaped relationship between children's cognitive achievement and housing affordability (Newman and Holupka, 2013). The next question is how housing affordability conveys its effects. Although affordable housing increases the family's disposable income, the economic theory of the family and the child development theory of parent investment posit that this increased income will only be a conduit to better developmental outcomes if at least some of the money is spent on children, and especially on enriching resources. Two hypotheses emanate from these closely related theories. The first is that families with high housing cost burdens are unable to spend as much on their children as families spending roughly 30% of income on housing. The second hypothesis is that families with low housing cost burdens are not making such financial investments in their children even though they have greater disposable income than those with high or even moderate housing cost burdens. This second hypothesis is essentially the opposite of the first: families who spend too little on housing may also spend too little on their children. Lower-income families spending too little on housing are more likely to live in physically inadequate units and distressed neighborhoods (e.g., Conley 2001; Emrath and Taylor 2012; Grigsby and Bourassa 2004), potentially jeopardizing their children's healthy development. Spending too little on children is similarly likely to affect them deleteriously.

1.6. Data and samples

The analysis relies on the 2004–2009 Consumer Expenditures Surveys (CE) of the Bureau of Labor Statistics. The CE is an annual survey of approximately 7000 households. It uses a rotating panel sample design, with each sample household surveyed for five consecutive quarters.[6] The questionnaire asks about spending on more than 600 items, and also collects basic demographic data on the household and its members (Meyer and Sullivan, 2003). CE geocodes provide information at the metropolitan area and county level only. We, therefore, enriched the CE data with two measures: MSA or county poverty rates, and HUD's Fair Market Rents (US Department of Housing and Urban Development 2011).

Up to four quarters of expenditure data are collected on each household in the CE sample. We compute annualized expenditures for each household by averaging across quarters and multiplying by four. This approach has the advantage of including seasonal and infrequent purchases. Households must have at least three interviews during a 12-month cycle during the 2004–2009 time period to be included in the analysis sample.[7] We further limit the sample to households with a child 12 years old or younger whose income falls at or below 200% of the poverty line across 3–4 waves.[8] The final sample includes 3075 households.

Previous research indicates some underreporting of expenditures in the CE (Garner et al., 2009; Meyer and Sullivan, 2008). However, this problem is estimated to be less serious for lower-income households who are the focus of this analysis (Meyer and Sullivan, 2009). The BLS also abated the CE's longstanding problem of nonresponse to

[5] Berlinghieri (2010) reports that the maximum back-end ratio for conventional mortgage loans in the late 2000s was 36%.

[6] The first quarter of data collection establishes a baseline on the household and is not used for expenditure analyses.

[7] More than half (56%) of households meeting the child age and income criteria for the analysis sample completed at least three waves of the CE during the 12-month cycle in which they were respondents.

[8] Households that neither own nor rent (roughly 1% of the sample) are excluded because their housing cost burden status is indeterminate.

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income questions by imputing income. Imputed data are available starting in 2004, the first year of our analysis.[9] While imputation can introduce error (as can respondent reports), recent research on a comparable group of households to the current analysis – single mothers with their own children – produced similar results whether the analysis included, or excluded, cases with imputed income (Meyer and Sullivan, 2008). BLS research also demonstrates that the imputed data capture 94% of income and 97% of wages and salary reported in the Current Population Survey (Garner et al., 2009).

2. Methods

2.1. Addressing endogeneity

2.1.1. Propensity score matching

As noted, we use propensity score matching in an attempt to address the endogeneity of housing cost burden. This technique simulates an experiment in which the family's income and other observed characteristics are fixed so the role of these features is removed from observed variations in child expenditures across the distribution of housing cost burden.

Procedurally, we begin by predicting housing cost burden (Z), the measure of affordability, given individual, household, and locational characteristics (X):

$$\hat{Z} = f(X). \tag{1}$$

Cases are then matched based on $\hat{Z}$ (i.e., grouping the cases within strata of $\hat{Z}$), checking the quality of matches on each individual, family and locational characteristic used in matching to make sure the X's balance within each stratum.[10] The propensity score and strata classifications are then included as covariates in the outcome analyses. The propensity score approach assumes that unmeasured characteristics (U) that predict Y are independent of housing cost burden (Z) after controlling for observed individual, household, and locational characteristics (X):

$$U \perp Z \mid X \tag{2}$$

The main and significant weakness of propensity methods are the exclusion of unobservables. However, there is a growing statistical literature demonstrating that the inclusion of a rich and extensive set of covariates in the propensity model produces results that align with those from experimental designs (e.g., Cook et al., 2008, 2009; Steiner et al., 2011; Stuart, 2010). Therefore, we include a broad array of controls in the first-stage propensity model (see Appendix Table 1 for propensity model results).

Stress testing results is also advisable because it reveals how strong the effects of unobservables would need to be to invalidate the observed results (Stuart, 2010). Therefore, we conduct such sensitivity tests.

Turning to the outcome models of child expenditures, because these distributions are skewed and, in the case of enrichment expenditures, contain zero values,[11] we estimate generalized linear models (GLM) (Jones, 2010; Manning and Mullahy, 2001) of the form:[12]

$$g\{E(y)\} = x\beta,\ y\tilde{F} \tag{3}$$

where g{} is the link function that defines the shape of the conditional mean of the outcome, "y"; "x" is a set of covariates, which include the propensity score and propensity strata classification; "β" represents the parameter estimates associated with each covariate; and "F" specifies the distribution of the error term. We estimate the model using a log-link with a gamma error, which is the most common GLM specification for analysis of cost data (Manning and Mullahy, 2001).

Although GLM accommodates zero values, results can become less stable as the number of cases with zero increases (Deb et al., 2012). Therefore, we also test a two-part model in which the first part, a logit model, predicts the likelihood of zero enrichment expenditures, and the second part, the GLM model, predicts how much spending occurs given at least some spending (Buntin and Zaslavsky, 2003). Marginal probabilities are based on both parts (Deb et al., 2012).

