Title: "Moving to Opportunity in the Wake of Disaster: From Spatial Displacement to Neighborhood Attainment"
Authors: Corina Graif and Mary Waters
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ABSTRACT

While some studies examine the repopulation of communities after disasters, disproportionately few track the evacuees who do not return to their old neighborhoods. Thus, we know very little about many evacuees' post-disaster residential contexts. This study analyses the spatial mobility patterns of over 850 low-income African American families interviewed in New Orleans before the Hurricane Katrina, whose addresses were tracked again anywhere they moved in the country by 2007. The results show that the respondents who move enter less disadvantaged neighborhoods with higher proportions of whites and Hispanics. Compared to the non-flooded families, the flooded ones experienced significantly higher improvements in neighborhood quality. Moreover, the respondents who move outside the city or outside Louisiana enter neighborhoods that are significantly improved compared to their pre-hurricane neighborhoods or compared to the post-hurricane neighborhoods of families within the city or in the state. The authors discuss the implications of these results for mobility programs.

INTRODUCTION

Hurricane Katrina prompted the largest abrupt displacement of population in the U.S. since the dust bowl migration of the 1930s (Falk et al 2006, Picou and Marshall 2007). About 1.7 million individuals and their families found themselves scattered across hundreds of towns and cities in all the fifty states as reflected in the applications for FEMA assistance related to Katrina in 2007[1]. Fourteen counties with a total population of 2.5 million people experienced flooding or structural damage due to Katrina, according to FEMA (Gabe, Falk, McCarty, and Mason 2005). African American families were disproportionately represented among those who left the New Orleans Metro area. The American Community Survey data[2] indicates that of the 1.17 million residents over 1 year old living in New Orleans MSA before Katrina, about 330,000 moved

[1] Source: www.**fema**.gov/pdf/hazard/hurricane/2005**katrina**/metro_stats.pdf, retrieved on March 2009. These data may contain duplicate observations.
[2] ACS 2005 table 6, source: http://www.census.gov/newsroom/emergencies/additional/gulf_migration.html, retrieved on 2010/06/08

outside the New Orleans MSA in the few months after Katrina and an additional 131,000 moved within the MSA[3]. Of all the stayers *within* the MSA (movers and non-movers), 21.5% were non-Hispanic African American and about 13% were in poverty, while of all movers to *outside* the MSA, 59.3% were non-Hispanic African American and 32% were in poverty.

As the evacuees returned home, the population of New Orleans city grew between 2006 and 2008 from 210,678 residents to 311,853 (U.S Census Bureau 2009). Yet, the 2008 number represents only about 70% of the pre-Hurricane city population (445,000) estimated based on the 2004 ACS, which indicates that close to a third had not returned to the city by then.

While many studies examine evacuees' patterns of return to the communities of origin after disasters (e.g. Smith and McCarty 2009), disproportionately few focus on those who do not return and especially on the communities that they end up living in. This study focuses on a sample of low income African American families interviewed in New Orleans before the Hurricane, whose residential locations were tracked wherever they moved by 2007. It is a valuable group to study because low-income African Americans were disproportionately represented among the evacuees who left the New Orleans Metro area and because evacuees who do not return to their area of origin are particularly challenging to capture by typical surveys.

This study purports to examine the migration, residential mobility, and locational attainment patterns of Katrina evacuees with the goal to understand the extent to which it varies from the typical patterns of non-disaster related mobility and migration of similar population groups. Across the U.S., over 37 million people changed their residence in 2008 -- about 12.5% of the 2009 U.S. population (U.S. Bureau of Labor Statistics, Current Population Survey 2009).

[3] ACS 2005 Table 5, source: http://www.census.gov/newsroom/emergencies/additional/gulf_migration.html, retrieved on 2010/06/08

Most moves tend to occur however across short distances, over 67% of the moves were within the same county and a total of about 85% occurred within the same state.

THEORETICAL AND EMPIRICAL FRAMEWORK

Migration and Neighborhoods

Moving to new neighborhoods, in general, can be the result of a family's improvements in its financial situation. As suggested by the *spatial assimilation perspective* (Alba et al 1999, Massey and Denton 1985), moving to a higher quality neighborhood may be a sign of, and perhaps also a further factor in, a family's upward mobility. Given the time, energy, and other resources required by house searching and moving to a new neighborhood, particularly over a larger distance, families may be reluctant to move unless they move to a better situation, a more suitable house, a better landlord, a safer and more resource full or child friendly neighborhood, in proximity to better schools, or better job options (e.g. Taylor et al 2008).

Alternatively, families may move when they lose a job – in which case they may move to a lower rent house and likely a more disadvantaged neighborhood. Even when gaining in employment, low-income minority families may not be able to move to significantly better neighborhoods as a result of insidious yet systemic barriers, a perspective that has been referred to as the *place-stratification thesis* (Crowder and South 2005, Alba et al. 1999). This perspective suggests that a major reason for little improvements in neighborhood quality despite frequent residential mobility may be related to discriminatory practices in the housing and mortgage market, for instance, by landlords, real-estate agents, lenders, or even neighbors (Logan and Alba 1993). The socio-structural barriers may additionally be compounded with situations of dependence on -- or caring for dependents in -- nearby family and friends for emotional or

material support, which may constrain how far a family can move (Taylor 2008). To the extent that disadvantaged neighborhoods tend to be surrounded by other disadvantaged neighborhoods (Briggs 2006, Graif and Sampson 2009)[4], which are also more likely to experience flooding or structural damage during an environmental disaster, a short move would not be expected to bring about significant gains in neighborhood quality. [H3.2]

Environmental Risk and Social Inequality

To the extent that environmental risk can be associated with a specific place or neighborhood (due to ground elevation for instance in the case of flood risk) this information has the potential to shape residential decisions of individuals and families with more resources, for whom it is less of a challenge to move away from risk. As increasing numbers of families with resources want to move into lower risk neighborhoods, the house values will increase, driving away disproportionately those with fewer resources -- who will then have little choice but to cluster into higher risk neighborhoods. When disaster strikes, they are the first to be affected [H1]. Alternatively, even if a 'natural' disaster may hit everybody similarity (or randomly), people with more resources would be able to rebuild their house and restore their neighborhood's social and physical infrastructure more promptly than people without resources (Wisner et al 2004).

While economic status predictably differentiates between who can move away from risky neighborhoods and who cannot, even after controlling for socioeconomic status, racial and ethnic minorities tend to live in neighborhoods that are closer to environmental pollution (Crowder and Downey 2010). An important body of work on disasters (Erikson 1976, Klinenberg 2002, Wisner et al 2004, Tierney 2006) highlights the key social component of

[4] See also Myers et al. (2008) for a county level account of the spatial clustering of disadvantage in the Gulf Coast area

"natural" hazards, suggesting that such extreme events only become disasters when they combine with vulnerable people and places, which are typically a product of dysfunctional social systems. By disproportionately affecting vulnerable individuals such as the poor, minority groups, illegal immigrants, refugees, the elderly, or the disabled who have fewer resources to begin with and who consequently experience inordinately more challenging recoveries, disasters thus tend to amplify existing gaps into inequality maelstroms (Hunter 2005).

A series of studies have highlighted the disproportionate impact of Hurricane Katrina on low income, minority, and elderly residents (Brunsma et al. 2007, Elliot and Pais 2006, Sharkey 2007, Falk et al 2006, Hartman and Squires 2006, Lavelle and Feagin 2006). Of the 879 people in the New Orleans area who died because of the storm, a large majority were elderly. Of the identified bodies, 74% were residents of Orleans Parish and of these, 63% were African American[5] (Bourque et al 2006). Although African Americans constitute 67% of the population of New Orleans city, analyses indicate that they made up 76% of all the residents of "deeply and persistently" flooded areas (Campanella 2007, p.714).

Fusell et al. (2010) indicate that the displaced Black residents of New Orleans lived in neighborhoods that were more seriously flooded, experienced greater housing damage, and as a result, returned much slower to the city than similar whites. Recent case studies (Elliot et al 2009) indicate that compared to neighborhoods that were less disadvantaged before the Hurricane, neighborhoods that were more disadvantaged experienced considerably lower return rates, adding to, and exacerbating the differential impacts by the hurricane to begin with (Tierney 2006, Pais and Elliott 2008).

[5] Close to the 68% African American representation in the population of the parish

Displacement and Residential Trajectories

The hurricane may have pushed into motion people who otherwise would not have moved. A survey of Katrina evacuees to Houston (Brezina 2008), shows that low income was a significant predictor in not evacuating in advance of the Hurricane. Race also predicted negatively pre-Hurricane evacuations, albeit it was not significant in this Houston sample. Elliott and Pais (2006) indicate that New Orleans's poor and African American families were less likely evacuate before Katrina. The designated shelters in New Orleans were predominantly filled by African Americans seeking refuge (Elder et al. 2007). Examining national-level data in order to understand how migration due to disasters differs from migration in general, Morrow-Jones and Morrow-Jones (1991) show that disasters are more likely to put into motion the low- income, female-headed families, black, and the less educated. In a study of 2004 Hurricanes in Florida, Smith and McCarty (2009) similarly found that income and ethnicity were associated with pre-Hurricane evacuation and that these associations operated primarily through more specific measures of socioeconomic and vulnerability.

While perhaps less able to evacuate preemptively and avoid the impact of a disaster of such tremendous proportion as Katrina, in general, low income American families are more likely than higher income families to move in the course of a year (Current Population Survey 2007). In 2007, about 60% of movers over 15 years old[6] had incomes below $25,000[7]. Movers constituted about 17% of all families with incomes below $25,000 but only about 8.6% of all families with incomes over $70,000[8]. About 12% of low income families (below $25,000) move

[6] About 23% of individual movers over 15 years old had on average an income below $10,000

[7] Percentages calculated by authors based on CPS table 5, for 2006-2007, source: http://www.census.gov/population/www/socdemo/migrate/cps2007.html]

[8] Also, about 10% of families with incomes over $50,000

to the same county while only about 5% of all families with incomes over $70,000 move to the same county[9] [10]. *In 2007, about 17% of Black households, compared to about 12% of white households, moved during the previous year. L*ow income households (incomes below $25,000) constitute a larger proportion of all moving Black households (48%) than of moving white households (31%). Moreover, l*ow income Black families* are more likely to move in a year (of all low income black families, 21% move) than are *low income white families (of all low income white families, about 16% move)*. Black families who move are also more likely to move within the same county than are moving white families.[11] Renters are found to move more frequently (Lee, Oropesa, and Kanan 1994).

