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Assessing the effect of changes in housing costs on food insecurity

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In this paper, we examine whether changes in housing costs lead to changes in rates of food insecurity for economically vulnerable families. We use data on a national, longitudinal sample of young families with children merged with data on housing (rental) costs at the state, metropolitan statistical area, and county levels (2001–2003). Focusing on families near or at the poverty level and using household fixed effects, we demonstrate that increased housing costs over this time period have indeed increased rates of food insecurity. Our preferred results suggest that a $500 increase in yearly rental costs is associated with nearly a 3% increase in food-insecurity rates (10% relative increase). We show that our measure of rental costs seems to affect only the food insecurity of renters and not that of poor low-income home owners, suggesting the validity of our methods and robustness of the findings. We also look at selected subgroups (e.g., food stamp recipients, individuals receiving housing subsidies) and find few differences in the effects of housing cost increases on food insecurity.

Introduction

Household food insecurity is a large problem facing families living near or below the poverty level. Research has shown that food insecurity is associated with several short- and long-term consequences for children and adults, including poor nutritional outcomes, mental health problems, child behavioral problems, distress, negative family and social interactions, and school performance (Olson 1999; Winicki and Jemison 2003; Bhattacharya, Currie, and Haider 2004; Whitaker, Phillips, and Orzol 2006; Nord et al. 2008). Economic factors such as lack of savings, unemployment, and income variability are also associated with food insecurity (Olson et al. 1997; Gunderson and Gruber 1999; Daponte and Stephens 2004).[1] Researchers also have begun to examine the individual and community-level determinants of food-insecurity status, including state economic and social characteristics (Bartfeld and Dunifon 2006). Along with demographic characteristics such as low education, poverty, lack of home ownership, race/ethnicity, and single parenthood, policy and contextual correlates such as a strong food-security infrastructure have been shown to play an important role in the food insecurity of low-income households (Bartfeld and Dunifon 2006). One potential determinant of household transitions into and out of food-insecurity status that has so far received few scholarly inquiries is expenditure shocks. In this paper we study price fluctuations in the residential housing market to estimate the effect of one type of expenditure shock on food insecurity. While significant increases in housing costs are

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not predicted for the near future, this information allows us to glean some information on the effect of other expenditure shocks.

Housing costs are a significant share of household budgets, particularly among low-income families. Research has indicated that individuals residing in areas with relatively high housing costs are more likely to report food insecurity. Yet the impact of changes in housing costs in the United States on the food security of individual families has yet to be studied. In this paper, we extend prior literature by pursuing two intertwined research questions. First, we assess whether recent changes in housing costs have increased food insecurity among low-income households with young children. Second, we explore whether this effect differs for selected subgroups (i.e., individuals receiving housing assistance, food stamp recipients).

In order to address these research questions, we use nationally representative data from the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B). These data include detailed longitudinal information on demographics, social program participation, and the Household Food Security Scale recommended by the US Department of Agriculture (USDA). Geographic identifiers available in a restricted-access version of the ECLS-B allow us to append important county- and state-level characteristics, such as housing costs. To control for individual-level heterogeneity, we use household fixed effect models to examine the effect of changes in housing costs on changes in household food security. To assess whether social programs mitigate the effect of housing costs on food-insecurity status for at-risk families, we use information about family transitions into food stamp and housing subsidy programs, as well as state-level information regarding program participation. This information provides evidence as to whether expanding social programs in times of housing cost increases might promote the food security of at-risk families.

Background and significance

Household food insecurity is defined by the USDA as difficulty providing enough food for all household members due to lack of resources at some time during the year (Nord et al. 2008). In 2007, 11.1% of American households reported being food insecure at some point during the year. Among poor households this number increased to 37.7%. Additionally, households with children were particularly at risk for food insecurity and experienced approximately twice the rate of food insecurity as households without children (15.8 versus 8.7%) (Nord et al. 2008).

