Natural Hazards and Residential Instability

Beyond Disasters: A Longitudinal Analysis of Natural Hazards' Unequal Impacts on Residential Instability

James R. Elliott, *Rice University*
Junia Howell, *University of Pittsburgh*

This study investigates the unequal impact of natural hazard damage on people's residential instability over time by shifting analyses from an event-centered design common in disaster studies to a longitudinal, population-centered approach. To demonstrate this approach, we link annual data on property damages from natural hazards at the county level to geocoded data on nationally representative samples of men and women from the Panel Study of Income Dynamics. Results indicate that the average US household lives in a county that experiences five documented hazards per year, totaling $20 million in direct property damage. Findings also indicate that as local damages accrue over time, so does residential instability, net of other factors. This pattern is particularly strong for Black and Latina women, for whom measurable differences in personal and social resources interact with hazard damages to significantly increase residential instability over time.

Climate change and high-profile disasters are raising concerns about how US society interacts with natural hazards, which are forecasted to increase in frequency and intensity over coming years (IPCC 2012; Preston 2013). At the same time, social inequalities in US society remain high, rendering some groups more vulnerable than others to their local impacts (Daniels, Kettl, and Kunreuther 2006). These dynamics are producing a volatile mix of socio-environmental conditions that threaten the well-being of untold numbers of households and communities throughout the country. To date, sociological research has illuminated these dynamics largely through case studies of extreme disasters such as Hurricanes Andrew and Katrina, the Northridge earthquake, and Superstorm Sandy (Bolin and Stanford 1998; Brunsma, Overfelt, and Picou 2010; Cutter, Schumann, and Emrich 2014; Elliott and Pais 2006; Peacock, Morrow, and Gladwin 1997). Repeatedly, this type of research shows how disasters derive as

We would like to thank the editor and anonymous reviewers for their constructive assistance in bringing this study to publication. We also thank Jeremy Pais for offering valuable conceptual and methodological insights. Please address correspondence to James R. Elliott, Rice University, Department of Sociology, MS-28, 6100 S. Main Street, Houston, TX 77005-1892, USA; phone: (713) 348-3812; E-mail: james.r.elliott@rice.edu.

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much from everyday vulnerabilities rooted in pre-existing social inequalities as from natural hazards themselves (see Tierney 2007; Klinenberg 2015).

A strength of this approach is that it brings society to the fore to highlight how processes of social stratification shape and differentiate natural hazard outcomes in the worst of cases. Yet, the field's focus on extreme events can also end up suggesting that underlying dynamics are somehow exceptional. This is problematic for a couple of reasons. First, if a core conclusion of recent research is that it is not just the scale and scope of natural hazards that matter but their interface with socially vulnerable groups, then the problem would seem to extend far beyond extreme events, given the pervasiveness of today's social inequalities. Second, when we extend our view beyond major disasters, we discover that natural hazards are actually quite common. Federal records indicate that since 1960, the United States has experienced more than a half million natural hazards that have caused notable property loss or one fatality (Hazards and Vulnerability Research Institute 2013). This means that over the past half century, the average county has experienced multiple hazards *per year*, with estimated damages now running in the millions of dollars annually and rising (Preston 2013).

The ubiquity of these dynamics, we think, calls for a new, complementary way of investigating the pervasive, ongoing intersection of social vulnerabilities and natural hazards throughout the United States. This way maintains recent case studies' deliberate focus on social stratification but turns it around analytically. Instead of selecting a specific event and studying how different subpopulations experience it, we start with a nationally representative sample of individuals. We then follow them through time as different hazards hit the areas where they live. We call this design a population-centered approach as opposed to an event-centered approach. To demonstrate its utility, we focus on an issue of central importance to the study of both disasters and social stratification: housing instability, measured as the number of moves that a household makes over time. In disaster studies, housing instability is often framed and analyzed in terms of environmental displacement, or dislocation (Mileti 1999). In stratification research, it is commonly linked to longer-term processes and outcomes of social disadvantage (Desmond 2012; Desmond and Gershenson 2016).

To apply our population-centered approach, we use restricted-access data from the Panel Survey of Income Dynamics (PSID). This version of the PSID allows us to append census data on neighborhood socioeconomic context to survey data on individual-, family-, and household-level characteristics as we follow respondents through time, from 1999 through 2011. To this information we merge annual data on county-level damage from natural hazards, compiled from federal sources in the Spatial Hazard Events and Losses Database for the United States (SHELDUS). We then estimate a series of statistical models to examine the additive and conditional effects of hazard damage on residential instability over time. Results consistently indicate that as local hazard damage accumulates, so does housing instability. This pattern is particularly strong for members of traditionally marginalized groups, including most prominently Black and Latina women. The broader implications are twofold. The intersections of natural hazards and social vulnerabilities are much more common and ongoing than we typically admit. And, these intersections accrue over time in ways that pose disproportionate challenges to those who often have the fewest resources to negotiate them successfully.

Natural Hazard Damage and Residential Instability

In a recent review of related literature, Hunter, Luna, and Norton (2015) contend that to understand the influence of environmental factors such as natural hazards on local mobility, researchers must develop more nuanced assessments of the ongoing contexts and processes involved. The present study contributes to this effort by taking a longitudinal, population-centered approach to the intersection of natural hazards, social inequalities, and residential instability. To start, we reiterate the importance of extending beyond major disasters to account for a fuller range of natural hazards. This approach recognizes not only that such hazards are more ubiquitous than commonly acknowledged (Hazards and Vulnerability Research Institute 2013) but also that their impacts can accrue over time and space to affect even those whose housing is not directly damaged. This perspective shifts us away from conceptualizing natural hazards as anomalous events to thinking of them as ongoing processes that regularly intersect with various forms of social inequality that are also ongoing.

A good way to make this conceptual shift, we think, is to focus on hazard-related property damage. Although such damage downplays the specifics of particular events, it is fungible and thus readily compared over time, space, and types of hazards for a wide range of people and places. Property damage is also the primary means by which US society organizes hazard mitigation and dispenses recovery resources (Perrow 2007). This organization—grounded in private insurance companies and public policy initiatives—overwhelmingly privileges the restoration of property over community and affordable housing. This means that damages from local hazards can have wide-ranging effects on local populations, even those whose housing is not directly affected and especially for those with relatively few social and financial resources (Elliott, Hite, and Devine 2009; Fothergill and Peek 2004; Fussell and Harris 2014; Myers, Slack, and Singelmann 2008).

After the Loma Prieta earthquake, for example, Comerio, Landis, and Rofe (1994) found that close to three-quarters of damaged housing units were modestly priced rentals. This meant that low-income residents throughout the area had a particularly difficult time finding housing after the hazard occurred. A year into recovery, nearly all single-family units had been rebuilt but only ten percent of multi-family units had. And four years later, roughly half of the damaged multi-family rentals remained either damaged or unreplaced. Research also shows how opportunism can exacerbate these housing dynamics. Bolin and Stanford (1998), for example, describe how when the Whittier earthquake hit southern California on the day that most rents were due, landlords evicted many low-income residents for late payment. Due to the timing of the hazard, landlords were able to skirt rent-control regulations and displace tenants, thereby aggravating hardships faced by predominantly low-income, Latino residents throughout the region. Other researchers have even found that landlords lie to tenants about damages to encourage them to vacate. Bolton, Liebow, and Olson (1993) describe how in one instance a landlord even posted evacuation notices on an undamaged building so that he could evict low-income tenants and raise rents. Still other studies document how low-income, minority residents often find it difficult to access and qualify for post-hazard housing assistance. This is not only because of the bureaucratic hurdles involved but also because temporary housing programs commonly cover only those who can prove they had "stable housing" prior to the hazard, which tends to exclude those lacking formal mortgages and rental contracts (Greene 1992).