Compared to their more affluent non minority counterparts or to people living in non-poor or white neighborhoods, those living in poor segregated neighborhoods may move more [H2.2] in an unremitting attempt to escape cumulative *social dysfunctions* associated with poverty, such as drugs, gangs, or crime. Nevertheless, they to *move across smaller distances*, because perhaps of their *dependence on locally embedded resource*s, such as friendship and kinship networks, on which they may need to draw for help with childcare, for instance. A Pew Social and Demographic Trends survey in 2008 found that two thirds of the respondents who stay or move within a community report the pull of family ties (and 49% report connections to friends) as a major reasons for not moving too far, if at all. Even for those who moved to a new community, family ties constitute the third major pull (after jobs and child friendliness) toward

[9] In other words, about 68% of all low income hh (<$25k) who move in 2007, move to the same county, while only 61% of all high income hh (over $70k) who move, move to the same county]

[10] About 34% of all household moves in 2007 were made by households with incomes less than $25,000. In contrast, about 23% of all the household moves were made by households with incomes over $70,000. Percentages calculated by authors based on CPS table 10, for 2006-2007, Source: http://www.census.gov/population/www/socdemo/migrate/cps2007.html

[11] Authors' calculations based on data by the U.S. Bureau of Labor Statistics 2007, Table 10.

certain communities rather than others. Moreover, the family reasons for moving are cited more often by those with lower income and with lower levels of educational attainment (Taylor et al 2008). Smith and McCarty (2009) show that the 2004 Hurricane evacuees in Florida tended to stay with family and friends during the evacuation. Some Katrina related evidence (Li et al 2010) indicates that many African American and Vietnamese American evacuees tended to have move in with relatives even as if move multiple times.

However, during Katrina, reports indicate that about 77 % of Orleans' population, 96% of St. Bernard's, 42% of Plaquemines', 40% of Jefferson's, and 41% of the population in the state of Louisiana were affected by flooding or structural damage (Gabe, Falk, McCarty, and Mason 2005). The unusually high proportions of people directly affected by the catastrophe decreased the evacuees' option to move in with other family members in nearby neighborhoods. As nearby family members or friends would be similarly affected by flooding and structural damage, evacuees will be more likely to end up in areas farther away from their neighborhood of origin. Overall, the temporary paralysis or destruction of the city infrastructure may push people to evacuate farther than they would otherwise. If disasters are more likely to affect poor neighborhoods directly or more severely and if the nature of the disaster is such that people have to evacuate their neighborhoods and temporarily not just their own neighborhoods but the city, it follows that poor *people who otherwise would not have moved or would not have moved too far may be set into motion and across larger distances* [H2.1].

Neighborhood Attainment

To the extent that longer distance moves become more likely, the newly widened horizons may open for evacuees access to new opportunities such as jobs or organizational connections (Taylor

et al 2008) that may otherwise not be available or apparent. To the extent that evacuees are in a position to find and seize up on such new opportunities, a return to their neighborhoods of origin may be seen as a less advantageous move. The temporary evacuation away from their dependence networks in tandem with temporarily mobilized resources and infrastructure of help may be able to disrupt the old routines and open new options that might otherwise not be possible for low income families. Analyses of net population changes across counties in the Golf Coast region in the year after Katrina and Rita (Myers, Slack, and Singelman 2008) indicate that counties with lower proportions of disadvantaged populations and, to a weaker extent, less densely populated experienced significant increases in population[12].

Evacuees may be also able to move to better neighborhoods if they are offered adequate assistance from local, state, or federal government. The multitude of organizations suddenly mobilizing to help in the aftermath of a disaster may be able to *garner resources* for and illuminate options and possibilities that might otherwise be inaccessible to the evacuees[13] [H3.1] Moreover, the media attention and the national profile of a disaster might make it more difficult for landlords or realtors to *discriminate* in allowing the evacuees entry to more affluent and white neighborhoods[14].

Alternatively, a disaster may push poor people to neighborhoods that are as disadvantaged or worse than the neighborhoods of residence before the disaster. For instance, if they move with other family members (Li et al 2010) and they tend to have similar socioeconomic status and to live in similarly disadvantaged neighborhoods, the move would be likely a horizontal move. To the extent that low income families affected by the disaster have to evacuate their homes but not receive adequate help, the exhaustion of their resources may permit

little else than a horizontal or even a downward move. Some studies indicate that disaster movers tend to be more dissatisfied with their housing, are more likely to lose home ownership status post disaster than other movers (Morrow Jones and Morrow Jones 1991). Limited research exists on the communities of reception and the discrimination experience of evacuees but the evidence that does exist suggests that Katrina evacuees living in predominantly white communities in Colorado, Utah, and Texas, had to deal with significant racial prejudice and discrimination (Hunt et al. 2009). Similarly, a recent study (Zissimopulos and Karoly 2010) indicates that Katrina evacuees who did not return to their state of origin about a year after the Hurricane are considerably less likely to be employed which indicates disproportionate hardship compared to the returnees or the non-evacuees in the main affected states. However the findings additionally indicate that the longer term evacuees are significantly more likely to be self- employed than the returnees or the non-evacuees, which may be consistent with the hardship thesis but may also constitute an indicator of new opportunities for starting a business.

DATA AND MEASURES

1 Opening Doors

Respondents are part of a longitudinal study[15] of low income parents enrolled in two community colleges in the city of New Orleans in 2004-2005 (Richburg-Hayes, Brock, LeBlanc, Paxon, Rouse, & Barrow, 2009)[16]. This study, Opening Doors, was designed to improve retention in community college. Participants had to be between 18 and 34 years old, parent of a child, family income below 200 percent of the federal poverty level, and possessing a high school

[15] MDRC Opening Doors study of 6 colleges in four states NY, OH, LA, and CA, specifically, Kingsborough CC in NY, Elyria OH Lorain CC in OH, Toledo OH Owens in OH, L-Tech W. Jefferson in LA, Delgado Community College in LA, [Delgado City Park in LA, Delgado West Bank,] Chaffee College in CA [*may not include this*]
[16] [to reconsider if we want to present the names of the colleges]

diploma or GED certificate. Participants were assigned randomly to a control, which received no benefits, and treatment group, which was eligible to receive $1000 scholarship for each of the two semesters (after spring 2004) and additional academic advising. At baseline in 2004, demographic and health information were collected[17] on 1019 participants. Louisiana Technical College - West Jefferson and the Delgado Community College[18]. Most respondents are single African American women. [[19]A 12-month follow up telephone survey was in the field in August 2005 when Hurricane Katrina struck. 492 respondents were interviewed before the hurricane interrupted the study. 81% of these respondents [(n=402)] were tracked again after Katrina and interviewed between May 2006 and March 2007. A second set of baseline respondents who were not interviewed immediately before the storm was also located and interviewed after Katrina during the same time period as the first set. Interviews with a total of 711 respondents yielded thus a comprehensive battery of data before and after Katrina, including physical and mental health, socioeconomic status, psychological attributes, and political attitudes, as well as information on experiences of the storm including experiencing flooding, evacuation experiences and help from government and non profits. Moreover, the residential location of the baseline participants was also tracked after Katrina, during 2006-2007.

2 ESRI Spatial Data and Decennial Census

In order to link residential addresses of the New Orleans' OD respondents with their neighborhoods of residence and to examine their spatial distribution before and after Katrina, we geocoded their baseline (2004) addresses and their location of residence during 2006/2007. The address information was cleaned, standardized, and matched in ARCGIS to an ESRI-Library file

[18] [

[19] [

with street level information across the whole US. As the initial matching rounds typically yield success rates lower than 100% due to spelling errors, a review and rematch interactive procedure was next used in multiple steps, manually coding the unmatched addresses using additional resources such as American Fact finder street search. The final matching success rate was 100% for pre-Katrina addresses and 88% for post Katrina addresses yielding a total of 893 respondents with latitude and longitude coordinates both before and after Katrina. The geographic coordinates were next merged to polygon shape files of all US census tracts. Each respondent was subsequently assigned a census tract code based on the spatial location of their geographic coordinates within a tract. Next, based on the census tract code assigned to each respondent before or after Katrina, addition of neighborhood level information was added. The census tracts measures used in the analyses here were generated based on the Decennial Census data in the Neighborhood Change Data Base (Geolytics 2003).

The *concentrated disadvantage index* was generated based on the first principal component -- and the *residential stability index* was generated based on the second principal component -- of a Principal Component Analysis (PCA) of six census tract measures: proportions of persons in poverty, proportion of female headed households with children under 18, proportion of households with public assistance, proportion of persons in the civil labor force who are unemployed (which loaded highest on the first main component) together with proportion in same house 5 years earlier, proportion of owner-occupied housing units (which loaded highest on the second main component). The PCA is based on data for all census tracts in the US, pooled across time. The *ethnic and racial diversity index* is calculated as a Herfindahl function, based on the proportion relative to the whole tract population of non-Hispanic Whites,

non-Hispanic Blacks, non-Hispanic Asians and Pacific Islanders, non-Hispanic other races, and Hispanics.

3 Longitudinal Employer Household Dynamics

The Longitudinal Employer Household Dynamics is a program at the US. Census Bureau that matches state level administrative data on employers and employees with the business and economic censuses. It covers 47 states so far and is based on the universe of business and employees. The employment data are based on Unemployment Insurance Wage Records, which are reported by employers and maintained by the states. [Employer locations are assigned by the state and employees' residence locations are assigned by the Census Bureau based on data from several federal agencies.] We aggregated the LEHD data in order to create measures of employment density and job concentration for all US census tracts in 2004 and 2007 and subsequently merged these data with the locations of our New Orleans respondents before and after Hurricane Katrina. The *employment density* measure is calculated as the total number of jobs (independent of their location) of all the residents in a census tract divided by the total tract population. The *job concentration* measure is calculated as the total number of jobs located in a census tract (independent of the residential location of the employees) divided by the total tract population. For each of the two measures, we also calculated a *spatially weighted index* as a function of the corresponding index score of four census tracts located closest to a focal tract, weighted by the distance to the focal tract. The distance is calculated base on the geographic coordinates of the census tract centroids.

4 FEMA Applications for Assistance

For an overview of the spatial dispersion of families across the country after Katrina, we also examine data based on the mailing addresses reported by applicants for assistance from FEMA as of July-August 2007. The total number of Katrina related applications for assistance was 1,713,973, of which more than 75% (1,291,779) are located in metropolitan areas (CBSA) with at least 50,000 inhabitants. The states with the largest number of applications as of 2007 other than Louisiana, are Texas (127,828), Mississippi (497,559), Alabama (131,241), Georgia (31,464), Florida (24,241), and California (14,347). Of all the 370 metropolitan areas from which applications were mailed, the largest numbers of applications -- other than from the New Orleans Metro area-- came from: Baton Rouge, LA (ranked 1st , with over 157,000 applications) Golport-Biloxi, MS (2nd with over 97,000), Houston, TX (6th with over 68,000), Atlanta, GA (11th with over 26,000), Los Angeles, CA (17th with about 5,500), Chicago, IL (20th with more than 4,700), New York, NY (27th with about 3,000)[20].

