# Online Appendix

## A.1 Impacts on Housing Supply

It is possible that housing supply could be constrained in the years following a disaster, which might impact our results (decreased probability of homeownership). We use Zillow data on housing stock and inventory available for a limited set of counties since 2010 to investigate this possibility. As shown in Panel A of Table A2, we find no statistically significant relationship between treatment (experiencing a disaster with more than three fatalities) and housing supply as a percent of housing stock. As shown in Panel B of the same table, we find little impact of treatment on the ratio of inventory to population except two years following a disaster, which experiences a small increase in inventory. This suggests there are no supply constraints and that if anything, housing prices could decrease in response to larger inventory, which we would expect to result in an increase in home ownership rather than the decrease we observe.

## A.2 Logit Model

We replicate the baseline regressions in Table 4 using a logit model instead of the OLS, and present the results in the first three columns in Panel A Table A4. Both the estimated coefficients and the marginal effects are reported. The marginal effects are slightly larger than the estimates in Table 4 in terms of the magnitude, which may suggest that there is no significant difference between the two regression models to estimate the treatment effect.

We also use the logit model to estimate other regression specifications presented in the paper. The estimates exhibit very similar patterns as those produced by the OLS.

## A.3 Spatial Clustering

Disasters can be spatially clustered. Consequently, two geographically close locations may not be comparable if one is frequently hit by disasters but the other is not. As a robustness check, we add the disaster history of a county/PUMA, measured by the total number of fatalities caused by natural disasters in that county/PUMA from 1996 to 2012, to the list of variables to match on in the nearest neighbor matching. The disaster history, in additional to longitude, latitude, and elevation, may reflect the propensity that a natural disaster occurs at a particular location. Therefore, the locations of the matched control group may resemble the locations of the treated group better regarding future risk of disasters.

We rerun the regressions in Columns 4 and 7 of Table 4 and present the results in the last two columns in Panel A Table A4. Due to the additional restriction in the nearest neighbor

matching, the matching quality declines and the trimmed samples become smaller. The coefficient on the treatment stays negative but is only statistically significant in the sample trimmed by the 5th percentile cutoff. Nevertheless, the estimated treatment effect increases dramatically in the tightly-trimmed sample compared to the baseline estimate.

## A.4 Hurricane Katrina

Because of its extreme severity, Hurricane Katrina is not comparable to other natural disasters that we include in the sample in many ways. Hurricane Katrina has fundamentally changed the population demographics, housing market, and labor market in New Orleans, the Mississippi Gulf Coast, and other areas that the hurricane hit. The recovery of the housing market in these areas is very costly and lengthy (**?**).

To rule out the probability that our findings are driven by the single event of Hurricane Katrina, we remove Louisiana and Mississippi, the two states where Katrina caused most fatalities and destruction, from the sample. The regression results are shown in the first three columns in Panel B Table A4. The estimates are in general similar to the ones in Table 4.

## A.5 Temporary Migrants

Natural disasters may lead people to migrate temporarily to the affected areas to provide disaster relief and assistance as well as to repair and rebuild houses. Since temporary migrants are more likely to rent than own, they may lower the home ownership rate immediately after a severe disaster. Provided that we link the housing tenure choices of households to disasters two years ago, the households in our sample are less likely to be the workers that migrate temporarily for disasters. In case rebuilding takes longer than two years, we repeat the regressions in Table 4 but exclude households with householders that work in construction, either as managers or as workers, from the sample.

Columns 4-6 in Panel B Table A4 show the results. About 4% of the observations of the full sample are dropped. The estimated treatment effects are analogous to the ones in the baseline regressions while the magnitude is slightly larger. These estimates suggest our baseline estimates (a decrease in home ownership following a severe disaster) are not driven by temporary migrant workers.