In addition, recent research shows how hazard damage and associated moves can disrupt social networks in ways that feedback to further increase housing instability. For example, in their study of Hurricane Katrina, Elliott, Haney, and Sams-Abiodun (2010, 643) document how among Lower Ninth Ward residents, "inequalities in social capital increase[d] noticeably over the course of disaster, from early preparation, to prolonged displacement, to uneven return, leaving the social safety nets of less-advantaged residents increasingly frayed and ineffective over time." As a result, periods of housing instability stretched further and further in time for some residents, as Asad (2015) documents in his study of low-income, African American mothers displaced by Katrina. In that study, Asad also explains how "This residential instability is further exacerbated by time limits on eligibility for disaster benefits" (300)—assuming, of course, one has access to such benefits to begin with.

Collectively, this body of research illuminates how challenges of affordable housing and residential instability—common for many residents in ordinary times—can become exacerbated after local hazards. It also hints at how these challenges can extend not only through time for many residents but also across local neighborhoods, as stocks of affordable housing shrink, demand rises, and higher insurance premiums get passed along to renters (Pais and Elliott 2008; Vigdor 2008). The result can be broad disruption of more marginal segments of local housing markets, which developers and government agencies are often slow and unmotivated to address. Following Hurricane Katrina, for example, the Housing Authority of New Orleans even blocked residents from returning to public housing units that experienced little or no damage from local flooding (Bullard and Wright 2009). Thus, it is little wonder that researchers continue to discover what Haas and colleagues documented decades ago: After natural hazards, many low-income and minority residents "find themselves moving frequently from one place to another (or even leaving the area forever), or in housing they can't afford" (Haas, Kates, and Bowden 1977, xxviii, original parentheses).

These findings help explain why natural hazards tend not to spawn new migratory systems but rather to increase the rate and volume of flows already in motion, which remain dominated by local moves (Curtis, Fussell, and DeWaard 2015; Elliott 2015; see also Pais and Elliott 2008). From this perspective, what happens in the United States after natural hazards is less a form of "environmental migration" than an exacerbation of ongoing processes of residential instability—a central issue in sociological research on stratification.

Social Stratification and Housing Instability

Whereas disaster studies tend to prioritize places and events in their investigation of social vulnerability, research on social stratification emphasizes everyday structures and processes of inequality, which can include many factors that contribute to residential instability. These factors include divorce, job and wage loss, domestic violence, forced eviction, and other family disruptions that, when they occur, tend to have disproportionately adverse effects on less advantaged individuals and households (Desmond and Gershenson 2016). Estimates from a ten-city survey of low-income, mostly minority households, for example, found that nearly half of those surveyed were "churning movers," that is, "moving in response to financial stress or problems in their rental agreements" (Coulton, Theodos, and Turner 2009).

Related studies of residential instability indicate that moving frequently over relatively short periods of time can bring negative consequences for those involved (Desmond 2012; ICP 2009). For example, research indicates that frequent moves, even if local, correlate with declines in social network ties (Sampson, Morenoff, and Earls 1999), personal health (Dong et al. 2005), school performance (Pribesh and Downey 1999), and personal safety (Sharkey and Sampson 2010). Moreover, households from lower socioeconomic strata and those who live in under-resourced communities are already more likely to experience residential instability, which means that any extra disruption is likely to exacerbate both the likelihood and extent of negative consequences. Related research indicates that this situation is particularly common among minority women for a variety of reasons (Desmond 2012).

One is that low-income, minority women are more likely than male partners to be responsible for housing contracts because they are more likely to be formally employed and less likely to have criminal records. At the same time, because women's wages tend to be lower and because household expenses tend to be greater as a result of primary childcare responsibilities, fulfilling residential contracts can be more burdensome for women, especially in times of unexpected strain. Public assistance may help, especially for single mothers, but motherhood also brings more expensive housing needed to accommodate children, as well as additional costs associated with regular provision of their clothes, food, medical care, and school supplies (Cancian and Meyer 2005). By contrast, non-custodial fathers can more easily rent an inexpensive room or crash on someone's couch when disruption occurs and temporary housing is needed.

The broad point is that residential instability is common among less advantaged households for a host of reasons. These reasons both reflect and reproduce ongoing hardship in ways that not only entangle with racial and class inequalities but also remain fundamentally stratified by gender (Coulton, Theodos, and Turner 2009; Crowley 2003). This stratification is echoed in recent research on disasters, which contends that women often experience hazards differently than men because of tendencies for role accumulation that involve the expansion of family, community, and work expectations following disruptive events (Fothergill 1999). In addition, research on social stratification illuminates how social inequalities stemming from a lack of homeownership, low incomes, minority status, and single-motherhood tend to cluster spatially, which can further compound housing challenges over time and weaken collective resources of entire communities (Sampson 2012). In this way, the spatial accumulation of social vulnerabilities can intersect with the temporal accumulation of local hazard damages to disproportionately affect not only specific households but entire neighborhoods of which they are a part.

Research by Graif (2016) following Hurricane Katrina not only underscores this point but suggests that it may be one way that hazard-related displacement might actually benefit some minority, female-headed households. This occurs by leading some families from more to less disadvantaged neighborhoods. While such neighborhood attainment can certainly occur and not all residential mobility is bad, we suspect that positive outcomes are more the exception than the rule. That is, in more common scenarios, mobility following local hazard damage is likely to be more constrained and disruptive for less advantaged households. Along these lines, research by Fussell and Lowe (2014) indicates that those who were more unstably housed after Hurricane Katrina had poorer mental health on average than those who returned to their pre-Katrina homes and communities. By examining related dynamics as they unfold for residents throughout the country, we hope to leverage and extend more dynamic, integrative research on the intersection of natural hazards and social stratification.

Below, we demonstrate this approach. Drawing from the literature reviewed above, we test two broad hypotheses. First, residential instability increases with local hazard damage over time, net of other contributing factors at the individual, family, household, and neighborhood levels. Second, these increases are especially pronounced among less advantaged, minority women. This is so not only because of mediating factors such as lower education and lack of homeownership but also because these factors interact with local hazard damages in ways that render their vulnerabilities multiplicatively higher than those of other groups.

Data and Methods

Data for our analyses come from three sources. The primary source is the Panel Study of Income Dynamics (PSID). The PSID began with a representative sample of the US population in 1968 and has tracked selected families, their children, and their children's children ever since. In 1999, the PSID expanded its original sample to capture new immigrant families that had moved to the United States after 1968. We use this later, larger sample beginning in 1999 to take advantage of robust numbers of Hispanic, Asian, and Other race respondents, in addition to Whites and Blacks—all of whom were interviewed every two years in our study, from 1999 through 2011. In order to link data on respondents' individual, family, and household attributes to data on neighborhood context, we use the restricted-access PSID, which has census tract identifiers for each place of residence.

To assemble tract-level data, we use a second source consisting of two pieces: the 2000 US Census and the 2006–2010 American Community Survey 5-Year Summary Files (ACS-5). From these datasets we derive information on the socioeconomic status of respondents' neighborhoods and total population of the county in which they live. Neighborhood socioeconomic status is measured using a common scalar variable that includes the respective census tract's median income, proportion of adults with at least a bachelor's degree, and portion of adults currently employed. Years between the 2000 Census and ACS-5 are linearly imputed, as are values for 2011.

The third source of data is the Spatial Hazard Events and Losses Database for the United States (SHELDUS), which provides annual information on county-level property damages directly attributable to natural hazards. SHELDUS is a government-funded database maintained by the Hazards and Vulnerability Research Institute (2013). This database collates local events and economic losses for eighteen types of natural hazards, including wildfires, floods, severe storms, tornadoes and hurricanes. Data come principally from the National Climatic Data Center, the National Geophysical Data Center, and the Storm Prediction Center. They include information on events that have occurred since 1960 and caused at least one death or $25,000 in direct property damage. In addition, the SHELDUS dataset includes start and end dates of respective hazards, which we use to demark and append information at different waves of the PSID, as described below.