ANALYSES AND RESULTS

1. Post Katrina neighborhoods look much better than the pre-Katrina neighborhoods of residence of our respondents.

1.1 Baseline context. Figure 1 indicates the spatial distribution of our respondents at baseline, before Hurricane Katrina hit and the level of neighborhood poverty as measured by the 2000 Census and classified in four categories based on quartiles. The darker shading indicates that the neighborhood poverty levels are in a higher quartile of the distribution across the New Orleans area. While the average neighborhood poverty of the respondents pre-Katrina is 26%, the first map of figure 1 indicates that they are exposed to a wide distribution of poverty rates. The

[20] [Source: www.**fema**.gov/pdf/hazard/hurricane/2005**katrina**/metro_stats.pdf, retrieved on March 2009. Note that these data may contain some duplicate observations.]

second map of figure 1 shows the spatial distribution of neighborhood employment density levels as measured in 2004 against the respondents distribution across the New Orleans area. The map indicates a tendency of the respondents to concentrate in the middle to lower quartiles of neighborhood employment density levels as measured in 2004.

Next, we interpolated the flood level of our respondents at their pre-Katrina location to the space surrounding their address and the result conveys a spatial distribution of the flooding levels represented in Figure 2, panel A. The color coding reflects four categories based on intervals of 1 standard deviations in the flooding levels experienced by the respondents. The spatial estimation of neighborhood flooding levels, while reconstructed from the flooding information for our respondents, overlaps strikingly well with the actual flooding map done by NOAA in 2005 after Katrina (see Panel B of Figure 2). This is in part the result of a wide spatial dispersion of respondents' location across the New Orleans area.

Figure 3 conveys the spatial distribution of neighborhood values on employment density (Panel A) and job concentrations (Panel B) as measured in 2007. As in the maps above, darker shades indicate higher quartiles. The triangles represent the spatial distribution of our respondents after Katrina, to the extent that they remained or returned to the area by the time of the post Katrina interview. Comparing against Panel B of figure 1, the spatial distribution of employment density across the New Orleans area looks more spatially clustered post-Katrina than before Katrina. Moreover, comparing Panel A and B of figure 3 indicates that the spatial concentration of jobs and the concentration of employed residents, overlap only to a limited extent.

In Figure 4 we show the post-Katrina spatial distribution of our respondents across the whole U.S. and compare it with the spatial distribution of applications for FEMA assistance in

2007. Although a lot fewer than the larger group of displaced population, our respondents are reasonably well distributed over space and seem to follow, albeit imperfectly, patterns that are proportionally overlapping with the FEMA applicants.

1.2 A disaster-based makeover? In Table 1 we present the results comparing the neighborhoods of residence of our respondents before and after Katrina. The post Katrina neighborhoods are on average significantly less densely populated and more diverse. They have about 9 percentage points more non-Hispanic whites, 14 percentage points fewer non-Hispanic blacks, 4 percentage points more Hispanics and 3.5 percentage points more first generation immigrants. While respondents still live in areas that are predominantly black, the new areas are considerably less segregated, , resulting in an improved diversity score. The neighborhoods post- Katrina have slightly lower concentrations of residents employed in service occupations. The neighborhood median family income is on average over $4000 higher than before Katrina and the neighborhood poverty level drops 4 percentage points to about 22%, as does the percentage of female-headed families with children, which drops 6%, from an average of over 46% in the pre-Katrina neighborhoods. About 14.5% of the respondents lived in neighborhoods pre-Katrina that had more than 40% residents in poverty. After Katrina, 11% live in neighborhoods of highly concentrated poverty. Overall the disadvantage index drops considerably from over 1 standard deviation[21] above the average US tract to only about .65 above the average. While before Katrina more than 21% of the residents lived in neighborhoods with a disadvantage level in the upper 5% of the distribution relative to the country, only 13.6% did so post-Katrina. The pre-Katrina neighborhoods looked about average in residential stability compared to the average US census tract, while post-Katrina the neighborhoods look slightly less stable. No significant change

exists, however, in the proportion of house ownership, which stays around 53%, as measured by the 2000 Census[22].

The improvement in neighborhood density of employment post-Katrina compared to pre-Katrina, albeit significant, is short of a percentage point, yet, the improvement in employment density in the surrounding neighborhoods (weighted by the distance to the neighborhood of residence) is more than 6.5 percentage points. Similarly, in contrast to a nonsignificant improvement in neighborhood concentrations of jobs per resident, the spatially weighted job concentration increases more than 300 percentage points, to an average of over 3.5 jobs to one resident.

Did flooding push into upward neighborhood mobility people who may not have otherwise moved or who would have moved to similar neighborhoods? The post Katrina improvements in neighborhood quality could be simply reflecting a temporal trend in individual mobility, to the extent that that people over time tend to gather enough resources, information, and skills to move to better neighborhoods. Indeed, the results indicate that those who moved significantly improved their neighborhoods compared to their own neighborhoods pre-Katrina as well as compared to the neighborhoods of those living in the same neighborhoods pre and post-Katrina when measured based on pre-Katrina and post-Katrina data.

In order to understand if Katrina had an additional positive effect on neighborhood mobility, we next compare the neighborhood characteristics between families whose houses were flooded by the Katrina and those who were not flooded. Any non-zero depth flooding is considered flooding. If Katrina did not have any additional positive effect on neighborhood attainment, then the flooding should not have any special role on the neighborhoods post-K. Moreover, to the extent that it pushed people to move too soon, before they were ready—it

should have a negative impact on the quality of neighborhoods post K. Thus, one should see that the flooded families ended up in neighborhoods of lower quality than (or at least the same quality as) those who were not flooded. H1a

2. Those flooded by Katrina end up on average in better neighborhoods than those not flooded (of whom a significant percent moved as well) [23].

2.1 ***A biased "natural" disaster*****?** Comparing the pre-Katrina neighborhoods of the flooded versus non-flooded families, the results (Table 2) indicate that the families mostly affected by the flood lived in neighborhoods pre-Katrina that were considerably more crowded, disadvantaged, and racially segregated. For instance, the pre-Katrina neighborhoods of the flooded families had about 85% non-Hispanic Blacks, which was about 38 percentage points more than the neighborhoods of the families not hit by the flood. In contrast, the neighborhoods of the flooded families had 33 percentage points less non-Hispanic whites than the non-flooded families. Compared to the corresponding attributes of the neighborhoods of the non-flooded families, the population density and disadvantage score of the pre-Katrina neighborhoods of the flooded families were more than double, while the median family income was on average more than $9000 lower. Compared to the non-flooded families, the neighborhood employment density and the job concentration pre-Katrina for the flooded families were also lower.

2.2 ***Displacement and* accelerated *mobility***. Despite the significant differences between the pre-Katrina neighborhoods of the flooded compared to the non-flooded families, and despite the fact that both the flooded and non-flooded families tend to move to better neighborhoods over time, the flooded are improving their neighborhoods to a dramatic extent relative to the non-flooded.

On many indices of neighborhood quality, the flooded families improve their neighborhoods post-Katrina to such an extent that they almost reach parity with the non-flooded families. As they surmount the majority of the gap in the quality of their neighborhood of residence, on some key measures, they even exceed the outcomes of the non-flooded. This is the case, for instance, with the spatially weighted job concentration, which becomes more than 6 times larger for the post-Katrina neighborhoods of the flooded than the non-flooded families (see Figure 6). It is important to note here[24] that in the post-Katrina neighborhoods of the flooded families the level of job concentration is still about the same and slightly lower compared to the non-flooded, indicating that the former, while able to improve their neighborhoods, are still limited in their resources and options. Yet, one option that they do seem to have is to make progress in moving to neighborhoods that have more resources and options in the surrounding areas.

3. *Comparing the comparable.*

Flooding was biased against poor neighborhoods and thus was not random. To the extent that one can assume that people who live in poor neighborhoods, do so as a result of fewer options (due perhaps to lower skills or racial discrimination, for instance) than people who live in less poor neighborhoods, and that these difference in options between poor neighborhood residents and less poor neighborhood residents change little over time – the neighborhood outcomes post-Katrina for the flooded respondents should look worse than for non-flooded respondents. H1b

Since flooding was biased against more disadvantaged neighborhoods, to fully understand the effect of flooding, it is useful to compare the outcomes of the flooded respondents with the outcomes of non-flooded respondents who started in similar neighborhoods as the flooded. Using propensity score matching, we systematically examined the neighborhood

[24]

outcomes of flooded and non-flooded families that are more closely comparable based on similarity in a set of pre-Katrina measures such as neighborhood disadvantage, ethnic and racial diversity, and population density. The analyses indicate that, indeed, flooding had a positive impact on neighborhood attainment. While, the results should be interpreted with caution as the size of the comparable control group drops considerably, the counterfactual analysis tends to support the results yielded by the more classical analyses above.

The improvement in neighborhoods post Katrina happened in a good part because (a) people moved and (b) for the flooded, in particular, because they moved outside the New Orleans metropolitan area (see Table A1). Using propensity score matching, we systematically examined the neighborhoods outcomes of movers and non-movers that are more closely comparable based on similarity in flooding experience and other pre-Katrina indices such as, neighborhood disadvantage, ethnic and racial diversity, and population density before Katrina. The results (Table 3) indicate that moving to a different neighborhood in general or moving outside New Orleans Metro area tended to significantly improve the quality of neighborhoods post-Katrina. As importantly, results from comparing groups flooded and non-flooded families similar in baseline neighborhood characteristics indicate that the flooding played a significant role in prompting respondents, to move to a new neighborhood and to move away from the metro area. The matching method allows a rough estimation of the counterfactual behavior of the flooded respondents in the hypothetical case that they were not flooded and the results suggest that the same respondents who ended up moving would not have moved or moved too far, had they not been flooded.

DISCUSSION

We showed that low income African American families living in New Orleans before Katrina moved after the Hurricane to neighborhoods of better quality than their neighborhoods of origin. At a first look, this finding stands in opposition to the *spatial stratification* thesis[25] and to evidence that suggest that low-income minority families (Crowder and South 2005; Sampson and Sharkey 2008; Graif and Sampson 2010; South, Crowder, and Chavez 2005) improve little in locational attainment when they move. One potential explanation -- consistent with *spatial assimilation* thesis (Massey and Denton 1985; Alba et al 1999) -- may be that a) these families would have moved to better neighborhoods anyway and that the Hurricane perhaps simply accelerated the locational attainment process that was bound to occur anyway. Alternatively, if the Hurricane had any effect on families' subsequent locational outcomes, it was likely negative (Li et al. 2010, Wisner et al. 2004; Hunter 2005; Fusell et al. 2010) -- even though overpowered by a stronger upward mobility trajectory that might have occurred in regular circumstances.

If this assumption is correct -- that the Hurricane had a negative direct impact on the outcomes of the evacuated low-income families, as studies suggest (e.g. Morrow-Jones and Morrow-Jones 1991) -- we should observe that those affected directly by the flooding during the hurricane experienced less of an improvement in neighborhood outcomes. The results, however, stood in contrast with this expectation. Instead, we observed that compared to the non-flooded families, the flooded families experienced significantly higher improvements in neighborhood quality, as reflected for instance in higher decreases in neighborhood poverty and disadvantage.