Food insecurity has been associated with negative health and social outcomes for both adults and children. Olson (1999) finds that food insecurity is associated with increased BMI in women of child-bearing age, and compromised psychosocial functioning in children. Bhattacharya, Currie, and Haider (2004) present evidence that food insecurity and poverty are both predictive of lower nutritional outcomes for adults and the elderly. Dunifon and Kowaleski-Jones (2003) find that food insecurity is associated with an increase in health limitations and decreased positive behavior for children. Whitaker, Phillips, and Orzol (2006) find a cross-sectional relationship between food insecurity and depressive symptoms for poor mothers with young children in the Fragile Families and Child Wellbeing Study. As discussed by Dunifon and Kowaleski-Jones (2003), several other studies examine the impact of food insufficiency (a more limited measure), and find negative impacts on child outcomes.

Unexpected expenditure or income shocks have been found to increase food insecurity for disadvantaged households. Bhattacharya et al. (2003) examine the effect of cold weather (and high home-fuel expenditures) on food consumption and find that cold weather and high home-fuel expenditure are associated with reduced food expenditure and caloric intake. Gunderson and Gruber (1999) find that low-income households that report food insufficiency face more frequent negative income shocks and also have fewer assets (such as savings accounts) than other households.

In this paper we examine a separate and important source of expenditure instability for low-income families – changes in housing costs. Between 2001 and 2005, among US households in the lowest income quintile, the average annual housing expenditure increased more than 10%, from $6834 to $7529. The share of expenditures for housing rose from 36.2 to 39.4% – a 9% increase. During the same time period, the expenditure share spent on food declined from 17.3 to 15.9% – a 9% decline (Bureau of Labor Statistics 2003, 2007). This is in contrast to higher-income households, for which the increase in housing budgets was associated with no change in the expenditure share spent on food (Bureau of Labor Statistics 2003, 2007). While previous research has found that states with high housing costs host a greater share of the households that are food insecure (Tapogna et al. 2004; Bartfeld et al. 2006; Nord et al. 2008), to our knowledge researchers have not examined the impact of recent increases in housing costs on individual households' food insecurity.

Given the changes in housing costs outlined above, one might hypothesize that public assistance programs (e.g., housing subsidies, food stamps) may mitigate the impact of the changes in housing costs on food expenditures for low-income families. While researchers have used different methods to study the impact of the food stamp program (see Wilde 2007 for a review of these methods), the results are ambiguous, with some studies finding a measurable impact, and others failing to document any benefit at all. This ambiguity likely stems partially from the thorny empirical issues around assessing the impact of participation in social programs like food stamps on food insecurity; the self-selection of more food-needy households into assistance programs is just one example. Our use of household fixed effects does not allow us to employ an instrumental variable strategy, so our approach is to examine individuals who either always or never participate in social programs. We then estimate the effect on food-insecurity status of variability in housing costs that the cushion of social program participation provides. The results of this analysis may be used to provide policymakers with evidence of the effectiveness of specific social programs in helping households sustain food security in an environment characterized by fluctuations in housing costs.

In particular, our paper has two complementary research goals. First, we assess whether changes in housing costs have increased food insecurity among low-income households with young children. Second, we assess whether this effect differs for selected subgroups (e.g., food stamp recipients, individuals receiving housing subsidies).

Data

In order to address these research questions, we use three primary data sources: (1) the restricted-access version of the Early Childhood Longitudinal Study, Birth

Cohort (ECLS-B); (2) the US Census Bureau's American Community Survey; and (3) data from the US Department of Housing and Urban Development (HUD) for county-level rental information.[2] We also include state-level measures of program participation and economic conditions from the Current Population Survey, and county-level demographic and social program characteristics from the Census and the Bureau of Economic Analysis (BEA).

The ECLS-B is a nationally-representative, longitudinal sample of 10,000 children born in 2001. Certain racial/ethnic minorities (Asian and Pacific Islander, American Indian, and Alaska Native children), twins, and low-birth-weight children were over-sampled. Data has been collected for the same children (and their families) at four age levels: nine months (2001); two years (2003); four years (2005); and five years (2006), with data available for the first three waves. Importantly, the survey provides data on food insecurity; social program participation (e.g., food stamps, housing subsidies, etc.); household income; family type; information about family moves, if any; and geographic identifiers. While all three waves of data include state-level identifiers, zip code-level identifiers were available only for the first two waves of data of the restricted-access version of the dataset. Thus, our analysis will focus on the 2001 and 2003 survey waves.