Residential Instability

Following prior research, we measure residential instability as the total number of moves that respondents report making (e.g., Coulton, Theodos, and Turner 2009). We operationalize this variable in two ways. For summary analyses (described below) in which we analyze aggregated changes over the entire time period, 1999–2011, we sum the total number of moves reported from the first through the last PSID interview. So, if a respondent does not move during the first two-year interval but does move during the second interval, and then twice more during the third interval, and then stays put for the rest of the observed time period, her aggregated residential instability score would be three. For longitudinal analyses, we analyze cumulative changes from one interview to the next. Using the above example, residential instability would equal zero for the first wave; one for the second wave; three for the third wave; and then would remain three for all subsequent waves, given no further moves. In all calculations, the number of moves is reported directly by the respondent.[1]

To assess the robustness of our approach, we fit random-effects models where we calculated discrete numbers of moves for each interview wave, rather than cumulatively summing them over successive waves, as described above. Results from these supplemental analyses (available in the supplemental appendix) affirm that property damage from local hazards has compounding effects on residential instability that stretch beyond the immediately observed wave.

Natural Hazard Damage

Property damage from natural hazards is measured at the county level, which allows for both direct and indirect effects on local residents. As with residential instability, we compute this variable in both aggregate and cumulative forms, utilizing information on inflation-adjusted property damage directly attributable to natural hazards in counties where respondents reside. If respondents migrate between counties, we use hazard start and end dates to compute the damage in each county for the time period they report residing there. For each interview wave, we compute the amount of direct property damage from all hazards that ended on or after March 1 of the previous interview-year and ended before March 1 of the current interview-year.[2] March was selected because it corresponds to the month when the first PSID interviews are conducted in each interview cycle. Because interviews are conducted every other year, local hazard losses accrue in two-year intervals based on where the respondent was living during the interval.

For all analyses, values for hazard damage reflect estimates of direct economic loss associated with the physical impacts of respective hazards and do not include disruption to commerce and production. Thus, the variable offers a highly conservative measure of local hazard damage and is best understood as a proxy rather than a literal measure of total economic losses incurred. Any spatial or temporal biases in reporting are assumed to be random or otherwise minimized by longitudinal analysis. Because the variable's range is large and right-skewed, we use log-transformed values in all regression models. And, because hazards such as droughts and heat waves rarely cause direct damage to (non-crop) property, their effects on residential instability are effectively ignored, as are considerations of whether the event qualifies as a federally declared disaster. As described above, we use a measure of total county population to control for the relative scale of local development, absent reliable data on total property values.

Other Independent Variables

For models described below, we include additional variables at different levels to control for sources of social vulnerability and to test for related interaction effects with hazard damage. At the individual level, we include four mutually exclusive indicators of *race*, coded as White, Black, Latino (or Hispanic), and Other (primarily Asian). We also include indicators of *foreign birth* (1 = foreign born; 0 = US native); *education* (measured as total years in school); and *age* (measured in quadratic form to account for variable effects on residential mobility over the life course).

At the family level, we include indicators of *marital status*, which in the PSID also includes permanently cohabiting couples (1 = married or permanently cohabiting; 0 = otherwise) and *parental status* (measured as the number of children under the age of 18 in the household). At the household level, we include a continuous measure of *income* (in logged dollars for regression analyses);

homeownership (1 = yes; 0 = no); and *rooms per capita*. At the neighborhood level, we include the index of *socioeconomic status* described above (computed for the residential census tract). Finally, at the county level, in addition to *total population* (described above), we include an index of "*rurality*" as indicated by the 2013 US Department of Agriculture Rural–Urban Continuum codes. These codes comprise a nine-point ordinal variable that distinguishes metropolitan counties based on the overall population of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area. Higher values indicate higher rural, or marginal, status within the US settlement system. We include this measure as well as county population to control for broad variation in the amount of people and property at risk of damage from natural hazards. For summary descriptions of all variables, see Appendix table A.

Stratifying Analyses by Gender

Unlike most surveys, the PSID collects data for every member of sampled households, which means that researchers must select who to analyze. This selection is important for the present study because residential instability is typically a household-level process and because including data for more than one adult from the same household can introduce bias. Historically, researchers have handled this problem by simply selecting the survey-designated "head" of household. In the PSID, this head is always the male partner, if one is present. Thus, adopting this strategy would simply replace one form of bias with another. Specifically, an implicit assumption would be made that the male partner's race, education, age, and other personal traits are more important in household decision-making than the female's corresponding traits. Moreover, by excluding all married and cohabiting women, analyses would end up comparing all men (married and single) to only single women. This approach diminishes comparative assessments and dismisses prior research indicating that residential instability is highly gendered.

For these reasons, we sought an alternative strategy. To start, we considered randomly selecting either heads or spouses of respective households. A shortcoming of this approach, however, is that not all married households stay intact. So, if we selected only one partner to follow through time and the household then split, we would lose information about how the unselected partner responded to local hazard impacts over time. We would also lose information about how marriage—continued and truncated—might affect residential instability differently for men and women. Therefore, as an alternative approach, we include adult men and women and analyze them separately to avoid double-counting household moves. The male subsample consists of 3,319 respondents; the female subsample consists of 4,136. For both genders, respondents are limited to individuals present in the PSID at the beginning and end of the entire period (1999 and 2011, respectively) and who participated in at least four of six possible interviews, or waves. Descriptive statistics for respective subsamples appear in table 1.

Table 1. Descriptive Statistics for Respondents for the Entire Time Period, 1999–2011, by Gender

	Men				Women			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Residential instability								
Number of moves, 1999–2011	1.26	1.52	0	7	1.30	1.54	0	7
Hazard damage								
Direct property damage in residential county ($millions)	243	708	0.01	7,160	252	768	0	8,080
Individual-level factors								
Race								
White	0.66				0.58			
Black	0.23				0.32			
Latino	0.07				0.07			
Other	0.04				0.03			
Foreign born	0.01				0.01			
Education (years)	13.17	2.86	0	17	12.94	2.69	0	17
Age (years)	45.35	12.04	26	87	45.56	12.64	26	88
Family-level factors								
Married (# of survey years)	9.61	4.10	0	12	7.80	5.11	0	12
Parenthood (# of survey years with children in home)	5.24	4.92	0	12	5.78	5.09	0	12
Household-level factors								
Annual income (mean from all survey years)	75,235	91,722	0	2,842,659	62,120	85,257	0	2,842,659
Owned home (# of survey years)	9.17	4.28	0	12	8.69	4.58	0	12
Rooms per capita (mean from survey years)	2.43	1.09	0.45	9.42	2.44	1.21	0.43	12.67

Neighborhood-level factors								
Tract socioeconomic status (mean from survey years)	0.04	0.71	−2.25	3.83	−0.06	0.72	−4.33	3.83
County-level factors (other than hazard damage)								
Total population (000s)	877.8	1,543.0	3.4	9,638.7	915.4	1,579.6	3.4	9,638.7
Rural/Urban scale (1 = most urban; 9 = most rural)	2.37	1.87	1	9	2.32	1.86	1	9
N		3,319				4,136		

Note: PSID data are assembled from six interview waves conducted every other year for a total of 12 years. Variable descriptors here correspond to those used for aggregated analyses in table 2. Variable descriptions for analyses in table 3 appear in appendix table A, along with the above for comparison.

Models

To assess the effects of county hazard damage on residential instability during 1999–2011, we conduct analyses for both aggregated and longitudinal forms of our data. Because approximately 40 percent of respondents did not move during 1999–2011 (i.e., have a score of 0 for residential instability), we deploy negative binominal regression for all models. In the longitudinal analyses in which variables shift from interview to interview, we use population-averaged estimation via generalized estimating equations (GEE). Like random- and fixed-effects models, population-averaged models adjust for the clustering of multiple observations for each respondent but do so using marginal instead of full distributions, which helps with convergence in more complex models utilizing higher-order interaction terms. What this means in practice is that population-averaged models estimate the effect that each independent variable has on the sample as a whole, rather than estimating the effect of each independent variable based on change within individuals and then using these estimates to calculate the average effect across the sample as a whole. These statistical intricacies aside, results and interpretations are very similar to conventional random-effects models, with population-averaged models facilitating convergence with longitudinal data in which the use of the negative binomial form is recommended (Rabe-Hesketh and Skrondal 2012).

