The Effect of Disasters on Migration

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Abstract

While post-disaster migration can move vulnerable peoples from dangerous regions to relatively safe areas, little is known about the processes through which migrants select new homes. We refine a spatial econometric model of migrant flows to examine the characteristics of the destinations of migrants leaving the New Orleans area following Hurricane Katrina in 2005 and in 2006 when the pressure to evacuate was lessened. We find that migrants in 2005 settled close to New Orleans, with little consideration for destination amenities or characteristics. After the immediate threat had dissipated, however, migrants were more likely to consider economic characteristics of destinations.

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Introduction

Natural disasters can cause widespread destruction and weaken local economies. These impacts can lead to permanent migration away from disaster-affected areas. Such permanent, or even semi-permanent, migration induced by natural disasters has the potential to significantly reshape the distribution of national and global populations and economies (see e.g. McIntosh (2008)). Moreover, because migration moves people out of the path of some disasters, and potentially into the path of other ones, post-disaster migration has implications for the risks associated with future events (See (Gráda and O'Rourke 1997)). Finally, the migration itself and the loss of community cohesion suggests the need for consideration of mental health support in communities that will receive large numbers of disaster migrants (See (Weber and Peek 2012)).

Migration following large disasters is well-documented after major events like Hurricane Katrina, the 2011 Tohoku earthquake/tsunami and subsequent Fukushima nuclear disaster, and the 2004 Indian Ocean tsunami. Because of the pressures placed on the affected population, disasters can cause migration among a wider portion of the population than those who migrate normally (in a non-disaster related context) (See (Gray et al. 2014)). While the propensity for disaster-affected populations to migrate is documented, less is known about the preferences that impact the destination of disaster-affiliated migrants.

Factors in migration decisions are generally framed in the context of "push" factors and "pull" factors. Push factors cause people to want to leave the origin while pull factors cause people to want to go to a specific destination. High unemployment in the origin might push people to leave, for example. Similarly, a low cost of living might pull people toward a particular destination.

The circumstances of a disaster, however, amy shift the relative importance of various pull factors in attracting migrants. This could occur either because preferences over these pull factors are dependent on the state in which the decision to migrate is made. Alternatively, the disaster induces traditional non-migrants to move and if these people have different preferences than those who are traditional movers, then the overall destination of post-disaster migrants will shift.

An understanding of these pull factors is important for crafting natural disaster policies, understanding the likely evolution of disaster damages, and evaluating the prospects for repatriation. For example, if post-disaster migrants are credit constrained and unable to move to the optimal location, government subsidies for relocation costs might be justified. Similarly, if post-disaster migrants move to other areas that are at high risk of natural disasters, future disaster losses may actually increase following the migration.

Hurricane Katrina, which struck New Orleans in 2005, provides an ideal case study to examine the factors that influence the destination of disaster migrants. Most residents of New Orleans evacuated prior to the Hurricane, and following the storm most remaining residents were evacuated by the Federal Emergency Management Agency (FEMA). Approximately 1.5 million people evacuated the New Orleans area. 96% of New Orleans residents and 80% of residents surrounding the city eventually left their homes (See (Groen and Polivka 2008; Elliott and Pais 2006)). While a large number of evacuees were relocated to Houston by FEMA, Katrina evacuees relocated throughout the country. Nearly every state received FEMA funding for costs associated with supporting evacuees from Katrina. Many of those who evacuated following Hurricane Katrina never returned to the New Orleans area. These permanent migrants were generally younger, more likely to have children, and more likely to be black than those who returned to New Orleans (See (Groen and Polivka 2010)). There was also an increased flow of migrants from neighboring communities in the years following Katrina compared to the years prior to Katrina, indicating that those migrants who relocated to nearby communities were more likely to return than those who relocated to distant ones (See (Fussell, Curtis, and DeWaard 2014)).

In this paper, we examine the migration pull factors in terms of characteristics of the destinations of post-Katrina migration out of the New Orleans area by using data on the movement of IRS return filings between counties and a range of county-destination attributes. This paper contributes to the literature by estimating the relative importance of a range of factors in post-disaster relocation decisions. This work conveys a range of policy implications surrounding disasters and climate change. By identifying the characteristics that draw migrants following natural disasters, we inform future migration patterns as disasters grow more frequent. Our consideration of distance in the relocation decision also highlights the extent to which post-disaster

migrants will be removed from similarly disaster-prone areas. Finally, we contribute to a small but growing set of studies that model migration in an explicitly spatial econometric context.