Even so, the spatial stratification thesis would still not be contradicted if, before the Hurricane, the neighborhoods of the flooded families happened to already be of better quality than the neighborhoods of the non-flooded [or if the respondents living in the flooded

[25] [

neighborhoods exhibited higher socioeconomic status at baseline than those living in the non-flooded neighborhoods]. However, the analyses indicate that the neighborhoods of the flooded respondents were in fact more disadvantaged than the neighborhoods of the non-flooded respondents. This finding is consistent with the increasing body of work on the unequal impact of "natural" disasters in general (e.g. Wisner et al 2004; Tierney 2006; Hunter 2005), and of Hurricane Katrina in particular (e.g. Brunsma et al. 2007; Lavelle and Feagin 2006; Sharkey 2007; Falk et al 2006), who tend to strike vulnerable individuals and communities more directly and more intensely (Campanella 2007). An implication of this finding that is consistent with the spatial stratification thesis would be that residents more directly affected by the Hurricane, would end up in similarly disadvantaged or more disadvantaged neighborhoods after the Hurricane. Contrary to expectations however, the results indicated that the low-income families whose house was directly impacted by the Katrina flooding (and living in more disadvantaged neighborhoods at baseline) improved their neighborhoods of residence after disaster significantly more than those whose house was not directly impacted.

If the *spatial assimilation thesis* is correct when suggesting that the contextual advantage is a result of differential socioeconomic individual and contextual characteristics associated with residential mobility, such as different baseline neighborhoods, the effect of moving should wither when comparing groups of movers and non-movers that are closely matched based on similar baseline characteristics. The results, nonetheless, indicate that even for respondents with similar baseline neighborhoods and similar Hurricane related flooding experience, moving in general and more specifically moving outside the New Orleans Metro area played a significant role in improving the post-Hurricane neighborhoods.

Most importantly, if the disaster did not thrust into movement people who otherwise would not have moved, then the effect of flooding on moving should fade away when comparing groups of flooded and non-flooded families restricted to exhibit more strictly similar neighborhoods at baseline. Likewise, if the disaster did not have the effect of pushing people to move farther away than they otherwise would have moved on their own, the effect of flooding on the distance of the move should fade away when comparing similar groups of flooded and non-flooded families. However, the results indicated that even when restricting the comparison groups to families with similar neighborhood conditions at baseline, the flooding effect on the chances of moving away from the baseline neighborhood and on the chances of moving outside the Metropolitan New Orleans area remains significant and positive. The key consequences of such *atypical spatial mobility*, especially for families who after the disaster move farther away from their baseline neighborhoods and expand their residential trajectory outside the Metropolitan area, are that it enables families to experience significant gains in locational attainment. The new neighborhoods of residence are significantly less disadvantaged and situated geographically in closer proximity to higher employment densities and jobs[26].

The findings of unusual locational attainment may be explained in part by the resources, information, and a wider range of support that have been mobilized by various organizations and institutions after Katrina, which may have enabled many families to move to better neighborhoods, farther away from their origin neighborhoods -- resources that are not typically available to low income African American families when they move [ref]. Another potential explanation is related to the idea that the tremendous devastation associated with Katrina has temporarily raised awareness in the general public and the media about discrimination and

[26] [

exclusion patterns and thus deterred gatekeepers from explicitly denying to the evacuees access to better neighborhoods. Limited research exists on this topic but the evidence so far suggests that Katrina evacuees still had to deal with racial prejudice and discrimination in their community of reception (Hunt et al. 2009). To the extent that the spatially displaced have been able to move in with family members and friends (Smith and McCarty 2009; Taylor et al. 2008; Li et al. 2010), the unprecedented scale and geographic reach of the disaster has likely restricted this option to family and friends that lived father away from the disaster area, and thus perhaps who had been able to break away from the concentrated disadvantage traps that had been marring the city long before Katrina (Berube and Katz 2005; Gabe et al. 2005; Briggs 2006).

This study has of course limitations of its own. The non-random selection of the sample limits the generalizability of the findings to the whole New Orleans population. While the selection criteria did render a group of respondents who look similar on many observable measures to many residents of the area[27] (African American, low income, single parents, and female), their student status in particular suggests that they may be especially able or driven to seek resources and opportunities to improve themselves and their families. The same characteristics – observed or unobserved -- that influenced their decision to register for community college may shape their residential trajectories after Katrina in ways that may not be possible for other population subgroups.

The study, nonetheless, contributes to the migration and residential mobility in key ways. It indicates that the poverty traps in which low-income minority families tend to repeatedly find themselves even as they move from a neighborhood to another (Crowder and South 2005) can be escaped. To the extent that future research can better understand the processes and mechanisms behind such unlikely mobility, we will have a greater chance to understand how similar groups

[27] [to double check and maybe add a table]

may become more able to improve their typical spatial trajectories even without an intervening disaster.

REFERENCES

Alba, Richard, John Logan, Brian Stultz, Gilbert Marzan, Wenquan Zhang.1999. "Immigrant Groups in the Suburbs: A Reexamination of Suburbanzation and Spatial Assimilation" *American Sociological Review* 64:446-460

Berube, Alan and Bruce Katz. 2005. *Katrina's Window: Confronting Concentrated Poverty Across America* Washington, DC: The Brookings Institution Metropolitan Policy Program

Bourque, Lind B., Judth M Siegel, Megumi Kano, and Michele M. Wood. 2006. "Weathering the Storm: The Impact of Hurricanes on Physical and Mental Health" Annals of the American Academy of Political and Social Science. 604:129-151.

[Bobo, Larry … Katrina . Dubois Review]

Briggs, Xavier de Souza. 2006. "After Katrina: Rebuilding Places and Lives." *City and Community* 5(2):119-128.

Brunsma, D.L., D Overfelt and J.S. Picou. 2007. *The Sociology of Katrina: Perspectives on a Modern Catastrophe*. Lanham, MD: Rowman and Littlefield

Campanella, Richard. 2007. "An Ethnic Geography of New Orleans" *The Journal of American History* December:704-15.

Crowder, Kyle and Liam Downey. "Interneighborhood Migration, Race, and Environmental Hazards: Modeling Microlevel Processes of Environmental Inequality." *American Journal of Sociology*. 115(4):1110-49.

Elder, Keith, Sudha Xirasagar, Nancy Miller, Shelly Ann Bowen, Saundra Glover, Crystal Piper. 2007. "African American' Decision Not to Evacuate New Orleans Before Hurricane Katrina: A Qualitative Study" *American Journal of Public Health* 97 (S1):124-129.

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

Elliott, J. R., A Bellone-Hite and J. Devine 2009 "Unequal Return: The Uneven Resettlements of New Orleans Uptown Neighborhoods." *Organization and Environment*, 22(4):410-421.

Erikson, T. Kai. 1976. *Everything in Its Path: Destruction and Community in the Buffalo Creek Flood*. New York: Simon and Shuster

Fusell, Elizabeth, Narayan Sastry, Mark VanLandingham. 2010. "Race, Socioeconomic Status, and Return Migration to New Orleans after Hurricane Katrina" *Population and Environment* 31:20-42

Gabe, Thomas, Gene Falk, Maggie McCarty, Virginia W. Mason. 2005. "Hurricane Katrina: Social-Demographic Characteristics of Impacted Areas" CRS Report to Congress

[Graif, Corina and Robert J. Sampson. 2009. "Spatial Heterogeneity in the Effect of Immigration on Homicide Rates" *Homicide Studies* 13:xx]

Hartman, Chester and Gregory Squires 2006. *There is No Such Thing as a Natural Disaster: Race, Class, and Katrina.* (Eds) New York; Routledge.

Hunt, Jennifer S., Brian E. Armenta, April L. Seifert, and Jessica L. Snowden. 2009. "The Other Side of the Diaspora: Race, Threat, and the Social Psychology of Evacuee Reception in Predominantly White Communities" *Organization and Environment* 22(4):437-447.

Hunter, Lori. 2005. "Migration and Environmental Hazards." *Population and Environment.* 26:273-302

Klinenberg, Eric. 2002. *Heat Wave: A Social Autopsy of Disaster in Chicago*. University of Chicago Press.

Kirk, S. David. 2009. "A Natural Experiment on Residential Change and Recidivism: Lessons from Hurricane Katrina" *American Sociological Review* 74:484-505

Lee, Barett A., R.S Oropesa, and James W. Kanan. 1994. "Neighborhood Context and Residential Mobility." *Demography* 31: 249-70. [renters move more frequently]

Li, Wei, Christopher A. Airriess, Angela Chia-Chen Chen, Karen J. Leong, and Verna Keith. 2010. "Katrina and Migration: Evacuation and Return by African Americans and Vietnamese Americans in an Easter New Orleans Suburb" *Professional Geographer*. 61(1):103-118.

Logan, John and Richard Alba. 1993. "Locational Returns to Human Capital: Minority Access to Suburban Community Resources." *Demography*. 30:243-68.[spatial assimilation thesis]

Logan, John R., Richard Alba, and Shu-Yin Leung. 1996.

Logan, John R., Richard Alba, Tom McNulty, and Brian Fischer. 1996. "Making a Place in the Metropolis: Locational Attainment in Cities and Suburbs." *Demography* 33:443-53. .[spatial assimilation thesis]

Massey, S. Douglas and Nancy A. Denton. 1985. "Spatial Assimilation as a Socioeconomic Outcome." *American Sociological Review* 50:94-106

[Massey, Doug. 1985. Xxx Social Science Research]

Morrow-Jones, H. A. and C.R. Morrow-Jones 1991. "Mobility due to Natural Disaster: Theoretical considerations and Preliminary analyses." *Disasters*. 15:126-32

Myers, Candice A., Tim Slack, and Joachim Singlemann. 2008. "Social Vulnerability and Migration in the wake of Katrina and Rita" *Population and Environment* 29:271-291.

[Picou and Marshall 2007. *The Sociology of Katrina xx]*

Sharkey, Patrick T. "Survival and Death in New Orleans: An Empirical Look at the Human Impact of Katrina". *Journal of Black Studies*. 37:482-501.

South, Crowder, and Chavez 2005. "Exiting and Entering High-Poverty Neighborhoods: Latinos, Blacks, and Anglos Compared." *Social Forces*. 84(2):873-900.

Smith, K. Stanley and Chris McCarty. 2009. "Fleeing the Storm(s): An Examination of Evacuation Behavior during Florida's 2004 Hurricane Season." *Demography*. 46(1):127-145.

Taylor, Paul, Rich Morin, D'Vera Cohn, Wendy Wang. 2008. *American Mobility. Who Moves? Who Stays Put? Where is Home?* Pew Research Center.