Results

For context, we first review the natural hazards landscape in the continental United States from March 1999 to March 2011. Areas with higher total damages during this period may be familiar. For example, it is probably no surprise that the 17 counties in Louisiana, Mississippi, and Florida hit by Hurricane Katrina in 2005 suffered billions of dollars in direct property damage. Similarly, Midwesterners may remember that Linn County, Iowa, experienced major flooding in 2008, followed by recurrent episodes that eventually caused $8 billion in cumulative property losses by 2011. Nationally, these counties are outliers, but they are not exceptions. Of the more than 3,100 counties and county-equivalents under investigation, only a dozen (or 0.3 percent) experienced no property damage from natural hazards during 1999–2011. And, this lack of damage was not because no hazards hit these counties. It was because they are located in such remote areas of Montana and South Dakota that there was little to no property to damage. Between these extremes, the average county experienced $78 million in total property damage during 1999–2011, mostly from multiple events rather than from one catastrophic disaster.

Yet, because areas with more people tend to have more property at risk of damage, and because a representative sample of US residents is likely to come disproportionately from more populated areas, we would expect damages to be *greater* for the average person than for the average county. This is in fact the case. Table 1 indicates that respondents lived in counties that experienced, on average, $250 million in property damage, with some respondents living in counties that experienced no damage while others lived in counties that experienced $8 billion in total damages during 1999–2011.

As for residential instability and related characteristics, table 1 indicates that over the observed twelve-year period, women moved an average of 1.30 times compared with 1.26 times for men, with a range of 0 to 7 for each group. Supplemental statistics indicate that for most respondents, at least one of these moves involved relocation to a different town, county, or state. Additionally, table 1 indicates that compared with women, men in our analyses tend to be more advantaged: On average, they have higher incomes; and they are more educated; more likely to be married; more likely to be living without children in the household; more likely to own their housing; and more likely to live in neighborhoods of higher socioeconomic status. These gender disparities make it all the more important to analyze men and women separately, as they respond not only to local hazard damages but to other ongoing challenges.

Aggregated Analyses

Next, we report aggregated analyses across the entire 1999–2011 period to assess the long-term relationship between local hazard damage and residential instability. Here, the focus is on changes over the entire period rather than variation from one interview period to the next, which we analyze below.

To start, model 1 of table 2 offers a baseline assessment with no covariates. Results indicate a positive, statistically significant relationship between local hazard damage and residential instability, with a coefficient of .03 for both men and women. This means that a respondent living in a county that experienced $250 million in damage over the 1999–2011 period (the average in our study) would experience an 18 percent increase in residential mobility, relative to a counterpart living in a county that experienced only a million dollars in damage.[3]

Next, model 2 adds individual-level covariates. Results indicate that for women, race (specifically, being Black as opposed to White), education, and age all correlate significantly with residential instability, in the expected directions. For men, race and age correlate significantly, but not education. More importantly for our purposes, however, results indicate that controlling for these factors does *not* reduce the influence of local hazard damage on residential instability. Hazard damage, in other words, exerts its own independent effect. Next, model 3 adds family- and household-level factors, and again we obtain expected results. While those who are married, own their home, and have fewer rooms per residents experience less residential instability, these factors barely change the observed relationship between local hazard damage and residential instability, which remains statistically significant for both men and women.

Finally, model 4 adds neighborhood socioeconomic status and county-level variables for total population and position in the US settlement system. Results indicate that residential instability tends to increase with the average socioeconomic status of one's neighborhood, all else equal, which is the opposite of what we expected, due largely to controls for homeownership. County-level population and rurality, by contrast, exhibit no statistically significant effect on

Table 2. Coefficients from Negative Binominal Regressions Predicting Aggregate Residential Instability, 1999–2011

	Model 1		Model 2		Model 3		Model 4	
	Men	Women	Men	Women	Men	Women	Men	Women
Hazard damage, logged	0.03 (0.01)*	0.03 (0.01)*	0.03 (0.01)*	0.03 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*
Individual-level factors								
Race								
Black			0.23 (0.05)*	0.27 (0.04)*	−0.12 (0.05)*	−0.22 (0.04)*	−0.09 (0.05)	−0.18 (0.04)*
Latino			−0.05 (0.09)	−0.01 (0.08)	−0.14 (0.08)	−0.18 (0.07)*	−0.11 (0.08)	−0.15 (0.07)*
Other			0.21 (0.10)*	0.21 (0.10)	−0.08 (0.09)	−0.06 (0.09)	−0.07 (0.09)	−0.06 (0.09)*
Foreign born			−0.06 (0.20)	−0.41 (0.21)	−0.12 (0.18)	−0.40 (0.19)*	−0.12 (0.18)	−0.39 (0.19)*
Education			−0.01 (0.01)	−0.03 (0.01)*	0.03 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*
Age			−0.04 (0.00)*	−0.04 (0.00)*	−0.03 (0.00)*	−0.03 (0.00)*	−0.03 (0.00)*	−0.03 (0.00)*
Age squared			0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*
Family-level factors								
Married					−0.02 (0.01)*	−0.02 (0.00)*	−0.02 (0.01)*	−0.02 (0.00)*
Parenthood					−0.02 (0.02)	−0.04 (0.02)	−0.02 (0.02)	−0.04 (0.02)
Household-level factors								
Income					0.02 (0.01)	0.01 (0.01)	−0.02 (0.01)	0.01 (0.01)
Owned home					−0.11 (0.00)*	−0.11 (0.00)*	−0.11 (0.00)*	−0.11 (0.00)*
Rooms per cap					−0.06 (0.02)*	−0.06 (0.02)*	−0.07 (0.02)*	−0.07 (0.02)*

Neighborhood-level factors								
Socioeconomic status							0.07 (0.04)*	0.08 (0.03)*
County-level factors								
Total population							−0.00 (0.02)	−0.00 (0.02)
Rural/Urban scale							0.01 (0.02)	0.01 (0.01)
Constant	0.23 (0.02)	0.26 (0.02)	−0.05 (0.03)	−0.08 (0.03)	0.00 (0.04)	0.02 (0.03)	−0.01 (0.04)	0.01 (0.03)
Pseudo R^2	0.0007	0.0007	0.0485	0.0429	0.1220	0.1227	0.1223	0.1232
N	3,319	4,136	3,319	4,136	3,319	4,136	3,319	4,136

Note: Variables correspond to those used for aggregated analyses, as described in appendix table A (below).

*$p < .05$; two-tailed test.

residential instability, net of other factors. Again, though, and most importantly for the present study, these factors do not change the observed relationship between local hazard damage and residential instability, which remains positive and statistically significant.

These findings support the general hypothesis that over time, local hazard damages increase residential instability, regardless of whether these damages occur all at once or accrue over time, as they more commonly do. To ensure that counties with extreme levels of hazard damage are not unduly driving these results, we conducted a number of supplemental tests to assess the effects of outliers and influential cases (see the supplemental appendix). Overall, results affirm that under a wide range of considerations, reported results remain substantively similar and statistically robust, all else equal. To further assess these findings as well as to test the hypothesis that related effects are stronger for specific groups, particularly less educated, minority women, we turn next to regression models that exploit the full power of the PSID's longitudinal design.

Longitudinal Analyses

For these analyses, we leverage each two-year interval between PSID interviews to develop a more refined assessment of the relationship between local hazard damage and residential instability. Results appear in table 3 and again show that hazard damage has a positive and statistically significant effect on residential instability, net of other factors. That is, even when we take into account short-term changes in individual-, family-, household-, neighborhood-, and county-level covariates from interview to interview, we find that as local hazard damages increase, so does residential instability. This is true for both men and women.