The rest of the paper proceeds as follows. In Section , we review the theoretical structure of migration decisions, in Section discuss our data sources, in Section present our estimating equations, and in Section present our results.

Conceptual Underpinnings

From an economic standpoint, migration decisions are based on households comparing their expected lifetime utility in their current location (the origin) to a location to which they could move (the destination) (See (Greenwood 1985; Greenwood 1975)). Yun and Waldorf (2016) examine the decision about whether or not to migrate in an expected lifetime utility framework and focus on the extent to which Katrina induced migration by those who would not otherwise have migrated. The utility that a household expects to receive from living in a particular location depends on economic variables such as the wages and cost-of-living associated with an area, but also on non-economic variables such as environmental amenities, family and social ties, and perceptions about safety. A household will decide to migrate if the increase in expected lifetime utility obtained by moving from the origin to the destination exceeds the costs associated with moving. These costs include the financial costs associated with moving, as well as more abstract factors such as the social costs incurred by the move.

The decision to migrate is generally endogenous to migrant characteristics. Highly-skilled migrants who expect to receive large wage premiums are more likely to migrate than low-skilled workers (See Borjas (1987)). Similarly, migration is costly, Chiswick (1999)] note that those who are less credit-constrained are more able to afford the upfront costs associated with an optimal relocation decision.

Natural disasters, however, cause exogenous variation in the expected lifetime utility at the origin. For example, property damage would require repair costs in order to stay at the origin, and a weakened local

economy would lower wages at the origin. Similarly, if a disaster causes households to update their beliefs about the likelihood and severity of subsequent events, this could lower the expected utility of remaining in the origin. These effects would cause households to re-evaluate their location decisions and potentially choose to migrate due to the decreased expected life-time utility at their origin (See (Yun and Waldorf 2016)).

In the event of major natural disasters like Hurricane Katrina and the Fukushima nuclear disaster, the push factors are relatively obvious; people leave the origin because of mandatory evacuation requirements, legal inability to return due to quarantines, loss of employment opportunities, etc. It is less obvious what draws migrants to particular locations following a disaster. One might be particularly concerned that post-disaster migrants are systematically different than those who choose to migrate under other circumstances. Disaster-related migrants, for example, might feel compelled to relocate more quickly or have less wealth with which to bear moving costs. Hence, they may not move to optimal locations in comparison to normal circumstances, or what Yun and Waldorf (2016) refer to as "double-victimization." Black et al. (2011) suggest that population movements due to disasters are typically short distance, though this conclusion seems to be counter to what happened in the aftermath of Hurricane Katrina.

Several variables have been suggested, and some tested, to explain the pull factors. Many of these are traditional in the gravity model literature of migration, such as wage and cost-of-living differentials, distance, moving costs, and general economic health of the destination (See (Borjas 1987; Rupasingha, Liu, and Partridge 2015)). Broadening the analysis leads to consideration of amenities, family ties, racial/ethnic affinities, migration networks, and institutions (See (McKenzie and Rapoport 2010; Nifo and Vecchione 2014)). The destination choice itself is dependent on the reason that drives the individual to migrate (See (Findlay 2011)). One might conclude that short or long-run hazard vulnerability would be major considerations, but Black et al. (2011) and Fielding (2011) emphasize the primacy of socioeconomic over environmental variables in current migration decisions, though on the basis of only anecdotal information.

Data

Our primary source of data is the Internal Revenue Service (IRS) Statistics of Income Division's migration data. These data report the flows of populations between counties based on changes in the location from which tax returns are filed and the number of exemptions that are claimed on those tax returns. The IRS reports both outflow migration as well as inflow migration. The IRS data also include the number of exemptions of people who do not move, providing a base-level population value that is comparable to the migration data. In order to ensure the privacy of individual filers, the IRS suppresses observations in which fewer than ten filers migrated between an origin-destination pair. We treat these values as true zeroes.

Given our focus on New Orleans, we restrict our interest to outflow migration from the parishes most severely affected by Hurricane Katrina in 2005. We define the population affected by Hurricane Katrina as those residing in Cameron, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. John the Baptist, St. Tammany, and Terrebonne Parishes. These parishes constitute the New Orleans metro, as well as two surrounding Parishes (Lafourche and Terrebonne) which adjoin the metro area.While there was some migration between affected regions (i.e., moving from a county that was severely affected to one that was slightly less affected), we remove these migrants from our sample to facilitate a simpler interpretation of outflow migrants. [^parish]: While Louisiana is organized into parishes rather than counties, we will use the term counties throughout this paper to facilitate discussion of destination locations.