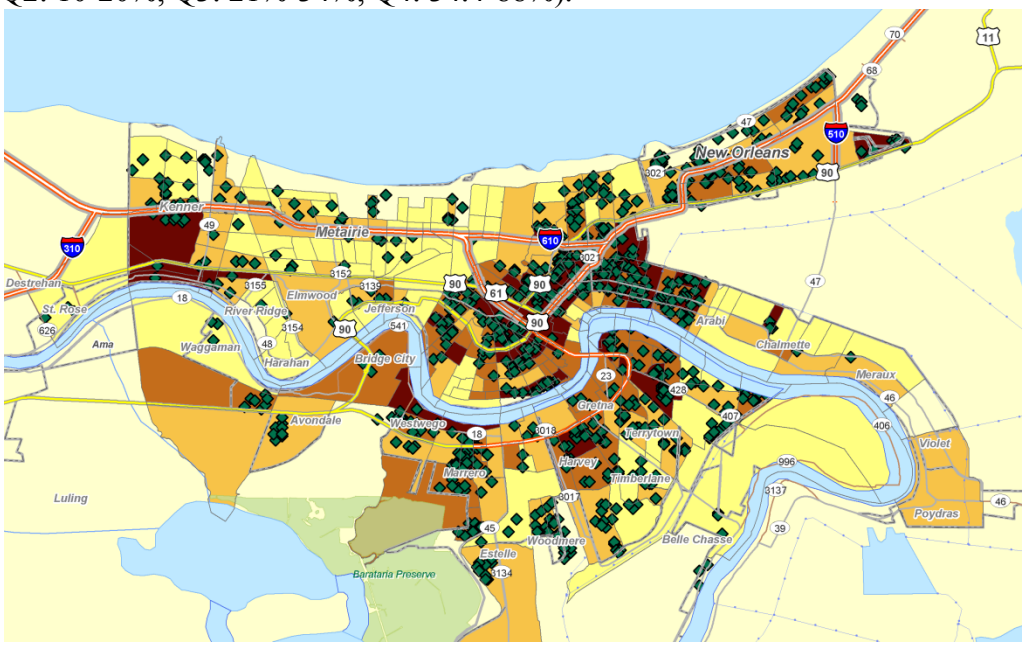
U.S Census Bureau. 2009. *New Orleans Was Nation's Fastest-Growing City in 2008. Population Getting Closer to Pre-Katrina Levels.* Press Release, July 1. [http://www.census.gov/newsroom/releases/archives/population/cb09-99.html]

Wisner, Ben, Piers Blaikie, Terry Cannon, and Ian Davis. *At Risk. Natural Hazards, People's Vulnerability, and Disasters*. 2nd edition. London and New York: Routlege.

Zissimopoulos, Julie and Lynn A. Karoly. 2010. "Employment and Self-Employment in the Wake of Hurricane Katrina" *Demography*. 47(2):345-367

Overview of Figures and Tables

Figure 1: Spatial distribution of respondents across New Orleans Area at baseline, before Katrina, by neighborhood poverty. Darker shades indicate higher poverty quartiles (Q1: 0-10%, Q2: 10-20%, Q3: 21%-34%, Q4: 34.4-88%).



Pre Katrina locations by neighborhood employment density in 2004 per pop in 2000. Darker shades indicate higher employment density. (Q1:0.107-0.3757, Q2:*-0.423, Q3:*-0.467, Q4:*-0.653)

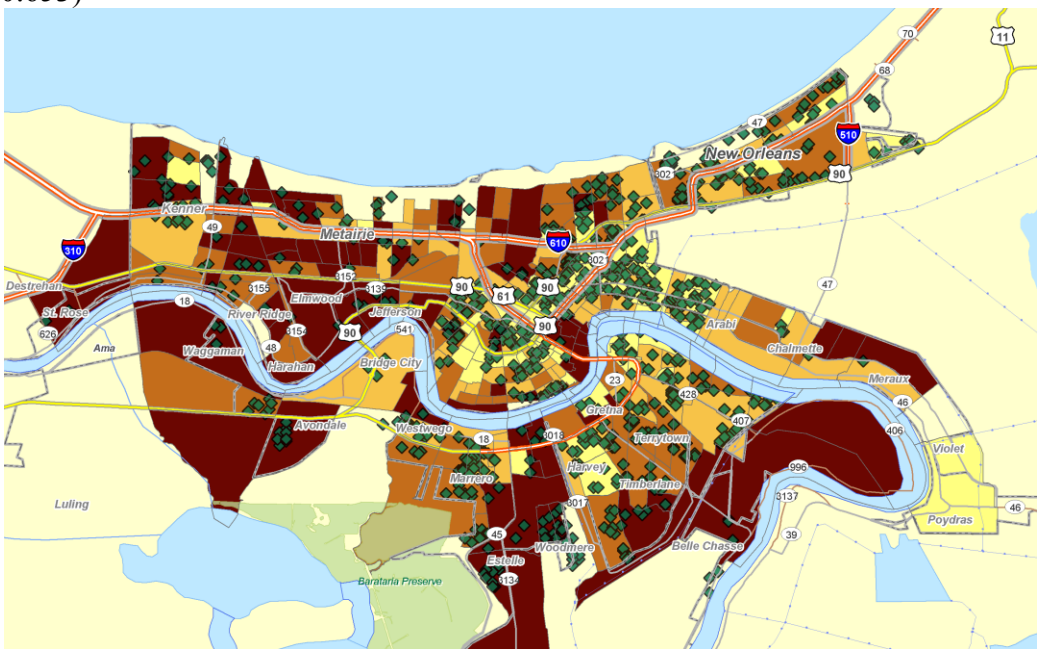
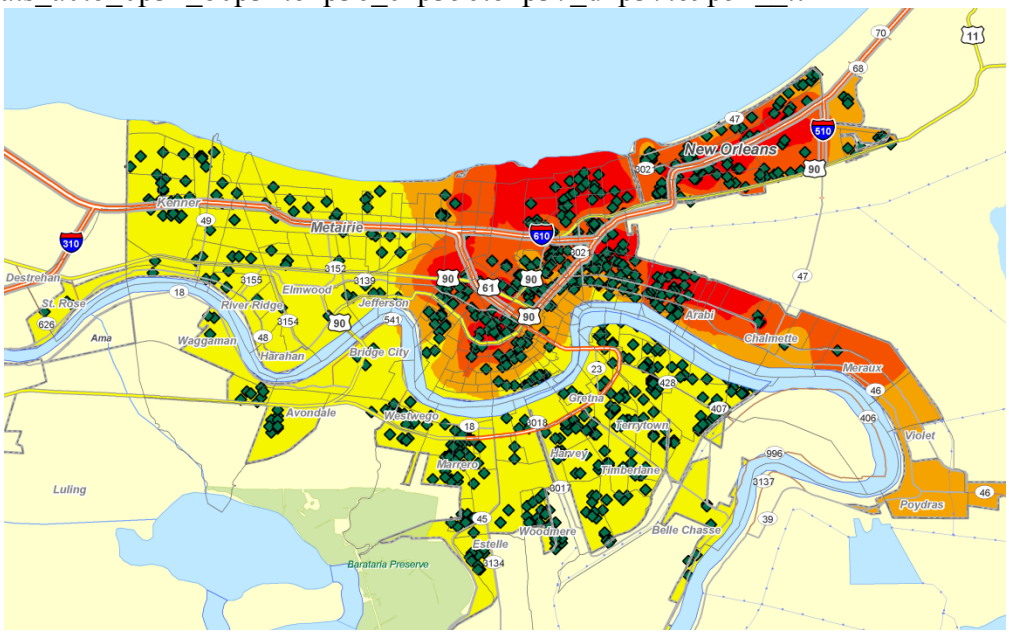


Figure 2: Neighborhood flood level interpolation based on flood depth experienced due to the Hurricane Katrina by the New Orleans area respondents in the Opening Doors study NextIs:KPD_postK_FEMA07cbsa_USAbasemaps_NewOrleansZoom_NeighFlooding4StdDevCats_a0to_0p34_b0p34to2p36_c2p356to4p37_d4p37to9p54__.tiff



[Next, is here for our reference. May be better to drop or move to appendix: Map of estimated flood depth and extent from the National Oceanic and Atmospheric Administration (NOAA) (on August 31 2005). Source: http://www.katrina.noaa.gov/maps/maps.html, retrieved on 2010/05/26]

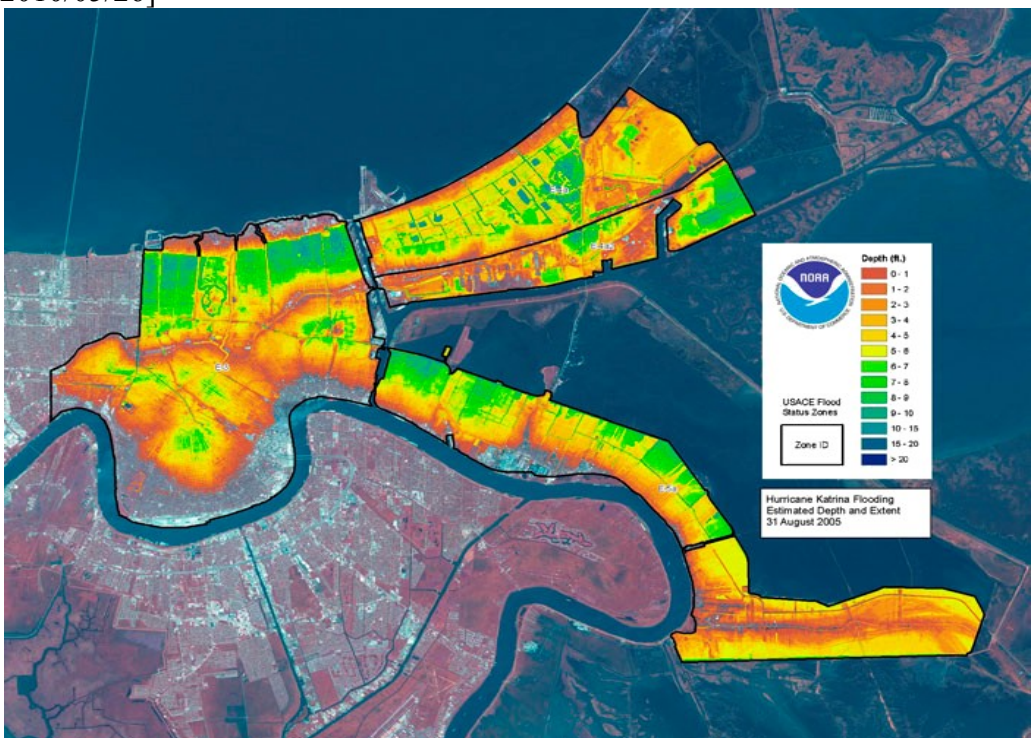
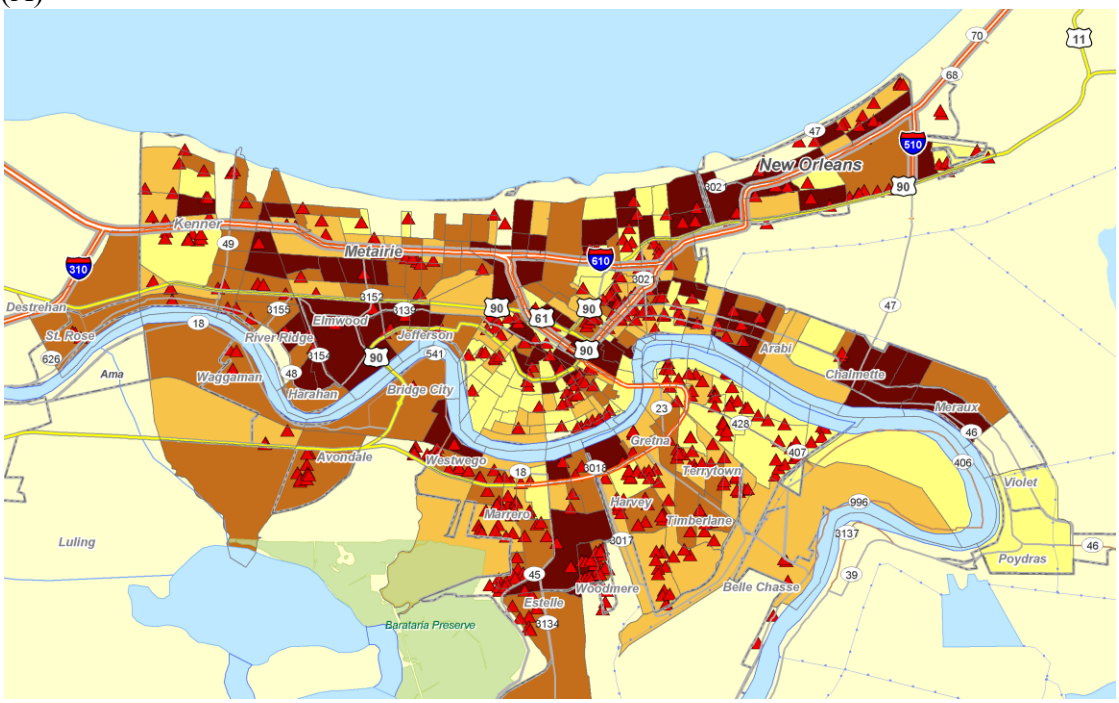