2.2. Measures

2.2.1. Child expenditures

There are no accepted standards for what constitutes adequate expenditures on children or for the goods and services that constitute the appropriate market basket (Bernstein et al., 2000). The same is true for the subcategory of child enrichment expenditures. In the absence of systematic evidence on the effects of different market baskets on children's outcomes, most research relies on a common sense approach and includes such expenditures as education, child care, toys and games (e.g., Kaushal et al., 2011; Kornrich and Furstenberg, 2013). The US has nothing approaching the Orshansky scale or thrifty food plan for child expenditures generally, or child enrichment expenditures in particular. Although the Australian government has adopted a normative "basket of goods" or "budget standards" approach to the cost of children (Henman et al., 2007; Social Policy Research Centre, 1998), it does not single out enrichment expenditures and acknowledges the "element of arbitrariness" in any budget approach (Gray, 2007, p. 93). Therefore, as is the case with defining housing affordability, we, like others, define expenditures

[9] Meyer and Sullivan (2008) estimate that 17% of single mothers with children are missing data on primary source of income in the 1993–2003 surveys. We estimate that more than 40% of our sample is missing some information on some aspect of income, but this consists almost entirely of income questions where the correct response is zero, thus overestimating the size of the problem. Less than 1% of the sample is missing data on one or more covariates and are excluded from the sample.

[10] Various matching methods can be used with propensity analysis, including 1:1, many:1 subclassification, weighting, and full matching (Stuart, 2010). This analysis uses subclassification, creating groups based on similar propensity scores. One advantage of subclassification, along with weighting and full matching, is that all cases are used in the analyses (Stuart, 2010).

[11] 12% of cases report no enrichment expenditures.

[12] See Jones (2010) for a discussion of the advantages of GLM over logged OLS models.

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heuristically. We identify three main categories of expenditures:

(1) *Child necessities:* child clothing, percent of food at home purchased for children, percent of health insurance purchased for children, and percent of medical spending for children.
(2) *Child enrichment:* child care (both in-home babysitting and nursery/pre-school) school fees, school resources, toys, musical instruments and instruction, playground equipment, admission costs for movies, theater and opera, and reading materials.
(3) *Total child expenditures:* child necessities and child enrichment plus spending on furniture, sports and other recreation equipment.

Because child care has elements of both necessity and enrichment, we test models of child enrichment and of total child expenditures with, and without, child care.[13]

We include a combination of both current consumption (e.g., clothing) and future investment (e.g., health insurance) because both are relevant to a child's well-being. To estimate expenditures on the child portion of food purchased for home use, health insurance, and medical expenditures, we use the USDA formulas based on a child's age (Betson, 2006). A 5-year old, for example, is estimated to consume 57% as much food as an adult; in a household with two parents and one child, a child is assumed to account for 22% of household food consumption (.57/2.57). The child portion of health expenditures is considerably higher at 70% of the household's health expenditures for 0–5 year olds, and 79% for children 6 and older.[14]

Children's well-being is also affected by expenditures and in-kind contributions from those outside their own households. Our side analysis of the 2002 and 2007 Child Development Supplements to the Panel Study of Income Dynamics suggests that such contributions may underestimate expenditures on toys and games (part of our "enrichment" category) by about 18%, roughly 12% for clothing (a "necessity"), 6% for school supplies ("enrichment"), and 6% for food ("necessity"). Research suggests that these contributions may be particularly important among ethnically diverse, immigrant, and lower-income families (Lugo-Gil and Yoshikawa, 2006). Although the CE collects data on expenditures on others outside the sample household, it does not track outside contributions to the sample household, nor does it identify immigrant status. Therefore, we are unable to account for outside contributions. Excluding these non-household contributions will underestimate expenditures. However, what is key is how these expenditures are associated with housing cost burden, which is an open question. It is possible that the addition of these contributions might shift expenditures upwards but not change the fundamental relationship between housing affordability and child expenditures.

2.3. Housing cost burden

Our measure of housing costs is the sum of: (1) mortgage principal, mortgage interest, property taxes and homeowners insurance (for owners); (2) rent (for renters); and (3) out-of-pocket utility costs (i.e., electricity, fuel, water and sewer).[15] We divide this summary cost measure by household income (including imputed values, as described earlier) to create the housing cost burden measure.

2.4. Other covariates

Drawing on past research on child expenditures, our multivariate analyses control for the mother's age, education, race/ethnicity, receipt of food stamps, and number of children by age (2 or less, and 3–17) (e.g., Kornrich and Furstenberg, 2013; Omori, 2010).[16] Income and expenditures are expressed in 2009 dollars using the CPI-U. We account for geographic price differences for the two expenditures for which such indices exist: food and health. The food index uses the USDA's Quarterly Food-At-Home Price Database (Todd et al., 2010) and is based on a market basket of 44 food groups in each of 35 areas (metro areas, combinations of metro areas, or nonmetro areas) across the US. For health prices, we use the Medicare Hospital Wage Index, which is based on the average hourly wage rate of hospitals in 441 labor markets (Department of Health and Human Services, 2007; National Academy of Sciences, 2011). Although multiple indices exist to account for the large geographic differences in house prices, housing costs are endogenous in this analysis, as explained earlier.

3. Results

3.1. Sample description[17]

As shown in Table 1, most spending on children, roughly $3000, is for child necessities, with one-quarter to one-fifth that amount for child enrichment, depending on whether child care is included or excluded. Combining necessities and enrichment, households spent somewhat more than $4000 per year, on average, on their children between 2004 and 2009. Spending on child care averages roughly $200 per year. Averages of each expenditure

[13] Child care is a necessity for working parents, and an enrichment expense because many parents seek "developmentally appropriate educational experiences for preschoolers" whether or not the parents are working (Hertz, 1997).

[14] We estimate that roughly 6% of all expenditures in the 2006–2009 CE are imputed by BLS. Most of these pertain to housing expenses. The fraction of imputed child expenditures is far smaller, 1% or less.