We aggregate annual migration flows to each destination county across the five highly-affected origin counties between 2000 and 2010 The result is an 11-year panel of population flows to the 3095 destination counties.[1] There is a non-zero number of migrants to approximately 5.4% of the county-year observations in our dataset. In 2005, however, 13.8% of US counties received migrants from the affected area. With the exception of 2005, the number of migrants and the proportion of counties that receive migrants from New Orleans is relatively consistent over time.

Most migrants from the New Orleans area move to counties that are relatively close. Table ~1 and ~2 present

[1]There are 3,144 counties and county equivalents in the U.S. and affected counties are removed from the set of potential destination counties as well as any counties for which explanatory variables are unavailable.

the states and counties that received the greatest proportion of migrants from the New Orleans area in 2005. Each of the five states that received the most migrants from New Orleans area in the South, as are the ten most common destination counties. With the exception of Tangiphoa and Ascension parishes in Louisiana, each of the most common destination counties contain a metropolitan area.

We supplement the IRS migration data with a number of explanatory variables that might affect the relative attractiveness of a destination county. Annual county-level unemployment rates are obtained from the Bureau of Labor Statistics (BLS). Average annual wage data are obtained the the BLS' Quarterly Census of Wages. Median monthly rents are obtained from the Department of Housing and Urban Development (HUD). For each variable we merge these data with the IRS migration data by county and year.

Methodology

In order to understand how Hurricane Katrina affected migration preferences, we estimate a series of models of migration outflow from the affected counties. We specify the model

$$mig_{jt} = \beta_0 + \beta_1 population_{jt} + \beta_2 distance_j + X_E + Year2005_t + \epsilon_{jt} \quad (1)$$

where mig_{jt} is the number of total migrants that moved from the parishes affected by Hurricane Katrina to county j in year t, $population_{jt}$ is county $j's$ population in year t, and $distance_j$ is the Euclidean distance between the New Orleans area and county j. X_E is a matrix of economic explanatory variables, composed of a county's unemployment rate, average annual wages, and average monthly rent, and a dummy variable for whether or not a county is in a metro area or not. Unemployment and average annual wages each convey information about the labor market in a given county, while the median rent proxies for the local cost-of-living. $Year2005_t$ is an indicator variable for whether or not an observation corresponds to 2005, accounting for the fact that many more migrants left the New Orleans area in 2005 than in other years. This formulation provides a baseline understanding of the preferences underlying migration decisions away from the New

Orleans area.

Next, we interact each of our explanatory variables with the $Year2005$ variable. The interaction terms capture the change in preferences over each pull factor variable relative to the other years in our sample, when a major disaster did not strike. If Hurricane Katrina shifted the relative importance of pull factors in the destination-selection process, we would expect these interaction terms to be statistically significant.

We consider a set of dependent variables for our regressions, and estimate the model separately with each potential dependent variable. First, we consider the number of migrants to county j itself. Next, we consider the inverse hyperbolic sine of migrants to county j, which is comparable to the natural log and yields semi-elasticities. Next, because many counties receive no migrants at all we estimate a linear probability model in which mig_{jt} takes on a value of one if any migrants are observed moving to a particular county in a given year. Finally, we calculate the share of New Orleans' area migration that goes to each county.

The first two variables capture the intensive margin of migration, while the third measures the extensive margin. These models describe the distribution and magnitude of post-disaster migration. The final specification speaks to the mix of migration across potential destinations, holding constant the magnitude of migration flows.

Results

In Table 3, we present the results of a series of OLS regressions related to the flow of migrants from the New Orleans area. In each column, we present a particular transformation of the flow of migrants from New Orleans to each destination county. Columns 1 and 2 correspond to the count of migrants and the inverse hyperbolic sine of migrant count, Column 3 relates to a dummy variable for whether or not a county had more than 10 migrants from any of the affected counties, and Column 4 is each county's share of all migrants leaving the New Orleans area.