Again, to test the robustness of these findings, we took several additional steps. First, to ensure that outliers and influential cases are not skewing results, we re-estimated all models in table 3 excluding cases in which local hazard damage exceeded three standard deviations from the mean; we then excluded all cases in which standardized residuals exceeded an absolute value of three. In all instances, results (available in the supplemental appendix) remain statistically significant and reveal an even *stronger* effect of local hazard damage on residential instability. Next, we re-estimated all models in table 3 using a hybrid-model approach, which allows us to simultaneously estimate within- and between-respondent effects of local hazard damage on residential instability (see Allison 2009). Results (available in our supplemental appendix) show that for both men and women, the within- and between-respondent coefficients for hazard damage are both statistically significant and of similar magnitude as those reported in table 3. This is true both with and without the use of a first-order, autoregressive error matrix (AR1) to address cumulative accounting in the dependent variable.[4]

Collectively, these supplemental tests offer even stronger support to the conclusion that residential instability increases with local hazard damage. As a substantive example, we can use the estimated coefficient of .03 in model 1 of table 3.

Table 3. Coefficients from Longitudinal Population Averaged Negative Binominal Models Predicting Residential Instability, Interval to Interval during 1999–2011

	Model 1		Model 2		Model 3		Model 4	
	Men	Women	Men	Women	Men	Women	Men	Women
Hazard damage, logged	0.03 (0.00)*	0.03 (0.00)*	0.03 (0.00)*	0.03 (0.00)*	0.05 (0.01)*	0.04 (0.00)*	0.05 (0.01)*	0.05 (0.00)*
Individual-level factors								
Race								
Black	0.08 (0.06)	0.07 (0.05)	−0.13 (0.16)	−0.23 (0.13)	0.08 (0.06)	0.06 (0.05)	0.07 (0.06)	0.05 (0.05)
Latino	0.08 (0.10)	−0.03 (0.09)	−0.53 (0.30)	−0.25 (0.25)	0.08 (0.10)	−0.03 (0.09)	0.08 (0.10)	−0.04 (0.09)
Other	0.13 (0.11)	0.01 (0.11)	0.04 (0.28)	0.48 (0.24)*	0.13 (0.11)	−0.01 (0.11)	0.10 (0.11)	−0.03 (0.11)
Foreign born	0.08 (0.22)	−0.35 (0.23)	0.06 (0.23)	−0.37 (0.23)	0.06 (0.22)	−0.35 (0.23)	0.07 (0.22)	−0.34 (0.23)
Education	0.02 (0.01)	−0.02 (0.01)*	0.02 (0.01)	−0.02 (0.01)*	0.02 (0.01)	−0.02 (0.01)*	0.02 (0.01)*	−0.01 (0.01)
Age	−0.04 (0.00)*	−0.03 (0.00)*	−0.04 (0.00)*	−0.03 (0.00)*	−0.04 (0.00)*	−0.03 (0.00)*	−0.04 (0.00)*	−0.03 (0.00)*
Age squared	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*	0.00 (0.00)*
Family-level factors								
Married	−0.16 (0.03)*	−0.16 (0.02)*	−0.16 (0.03)*	−0.16 (0.02)*	0.17 (0.12)	0.07 (0.09)	−0.15 (0.03)*	−0.16 (0.02)*
Parenthood	0.02 (0.01)	−0.00 (0.01)	0.02 (0.01)	−0.00 (0.01)	0.02 (0.01)	−0.00 (0.01)	0.02 (0.01)	−0.00 (0.02)
Household-level factors								
Income	−0.01 (0.00)*	−0.00 (0.00)	−0.01 (0.00)*	−0.00 (0.00)	−0.01 (0.00)*	−0.00 (0.00)	−0.01 (0.00)*	−0.00 (0.00)
Owned home	−0.35 (0.02)*	−0.39 (0.02)*	−0.35 (0.02)*	−0.39 (0.02)*	−0.35 (0.02)*	−0.39 (0.02)*	0.17 (0.10)	0.18 (0.09)*
Rooms per cap	−0.01 (0.01)	−0.02 (0.01)*	−0.01 (0.01)	−0.02 (0.01)*	−0.01 (0.01)	−0.02 (0.01)*	−0.01 (0.01)	−0.02 (0.01)*
Neighborhood-level factors								
Socioeconomic status	0.00 (0.02)	0.01 (0.02)	0.00 (0.02)	0.01 (0.02)	0.00 (0.02)	0.01 (0.02)	0.01 (0.02)	0.01 (0.02)

(*Continued*)

Table 3. ***continued***

	Model 1		Model 2		Model 3		Model 4	
	Men	Women	Men	Women	Men	Women	Men	Women
County-level factors								
Total population	−0.03 (0.01)*	−0.03 (0.01)*	−0.03 (0.01)*	−0.03 (0.01)*	−0.03 (0.01)*	−0.03 (0.01)*	−0.03 (0.01)*	−0.04 (0.01)*
Rural/Urban scale	−0.02 (0.01)	−0.02 (0.01)	−0.02 (0.01)	−0.02 (0.01)	−0.02 (0.01)	−0.02 (0.01)	−0.02 (0.01)	−0.02 (0.01)*
Year	0.36 (0.01)*	0.35 (0.01)*	0.36 (0.01)*	0.35 (0.01)*	0.36 (0.01)*	0.35 (0.01)*	0.36 (0.01)*	0.35 (0.01)*
Interaction terms								
Hazard*Black			0.01 (0.01)	0.02 (0.01)*				
Hazard*Latino			0.03 (0.01)*	0.01 (0.01)				
Hazard*Other			0.00 (0.01)	−0.02 (0.01)*				
Hazard*Married					−0.02 (0.01)*	−0.01(0.01)*		
Hazard*Own							−0.03 (0.01)*	−0.04 (0.01)*
Constant	−1.87 (0.15)	−1.30 (0.13)	−1.78 (0.16)	1.20 (0.14)	−2.11 (0.17)	−1.42 (0.14)	−2.18 (0.17)	−1.65 (0.15)
N of individuals	3,255	4,060	3,255	4,060	3,255	4,060	3,255	4,060

Note: Variables correspond to those used for longitudinal, cumulative analyses, as described in appendix table A (below).

*$p < .05$; two-tailed test.