To determine food security, the ECLS-B included 18 questions in accordance with the standards described in the *Guide to Measuring Household Food Security, Revised 2000* (Bickel et al. 2000).[3] These questions measured a wide range of food-security and food-intake domains. Responses from these questions are aggregated to form two measures: (1) a raw score (i.e., a count of the affirmative responses); and (2) a categorical measure indicating whether the family can be categorized as a 'food secure household,' a household with low food security (known prior to 2006 as 'food insecure without hunger'), or a household with very low food security (known previously as 'food insecure with hunger').

These measures are available at the household level, separately for children (as a group) in each household, and for adults (as a group) in the household (NCES 2005).[4] For most analyses, we will focus only on low-income households, defined as households with incomes below 100% of the federal poverty threshold. Note that due to the design of the sample, all of these households contain at least one young child.

Since the ECLS-B does not contain information on housing costs, we obtained state-level rental costs from the American Community Survey, which is conducted by the US Census Bureau (2006). During the time period we considered, approximately 800,000 households were sampled annually. At the state level, estimates of housing costs are produced yearly. Information on median monthly housing costs for renter-occupied housing units is considered.

In addition to state-level rental costs data, we also used county-level median rental rates collected by HUD on 50th and 40th percentile Fair Market Rents in each fiscal year across metropolitan statistical areas (MSAs) and non-MSA counties. We examined other potential sources of county and MSA-level rental data, including the ACCRA Cost of Living Index, the American Housing Survey, and the American Community Survey. Since HUD uses information from these sources and adds information from the Census and telephone surveys, the HUD data appeared to have better coverage of counties and MSAs for our time period (2001 and 2003), and allowed us to retain a larger sample for our analysis. To measure the housing costs faced by individual households, we merged household-level data from the ECLS-B

with the area-level rental rates collected by HUD. This measure indicated the median rent, by year, in a given area. Most previous research on housing costs and food insecurity had considered state-level housing costs. Because there is significant intrastate variation in housing costs, the use of MSA-level and county-level data was an improvement over prior studies. We considered rental information, because most poor households with children do not own their homes.[5] We also incorporated county-level information from the Census and BEA for percent of poverty, number of housing units, and basic demographic characteristics that we used in robustness checks of our main results.

While the ECLS-B contains data for over 10,000 children, we focused on a more limited sample. Of the 10,688 children at baseline in 2001, we focused on the approximately 1400 children in families with household income below 100% of the federal poverty line in both data waves (2001 and 2003), with valid longitudinal sample weights and complete demographic information. We present weighted summary statistics in Table 1.[6] Of the low-income households in Wave 1 (Wave 2), 68% (76%) were food secure, 24% (19%) reported low-food security, and 8% (5%) had very low-food security. As expected, given our focus on low-income households, the rates of food insecurity were higher than for the general population statistics. Furthermore, 65% of the sample participated in the food stamp program and 27% received some housing assistance.

We also examined the change in consumer price index (CPI)-adjusted housing costs from 2001 to 2003 for our sample of low-income households. In 2001, median rental costs across the 50 states averaged approximately $7770 per year measured at the state level. Similarly, median rental costs across the counties/MSAs in our sample averaged $6116. By 2003 (Wave 2), median rental costs at the state level had fallen slightly, to $7585 per year; but the county/MSA measured rents suggested an increase to $6293 per year.[7] The nominal range of the change in housing costs varied greatly state by state, with several states experiencing real housing cost increases of over $500 in only two years.

Methodology

In order to answer our research questions using the ECLS-B data, we draw on several econometric methods, including cross-sectional models and fixed effects models.

First, we examine the cross-sectional relationship between housing costs and food-insecurity status, using single-year cross-sections and pooling the data across years to maximize the sample size. Our basic specification takes the form:

$$y_{ist} = \beta X_{ist} + \delta \text{Housing}_{ist} + Y_t + \varepsilon_{ist} \tag{1}$$

where y is the food-insecurity outcome of household i in state s at time t, X is a vector of individual-level characteristics of the responding adult and household-level characteristics (e.g., respondent's race and age, number of adults in the household, family type (i.e., married), and number of children in the household). Housing is the yearly median rent in the family residence area (measured at the state or county level), and Y represents year fixed effects.[8] We estimate our models using weighted OLS regression specifications to consider whether a household is food insecure (combining households with low- and very low-food security).[9]

Table 1. Summary statistics, ECLS-B Waves 1 and 2, families always below 100% of poverty level (N ~ 1400).