Figure 3: Post Katrina locations of respondents by neighborhood employment density 2007 per neighborhood population 2007. Darker shades indicate higher quartile. (B) Post Katrina locations of respondents by 2007 job concentration per neighborhood population. Darker shades indicate higher quartile.

(A)



(B)

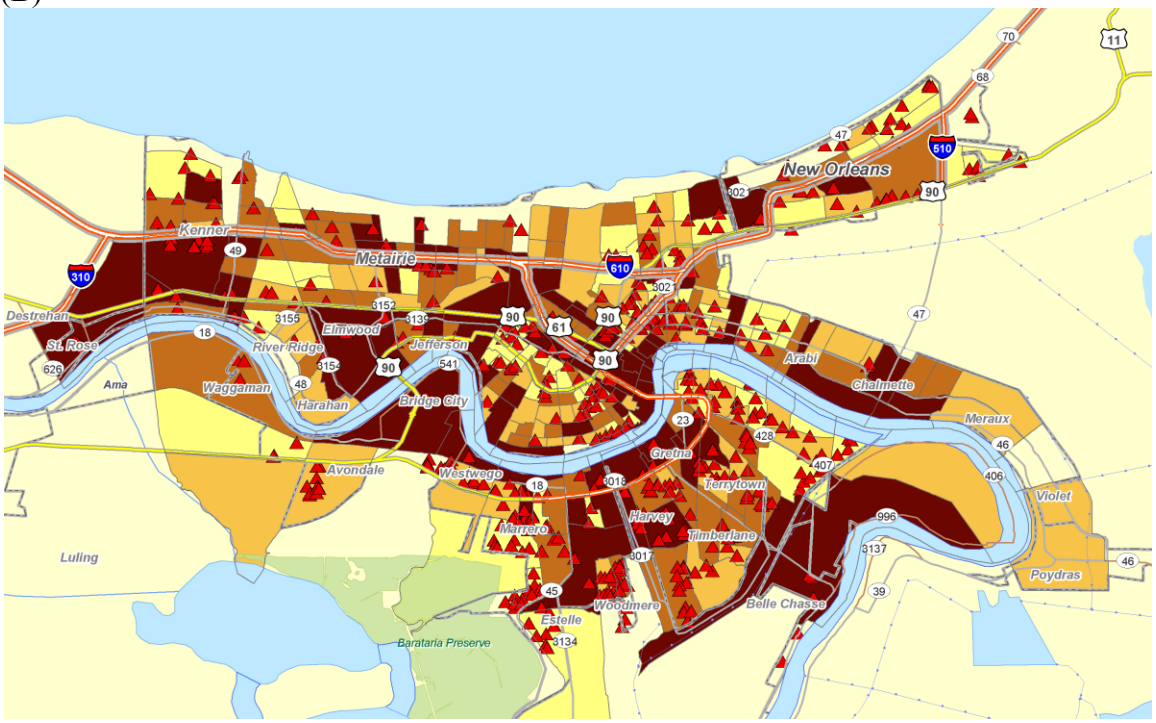
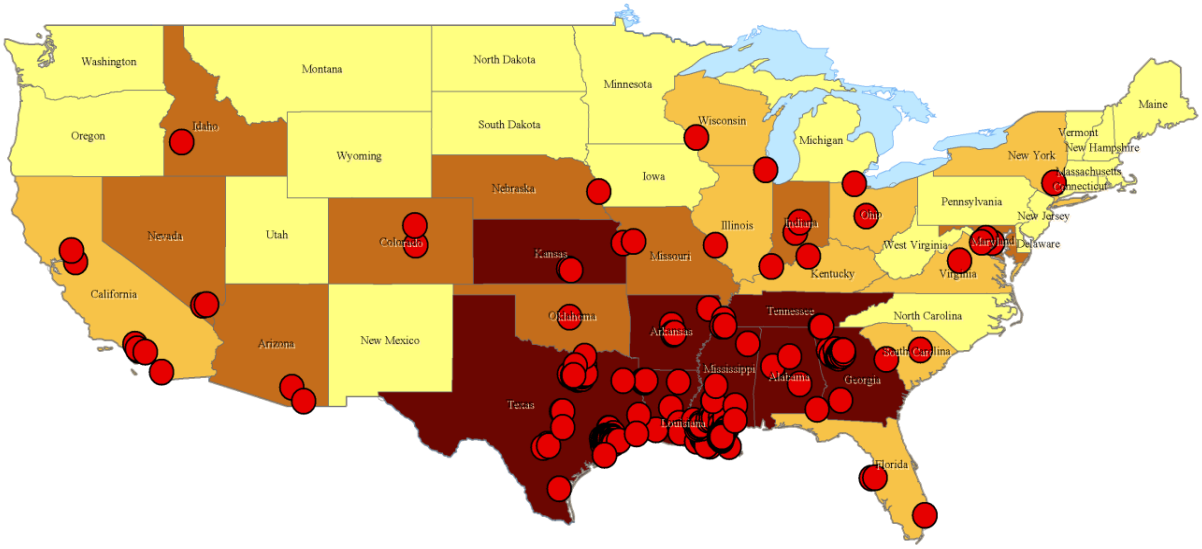
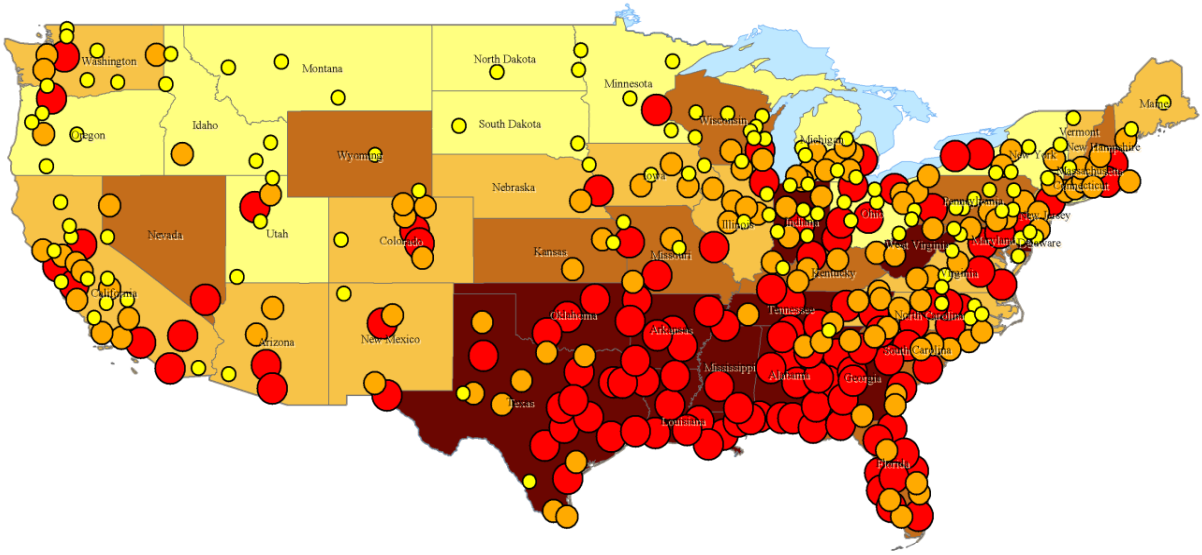


Figure 4: (A) Spatial distribution across the U.S. of New Orleans respondents one to two years after Katrina. (B) Distribution of individual applications for assistance from FEMA in 2007 at the Metro area level.

(A)



(B)



Notes: (A).Spatial distribution of New Orleans Opening Doors respondents after Hurricane Katrina 2006-2007. Dots represent residential locations of respondents (N = 856). Background shades represent different proportions of relocated respondents relative to the population of the relocation state. The darker the shade the higher the quartile (First map). (B).Distribution of individual applications for assistance from FEMA in 2007 at the CBSA level. Size of a dot represents the number of applications per CBSA area (Second Map). The larger the circle the higher the number of applications. [Small size represents 51 or less applications. Medium size represents 52 to 225 applications. Large size represents 226 or more applications.] Background shades represent different proportions of FEMA applications relative to the population of the relocation state. The darker the shade the higher the quartile.