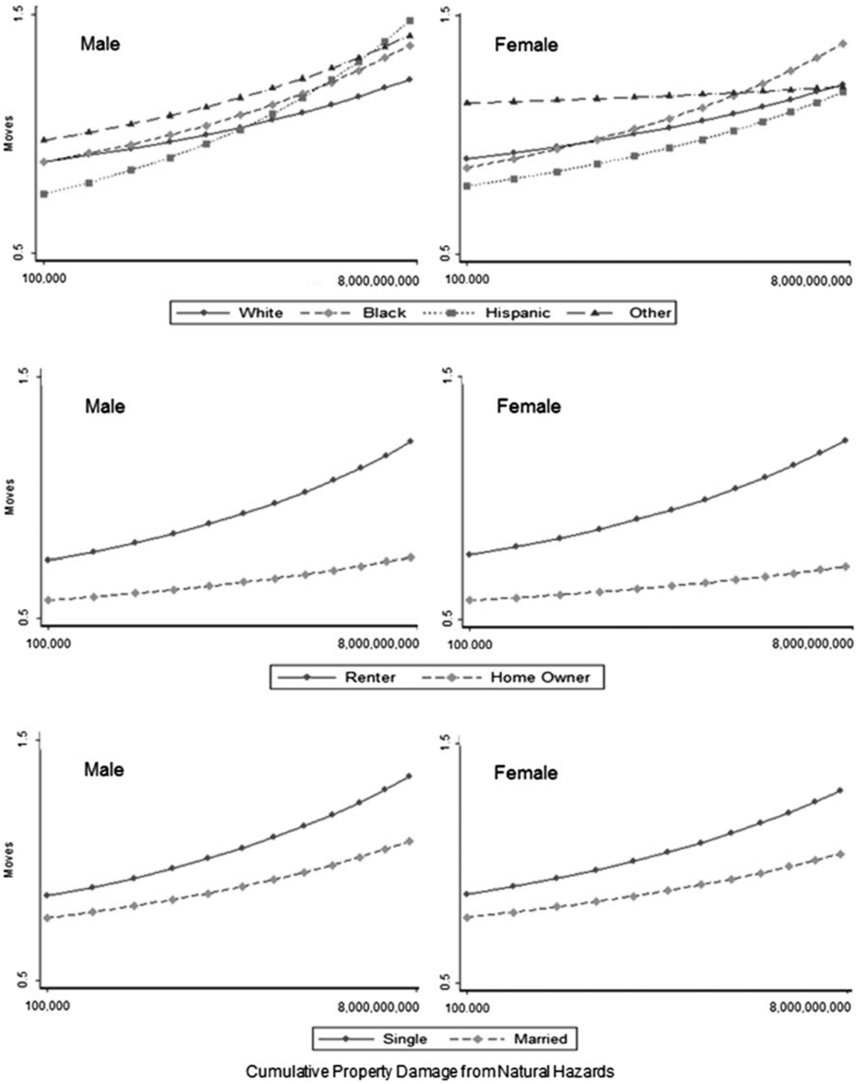
This value is not only equivalent for men and women but also roughly the same for both within- and between-respondent effects estimated in our supplemental hybrid models (see note 4). Using this coefficient, we would expect a person living in a county with $1 billion in local hazard damage (roughly 1 s.d. above the mean, with a logged value of 20.72) to have a rate of residential instability that is $e^{(20.72*.03)} = 1.86$ times higher than a person living in a county with no local hazard damage (the tacit assumption in most stratification research). Furthermore, results from our hybrid models indicate that this difference holds over both time and space. That is, whether we are comparing individuals across counties or a given individual over time, increases in local hazard damage tend to increase residential instability, all else equal.

Next, we turn to whether observed effects are stronger for some groups than others, especially those who tend to be more socially vulnerable. To investigate this question, models 2–4 of table 3 report results from models that include statistically significant interactions between local hazard damage and respective covariates. For these analyses, we estimated models for all possible two- and three-way interaction effects and then selected those in which respective coefficients reached statistical significance at the .05 level. To facilitate interpretation, figure 1 displays key findings, holding all else in the respective models constant.

Starting with the top panel of figure 1 (derived from model 2 of table 3), we see that Latino men's residential instability is affected more by local hazard damage than White men's residential instability, all else equal. Between the lower and upper values of observed local hazard damage, Latino men go from being the group with the lowest residential instability, all else equal, to the group with the highest. Among women, significant racial variation also exists, but patterns differ. Consistent with expectation, it is Black women who experience the greatest conditional increase in residential instability from local hazard damage, all else equal, followed by Latinas. The broad implication is that minority households generally experience more residential instability from hazard damage than otherwise similar White households.

The middle panel of figure 1 (derived from model 4 of table 3) also shows that, as expected, the effects of local hazard damage on residential instability are stronger for renters than homeowners. Indeed, this conditional, or multiplicative, effect is the strongest one observed for both men and women, indicating that as local hazard damages accrue, they do not simply displace renters but make them more residentially unstable. Turning next to the bottom panel of figure 1, we see that just as there are differences between owners and renters, there are also differences between married and single households. To develop a deeper sense of these dynamics, we interacted marital status with education and race. Results for the marriage–education interactions and marriage–race interactions appear in our supplemental appendix. Both sets of findings indicate that the conditioning effect of marriage on the damage–instability relationship depends on the race and education of the person involved. To illustrate, figure 2 graphs results for select groups, holding all other factors constant. Here, we find additional support for evaluating men and women separately.

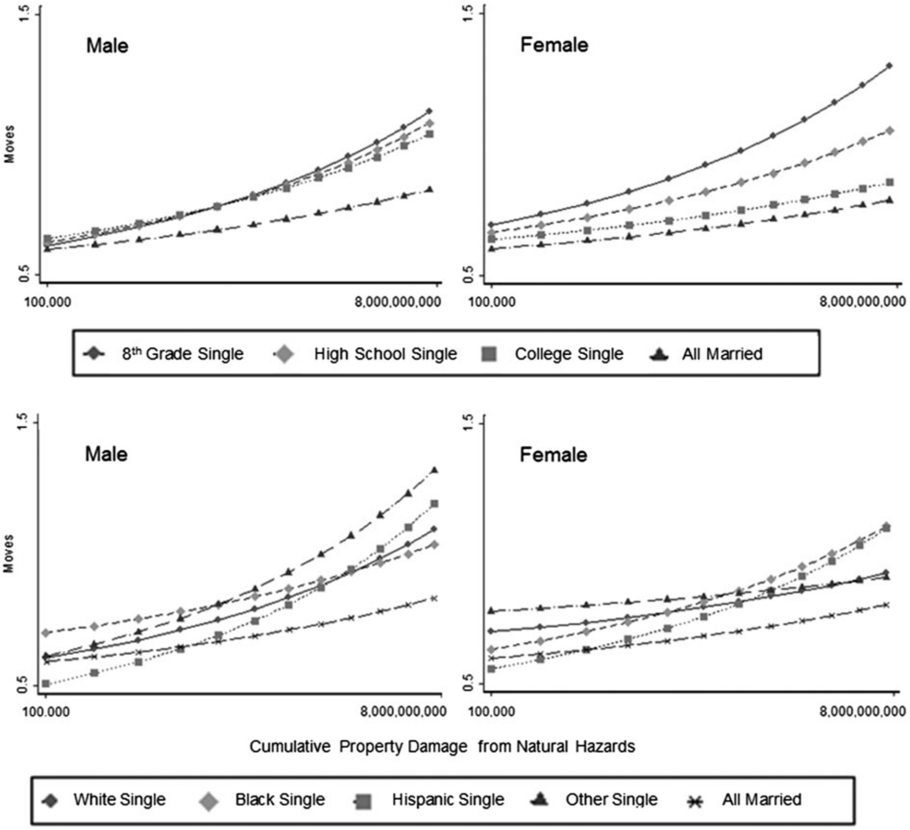
Figure 1. Estimated number of moves by local hazard damage



Source: Respective interaction models in table 3; all other covariates are held constant at sample means.

The top panel of figure 2 shows that local hazard damage has a comparable effect on residential instability, regardless of men's educational attainment. And, when we condition this effect on marriage, the story remains much the same. Yet, for women, education *does* influence how hazard damage affects residential instability. As a result of these conditional effects, single women with less education experience the greatest residential instability in the face of local hazard damages. This pattern is even starker in the unreported results, which show that

Figure 2. Estimated number of moves by local hazard damage



Source: Respective interaction models in supplemental regression analyses (available in supplemental appendix); all other covariates are held constant at sample means.

hazard damage has little effect on married women's residential instability, *regardless* of their education level.

The bottom panel of figure 2 shows similar patterns for respective interactions between marital status and race. As background, unreported results indicate that for both married men and married women, racial identity has little moderating effect on the relationship between local hazard damage and residential instability. This is not the case for single men and women, as illustrated in the bottom panel of figure 2. Here, we see that as local hazard damage increases over time, Latino and "Other race" (mostly Asian) single men become particularly prone to residential instability. So, too, do Black and Latina single women.

These findings show how the effects of local hazard damage on residential instability vary depending on the social statuses of those involved, all else equal. But, of course, "all else" is not equal. Some groups, such as Black women, tend on average not only to be single and less educated, but also to rent rather than own their housing. These historical, overlapping inequalities remind us that social disadvantages can be cumulative, as well as interactive, much like the hazard damages with which they intersect. Uncovering these dynamic, overlapping intersections, we believe, is the key to building better understanding of the pervasive effects of natural hazards on socially vulnerable groups now and in the future.