Variable	Wave	Mean	Standard deviation	Minimum	Maximum
Food secure	1	0.68	0.47	0	1
Food insecure (without hunger)	1	0.24	0.43	0	1
Food insecure (with hunger)	1	0.08	0.27	0	1
Food secure	2	0.76	0.43	0	1
Food insecure (without hunger)	2	0.19	0.39	0	1
Food insecure (with hunger)	2	0.05	0.22	0	1
Yearly county housing cost (2003$)	1	8103	2209	4730	18,483
Yearly county housing cost (2003$)	2	8600	2677	4800	21,120
Yearly state housing cost (2003$)	1	8349	1375	5666	10,496
Yearly state housing cost (2003$)	2	8193	1531	5472	10,680
Food stamps	1	0.62	0.48	0	1
Food stamps	2	0.66	0.47	0	1
Welfare	1	0.28	0.45	0	1
Welfare	2	0.25	0.43	0	1
Housing subsidy	1	0.27	0.44	0	1
Housing subsidy	2	0.27	0.44	0	1
Income	1	10,910	6753	2500	32,500
Income	2	11,402	6656	2500	32,500
White	All	0.26	0.44	0	1
Black	All	0.30	0.46	0	1
Hispanic	All	0.37	0.48	0	1
Asian	All	0.01	0.11	0	1
Multi-race	All	0.04	0.20	0	1
Other race	All	0.01	0.12	0	1
Parent health	All	3.61	1.05	1	5
Married household	1	0.35	0.48	0	1
Married household	2	0.36	0.48	0	1
Number of children	1	2.46	1.39	1	10
Number of children	2	2.61	1.42	1	11
Number of adults	1	2.50	1.70	1	12
Number of adults	2	2.34	1.53	0	12
Household size	1	4.96	1.91	2	15
Household size	2	4.96	1.88	2	14

Longitudinal sample weights are used. The number of observations is rounded to the nearest 50 in order to comply with the ECLS-B guidelines.

One important limitation of our cross-sectional methodology is that there may be a third factor that affects both where a family lives (and thus the amount of its housing costs) and its food-insecurity status. Thus, finding a cross-sectional relationship between housing costs and food insecurity does not demonstrate a causal effect. In our next preferred set of models we make use of the longitudinal nature of the data by including household-level fixed effects. Conceptually, we use multiple observations of the same household across different economic environments – environments with relatively high housing costs and environments with relatively low housing costs – to examine each household's change in food-security status.

Using multiple waves of data, we include a household-level fixed effect, μ_i, to guard against unobserved household characteristics and attributes:

$$y_{ist} = \beta Z_{ist} + \delta \text{Housing}_{ist} + Y_t + \mu_i + \varepsilon_{ist} \tag{2}$$

Unlike X in Equation (1), Z includes only characteristics that change over time (e.g., income). Our estimate of δ is robust due to unobserved individual-level characteristics that do not change between waves in Equation 1 and in fact move us closer to uncovering a causal effect of housing costs on food insecurity.

Finally, to assess whether these effects differ by social program participation, we estimate Equation (2), stratifying our sample by social program participation history. For example, we compare estimates using Equation (2) for low-income households that always receive food stamps, versus those that never receive food stamps.[10] These empirical models can provide suggestive evidence of whether social programs are able to mitigate the effects on food insecurity of housing-cost fluctuations.

We use sample weights and clustered standard errors at the household level to account for pooling households across waves. We also conduct several robustness checks to improve our confidence in any significant results. For example, we expect little or no significant effect of increased housing costs for households that own their homes. We also expect increased housing to have less of an impact on food security on higher-income households (i.e., households with incomes greater than 185% of the federal poverty level).