[15] We also include the category "other lodging expenses," a miscellany of expenses (e.g., special security fees in condos and coops) that are relatively rare and nominal.

[16] We include a larger number of measures in the first-stage propensity model but a more parsimonious set in the outcome models. For example, despite the volatile economy of the 2004–2009 period, year dummies were statistically insignificant in the first-stage and, therefore, were excluded from final models. Seasons do not need to be accounted for because sample members are observed across seasons, thereby capturing the seasonality of some expenditures. Household income is excluded both because eligibility restrictions on the sample capture a relatively narrow income range and because income is the denominator in the affordability indicator, housing cost burden.

[17] Data in these descriptive estimates are weighted using the average of the CE's final quarterly weights for the periods included in the analysis.

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Table 1
Univariate statistics, CE sample.

	Mean	(S.D.)
Outcomes		
Child necessities	$3150	(1779)
Child enrichment (with child care)	$895	(1417)
Child enrichment (w/o child care)	$552	(962)
Total child (with child care)	$4395	(2909)
Total child (w/o child care)	$4068	(2431)
Housing affordability		
Average housing cost burden (HCB)	40.4	(22.9)
HCB Distribution		
⩽10	3.3	
>10 to <20	11.9	
20 to <30	21.5	
30 to <40	25.1	
40 to <50	14.7	
50 to <60	7.8	
60+	15.7	
Average fair market rent	$ 724	(231)
Background		
Head of households:		
Age	34.2	(7.9)
Education < high school	30.8	(46.2)
Education = high school	32.8	(46.9)
Education = some college	27.9	(44.9)
Education = college grad	8.5	(27.9)
Average family income	$ 25332	(12247)
Receive food stamps	34.9	(47.8)
Receive welfare	9.2	(28.9)
#Children	2.32	(1.18)
#Adults	1.94	(1.24)
#Wage earners	1.36	(.72)
Single parent	29.7	(45.7)
%White	40.2	(49.0)
%Black	21.1	(40.8)
%Hispanic	33.9	(47.3)
%Other race	4.8	(21.3)
Owner occupied housing	45.0	(49.2)
Community & metropolitan characteristics		
Crime/100,000 population	4822	(1750)
Natural amenities scale	1.53	(3.38)
Library expenditures per capita	$ 27.7	(19.7)
Park expenditures per capita	$ 99.4	(76.6)
%Metropolitan vacant housing units	11.4	(5.2)
Metro population density/square mile	659	(793)
Region of country		
Northeast	14.5	(35.2)
Midwest	18.8	(39.1)
West	23.3	(42.3)
South	43.3	(49.6)
Rural	10.1	(30.2)
Metro area population		
4 million+	26.7	(44.3)
1.2–4 million	19.9	(40.0)
33–1.19 million	11.1	(31.5)
125,000–329,999	21.9	(41.4)
<125,000	20.3	(40.2)

Notes:
(1) Weighted estimates. Unweighted $N = 3075$.
(2) Monetary values expressed in 2009$.
(3). FMR = fair market rent set by HUD for each housing market (see text for details).

category have large standard deviations because they are skewed in most cases by a few high values. In the case of child enrichment, however, the data are skewed by both high values and by the 12% of households with zero enrichment expenditures.

Mothers are about 33 years old, households average four persons, roughly 60% are minorities, and most live in large metropolitan areas with FMRs averaging $724. Housing cost burden is roughly normally distributed, though a larger proportion of the sample spends 60% or more of income on housing than spends 10% or less. Thus, approximately 3% of the sample spends 10% or less of income on housing at the low end, roughly 25% spending between 30 and 40% in the middle of the distribution, and about 16% spend 60% or more. Most mothers have a high school degree or less, and about 10% have at least a bachelor's degree. Household income is roughly $25,000, about one-third of households receive food stamps and 9% receive other welfare.

Given the transitory nature of low income for many households, the restriction of the CE analysis sample to households with an average income at or below 200% of poverty across the 3–4 waves should provide a conservative test of the effects of housing affordability on child expenditures. CE households who are experiencing only a temporary decline in income may not cut back substantially on spending for their children. Even if they do, their expenditures may not fall as low as those with persistently low income.

The correlations between housing cost burden and each set of expenditures are small, never reaching more than .05 (not shown). The essentially flat spending on child necessities likely arises because two key components of this expenditure category – food and health – are covered by safety net programs for the poor and near-poor (i.e., food stamps and Medicaid). The only exception is the 3% of households with housing cost burdens below 10%. This group spends roughly $500 more per year on necessities than virtually all other households. But this is also the group with the highest income in the sample, making it unclear whether their greater expenditures should be attributed to their higher income or greater housing affordability.[18]

3.2. Multivariate models

If child expenditures, and particularly enrichment expenditures, explain at least part of the inverted U-shaped relationship between housing affordability and children's cognitive achievement, then child expenditures should follow a similar nonlinear form. Therefore, we use linear, quadratic, and cubed specifications of the relationship between housing affordability and expenditures on children, and determine the best-fitting functional form with a likelihood ratio test of the relative improvement in model fit as additional nonlinear terms are added (Singer and Willett, 2003; Kleinbaum et al., 1998). A cubic model proves to be the best fit for child enrichment expenditures, but neither child necessities nor total child spending requires a nonlinear formulation.

Table 2 summarizes the key results from the GLM models using these formulations, and shows parameter estimates, standard errors for the policy variable, housing cost burden, and Wald tests of statistical significance.[19]

[18] This low housing cost burden group also spends roughly $150 more per year on "luxuries" (e.g., tobacco) than those with 30% cost burdens.
[19] Because the sample is not geographically clustered, there is no need to use clustered standard errors.

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Table 2
GLM regression results: housing cost burden on child spending, CE sample.