Conclusion

When major disasters strike, they elicit widespread concern for victims and motivate substantial research. Increasingly, the aim of this research is to glean clues for developing more resilient societies through improved understanding of social dynamics that render some groups more vulnerable than others to such events. This type of work remains vital and has clearly inspired our own. Yet, we contend that to focus only on large-scale disasters is to miss much of the current and future problem. This is because disasters are only a small part of a much more common and ongoing set of interactions with natural hazards throughout the country. It is also because the social inequalities that drive much of today's vulnerabilities to such hazards are also common and ongoing. Thus, we need to find better ways to more fully integrate and understand how these twin dynamics come together regularly to affect people throughout the country. In this vein, we advanced a novel approach. It blends and extends insights from disaster studies and stratification research to shift inquiry from an event-centered analysis to a more longitudinal, population-centered approach. To demonstrate its utility, we focused on residential instability, a concern of both disaster and stratification research. What did we find?

Our results consistently indicate that as local property damage from natural hazards increases, so too does residential instability. This relationship holds regardless of whether the damage accrues all at once, say as it did with Hurricane Katrina, or more incrementally, say as it does with the chronic flooding that now characterizes many areas of the country. Our findings also indicate that this increased mobility is particularly evident among more marginalized segments of society, including racial and ethnic minorities, renters, and the less educated. Moreover, this heightened mobility hits Black and Latina women especially hard. This occurs not simply because inequalities stemming from a lack of educational credentials and homeownership "add up" for members of these groups. They also *multiply* in ways that they do not for other groups in US society. That is, controlling for a host of other factors, the residential instability of Black and Latina women increases even more than we would otherwise expect as local hazard damages increase over time. When we then consider how ubiquitous these damages are across the country and how much they exceed those associated with major disasters, we begin to get a better sense of the growing scale and scope of the challenges ahead.

This expanded view, of course, does not diminish the importance of disaster planning and research. Nor does it imply that all residential mobility is bad. Indeed, sociological research indicates that after Hurricane Katrina, some of the most socially vulnerable residents of New Orleans—low-income, minority mothers—were displaced to neighborhoods with more organizational connections and social advantages than whence they came (Graif 2016; see also Asad 2015). Whether these families were able to successfully incorporate themselves into their new neighborhoods, however, remains unclear. What also remains unclear is how relationships between residential mobility and instability can change over time. Generally we have assumed a direct connection, especially among less advantaged populations for whom increasing numbers of moves can become not just a consequence of vulnerability but also a cause. Yet, clearly more work remains.

For example, it is quite possible that even if the above assumptions hold, some individuals and families can become simply too disadvantaged to move. It is also possible, however, that as Desmond's (2016) work demonstrates and prior disaster scholarship has shown, the most disadvantaged residents may be those who are *forced* to move. In these instances, it is not about having the resources to move, it is about habitual movement that results from having no other choice. Both scenarios can be exacerbated in areas hit by natural hazards. This suggests that future research should focus more intensively on the lower tail of the socioeconomic distribution; that is, it should follow up the more representative sampling procedures that we have deployed in the present study with more targeted assessments of more vulnerable subpopulations. We think this is an important next step.

In moving in that direction, however, our findings also indicate that related dynamics are grounded less in the low socioeconomic status of particular neighborhoods than in individual-, family-, and household-level factors that tend to concentrate residents in such environments. In other words, when it comes to local hazard damages and residential instability, it seems that neighborhoods play more of a role in spatially clustering pertinent vulnerabilities than in producing or adding to them. This finding, however, does not mean that disadvantaged neighborhoods should be ignored when it comes to planning and research. As areas where socially vulnerable households disproportionately reside, they make smart choices for targeting public policy and resources. Yet, analytically these neighborhoods do not appear to be the root problem. Rather, they are symptoms of more pervasive, underlying vulnerabilities that leave less advantaged households susceptible to serial displacement more generally.

The present study has illuminated how pervasive these dynamics are and how natural hazards can feed them, thereby not only extending disaster and stratification research but also helping link them. Yet, other work remains. In addition to investigating how, when, and for whom increased hazard-related mobility tends to lead to better or worse outcomes, there is the question of how long local hazard impacts last. Untangling these questions will require prolonged investigation, which we believe will continue to benefit from a population-centered approach of the sort we have advanced here. Not only can it serve as a valuable complement to existing place- and event-centered research, it can also be integrated with them in various ways. One way is by designing research that pays more detailed, comparative attention to geographic variation in observed processes and outcomes, including not only differences in hazard types and related impacts but also types of households and communities at risk.

Another way is by designing research that further investigates the mechanisms through which local hazard damage ripples forth to affect those whose housing is not directly damaged. Given the consistency of our findings, we are fairly certain that such mechanisms are operating. Yet, our supposition regarding general disruption of marginal segments of local housing markets, although grounded in prior case-study research, remains, for now, just that: a supposition. We look forward to future work along these lines and believe that continued and more explicit integration of hazards and stratification research offers a fruitful way to proceed.

Notes

1. We use reported number of moves, rather than comparing addresses of respondents at each interview wave, to capture multiple moves between surveys, including moves to and from the same address. However, if a respondent reports not moving but address information indicates residence in a new census tract from one interview to the next, we count the respondent as moving once.
2. The PSID's immigrant sample does not have residential information before 1999. Thus, our first wave of data measures local damages from March 1999 to March 2001, the same period for which our measure of residential instability begins. This approach means that we do not account for effects of past hazard damage on residential mobility but rather observe each changing concurrently over time. We believe this approach introduces the fewest assumptions and produces conservative estimates of hazard-related effects on residential instability by not recovering prior, indirect effects. Future research may wish to investigate more complex lagged, or dynamic, panel specifications.
3. The equation for calculating this proportional increase is as follows: $\frac{e^{(0.23 + 0.03 \times \ln(250{,}000{,}000))}}{e^{(0.23 + 0.03 \times \ln(1{,}000{,}000))}}$.
4. In hybrid models corresponding to model 1 of table 3, estimated coefficients for within- and between-respondent effects of hazard damage on residential instability are, respectively, .03 and .04 for men, and .03 and .05 for women. The same models with an AR(1) error matrix have coefficients of .04 and .03 for men, and .03 and .04 for women. All have *p*-values below .01.

About the Authors

James Elliott is Professor of Sociology at Rice University. His current research focuses on how urbanization, environment, and social inequality intersect over time and space to shape the prospects of a more just and sustainable future. Recent work has received funding from the National Science Foundation and has appeared in *American Sociological Review*, *American Journal of Sociology*, as well as other social science outlets.

Junia Howell is a PhD candidate at Rice University. Her work examines the relationship between residential segregation, neighborhood context, and socioeconomic mobility. Current research examines these intersecting dynamics not only in the United States but cross-nationally as well, including work in European contexts.

Supplementary Material

Supplementary data is available at *Social Forces* online.

References

Allison, Paul. 2009. *Fixed Effects Regression Models*. Thousand Oaks, CA: Sage.

Asad, Asad L. 2015. "Contexts of Reception, Post-Disaster Migration, and Socioeconomic Mobility." *Population and Environment* 36:279–310.

Bolin, Robert, and Lois Stanford. 1998. "The Northridge California Earthquake: Community-Based Approaches to Unmet Recovery Needs." *Disasters* 22(1):21–38.

Bolton, P. A., E. B. Liebow, and J. L. Olson. 1993. "Community Context and Uncertainty Following a Damaging Earthquake: Low-Income Latinos in Los Angeles, California." *Environmental Professional* 15:240–47.

Brunsma, David L., David Overfelt, and J. Steven Picou. 2010. *The Sociology of Katrina: Perspectives on a Modern Catastrophe*. New York: Rowman & Littlefield.

Bullard, Robert D., and Beverly Wright. 2009. *Race, Place and Environmental Justice after Hurricane Katrina*. Boulder: Westview.