Results

We present cross-sectional relationships between housing costs and food insecurity for each wave separately, as well as pooled results, in Table 2. The results are counterintuitive, suggesting that households in states with higher housing (rental) costs are slightly *less* likely to report food insecurity in Wave 1 and slightly less likely in Wave 2, though the latter result is not statistically significant. One might suspect that this cross-sectional relationship may reflect the fact that the poorest households live in areas with lower rental costs than near-poor households (recall that the entire sample is poor). The results control for household-level income, which may partially mitigate this issue. Higher state-level rental costs may be correlated with other state-level policies, such as more generous social services, which could result in lower rates of food insecurity in high-cost states in the cross-sectional analysis. An alternative explanation is that households living in high-cost areas may have higher permanent income and/or more stable income and employment. To further investigate the relationship between rental costs and food insecurity, we present longitudinal data estimates of Equation (2) in Table 3.

Table 3 offers results for the association between rental costs measured at the state level, and household food insecurity. In Column 1, we pool the observations and control for household fixed effects. Intuitively, our specification compares the same household over a two-year period and examines whether food-insecurity rates increase during times of high housing costs for these households with young children. Using rental costs measured at the state level imposes several limitations in our results. First, we only have variation at the state level, which may not allow us to estimate precise coefficients. Second, state-level rental costs introduce considerable measurement error when we examine household-level associations, likely attenuating

Table 2. Association between state-level housing costs and food insecurity, cross-sectional evidence using weighted least squares.

Year	2001	2001	2003	2003	Pooled
Specification	Basic	Adjusted	Basic	Adjusted	Adjusted
Annual housing costs ($1000s)	−0.014**	−0.013**	−0.003	−0.006	−0.029***
	(0.006)	(0.006)	(0.009)	(0.009)	(0.009)
Family income ($1000s)		−0.006**		−0.005	−0.005**
		(0.003)		(0.003)	(0.002)
Black		−0.006		0.047	0.018
		(0.042)		(0.045)	(0.036)
Hispanic		0.077		0.095*	0.105***
		(0.056)		(0.054)	(0.038)
Asian		0.008		−0.049	0.004
		(0.063)		(0.066)	(0.067)
Other race		0.028		0.005	0.006
		(0.088)		(0.047)	(0.053)
Multi-race		−0.002		0.125*	0.069
		(0.074)		(0.072)	(0.063)
Married		0.076		0.076**	0.080***
		(0.046)		(0.037)	(0.031)
Number of adults in household		−0.023*		−0.007	−0.016**
		(0.011)		(0.013)	(0.007)
Number of children in household		0.016		0.008	0.013
		(0.010)		(0.011)	(0.009)
Wave 1 dummy					0.085***
					(0.019)
Constant	0.436***	0.461***	0.270***	0.258***	0.465***
	(0.051)	(0.054)	(0.073)	(0.088)	(0.080)
Observations	1400	1400	1400	1400	2800

*10%, **5%, ***1%. Robust standard errors are clustered at the state level. The number of observations is rounded to the nearest 50 in order to comply with the ECLS-B guidelines.

our results. Table 4 shows the correlation between our state-level measures of housing costs and our county-level measures of housing costs. Third, state-level rental costs are likely correlated with other unobservable factors that may lead to an upward bias in our estimates. This combination of limitations with our measure does not allow us to conjecture whether our estimates are upward or downward biased.

Overall, our results in Table 3 are in the hypothesized direction but imprecisely measured. The results suggest that a $1000 increase in average rental costs is associated with a 15.2 percentage point (greater than 50%) increase in food insecurity, controlling for individual heterogeneity. Of course, since individuals are mobile in our dataset, rental cost changes can arise from moves across localities as well as intra-state rental cost changes. To account for this feature of our data, we include state fixed effects and household fixed effects in the second column of results. In Column 2, these additional controls increase the estimate of the association between housing costs and food insecurity to nearly 20 percentage points. In order to reduce concerns with endogenous mobility among states due to housing cost

Table 3. Association between state-level housing costs and food insecurity, fixed effects evidence using weighted least squares.