	Child necessities	Child enrichment		Total child expenditures	
		With child care	Without child care	With child care	Without child care
HCB	−.010	3.140	2.391	.081	.054
	[.042]	[1.584]	[1.665]	[.059]	[.051]
	(.819)	(.047)	(.151)	(.168)	(.283)
HCB^2		−7.151	−6.951		
		[3.393]	[3.567]		
		(.035)	(.051)		
HCB^3		4.693	5.105		
		[2.097]	[2.207]		
		(.025)	(.021)		
Wald test	.05	7.33	10.90	1.90	1.15
	.820	.062	.012	.168	.283

Notes:
(1) Sample limited to families with incomes ⩽200% of poverty.
(2) Unweighted $N = 3075$. Unweighted GLM regression.
(3) HCB = housing cost burden.
(4) Standard error in bracket [ ]; p-value in parentheses ().
(5) Wald test of likelihood that HCB = HCB^2 = HCB^3 = 0 (when HCB^2 or HCB^3 in model).

(Complete results for all covariates are shown in Appendix Table 2.) Housing affordability is not a significant predictor of spending on child necessities or on total child expenditures. As just noted, safety net programs may explain, at least in part, the essentially flat expenditure pattern across the housing cost burden distribution. The multivariate results suggest that the relationship between affordability and these two categories of spending are not affected by household characteristics or selectivity bias to any appreciable degree.

By contrast, the relationship between housing affordability and child enrichment expenditures is statistically significant. Fig. 1A and 1B plot the predicted child enrichment spending and its 95% confidence interval. The shape, again, approximates an inverted U, with expenditures increasing until a housing cost to income ratio of 30–35% for enrichment spending including child care and a ratio of about 25% for enrichment spending without child care. Spending on child enrichment then declines as the housing cost burden increases.[20] The child enrichment expenditure curves approximate the concave plot of the relationship between the two measures of children's cognitive achievement and affordability estimated in Newman and Holupka (2013), although the expenditure curves are shallower.

We assess the size of the association between housing affordability and enrichment spending by comparing the size of the affordability coefficient to that of other covariates in the GLM model. As shown in Table 3, mothers with at least a college education spend $1459 more per year on child enrichment (including child care) than parents with a high school degree or less education. Mother's education is the most important predictor by far, explaining 80–90% of the variance in child enrichment spending. Moving beyond mother's education, the next two most important predictors are race and receipt of food stamps. Being white (relative to another race/ethnicity) is associated with $394 additional dollars in child enrichment spending, while receipt of food stamps is associated with a $179 decline in spending. Housing cost burden is the next most important predictor.

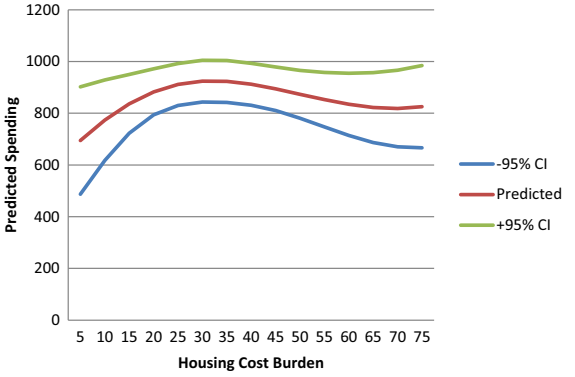

Fig. 1A. Predicted effects, CE spending on child enrichment (with child care), with 95% confidence intervals. *Notes:* 1. Sample limited to families with incomes ⩽200% of poverty. 2. Unweighted $N = 3075$.

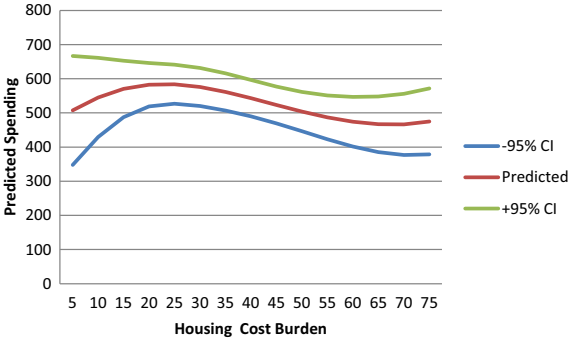

Fig. 1B. Predicted effects, CE spending on child enrichment (without child care), with 95% confidence intervals. *Notes:* 1. Sample limited to families with incomes ⩽200% of poverty. 2. Unweighted $N = 3075$.

[20] The figure appears to show a slight upturn in the curves at a 75% housing cost burden. However, the predicted child enrichment spending at this part of the curve is within $9 of spending at a 60% cost burden when child care is included and within 90 cents of spending at a 60% cost burden when child care is excluded. The differences at 65% and 70% cost burdens are less than $10 in both cases.

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Table 3
Odds ratios from child enrichment model, CE sample.

Variable	GLM coefficient	Odds ratio	Difference from mean
⩾College	.966	2.63	$1459
Some college	.536	1.71	635
Primary parent white	.365	1.44	394
Number of children 3–17	.080	1.08	72
Number of infants	.079	1.08	72
Primary parent age	−.013	.99	−9
Receive food stamps	−.219	.80	−179
HCB 10 to 30%		1.19	170
% ⩾College			11.7%
%Some college			26.8%
%White			42.2%
HCB 60 to 30%		1.11	98
% ⩾College			6.7%
%Some college			15.4%
%White			25.0%

Notes:
(1) Sample limited to families with incomes ⩽200% of poverty.
(2) Unweighted $N = 3075$. Unweighted GLM regression.
(3) For change in HCB, Odds Ratio = (Marginal at 30% HCB – Marginal at 10/60% HCB)/(Marginal at 10/60% HCB).
(4) Mean spending on child enrichment = $895. "Difference from mean" is the difference in predicted spending on child enrichment based on one SD change in covariate, change in value for dichotomous covariate, or change in housing cost burden compared to average spending on child enrichment.