Figure 5: Respondents' exposure to neighborhood poverty and disadvantage before and after hurricane Katrina

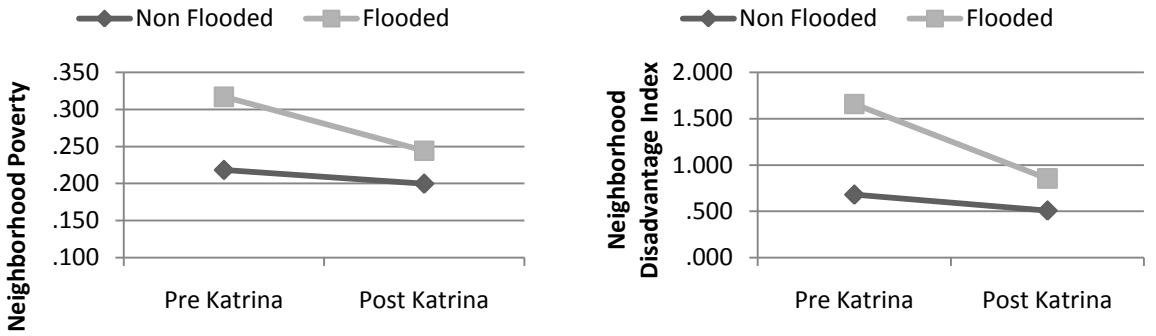


Figure 6: Respondents' exposure to neighborhood employment and job concentration before and after hurricane Katrina

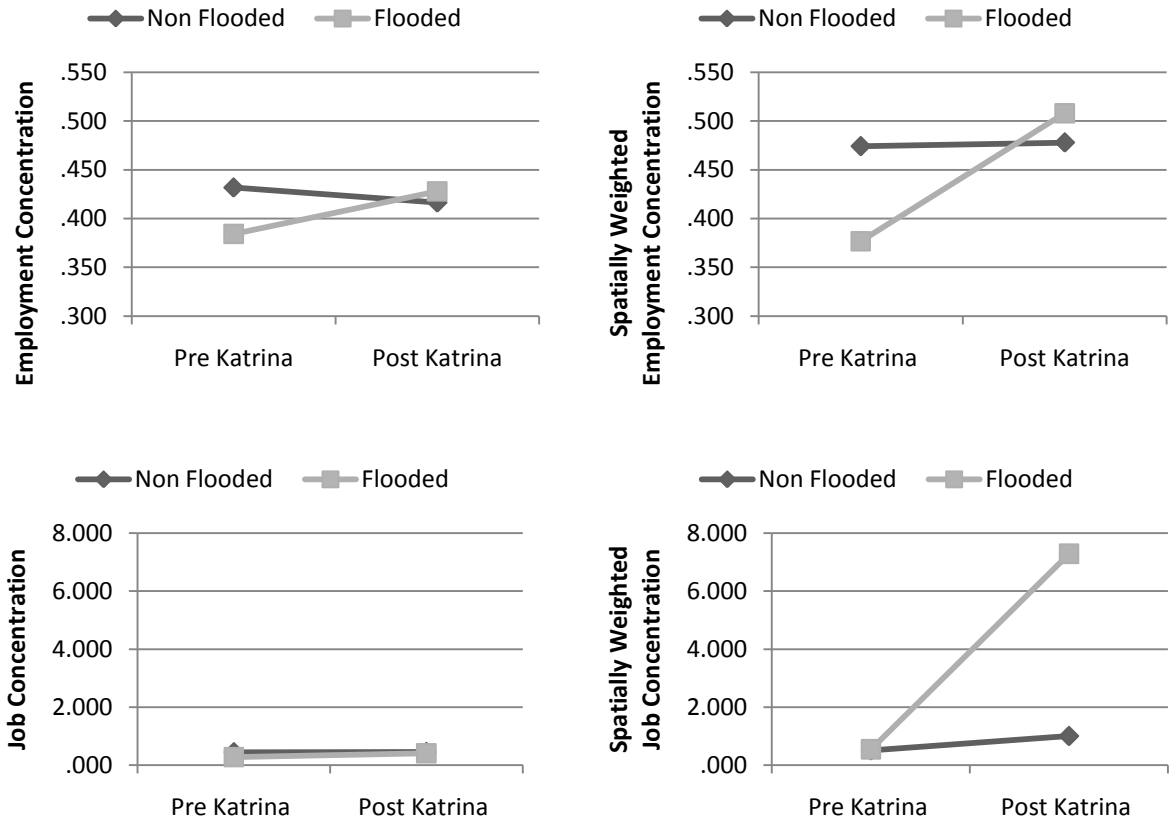


Table 1: Characteristics of neighborhoods of residence of respondents before and after the hurricane Katrina

	Pre-Katrina		Post-Katrina		Paired Δ		
Neighborhood Size and Age Structure							
Total population (a)	4350	(2009)	4918	(3299)	553	(3559)	***
Population density (a)	6880	(5569)	4560	(3399)	-2321	(5445)	***
Prop. < 5 yrs old	.077	(.020)	.078	(.021)	.001	(.023)	+
Prop. <18 yrs old	.295	(.063)	.288	(.063)	-.008	(.068)	***
Prop. >= 65 yrs old	.099	(.048)	.091	(.051)	-.008	(.055)	***
Ethnic and Racial Composition							
Prop. non-Hisp whites	.301	(.280)	.392	(.286)	.087	(.273)	***
Prop. non-Hisp Blacks	.626	(.314)	.477	(.320)	-.142	(.328)	***
Prop. Hispanics	.042	(.043)	.086	(.119)	.043	(.122)	***
Prop. first generation immigrants	.048	(.049)	.085	(.097)	.035	(.100)	***
Ethnic and racial diversity index	.344	(.199)	.417	(.195)	.067	(.206)	***
Education and Occupational Structure							
Prop. 25 yrs+ with a college degree or higher	.153	(.109)	.179	(.127)	.026	(.132)	***
% in professional occupations	14.666	(6.927)	15.799	(6.940)	1.074	(7.300)	***
% in service occupations	20.504	(6.496)	17.895	(6.469)	-2.546	(6.732)	***
% in business occupations	2.704	(1.630)	3.249	(2.034)	.547	(2.191)	***
Socioeconomic Indicators							
Median family income	33694	(13834)	38312	(15927)	4438	(16675)	***
Prop. of persons in poverty	.260	(.145)	.218	(.142)	-.040	(.143)	***
Unemployment rate	.101	(.061)	.087	(.055)	-.014	(.059)	***
Prop. female-headed families with kids	.463	(.177)	.399	(.179)	-.061	(.175)	***
Prop. households with public assistance	.139	(.080)	.110	(.080)	-.029	(.086)	***
Concentrated Disadvantage							
Disadvantage index	1.089	(1.158)	.648	(1.155)	-.426	(1.190)	***
Poverty less than 20%	.411	(.492)	.536	(.499)	.119	(.505)	***
Poverty more than 40%	.145	(.352)	.107	(.310)	-.043	(.349)	***
Disadvantage in upper 5% of all US tracts	.211	(.408)	.136	(.343)	-.073	(.376)	***
Housing and Residential Stability							
Residential stability index	.097	(.947)	-.207	(1.142)	-.301	(1.197)	***
Prop. persons 5+ yrs in same house 5 yrs earlier	.588	(.121)	.537	(.148)	-.049	(.158)	***
Prop. of owner occupied housing units	.532	(.223)	.541	(.237)	.007	(.224)	
Prop. vacant housing units	.094	(.063)	.082	(.060)	-.012	(.062)	***
Employment Density (b)							
Employment density	.412	(.063)	.421	(.091)	.009	(.101)	*
Spatially weighted employment density	.433	(.468)	.490	(.634)	.065	(.724)	**
Job Concentration (b)							
Job concentration	.374	(1.191)	.436	(1.072)	.049	(1.541)	
Spatially weighted job concentration	.526	(1.262)	3.556	(43.131)	3.020	(43.166)	*

Notes: Cell values represent averages. Standard deviation in parentheses. Unless otherwise noted, the measures are based on Census 2000 data. (a) The measures are based on 2000 Census data for neighborhoods od residence pre-Katrina and on 2007 Census data for neighborhoods of residence post-Katrina. (b) The measures are based on 2004 LEHD data for neighborhoods of residence pre-Katrina and on 2007 LEHD data for neighborhoods of residence post-Katrina. ***p<.001, **p<.01, *p<.05, +p<.10

Table 2: Neighborhood mobility of families flooded and those not flooded by Katrina

	Non-Flooded Families							Flooded Families						
	Pre-Katrina		Post-Katrina		Paired Δ			Pre-Katrina		Post-Katrina		Paired Δ		
Neighborhood Size and Age Structure														
Total population (a)	4675	(1859)	5202	(2668)	502	(2654)	***	3899	(2122)	4503	(4018)	627	(4575)	*
Population density (a)	4827	(3948)	4419	(3345)	-459	(3906)	**	9737	(6206)	4767	(3471)	-5044	(6186)	***
Prop. < 5 yrs old	.078	(.017)	.078	(.020)	.000	(.020)		.075	(.024)	.078	(.022)	.003	(.026)	+
Prop. <18 yrs old	.294	(.060)	.290	(.062)	-.004	(.064)		.298	(.066)	.285	(.065)	-.013	(.072)	***
Prop. >= 65 yrs old	.092	(.050)	.090	(.053)	-.002	(.054)		.110	(.044)	.093	(.047)	-.016	(.056)	***
Ethnic and Racial Composition														
Prop. non-Hisp whites	.439	(.268)	.450	(.271)	.011	(.242)		.108	(.154)	.308	(.286)	.199	(.278)	***
Prop. non-Hisp Blacks	.466	(.292)	.426	(.289)	-.040	(.268)	***	.848	(.181)	.553	(.347)	-.292	(.350)	***
Prop. Hispanics	.056	(.047)	.080	(.106)	.024	(.107)	***	.024	(.026)	.096	(.136)	.071	(.137)	***
Prop. first generation immigrants	.062	(.049)	.080	(.082)	.017	(.082)	***	.029	(.043)	.092	(.115)	.062	(.118)	***
Ethnic and racial diversity index	.434	(.171)	.447	(.179)	.010	(.160)		.218	(.165)	.373	(.209)	.152	(.234)	***
Education and Occupational Structure														
Prop. 25 yrs+ with a college degree or higher	.154	(.112)	.166	(.117)	.010	(.121)	+	.151	(.104)	.199	(.137)	.048	(.144)	***
% in professional occupations	14.829	(6.762)	15.362	(6.542)	.482	(6.757)		14.440	(7.151)	16.438	(7.448)	1.938	(7.958)	***
% in service occupations	18.137	(6.048)	17.127	(5.855)	-.951	(5.769)	***	23.792	(5.611)	19.017	(7.135)	-4.875	(7.341)	***
% in business occupations	2.849	(1.707)	3.152	(1.849)	.315	(1.950)	***	2.501	(1.496)	3.391	(2.273)	.886	(2.466)	***
Socioeconomic Indicators														
Median family income	37613	(14083)	39492	(14628)	1704	(15606)	*	28241	(11444)	36587	(17535)	8439	(17387)	***
Prop. of persons in poverty	.218	(.121)	.200	(.124)	-.018	(.118)	***	.317	(.156)	.244	(.162)	-.073	(.167)	***
Unemployment rate	.084	(.046)	.079	(.043)	-.005	(.046)	*	.125	(.071)	.098	(.068)	-.027	(.072)	***
Prop. female-headed families with kids	.392	(.163)	.370	(.165)	-.022	(.155)	***	.561	(.147)	.441	(.191)	-.119	(.187)	***
Prop. households with public assistance	.113	(.067)	.103	(.072)	-.010	(.068)	***	.175	(.083)	.120	(.090)	-.056	(.101)	***
Concentrated Disadvantage														
Disadvantage index	.679	(.951)	.507	(.987)	-.166	(.956)	***	1.659	(1.180)	.855	(1.340)	-.806	(1.384)	***
Poverty less than 20%	.522	(.500)	.590	(.492)	.064	(.473)	**	.257	(.437)	.457	(.499)	.199	(.539)	***
Poverty more than 40%	.091	(.288)	.072	(.258)	-.025	(.281)	*	.219	(.414)	.159	(.366)	-.068	(.428)	***
Disadvantage in upper 5% of all US tracts	.124	(.329)	.097	(.296)	-.025	(.281)	*	.332	(.471)	.193	(.395)	-.142	(.474)	***
Housing and Residential Stability														
Residential stability index	.121	(1.045)	-.019	(1.127)	-.143	(1.068)	**	.063	(.791)	-.483	(1.110)	-.532	(1.333)	***
Prop.5+ yrs in same house 5 yrs earlier	.580	(.130)	.557	(.142)	-.023	(.138)	***	.600	(.108)	.508	(.151)	-.089	(.177)	***
Prop. of owner occupied housing units	.594	(.222)	.594	(.229)	-.001	(.204)		.445	(.195)	.464	(.227)	.019	(.251)	
Prop. vacant housing units	.079	(.058)	.072	(.054)	-.007	(.056)	**	.115	(.064)	.096	(.065)	-.020	(.069)	***
Employment Density (b)														
Employment density	.432	(.057)	.416	(.077)	-.015	(.081)	***	.384	(.059)	.428	(.108)	.044	(.115)	***
Spatially weighted employment density	.474	(.609)	.478	(.601)	.021	(.750)		.377	(.047)	.508	(.680)	.130	(.681)	***
Job Concentration (b)														
Job concentration	.444	(.785)	.454	(1.262)	.002	(1.301)		.277	(1.588)	.409	(.702)	.119	(1.840)	
Spatially weighted job concentration	.512	(.534)	1.005	(11.661)	.489	(11.684)		.545	(1.848)	7.289	(66.083)	6.722	(66.138)	+
In different neighborhood post Katrina				.501							.702			
Valid N				514							346			