Wave Fixed effects Sample	Pooled Individual Poverty	Pooled Individual/state Poverty	Pooled Individual Poverty/ immobile	Pooled Individual Own home/ immobile	Pooled Individual Rent/ immobile
Annual housing	0.152*	0.197*	0.194	−0.105	0.278**
costs ($1000s)	(0.087)	(0.119)	(0.119)	(0.432)	(0.134)
Family income	−0.001	−0.002	−0.002	0.005	−0.004
	(0.004)	(0.004)	(0.004)	(0.007)	(0.004)
Wave 1 dummy	0.054*	0.043	0.043	0.124	0.026
	(0.029)	(0.033)	(0.032)	(0.130)	(0.036)
Constant	−0.986	−1.401	−1.323	0.934	−2.014*
	(0.711)	(1.006)	(0.972)	(3.298)	(1.108)
Observations	2800	2800	2750	450	2300
R^2	0.664	0.671	0.659	0.734	0.677

*10%, **5%. Robust standard errors are clustered at the household level. The number of observations is rounded to the nearest 50 in order to comply with the ECLS-B guidelines.

changes, we next focus only on 'immobile' households, which remain in the same state in each wave. Due to the relatively small number of 'mobile' households in our data, the results presented in Column 3 are nearly identical to previous results.

As a further test of our hypotheses, we stratify households into home owners, whom we expect to be unaffected by rental cost changes, and renters. We find that rental price increases are much more strongly associated with food insecurity for renters and have no effect on home owners. In fact, a $1000 increase in state-level rental costs is associated with a 27.8 percentage point (100%) increase in food insecurity for renters. While the results are consistent with our hypotheses, because of the limitations with the state-level rental cost measure that we outlined above, we also examine results based on county and MSA-level rental cost measures.

In Column 1 of Table 5, we present results using our county- and MSA-level cost measures, controlling for state- and individual-level fixed effects. Our results suggest that a $1000 increase in rental costs is associated with a 5.2 percentage point increase in household food insecurity (a 20% increase). In Column 2, we show that the results

Table 4. Correlation between state and county housing costs measures, poverty sample and full sample.

		State housing costs	State housing costs
		2001	2003
Full sample			
County housing costs	2001	0.6687	
County housing costs	2003		0.6763
Poverty sample			
County housing costs	2001	0.6676	
County housing costs	2003		0.6885

Table 5. Association between county-level housing costs and food insecurity, fixed effects evidence using weighted least squares.

Wave Fixed effects Sample	Pooled Individual/state Poverty	Pooled Individual Immobile	Pooled Individual Own home/immobile	Pooled Individual Rent/immobile
Annual housing	0.052**	0.052**	0.011	0.057*
costs ($1000s)	(0.026)	(0.026)	(0.063)	(0.031)
Family income	−0.002	−0.002	0.005	−0.004
	(0.004)	(0.004)	(0.007)	(0.005)
Wave 1	0.099***	0.099***	0.108	0.096***
	(0.030)	(0.030)	(0.109)	(0.035)
Constant	−0.172	−0.192	0.050	−0.216
	(0.242)	(0.233)	(0.483)	(0.281)
Observations	2800	2750	450	2300
R^2	0.671	0.659	0.734	0.675

*10%, **5%, ***1%. Robust standard errors are clustered at the household level. The 'immobile' sample refers to those households who do not move between states between survey waves. The number of observations is rounded to the nearest 50 in order to comply with the ECLS-B guidelines.

are again nearly identical if we focus on 'immobile' households only. In Columns 3 and 4 of Table 5, we again stratify by home owners versus renters. Consistent with our hypothesis is our finding that only renters seem to be negatively affected by rental cost increases at the county or MSA level.[11]

To examine the heterogeneity of the magnitude of the association across important sub-groups, we present stratified results in Table 6. We do not find meaningful variation in the estimated effects according to marital status. When we stratify our results by race and Hispanic ethnicity, we find a stronger relationship between housing costs and food-insecurity status for black households and nearly no relationship for non-Hispanic white households, although the results are not statistically significant. We also find suggestive evidence that individuals who receive public assistance such as food stamps or housing subsidies are *more* likely to report food insecurity as a result of rental cost increases, though the differences are not statistically significant. These results are suggestive, though not conclusive, that those households receiving housing subsidies or food stamps are not fully protected from the effects of changes in housing costs.