In general, the results reflect relatively standard migration preferences. Counties that are large, or close to

the New Orleans area are more likely to receive migrants than less populous counties or those that are far from southern Louisiana. Similarly, counties with lower unemployment and higher wages are more likely to receive migrants than counties with less robust economies, although we find no statistically significant effect of a destination county's median rent on migration decisions. Unsurprisingly, in 2005, overall flows and the frequency with which counties received migrants from the New Orleans area rose. While the scale of the coefficients changes, the sign and statistical significance of these impacts are consistent across each of our four dependent variables.

In Table 4, we present estimation results with interactions between our key explanatory variables and a dummy variable for whether or not an observation corresponds with 2006. The interaction term coefficients are interpreted as the effect of a given explanatory variable on outflow migration in 2005 relative to the impact of that variable in all other years. We attribute these differences to changes in the migration decision-making process following a natural disaster.

In 2005, the relative importance of distance *increased* relative to the sample as a whole. While a one hundred-mile increase in distance decreases the probability that a county receives migrants from the New Orleans area by about 0.4 percentage points, in 2005 each additional one hundred miles decreased the probability of migration by an additional percentage point. Similarly, while each hundred miles of distance reduced the number of migrants moving to a county by about one indivudal, in 2005 each hundred miles of distances reduced the number of migrants by about 8 individuals.

In general, economic factors were less important in determining potential destinations than in non-disaster affected years. While migrants tend towards areas with low levels of unemployment in most years, the countervaling effect in 2005 was so large that migrants actually moved towards counties with high unemployment rates. Similarly, while there is not a statistically significant effect of average monthly rent on migrant flows in most years, in the inverse hyperbolic sine and linear probability models, 2005 migrants moved towards areas that had high rents rather than low ones. On the other hand, in these models the impact of average pay on migration became more important than most years.

There is less evidence of a differential effect of pull factors in 2005 when we examine the share of migrants that moved to a particular county. In that specification, the only statistically significant interaction effect is on the unemployment rate, again signaling that economic conditions were less important in 2005 than in other years. Across the other explanatory variables, however, there are no statistically significant effects. This may indicate that the results in the other specifications are driven by *new* migrants rather than shifts in the preferences of existing migrants.

Together, these results raise concern regarding the ability of migration to serve as a mechanism that will limit future disaster losses. The results broadly indicate that in the aftermath of a disaster, migrants focus primarily on proximity, to the detriment of economic considerations. Because post-disaster migrants tend to move to areas with weaker economies than non-disaster migrants, these migrants may have difficulty finding new jobs and recovering from the financial stress of the disaster. More importantly, under the assumption that disaster exposure is spatially correlated, the preference for close destinations suggests that migration is not an effective tool for reducing future disaster losses. Migrants are merely shifting from one risky county towards another risky county.

Conclusion

This study has focused on the characteristics of the destinations of post-Katrina migrants from the New Orleans area using IRS data on the movement of tax returns and exemptions in order to explain the pattern of out-migration. An understanding of the factors driving post-disaster migration is important both in planning for shifts in population and in assessing future damages from natural disasters.

In most years, migration away from the New Orleans area corresponds with traditional gravity model results. Migrants prefer close destinations to distant ones, and tend towards large, economically strong counties rather than rural ones with fewer economic prospects.

In the immediate aftermath of Hurricane Katrina, however, the forces driving migration decisions shifted.

Proximity became even more important to the migration destination decision than in most years. The marginal impact of each one-hundred miles of distance from the New Orleans area more than doubled in three of our four dependent variable formations. In normal times, a county that was one-hundred miles further from New Orleans would expect around 0.4% fewer migrants but in 2005, it would receive 1.4% fewer migrants. At the same time, economic considerations became less important than in non-disaster years. The change in preferences is sufficiently strong to result in migrants moving to areas with weak economies rather areas with strong ones.

Our results suggest the need for caution when projecting the benefits of post-disaster migration as a tool for mitigating future disaster damages. Disaster-migrants tend to relocate to destinations that are close to their disaster-afflicted origin. Because disaster risks are correlated spatially, this suggests that those impacted by disasters will move to locations that are also susceptible to natural disasters and that aggregate exposure to disaster risks will remain relatively unchanged. Further, post-disaster migrants are less likely to recover rapidly economically because they place little consideration on economic conditions in the migration decision.

