Moving to Adaptation? Understanding the Migratory Response to Hurricanes in the United States

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Introduction

An increase in storm driven natural disasters will be one of the most significant consequences of climate change. These disasters impose substantial cost on the communities that they impact, both in terms of asset destruction and loss of human life (Baylis and Boomhower, 2021). However, the incidence of these storms varies over space and while climate change will increase the frequency, severity, and range of these storms it will remain true that some areas will be more impacted than others.

As a consequence of this variation in incidence over space, many have suggested that migration away from areas that will be more impacted by these disasters will be an important form of adaptation to climate change (Bardsley and Hugo, 2010; Black et al., 2011; Boustan et al., 2012). However, there are reasons to be skeptical of this hypothesis. The drivers of migration are complex. It is well known that most migration is driven by existing networks and takes place over relatively short distances (Cattaneo et al., 2019). To the extent that these networks are geographically concentrated, and the incidence of storms only changes slowly over space, migration along these existing networks may offer little protection from future storms.

The process of migration is also expensive. Individuals impacted by disasters have often suffered a substantial negative shock to their wealth and thus may not be able to incur the substantial costs of a significant relocation (Cattaneo et al., 2019). This is exacerbated by the fact that housing costs in less vulnerable areas may be bid up precisely because these areas are less vulnerable (Hummel et al., 2021).

Using data on the path of all Atlantic basin hurricanes from 1992 to 2017, we study whether county-to-county migration has reduced risk for migrants in recent history. In particular, we focus on whether out-migration increases (and net-migration declines) in areas hit by hurricanes and whether migrants relocate to areas that are less exposed to disasters.

One stylized fact that motivates our skepticism: when we examine population level exposure to storms – holding location specific risk levels constant – over our sample period we find that it is flat or slightly increasing. Over time it appears that individuals are moving towards risk, rather than away from it. If migration were being used as an adaptive strategy we would expect to see population level exposure declining over time.

Data

We use data on the tracks of every Atlantic basin hurricane that has struck the continental United States from 1988 to 2018 (Anderson et al., 2020). These data are based on information tracked by the NOAA Storm Events database and the National Hurricane Center. They provide us with information on the track, rainfall totals, and wind speeds associated with the storms, as well as the counties that experienced a flood event as a consequence of each storm. We supplement these data with data from FEMA on the total payments made to individuals for every disaster declared by FEMA since 1954.

Our migration data come from the IRS Statistics of Income's county-to-county migration flows. The IRS publishes data on the number of migrants leaving each county and their destination based on aggregated tax return data for each year from 1991 to 2019.

From these datasets, we assemble a balanced panel that lists all migration to and from all counties in the United States and the number of storms each county experienced from 1991 to 2018. We restrict our analysis sample to the counties in the Eastern half of the United States and along the Gulf Coast.

Empirical Approach

Our base specification is a two-way fixed effects model of the form:

$$Y_{ist} = \beta_1 \mathbb{1}\left[\text{Storm}_{ist}\right] + \sum_{\tau=1}^{5} \beta_t \mathbb{1}\left[\text{Storm}_{is,t-\tau}\right] + \alpha_{is} + \chi_t + \eta_s + \epsilon_{it} \tag{1}$$

where, in our first analysis, Y_{ist} is the number of migrants (or net migration) from county i in state s and year t. We estimate models using the IHS transformation of these outcomes, as well as a Poisson specification. $\mathbb{1}\left[\text{Storm}_{ist}\right]$ is an indicator for whether a county experiences a storm in a given year. We define exposure in a variety of ways (e.g., maximum wind speed, flood declarations, etc.), taking advantage of the range of data we have on each hurricane. In some specifications, we also allow storms to have a 5-year lagged effect. α_{is} is a county fixed effect, χ_t a year fixed effect, and η_s a state fixed effect.

In our second analysis our outcome, Y_{ist}, is the weighted average difference in exposure to storms between the counties receiving migrants from county i over our full sample and county i. We weight by the number of migrants heading to each receiving county in a given year. Exposure is defined as the total number of storms each county experiences in our sample period. The purpose of this analysis is to measure whether migrants move to counties with lower storm risk when they move after a storm. We also examine whether the migrants who move after a storm move to counties with different levels of storm risk, regardless of how that risk level relates to their home county, and whether such patterns are different for migrants who move in a non-storm year.

Results

We have three main findings. First, we find that on average migration out of counties impacted by storms does not increase after storm years. Second, the migrants who leave counties in the year(s) following a storm do not appear to move to counties that are significantly less exposed to storms than the counties they are departing. They also do not move to counties at lower risk than the average migrant from their county in a non-storm year. Third, storms in the top 10% of the damages distribution do appear to lead to increased out-migration in the year of the storm. However, these migrants do not move to counties with lower risk of future storms. Further, return migration in the years following the storms appears to offset any out-migration in the year of the storm.

Our first result is robust to examining out-migration across a range of time-periods following a storm and a variety of definitions of storm exposure and intensity. We estimate that out-migration increases by 0.3% (se: 0.7%) in the year of a storm relative to non-storm years. Estimating a distributed lag model suggests that changes in migration in the five years following a storm remains close to zero with the sum of lags equal to a 1% (se: 4.7%) increase. In contrast, we find weak evidence that in-migration increases after storms and the magnitude of this increase more than offsets any out-migration so that total population in impacted counties increases after storms.

Examining how the exposure of those who do migrate in storm years changes leads to our second result. We find that on average migrants who do leave a county after a storm (a) do not move to areas that are less exposed to storms than migrants who leave in non-storm years and (b) do not move to counties that are less exposed to storms than their home county. Our point estimates for the change in risk are not statistically significant, but suggest that migrants in fact move to areas that are slightly (0.5%) more exposed. This is consistent with individuals experiencing a negative wealth shock after a storm and moving to areas that are less expensive than their counties of origin.

Examining migration from the counties impacted by the most damaging storms using data from FEMA on total compensation paid to disaster victims reveals a slightly different pattern of migration due to these storms. Individuals appear to leave their home county after the most damaging storms, however they do not move to counties with lower risk than the county they leave. In that they do not appear to be adapting. Further, examining flows from the counties migrants move to in a storm year back to the home county in the years following the storm suggests that migration after a storm is only temporary. Migration during the storm year is fully offset by return migration following the storm. This is consistent with a model in which individuals leave their home county due to property destruction but return in the years following after rebuilding.

Conclusion

Our results have important implications for understanding how migration after hurricanes will serve as an adaptation to future climate change. We do not find that individuals appear to move to areas that are lower risk than their home county after they are impacted by storms. Rather, we find that the population of impacted counties may actually increase after storms, consistent with evidence that demand for homes in impacted counties exceeds supply in the years after hurricanes (Zivin et al., 2020). Further, we find that migration does not serve to reduce future exposure to storms on a population level. Our results suggest that migration, as it has occurred to date, is not working as an adaptation strategy that will reduce the impacts of future climate change on a population level. To the extent that our results on net migration are robust, they instead indicate that migration is increasing future exposure to storms driven by climate change.

We have some suggestive evidence that this movement towards risk is driven by the power of agglomeration economies. Many of the most productive economic counties in our sample (e.g. New York City, Houston, and Miami) are also among the most exposed to storms. It appears that agglomeration benefits offered by locating in these cities may outweigh the incentive to adapt to future storms by relocating.