The final columns in Table 6 extend our sample to include the 'near poor.' We include individuals whose incomes are less than 135% of the federal poverty threshold and then add individuals whose income is less than 185% of the poverty threshold.[12] In each case we find evidence of much smaller effects on food insecurity after increases in rental costs for the 'near poor' compared with the poor.

Discussion

While this paper presents relatively robust evidence of an important association between rental cost increases and food insecurity, our study is not without limitations. We examine housing costs aggregated to the state, MSA, or county level rather than housing costs experienced by individual households. Second,

Table 6. Association between county-level housing costs and food insecurity, fixed effects evidence across sub-samples of renters.

Wave Fixed effects Sample	Pooled Individual Unmarried	Pooled Individual Married	Pooled Individual Hispanic	Pooled Individual Black	Pooled Individual White	Pooled Individual Food stamps	Pooled Individual No food stamps	Pooled Individual Housing subsidy	Pooled Individual No housing subsidy	Pooled Individual 130% poverty line	Pooled Individual 185% poverty line
Annual housing	0.062	0.068	0.061	0.102	0.027	0.084	0.019	0.150*	0.057	0.026	0.019
costs ($1000s)	(0.047)	(0.046)	(0.042)	(0.070)	(0.075)	(0.058)	(0.036)	(0.089)	(0.036)	(0.022)	(0.017)
Observations	1600	600	700	800	400	1350	500	550	1300	1350	2800
R^2	0.678	0.666	0.684	0.664	0.703	0.673	0.700	0.652	0.689	0.692	0.696

*10%, **5%, ***1%. Robust standard errors clustered at household level. Additional control variables: year dummy and family income, constant. All results use the sample of households who do not move between states between survey waves and are not homeowners. The number of observations is rounded to the nearest 50 in order to comply with the ECLS-B guidelines.

because our sample is limited to families with very young children, it may be impossible to generalize results to other families (e.g., the elderly). Finally, program participation may be endogenous in that families that experience high housing costs may be more likely to enroll in these programs. Yet these limitations must be weighed against the many strengths of this study. These include the use of a recent, rich, longitudinal dataset with information on a policy-relevant group of families with young children; the availability of a recently developed food-security measure for these families; and the methodological design that allows the inclusion of household fixed effects.

Overall, we find considerable evidence that increases in rental costs lead to higher rates of food insecurity for low-income households. More broadly, our results are suggestive of the importance of expenditure shocks, such as energy costs, food prices, and medical expenses, in increasing the risk of food insecurity for low-income families. Importantly, our results indicate these effects only for renters and find no effects for home owners, which is an important test of the robustness of the reported findings. Additionally, we find suggestive evidence that households participating in social programs such as food stamps and housing subsidies are less able to weather these expenditure shocks, though the results are not statistically significant, suggesting that these households may require additional social assistance in order to retain their food security.

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Notes

1. In contrast, see Bhattacharya, Currie, and Haider (2004). The authors find that food insecurity is not strongly associated with nutritional outcomes for school-aged children.
2. See http://www.huduser.org/datasets/fmr.html.
3. See Haider (2005) for a comprehensive examination of current datasets that include measures of food insecurity and hunger.
4. The questions from the ECLS-B survey are presented in Appendix 1.
5. In our sample, 56% of households above the federal poverty line reported owning a home, while 14% of households below the federal poverty line reported owning a home.
6. See Table A1 for descriptive statistics of the non-poor sample.
7. These housing cost estimates are for the 50 states and for 2900 counties. They are not the averages of the housing costs of the individuals in our sample, which are reported in Table 1. It is important to note that changes in the averages in Table 1 include both housing costs that occur at the county/MSA/state level and changes to housing costs created by moving from one state to another between sample waves.
8. Recognizing that food insecurity may fluctuate seasonally, we also included the month of the interview in unreported results. Since this information is not available for the second wave, we could only include these measures in the cross-sectional regressions for Wave 1. We found no differences after including the month of the interview dummy variables.
9. We chose to use linear models rather than non-linear models, such as the logit or probit, because non-linear models are ill-suited for using a large number of fixed effects, which is the case in our preferred specifications.
10. We attempted to estimate instrumental variables specifications using county or state-level social program participation (e.g. food stamps) as an instrument, but considering the

inclusion of the household fixed effects, we realized that our instruments were too weak to be informative.