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Tables and Figures

Table 1: Most Common State Destination for Migrants in 2005

State	Migrants	Percentage of Total
Texas	73,252	40.3%
Louisiana	45,014	24.8%
Georgia	14,480	7.96%
Mississippi	10,327	5.68%
Florida	5,951	3.27%
Tennessee	4,896	2.69%

Table 2: Most Common County Destination for Migrants in 2005

FIPS	County	State	Migrants	Percentage of Total
48201	Harris	Texas	38,033	20.9%
22033	East Baton Rouge	Louisiana	14,291	7.86%
48113	Dallas	Texas	9,971	5.48%
48439	Tarrant	Texas	5,575	3.07%
22105	Tangipahoa	Louisiana	4,758	2.62%
22055	Lafayette	Louisiana	3,377	1.86%
48029	Bexar	Texas	3,114	1.71%
22005	Ascension	Louisiana	2,912	1.6%
13089	Dekalb	Georgia	2,783	1.53%
47157	Shelby	Tennessee	2,769	1.52%

Table 3: Effect of Destination County Characteristics on New Orleans Outflow

term	Flow	IHS	LP	Share
Intercept	14.9776	-0.031	-0.0197	0.0457*
	(12.7703)	(0.1154)	(0.023)	(0.0278)
Population (Millions)	193.085*	2.2278***	0.399***	0.4739**
	(110.3741)	(0.5207)	(0.1027)	(0.2188)
Distance (Hundreds of Miles)	-1.8107***	-0.0268***	-0.0048***	-0.005***
	(0.4174)	(0.003)	(5e-04)	(0.0012)
Unemployment Rate	-0.1302	-0.0161***	-0.0034***	-0.0015**
	(0.2915)	(0.0035)	(7e-04)	(7e-04)
Annual Pay (Thousands of USD)	0.7592*	0.0176***	0.0036***	0.002*
	(0.4331)	(0.0047)	(9e-04)	(0.001)
Median Monthly Rent	-3.9228	0.019	0.0056*	-0.0072
	(3.7936)	(0.0155)	(0.0031)	(0.0076)
Non-Metro	4.1402	-0.1108**	-0.0269***	0.0136
	(7.3912)	(0.0499)	(0.0096)	(0.0168)
Is 2005	51.6486***	0.5169***	0.092***	-1e-04
	(12.9228)	(0.025)	(0.005)	(0.0038)
Adjusted R-Squared	0.037	0.306	0.288	0.114
Observations	34045	34045	34045	34045

Table 4: Effect of Destination County Characteristics on New Orleans Outflow - 2005 Interactions

term	Flow	IHS	LP	Share
Intercept	9.628**	0.0534	-0.0032	0.0451*
	(4.5868)	(0.1094)	(0.0225)	(0.0246)
Population (Millions)	101.4603**	2.1373***	0.3926***	0.4586**
	(45.2638)	(0.4864)	(0.0989)	(0.1977)
Distance (Hundreds of Miles)	-1.1177***	-0.0222***	-0.004***	-0.005***
	(0.2703)	(0.003)	(5e-04)	(0.0012)
Unemployment Rate	-0.5571***	-0.0169***	-0.0035***	-0.0019***
	(0.1575)	(0.0033)	(7e-04)	(7e-04)
Annual Pay (Thousands of USD)	0.4719**	0.0158***	0.0033***	0.002**
	(0.2193)	(0.0045)	(9e-04)	(0.001)
Median Monthly Rent	-1.4372	0.0028	0.0023	-0.0063
	(1.3126)	(0.0149)	(0.0031)	(0.0068)
Non-Metro	3.906	-0.0975**	-0.0244**	0.0135
	(6.3036)	(0.0488)	(0.0095)	(0.0164)
Is 2005	95.2344	-1.7451***	-0.3377***	-0.0043
	(216.3055)	(0.2252)	(0.0366)	(0.0861)
Population x 2005	1054.8424	0.758**	0.0197	0.1771
	(772.3893)	(0.3754)	(0.0427)	(0.2535)
Distance x 2005	-7.3184***	-0.059***	-0.0099***	2e-04
	(1.6825)	(0.0039)	(8e-04)	(6e-04)
Unemployment Rate x 2005	10.3372***	0.1043***	0.0187***	0.0071***
	(3.8548)	(0.0167)	(0.003)	(0.0024)
Pay x 2005	2.8674	0.0313***	0.0053***	0
	(3.5047)	(0.0065)	(0.0012)	(0.0013)
Monthly Rent x 2005	-29.428	0.2783***	0.056***	-0.0091
	(36.758)	(0.0308)	(0.0059)	(0.0132)
Adjusted R-Squared	0.112	0.335	0.31	0.115
Observations	34045	34045	34045	34045