Cancian, Maria, and Daniel R. Meyer. 2005. "Child Support: An Uncertain and Irregular Income Source?" Revised report to the Wisconsin Department of Workforce Development, issued as Discussion Paper 1298-05, Institute for Research on Poverty, Madison, WI.

Comerio, M. C., J. D. Landis, and Y. Rofe. 1994. "Post-Disaster Residential Rebuilding." Working Paper 608, Institute of Urban and Regional Development, University of California–Berkeley.

Coulton, Claudia J., Brett Theodos, and Margery Austin Turner. 2009. "*Family Mobility and Neighborhood Change: New Evidence and Implications for Community Initiatives*." Washington, DC: Urban Institute.

Crowley, S. 2003. "The Affordable Housing Crisis: Residential Mobility of Poor Families and School Mobility of Poor Children." *Journal of Negro Education* 72(1):22–38.

Curtis, Katherine J., Elizabeth Fussell, and Jack DeWaard. 2015. "Recovery Migration after Hurricanes Katrina and Rita: Spatial Concentration and Intensification in the Migration System." *Demography* 52(4): 1269–93.

Cutter, Susan L., Ronald L. Schumann III, Christopher T. Emrich. 2014. "Exposure, Social Vulnerability and Recovery Disparities in New Jersey after Hurricane Sandy." *Journal of Extreme Events* 1(1): 1–23.

Daniels, Ronald J., Donald F. Kettl, and Howard Kunreuther. 2006. *On Risk and Disaster: Lessons from Hurricane Katrina*. Philadelphia: University of Pennsylvania Press.

Desmond, Matthew. 2012. "Eviction and the Reproduction of Urban Poverty." *American Journal of Sociology* 118(1):88–133.

———. 2016. *Evicted: Poverty and Profit in the American City*. New York: Crown.

Desmond, Matthew, and Carl Gershenson. 2016. "Housing and Employment Insecurity among the Working Poor." *Social Problems* 63(1): 46–67.

Dong, Maxia, Robert F. Anda, Vincent J. Felitti, David F. Williamson, Shanta R. Dube, David W. Brown, and Wayne H. Giles. 2005. "Childhood Residential Mobility and Multiple Health Risks During Adolescence and Adulthood: The Hidden Role of Adverse Childhood Experiences." *Archives of Pediatrics Adolescent Medicine* 159(12):1104–10.

Elliott, James R. 2015. "Natural Hazards and Residential Mobility: General Patterns and Racially Unequal Outcomes in the United States." *Social Forces* 93(4):1723–47.

Elliott, James R., Timothy J. Haney, and Petrice Sams-Abiodun. 2010. "Limits to Social Capital: Comparing Network Assistance in Two New Orleans Neighborhoods Devastated by Hurricane Katrina." *Sociological Quarterly* 51(4):624–48.

Elliott, James R., Amy Bellone Hite, and Joel A. Devine. 2009. "Unequal Return: The Uneven Resettlements of New Orleans' Uptown Neighborhoods." *Organization & Environment* 22(4):410–21.

Elliott, James R., and Jeremy Pais. 2006. "Race, Class, and Hurricane Katrina: Social Differences in Human Responses to Disaster." *Social Science Research* 35(2):295–321.

Fothergill, Alice. 1999. "Women's Roles in a Disaster." *Applied Behavioral Science Review* 7(2):125–43.

Fothergill, Alice, and Lori A. Peek. 2004. "Poverty and Disasters in the United States: A Review of Recent Sociological Findings." *Natural Hazards* 32:89–110.

Fussell, Elizabeth, and Elizabeth Harris. 2014. "Homeownership and Vulnerability to Housing Displacement after Hurricane Katrina." *Social Science Quarterly* 95(4):1086–110.

Fussell, Elizabeth, and Sarah Lowe. 2014. "The Impact of Housing Displacement on Mental Health among Low-Income Parents after Hurricane Katrina." *Social Science & Medicine* 113(July):137–44.

Graif, Corina. 2016. "(Un)Natural Disaster: Vulnerability, Long-Distance Displacement, and the Extended Geography of Neighborhood Distress and Attainment after Katrina." *Population and Environment* 37: 288–318.

Greene, M. 1992. "Housing Recovery and Reconstruction: Lessons from Recent Urban Earthquakes." *Proceedings of the 3rd U.S./Japan Workshop on Urban Earthquakes*. Oakland, CA: Earthquake Engineering Research Institute (EERI) Publication No. 93-B.

Haas, J. Eugene, Robert W. Kates, and Martyn J. Bowden. 1977. *Reconstruction Following a Disaster*. Cambridge, MA: MIT Press.

Hazards and Vulnerability Research Institute. 2013. *The Spatial Hazard Events and Losses Database for the United States, Version 12.0* [Online Database]. Columbia: University of South Carolina. Available from http://www.sheldus.org, accessed 11/20/2015.

Hunter, Lori M., Jessie K. Luna, and Rachel M. Norton. 2015. "Environmental Dimensions of Migration." *American Review of Sociology* 41:377–97.

Institute for Children and Poverty (ICP). 2009. *Examination of Residential Instability and Homelessness among Young Children*. Available from http://www.icphusa.org/index.asp?page=16&report=58, Accessed online, 11/27/2015.

Intergovernmental Panel on Climate Change (IPCC). 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. Cambridge: Cambridge University Press.

Klinenberg, Eric. 2015. *Heat Wave: A Social Autopsy of Disaster in Chicago*, 2nd ed. Chicago: University of Chicago Press.

Mileti, Dennis S. 1999. *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Washington, DC: Joseph Henry Press.

Myers, Candice A., Tim Slack, and Joachim Singelmann. 2008. "Social Vulnerability and Migration in the Wake of Disaster: The Case of Hurricanes Katrina and Rita." *Population and Environment* 29(6): 271–91.

Pais, Jeremy, and James R. Elliott. 2008. "Places as Recovery Machines: Vulnerability and Neighborhood Change after Major Hurricanes." *Social Forces* 86(4):1415–53.

Peacock, Walter Gillis, Betty Hearn Morrow, and Hugh Gladwin, eds. 1997. *Hurricane Andrew: Ethnicity, Gender and the Sociology of Disaster*. London: Routledge.

Perrow, Charles. 2007. *The Next Catastrophe: Reducing Our Vulnerabilities to Natural, Industrial, and Terrorist Disasters*. Princeton, NJ: Princeton University Press.

Preston, Benjamin L. 2013. "Local Path Dependence of U.S. Socioeconomic Exposure to Climate Extremes and the Vulnerability Commitment." *Global Environmental Change* 23(4):719–32.

Pribesh, Shana, and Douglas B. Downey. 1999. “Why Are Residential and Social Moves Associated with Poor School Performance?” *Demography* 36(4):521–34.

Rabe-Hesketh, Sophia, and Anders Skrondal. 2012. *Multilevel and Longitudinal Modeling Using Stata,* 3rd ed., vol. 2: Categorical Responses, Counts and Survival. College Station,TX: Stata Press.

Sampson, Robert J. 2012. *Great American City: Chicago and the Enduring Neighborhood Effect*. Chicago: University of Chicago Press.

Sampson, Robert J., Jeffrey D. Morenoff, and Felton Earls. 1999. “Beyond Social Capital: Spatial Dynamics of Collective Efficacy for Children.” *American Sociological Review* 64(5):633–60.

Sharkey, Patrick, and Robert J. Sampson. 2010. “Destination Effects: Residential Mobility and Trajectories of Adolescent Violence in a Stratified Metropolis.” *Criminology* 48(3):639–81.

Tierney, Kathleen J. 2007. “From the Margins to the Mainstream? Disaster Research at the Crossroads.” *Annual Review of Sociology* 33:503–25.

Vigdor, Jacob. 2008. “The Economic Aftermath of Hurricane Katrina.” *Journal of Economic Perspectives* 22(4):134–45.