11. In auxiliary analysis available upon request, we further assessed the robustness of our results by including time-varying, county-level variables in our analysis, such as percent of the county population living in poverty, county median income, number of housing units in the county, and other measures. The inclusion of these measures was meant to control for other county-level characteristics that could be biasing the housing cost coefficient upward. Our findings are nearly identical with the inclusion of the county-level characteristics.
12. This sample includes households that were not 'always poor' (those in our primary analysis sample), but were 'always at least near poor.' This means households could have been 'poor' in one wave and 'near poor' in the second wave or 'near poor' in both waves. 'Near poor' is defined as households that are below 130% of the poverty level and below 185% of the poverty level in the two columns, respectively.

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Appendix 1

Food Security Questions:

I am going to read you several statements that people have made about their food situation. For these statements, please tell me whether the statement was often true, sometimes true, or never true for {you/your household} in the last 12 months, that is, since last {CURRENT MONTH}.
a. {I/we} worried whether {my/our} food would run out before {I/we} got money to buy more.
b. The food that {I/we} bought just didn't last, and {I/we} didn't have money to get more.
c. {I/We} couldn't afford to eat balanced meals.
d. {I/We} relied on only a few kinds of low-cost food to feed {{CHILD}/the children} because {I was/we were} running out of money to buy food.
e. {I/We} couldn't feed {{CHILD}/the children} a balanced meal because {I/we} couldn't afford that.

In the last 12 months, since last {CURRENT MONTH}, did {you/you or other adults in your household} ever cut the size of your meals or skip meals because there wasn't enough money for food?
In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?

In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?
In the last 12 months, did you lose weight because you didn't have enough money for food?
In the last 12 months, did {you/you or other adults in your household} ever not eat for a whole day because there wasn't enough money for food?

Table A1. Summary statistics, ECLS-B wave I and II: Dropped sample (N = 6959).

Variable	Wave	Mean	Std Dev	Min	Max
Food Secure	1	0.91	0.29	0	1
Low food security	1	0.07	0.26	0	1
Very low food security	1	0.02	0.13	0	1
Food Secure	2	0.94	0.24	0	1
Low food security	2	0.05	0.22	0	1
Very low food security	2	0.01	0.10	0	1
Yearly County Housing Cost (2003$)	1	8628	2386	4730	18,483
Yearly County Housing Cost (2003$)	2	9287	3030	4800	24,636
Yearly State Housing Cost (2003$)	1	8425	1320	5666	10,496
Yearly State Housing Cost (2003$)	2	8249	1479	5472	10,680
Food Stamps	1	0.12	0.33	0	1
Food Stamps	2	0.13	0.33	0	1
Welfare	1	0.05	0.21	0	1
Welfare	2	0.04	0.19	0	1
Housing Subsidy	1	0.04	0.20	0	1
Housing Subsidy	2	0.04	0.19	0	1
Income	1	56,881	43,454	2500	200,000
Income	2	59,804	44,536	2500	200,000
<100% Poverty Line	1	0.10	0.30	0	1
<130% Poverty Line	1	0.24	0.43	0	1
<185% Poverty Line	1	0.39	0.49	0	1
<100% Poverty Line	2	0.10	0.29	0	1
<130% Poverty Line	2	0.21	0.41	0	1
<185% Poverty Line	2	0.36	0.48	0	1
White	All	0.59	0.49	0	1
Black	All	0.11	0.31	0	1
Hispanic	All	0.23	0.42	0	1
Asian	All	0.03	0.17	0	1
Multirace	All	0.04	0.19	0	1
Other Race	All	0.01	0.07	0	1
Parent Health	All	4.02	0.92	1	5
Married Household	1	0.73	0.44	0	1
Married Household	2	0.74	0.44	0	1
Number of Children	1	0.92	1.03	0	7
Number of Children	2	1.04	1.04	0	7
Household Size	1	4.22	1.32	2	19
Household Size	2	4.26	1.30	2	16