The bottom panel of Table 3 presents the relationship between moving from a low housing cost burden of 10% to the 30% standard (roughly the inflection point for child enrichment spending, as shown in Fig. 1), and from a high housing cost burden of 60% to the 30% housing cost burden standard. The table indicates that moving from a 10% to a 30% housing cost burden is associated with an increase in child enrichment spending by $170. This represents 43% of the increased spending associated with being white versus another race/ethnicity, and 95% of the decreased spending associated with receiving food stamps. Moving from a 60% to a 30% housing cost burden is associated with a $98 increase in child enrichment spending. This amount is one-quarter of the increased spending associated with being white and 55% of the decreased spending associated with receipt of food stamps.[21]

3.3. Sensitivity test

As noted, because the key weakness of the propensity score matching technique to address selection is that it accounts for observables only, we test the sensitivity of these results for the plausible effects of unobserved factors (VanderWeele and Arah, 2011).[22] We apply middle-ground assumptions: an effect size of 20 (the average of the effect of race and receipt of food stamps), and a correlation of .13 (the average of the correlation between race and child enrichment expenditures, on the one hand, and receipt of food stamps and child enrichment expenditures, on the other). Results indicate that the marginal effects are $35–$40 lower than those reported (roughly two-thirds to three-quarters as large). Thus, an increase in housing cost burden from 10% to 30% would be associated with a predicted increase in spending on child enrichment by $134, while a decrease in housing cost burden from 60% to 30% would be related to a predicted increase in spending by $62. These relatively small changes in expected spending on child enrichment after adjusting for unobserved factors increases confidence in the multivariate result demonstrating that housing cost burden is associated with child enrichment spending.

4. Discussion

Despite widespread agreement that affordability is the main housing problem facing lower-income families and, therefore, an important target for policy, empirical evidence on the effects of affordable housing on residents is

Appendix Table 1
Propensity Regression Results.

Variables	Coefficient	Robust SE	*P*-value
Primary parent's			
Age	−0.0001	(0.0005)	0.783
Gender	−0.0042	(0.0147)	0.773
Education < High school	−0.0589	(0.0130)	0.000
Education = High school	−0.0313	(0.0136)	0.022
White	−0.0009	(0.0079)	0.914
Receive food stamps	0.0068	(0.0085)	0.425
Receive welfare	−0.0289	(0.0128)	0.023
Census region			
Midwest	0.0090	(0.0131)	0.492
South	−0.0153	(0.0131)	0.245
West	−0.0045	(0.01257)	0.723
Rural (BLS-defined)	−0.0242	(0.0155)	0.119
Area population			
4 million+	0.0289	(0.0169)	0.088
1.2–4 million	0.0352	(0.0153)	0.022
.33–1.198million	0.0219	(0.0155)	0.161
125,000–329,999	0.0171	(0.0131)	0.194
Year observed			
2004	−0.0247	(0.0125)	0.048
2005	−0.0067	(0.0126)	0.596
2006	0.0039	(0.0129)	0.763
2007	−0.0032	(0.0129)	0.805
2008	0.0023	(0.0129)	0.856
#Infants	0.0122	(0.0117)	0.297
#Children 3–17	0.0120	(0.0104)	0.247
#Adults	0.0213	(0.0110)	0.052
Total family size	−0.0349	(0.0103)	0.001
#Wage earners	−0.0436	(0.0061)	0.000
1-parent household	0.0236	(0.0105)	0.025
Own home	−0.0207	(0.0085)	0.016
Home has air conditioning	−0.0004	(0.0088)	0.960
#Bedrooms	0.0304	(0.0046)	0.000
Single-family home	0.0660	(0.0084)	0.000
Poverty status	−0.2112	(0.0085)	0.000
Crime/100,000 population	0.0034	(0.0250)	0.893
MSA/county FMR	0.0003	(0.0000)	0.000
Constant	0.6454	(0.0394)	0.000
Observations	3075		
R^2	.342		
Adjusted R^2	.335		

Note: Dependent variable = housing cost burden.

[21] These analyses are based on samples of owners and renters combined. Results do not change when renters and owners are analyzed separately. The inverted U-shaped relationship between housing cost burden and child enrichment applies to both housing tenure groups.
[22] VanderWeele and Arah (2011) indicate that this technique is not restricted to particular methods or functional forms.

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Appendix Table 2
GLM regression results, CE sample.

	Child necessity	Child enrich (with child care)	Child enrich (w/o child care)	Total (with child care)	Total (w/o child care)
Housing Cost Burden (HCB)	−.010	3.140	2.391	.081	.054
	(.042)	(1.584)	(1.665)	(.059)	(.051)
	[.819]	[.047]	[.151]	[.168]	[.283]
HCB squared		−7.151	−6.951		
		(3.393)	(3.567)		
		[.035]	[.051]		
HCB cubed		4.693	5.105		
		(2.097)	(2.207)		
		[.025]	[.021]		
Predicted HCB	.876	−2.020	−3.223	.245	.313
	(.467)	(1.653)	(1.840)	(.649)	(.557)
	[.061)	[.222]	[.080]	[.705]	[.575]
Propensity stratum 2	−.065	.042	.158	−.034	−.036
	(.053)	(.196)	(.211)	(.074)	(.063)
	[.217]	[.833]	[.454]	[.643]	[.573]
Propensity stratum 3	−.059	.390	.466	.094	.061
	(.063)	(.231)	(.249)	(.088)	(.076)
	[.349]	[.092]	[.062]	[.284]	[.417]
Propensity stratum 4	−.032	.512	.695	.090	.077
	(.072)	(.263)	(.287)	(.101)	(.087)
	[.654]	[.052]	[.015]	[.369]	[.376]
Propensity stratum 5	−.076	.413	.790	.019	.018
	(.081)	(.295)	(.321)	(.113)	(.097)
	[.344]	[.161]	[.014]	[.867]	[.847]
Propensity stratum 6	−.117	.527	.763	.047	.018
	(.089)	(.324)	(.351)	(.124)	(.107)
	[.187	[.103]	[.030]	[.705]	[.867]
Propensity stratum 7	−.094	.316	.473	.017	−.011
	(.098)	(.354)	(.385)	(.136)	(.117)
	[.336]	[.373]	[.219]	[.900]	[.927]
Propensity stratum 8	−.086	.583	.841	.081	.047
	(.108)	(.387)	(.425)	(.150)	(.129)
	[.425]	[.131]	[.048]	[.588]	[.714]
Propensity stratum 9	−.153	.217	.546	−.081	−.076
	(.119)	(.428)	(.467)	(.166)	(.142)
	[.198]	[.612]	[.242]	[.625]	[.595]
Propensity stratum 10	−.195	.452	.837	−.068	−.076
	(.131)	(.470)	(.516)	(.183)	(.157)
	[.137]	[.336]	[.105]	[.712]	[.630]
Propensity stratum 11	−.247	.179	.767	−.175	−.162
	(.145)	(.518)	(.572)	(.202)	(.173)
	[.058]	[.730]	[.180]	[.386]	[.349]
Propensity stratum 12	−.285	.480	.971	−.152	−.155
	(.161)	(.573)	(.634)	(.224)	(.192)
	[.077]	[.402]	[.125]	[.496]	[.420]
Propensity stratum 13	−.318	.352	.856	−.172	−.173
	(.178)	(.633)	(.698)	(.248)	(.213)
	[.074]	[.578]	[.220]	[.489]	[.416]
Propensity stratum 14	−.307	.777	1.371	−.102	−.113
	(.200)	(.715)	(.793)	(.279)	(.240)
	[.126]	[.277]	[.084]	[.716]	[.636]
Propensity stratum 15	−.422	.729	1.578	−.195	−.194