Notes: Cell values represent averages. Standard deviation in parentheses. Unless otherwise noted, the measures are based on Census 2000 data. (a) The measures are based on 2000 Census data for neighborhoods od residence pre-Katrina and on 2007 Census data for neighborhoods of residence post-Katrina. (b) The measures are based on 2004 LEHD data for neighborhoods of residence pre-Katrina and on 2007 LEHD data for neighborhoods of residence post-Katrina. ***p<.001, **p<.01, *p<.05, +p<.10

Table 3: Counterfactual estimations of post-Katrina neighborhood characteristics as a function of flooding, moving, or moving outside the New Orleans Metro area.

	Concentrated Disadvantage[a]		Employment Density [b]		Job Concentration [b]	
	Neighbor hood of residence	Distance weighted neighboring areas	Neighbor hood of residence	Distance weighted neighboring areas	Neighbor hood of residence	Distance weighted neighboring areas
Flooded during the Katrina hurricane (c)	-.595 *	-.252	.049 *	.108 **	-.003	6.887 +
t-statistic	-2.190	-1.050	2.170	2.590	-.010	1.950
Bias range after matching (abs)	1.0-12.5%	5-11.1%	9.3-27.5%	0.5-18.2%	0.9-16.9%	6.4-21.4%
Moving (d)	-.732 **	-.631 ***	.007	.088 *	.035	5.250 *
t-statistic	-5.260	-5.340	.540	2.350	.180	2.090
Bias range after matching (abs)	0.1-2.6%	0-5.8%	0.8-7.5%	0-5.7%	0.4-9.8%	0.7-4.0%
Moving out of New Orleans Metro area (d)	-1.148 **	-.967 ***	.013	.089 *	.178 *	8.780 *
t-statistic	-8.490	-8.420	1.050	2.030	2.190	2.090
Bias range after matching (abs)	0-4.5%	0-2.4%	0.7-3.9%	0.4-3.2%	0-7.0%	0-7.7%

Notes: (a) Measure of neighborhood of residence post Katrina is based on 2000 Decennial Census. (b) Measure of neighborhood of residence post Katrina is based on 2007 LEHD data. (c) Propensity scores are based on neighborhood population density, ethnic and racial diversity index, and the pre-Katrina value on the dependent variable. (d) Propensity scores are based on flooding status, neighborhood population density, ethnic and racial diversity index, and the pre-Katrina value on the dependent variable. **p<.01, *p<.05,

Table A1. Neighborhood characteristics for movers outside the New Orleans metro area and movers or stayers within the metro area

	Within New Orleans Metro Area							Outside New Orleans Metro Area						
	Pre-Katrina		Post-Katrina		Paired Δ			Pre-Katrina		Post-Katrina		Paired Δ		
Neighborhood Size and Age Structure														
Total population (a)	4418	(2035)	3845	(2302)	-598	(2126)	***	4228	(1962)	6937	(3896)	2717	(4568)	***
Population density (a)	6500	(5217)	4666	(3277)	-1807	(4475)	***	7550	(6077)	4362	(3615)	-3287	(6814)	***
Prop. < 5 yrs old	.077	(.020)	.077	(.020)	.000	(.016)		.077	(.021)	.081	(.023)	.003	(.031)	+
Prop. <18 yrs old	.294	(.063)	.294	(.063)	.001	(.052)		.297	(.062)	.276	(.061)	-.024	(.087)	***
Prop. >= 65 yrs old	.097	(.051)	.094	(.048)	-.003	(.045)	+	.103	(.044)	.085	(.055)	-.016	(.070)	***
Ethnic and Racial Composition														
Prop. non-Hisp whites	.323	(.280)	.357	(.281)	.027	(.199)	***	.262	(.276)	.460	(.283)	.200	(.348)	***
Prop. non-Hisp Blacks	.599	(.315)	.559	(.310)	-.031	(.217)	***	.673	(.308)	.324	(.280)	-.350	(.395)	***
Prop. Hispanics	.045	(.043)	.046	(.041)	.000	(.030)		.037	(.040)	.161	(.171)	.124	(.177)	***
Prop. first generation immigrants	.051	(.049)	.055	(.048)	.002	(.039)		.042	(.050)	.141	(.134)	.097	(.142)	***
Ethnic and racial diversity index	.362	(.198)	.387	(.198)	.019	(.149)	**	.312	(.198)	.474	(.177)	.158	(.261)	***
Education and Occupational Structure														
Prop. 25 yrs+ with a college degree or higher	.156	(.110)	.152	(.106)	-.006	(.085)	+	.147	(.106)	.231	(.145)	.085	(.177)	***
% in professional occupations	14.845	(7.101)	14.902	(6.755)	-.061	(5.518)		14.352	(6.625)	17.485	(6.980)	3.204	(9.456)	***
% in service occupations	19.983	(6.625)	19.363	(6.518)	-.481	(4.751)	*	21.411	(6.181)	15.133	(5.392)	-6.422	(8.072)	***
% in business occupations	2.781	(1.617)	2.807	(1.586)	.022	(1.316)		2.570	(1.649)	4.080	(2.479)	1.531	(3.017)	***
Socioeconomic Indicators														
Median family income	34784	(14340)	35535	(14326)	415	(11855)		31795	(12730)	43534	(17430)	12003	(21213)	***
Prop. of persons in poverty	.250	(.145)	.244	(.147)	-.003	(.102)		.277	(.143)	.169	(.119)	-.110	(.178)	***
Unemployment rate	.098	(.060)	.096	(.060)	-.001	(.042)		.108	(.064)	.070	(.041)	-.039	(.076)	***
Prop. female-headed families with kids	.452	(.178)	.434	(.180)	-.014	(.123)	**	.482	(.174)	.332	(.157)	-.151	(.219)	***
Prop. households with public assistance	.130	(.077)	.126	(.080)	-.003	(.056)		.154	(.084)	.079	(.072)	-.077	(.108)	***
Concentrated Disadvantage														
Disadvantage index	.993	(1.135)	.923	(1.162)	-.045	(.779)		1.257	(1.180)	.131	(.948)	-1.141	(1.470)	***
Poverty less than 20%	.446	(.497)	.466	(.499)	.012	(.392)		.349	(.477)	.668	(.472)	.319	(.620)	***
Poverty more than 40%	.129	(.335)	.136	(.343)	.005	(.263)		.173	(.379)	.053	(.225)	-.133	(.457)	***
Disadvantage in upper 5% of all US tracts	.190	(.392)	.178	(.383)	-.009	(.288)		.247	(.432)	.056	(.231)	-.193	(.479)	***
Housing and Residential Stability														
Residential stability index	.080	(.969)	.120	(.942)	.043	(.799)		.126	(.909)	-.823	(1.231)	-.947	(1.515)	***
Prop. 5+ yrs in same house 5 yrs earlier	.584	(.124)	.587	(.118)	.004	(.105)		.595	(.117)	.443	(.152)	-.150	(.190)	***
Prop. of owner occupied housing units	.542	(.230)	.559	(.234)	.015	(.176)	*	.513	(.212)	.508	(.239)	-.006	(.294)	
Prop. vacant housing units	.089	(.064)	.086	(.066)	-.002	(.050)		.102	(.061)	.073	(.045)	-.031	(.076)	***
Employment Density (b)														
Employment density	.417	(.062)	.416	(.095)	-.002	(.099)		.403	(.062)	.431	(.081)	.029	(.100)	***
Spatially weighted employment density	.452	(.587)	.468	(.561)	.031	(.705)		.401	(.054)	.532	(.752)	.130	(.755)	**
Job Concentration (b)														
Job concentration	.382	(.702)	.409	(1.217)	.021	(1.198)		.360	(1.738)	.484	(.732)	.100	(2.031)	
Spatially weighted job concentration	.453	(.643)	.467	(.672)	.008	(.763)		.653	(1.899)	9.366	(72.919)	8.684	(72.996)	*
House flooded during Katrina			.340							.554				
Valid N			559							301				

Notes: Cell values represent averages. Standard deviation in parentheses. Unless otherwise noted, the measures are based on Census 2000 data. (a) The measures are based on 2000 Census data for neighborhoods od residence pre-Katrina and on 2007 Census data for neighborhoods of residence post-Katrina. (b) The measures are based on 2004 LEHD data for neighborhoods of residence pre-Katrina and on 2007 LEHD data for neighborhoods of residence post-Katrina. ***p<.001, **p<.01, *p<.05, +p<.10