(*continued on next page*)

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Appendix Table 2 (*continued*)

	Child necessity	Child enrich (with child care)	Child enrich (w/o child care)	Total (with child care)	Total (w/o child care)
	(.237)	(.860)	(.944)	(.331)	(.284)
	[.075]	[.397]	[.095]	[.556]	[.495]
Parent Age	.003	-.013	.001	-.004	-.002
	(.001)	(.004)	(.005)	(.002)	(.001)
	[.024]	[.002]	[.753]	[.006]	[.226]
Parent educ.: HS	.071	.536	.572	.204	.177
	(.018)	(.069)	(.074)	(.026)	(.022)
	[.000]	[.000]	[.000]	[.000]	[.000]
	Child necessity	Child enrich (with child care)	Child enrich (w/o child care)	Total (with child care)	Total (w/o child care)
Parent educ.: >High school	.147	.966	1.029	.382	.349
	(.030)	(.113)	(.120)	(.042)	(.036)
	[.000]	[.000]	[.000]	[.000]	[.000]
Receive food stamps	−.093	−.219	−.333	−.103	−.108
	(.018)	(.068)	(.073)	(.025)	(.021)
	[.000]	[.001]	[.000]	[.000]	[.000]
#Infants	.207	.079	−.043	.173	.173
	(.014)	(.055)	(.058)	(.020)	(.017)
	[.000]	[.153]	[.459]	[.000]	[.000]
#Children 3–17	.300	.080	.127	.224	.242
	(.007)	(.026)	(.028)	(.010)	(.009)
	[.000]	[.002]	[.000]	[.000]	[.000]
White	.098	.365	.549	.143	.150
	(.017)	(.063)	(.078)	(.023)	(.020)
	[.000]	[.000]	[.000]	[.000]	[.000]
Constant	7.016	6.667	5.896	7.780	7.577
	(.100)	(.397)	(.432)	(.137)	(.118)
	[.000]	[.000]	[.000]	[.000]	[.000]
Observations	3075	3075	3075	3075	3075

Note:
GLM coefficient, standard error in parentheses, *p*-value in bracket.

lacking. This paper begins to address part of this gap with a focus on children. We explore expenditures on children as one possible mechanism that explains the inverted U-shaped relationship between housing affordability and children's cognitive achievement (Newman and Holupka, 2013). In particular, this earlier analysis finds that children's cognitive performance suffers in families with very high housing cost burdens, consistent with the conventional wisdom. But cognitive outcomes also suffer in families with very low housing cost burdens, demonstrating that low housing cost burdens are not always "better." It is rarely acknowledged that for low-income families, a low housing cost burden warrants concern because of its likely association with living in a poor quality housing unit and neighborhood (Conley 2001; Emrath and Taylor 2012; Grigsby and Bourassa, 2004).

This analysis of child expenditures produces an inverted U-shaped relationship between enrichment expenditures and housing cost burden, indicating that these expenditures are lowest when the fraction of income spent on housing is either very high or very low. This approximates the pattern observed by Newman and Holupka (2013) between housing cost burden and child cognitive achievement scores in reading and math. Thus, at least part of the explanation for the better cognitive outcomes of low-income children in the middle range of the housing cost burden distribution and worse outcomes at either end may be that parents with moderate cost burdens spend more on child enrichment than those with high or low cost burdens. Consistent with the objective of enrichment goods and services, it is plausible that these expenditures contribute to the child's cognitive development.

Beyond contributing to the knowledge base about housing affordability mechanisms, this analysis, when coupled with the prior work on the effects of affordability on children, offers suggestive empirical evidence to support the 30% rule-of-thumb for defining housing affordability in both government and private sector housing policies. Both suggest that the inflection point for children's cognitive achievement and child enrichment expenditures occurs at roughly 30%.

The estimated effect sizes of this analysis also are sufficiently large to be meaningful for policy. Mother's education is by far the strongest predictor, accounting for nearly 90% of the variance in child enrichment spending. Thus, its effect size overwhelms any other measure. The mother's race and the family's receipt of food stamps are the next strongest predictors and roughly in the range of housing affordability, so they provide a more level playing field for comparing effect sizes. Moving from a very low housing cost burden of 10% to the affordability standard of 30% is associated with an increase in child enrichment spending by an estimated $170. This is somewhat less than half the increase associated with race and nearly the same as receipt of food stamps (albeit in the opposite direction). While not a large amount, it is nonetheless sufficient to purchase books and games, and pay for some outings. Moving from a 60% housing cost burden to 30% is associ-

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ated with a more modest $98 increase in spending, which is about 25% that for race and somewhat more than half that of food stamps. But, again, it is sufficient for at least some educational purchases.

This analysis further suggests that housing cost burden is not simply a reflection of income. If it were, then we should see a monotonic decline in enrichment expenditures with increases in housing cost burdens because of the linear relationship between income and cost burden. That is, by definition, if housing cost is held constant, then housing cost burden increases as income declines. If the relationship between housing cost burden and child expenditures were only a function of income, which has a linear relationship with expenditures, then we would expect a similar linear relationship with housing cost burden. Instead, housing cost burden has a nonlinear relationship to expenditures on child enrichment. Still to be determined is whether the fraction of income a family devotes to housing reflects the tradeoffs the family makes, the personalities or other characteristics of family members, or additional features yet to be identified.

These results provide intriguing evidence that one reason why housing affordability affects children's cognitive achievement may be the effect of housing affordability on family spending on their children, and particularly on child enrichment. An important agenda for future research is to extend this work to other age groups and outcomes. Results for younger and older adults and for a wider range of outcomes would substantially strengthen the evidence base for future housing policy.

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Appendix D.

References

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Rev. Econ. Stud. 58, 277–297.
Becker, G., 1991. A Treatise on the Family, Enlarged Edition. Harvard University Press, Cambridge, MA.
Belsky, E., Goodman, J., Drew, R., 2005. Measuring the nation's rental housing affordability problems. Harvard University, Report of the Joint Center for Housing Research.
Berlinghieri, L., 2010. Essays on House Price Fluctuations in the U.S. Ph. D. thesis, University Washington, Seattle, USA.
Bernstein, J., Brocht, C., Spade-Aguilar, M., 2000. How Much is Enough? Basic Family Budgets for Working Families, Economic Policy Institute, Washington, DC.
Betson, D., 2006. Parental expenditures on children: Rothbarth estimates. Report prepared for Policy Studies, Inc. for the State of Oregon.
Blau, D., Haurin, D. 2012. The impact of housing on the wellbeing of children and youth. Paper prepared for the 2012 APPAM fall research conference.
Bogdon, A., Can, A., 1997. Indicators of local housing affordability: Comparative and spatial approaches. Real Estate Econ. 25, 43–80.
Buntin, M., Zaslavsky, A., 2003. Too much ado about two-part models and transformation? Comparing methods of modeling Medicare expenditures. J Health Econ. 23, 525–542.
Cook, T., Shadish, W., Wong, V., 2008. Three conditions under which experiments and observational studies produce comparable causal estimates: new findings from within-study comparisons". J. Policy Anal. Manage. 27, 724–750.
Cook, T., Steiner, P., Pohl, S., 2009. 2008 Saul B. Sells Award address paper – How bias reduction is affected by covariate choice, unreliability, and mode of data analysis: Results from two types of within-study comparisons. Multivariate Behav. Res. 44, 828–847.
Conley, D., 2001. A room of one's own or a room with a view? Housing and educational stratification. Sociol. Forum 16, 263–280.
Cunha, F., Heckman, J., 2007. The technology of skill formation. Working Paper 12840 National Bureau of Economic Research.
Dearing, E., McCartney, K., Taylor, B., 2001. Change in family income-to-needs matters more for children with less. Child Dev. 72 (6), 1779–1793.
Deb, P., Manning, W., Norton, E., 2012. Preconference course: Modeling health care costs and counts. ASHEcon, Minneapolis Conference 2012.
Department of Health and Human Services, 2007. Review of hospital wage data used to calculate inpatient prospective payment system wage indexes. Office of Inspector General, Report A-01-05-00504.
Duncan, G., Magnuson, K., Votruba-Drzal, E. forthcoming. Boosting family income to promote child development. The Future of Children.
Edin, K., Lein, L., 1997. Making Ends Meet: How Single Mothers Survive Welfare and Low-Wage Work. Russell Sage Foundation, New York, NY.
Emrath, P., Taylor, H., 2012. Housing value, costs, and measures of physical adequacy. Cityscape 14, 99–126.
Feins, J.D., Lane, T.S., 1981. How Much for Housing? Abt Books, Cambridge, MA.
Foster, E.M., 2002. How economists think about family resources and child development. Child development 73 (6), 1904–1914.
Garner, T., McClelland, R., Passero, W., 2009. Strengths and weaknesses of the Consumer Expenditure Survey from a BLS perspective. National Bureau of Economic Research, Summer Institute 2009. Conference on Research on Income and Wealth. Cambridge, MA.
Gershoff, E., Aber, L., Raver, C., Lennon, M., 2007. Income is not enough: Incorporating material hardship into models of income associations with parenting and child development. Child development 78, 70–95.
Goodman, J., 2001. Housing affordability in the United States: Trends, interpretations, and outlook. Report prepared for the Millenial Housing Commission. Arlington, VA: Hartrey Advisors.
Gray, M., 2007. "Costs of Children and Equivalence Scales: A Review of Methodological Issues and Australian Estimates". In Henman, P., Percival, R., Harding, A., Gray, M., Costs of Children: Research Commissioned by the Ministerial Taskforce on Child Support. Australian Government, Department of Families, Community Services, and Indigenous Affairs, pp. 85–113.
Grigsby, W., Bourassa, S., 2004. Section 8: The time for fundamental program change? Housing Policy Debate 15, 805–834.
Harkness, J., Newman, S., 2005. Housing affordability and children's well-being: Evidence from the National Survey of America's Families. Housing Policy Debate 16, 223–255.
Harkness, J., Newman, S., Holupka, C.S., 2009. Geographic differences in housing prices and the well-being of children and parents. J. Urban Affairs 31, 123–146.
Henman, P., Percival, R., Harding, A., Gray, M., 2007. Costs of children: research commissioned by the Ministerial Taskforce on Child Support. Australian Government, Department of Families, Community Services, and Indigenous Affairs. Occasional Paper #18.
Hertz, R., 1997. A typology of approaches to child care: The centerpiece of organizing family life for dual-earner couples. J. Family Issues 18 (4), 355–385.
Hulchanski, J., 1995. The concept of housing affordability: six contemporary uses of the housing expenditure-to-income ratio. Housing Stud. 10, 471–491.
Jones, A., 2010. Models for health care. The University of York, HEDG Working Paper 10/01, Retrieved February 2013 from <http://york.ac.uk/res/herc/hedgwp>.
Kaushal, N., Magnuson, K., Waldfogel, J., 2011. How is Family Income Related to Investments in Children's Learning? In: Duncan, G., Murnane, R. (Eds.), Whither Opportunity? Sage, Russell, pp. 187–205.
Kleinbaum, D., Kupper, L., Muller, K., Nizam, A., 1998. Applied Regression Analysis and Multivariable Methods. Brooks/Cole, Pacific Grove, CA.
Kornrich, S., Furstenberg, F., 2013. Investing in children: changes in parental spending on children, 1972–2007. Demography 50 (1), 1–23.

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Lino, M., 2008. Expenditures on children by families, 2007. US Department of Agriculture, Center for Nutrition Policy and Promotion. Publication, 1528–2007.

Linver, M., Brooks-Gunn, J., Kohen, D., 2002. Family processes as pathways from income to young children's development. Dev. Psychol. 38 (5), 719–734.

Lugo-Gil, J., Yoshikawa, H. 2006. Assessing expenditures on children in low-income, ethnically diverse and immigrant families. National Poverty Center Working Paper Series #06-36.

Manning, W., Mullahy, J., 2001. Estimating log models: to transform or not to transform? J. Health Econ. 20, 461–494.

Mayer, S., 1997. What Money Can't Buy: Family Income and Children's Life Chances. Harvard University Press, Cambridge, MA.

Meyer, B., Sullivan, J., 2003. Measuring the well-being of the poor using income and consumption. J. Human Res. 38 (Suppl.), 1180–1220.

Meyer, B., Sullivan, J., 2008. Changes in the consumption, income, and well-being of single mother headed families. Am. Econ. Rev. 98, 2221–2241.

Meyer, B., Sullivan, J., 2009. Five decades of consumption and income poverty. NBER Working Paper 14827.

Mistry, R., Lowe, E., 2006. "What Earnings and Income Buy: The 'Basics', Plus 'A Little Extra': Implications for Family and Child Well-Being", in H. Yoshikawa, T. S. Weisner and E. D. Lowe (Eds.), Making It Work: Low-Wage Employment, Family Life, and Child Development, Russell Sage Foundation, pp. 173–205.

Mistry, R., Lowe, E., Benner, A., Chien, N., 2008. Expanding the family economic stress model: Insights from a mixed methods approach. J. Marriage Family 70, 196–209.

National Academy of Sciences, 2011. Geographic Adjustment in Medicare Payment: Phase I: Improving Accuracy. Edited by Margaret Edmunds and Frank Sloan. Committee on Geographic Adjustment Factors in Medicare Payment; Board on Health Care Services; Institute of Medicine.

Newman, S., Holupka, S. 2013. "Housing Affordability and Children's Well-Being". Working Paper, Center on Housing, Neighborhoods, and Communities, Institute for Health and Social Policy. Baltimore, MD: Johns Hopkins University.

Omori, M., 2010. Household Expenditures on Children, 2007–2008. Monthly Labor Rev. 133 (9), 3–16.

Pelletiere, D., 2008. Getting to the Heart of Housing's Fundamental Question: How Much Can a Family Afford? Retrieved February 2012 from <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1132551>.

Quigley, J., 2008. "Just Suppose: Housing Subsidies for Low-Income Renters". In Retsinas, N., Belsky, E. (Eds.), Revisiting Rental Housing, Harvard University Joint Center for, Housing Studies, pp. 300–318.

Singer, J., Willett, J., 2003. Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence. Oxford University Press, New York, NY.

Smith, J., Brooks-Gunn, J., Klebanov, P., 1997. Consequences of Living in Poverty for Young Children's Cognitive and Verbal Ability and Early School Achievement. In: Duncan, G., Brooks-Gunn, J. (Eds.), Consequences of Growing Up Poor. Russell Sage Foundation.

Social Policy Research Centre, 1998. Development of indicative budget standards for Australia. Research Paper #74.

Steffen, B., Fudge, K., Martin, M., et al., 2011. Worst case housing needs 2009: Report to Congress. Retrieved February 7, 2011, from <http://www.huduser.org/portal/publications/ affhsng/wc_HsgNeeds09.html>.

Steiner, P., Cook, T., Shadish, W., 2011. On the importance of reliable covariate measurement in selection bias adjustments using propensity scores. J. Educ. Behav. Stat. 36, 213–236.

Stone, M.E., 2006. What is housing affordability? The case for the residual income approach. Housing Policy Debate 17 (1), 151–183.

Stuart, E., 2010. Matching methods for causal inference: A review and a look forward. Stat. Sci. 25, 1–21.

Todd, J., Mancino, L., Leibtag, E., Tripodo, C., 2010. Methodology behind the quarterly Food-at-Home Price Database". U.S. Department of Agriculture. Economic Research Service. Technical, Bulletin #1926.

US Department of Housing and Urban Development, 2011. Fair Market Rent history file, 1983-2011: 2-bedroom unit data. Retrieved January 2012 from <http://www.huduser.org/portal/ datasets/fmr. html>.

VanderWeele, T., Arah, O., 2011. Bias formulas for sensitivity analysis of unmeasured confounding for general outcomes, treatments, and confounders. Epidemiology 22, 42–52.

Woodcock, R., Johnson, M., 1990. Woodcock-Johnson Psycho-Educational Battery-revised. Riverside Publishing, New York, NY.

Yeung, W., Linver, M., Brooks-Gunn, J., 2002. How money matters for young children's development: Human capital and family process. Child Dev. 73, 1861–1879.

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