## A.6 Locations of Disasters

In considering the heterogenous effects of various types of disasters discussed in Section

6.2, one possibility is that different locations are related to different types of disasters and the heterogeneity in the corresponding change in home ownership rates results from varying locations. To disentangle the effects of disasters and locations, we perform two tests. First, we restrict our sample to households in metropolitan areas. Typically, natural disasters that impact populous metropolitans lead to more serious damage, a higher number of fatalities, and subsequently receive more media coverage. Second, coastal cities can be attractive to migrants due to not only job market opportunities but also the amenities they offer. However, coastal areas are subject to a high risk of hurricanes and other coastal disasters. Accordingly, we exclude from our sample the coastal areas that experience an annual population growth rate higher than the national average. We identify coastal areas based on the list of coastal counties defined by the Strategic Environmental Assessments Division of the National Oceanic and Atmospheric Administration (NOAA). The population growth rate is calculated at the metropolitan level. For non-metropolitan areas, we calculate the population growth rate at the state level, excluding population residing in metropolitan areas in that state.

The regression results are displayed in Panel C Table A4. Compared to the baseline estimates, both tests produce very similar estimates. In general, in these specific areas, one or more severe disasters two years ago lead to a three to four percentage point decrease in the propensity of a migrant household becoming homeowners. These results suggest that metropolitan areas and fast-growing coastal locations may not be responsible for the varying effects of disasters on home ownership.

## A.7 Continuous Disaster Measures

The advantages of a continuous measure over a discrete treatment variable include capturing more heterogeneity in the salience of disasters and avoiding arbitrary definitions of binary treatments. We consider continuous measures for disasters based on fatality and damage. Specifically, we employ the number of total fatalities, the number of total fatalities per capita, the log number of total damage, the log number of property damage, the log number of total damage per capita, and the log number of property damage per capita[1] caused by extreme weather events two years prior. If there were no disasters, all these measures are set to zero. Table A5 reports the summary statistics of these measures at the household level.

We replicate the regression in Column 2 of Table 4, replacing the binary treatment indicator with each of the continuous measures. The estimates are displayed in Table A6. Consistent with the previous findings, the coefficients on the disaster measures are all neg-

[1] All four measures of damage are in 2005 US dollars for ease of comparison across years.

ative and significant, suggesting that a recent natural disaster exerts a negative effect on the home ownership rate. These estimates also suggest that more severe natural disasters discourage households from becoming homeowners to a greater extent.

### A.8 Alternative Treatment Lags for Coastal Areas

Table A7 shows the results using various lags and restricting the sample to coastal areas. The location restriction results in much smaller treated groups, which do not allow us to construct comparable control groups of sufficient size using nearest-neighbor matching. Coastal areas are more prone to hurricanes and floods, the two types of disasters for which we find significant impacts (see Table 5).[2] In Table A7, the first, second, and fourth year lags have significant negative coefficients. The sixth year coefficient is positive and significant, perhaps resulting from unobserved new information or favorable buying conditions following the continuous decrease in home ownership. This suggests that in the four years following a disaster, incoming migrants are less likely to purchase homes. These effects would accumulate in decreasing the proportion of buyers versus renters, which, holding constant migrant cohort sizes, would not be reversed by the sixth year increase. One caveat is that, especially in coastal areas (including control counties) that are more prone to disasters, the longer the lag, the more likely the results may be confounded by subsequent disasters in treated and/or control counties (i.e., more disasters may occur between the treatment disaster and the year of the lag). Including multiple lags (as in Table 10) is more robust to this possibility.

## References

**McCarthy, Kevin F. and Mark Hanson**, "Post-Katrina Recovery of the Housing Market Along the Mississippi Gulf Coast," Technical Report, RAND Corporation 2008.

[2] If we instead restrict the sample to coastal disasters, for some lags, there are fewer than ten treated households.

Table A1: Summary Statistics: Pre- and Post-Treatment

| | Pre-Treatment | | Post-Treatment | | $\|t\|$ |
|---|---|---|---|---|---|
| Variables | Mean | S.D. | Mean | S.D. | -stat |
| No. of Migrant Households/1000 | 2.14 | 4.09 | 1.32 | 2.44 | 2.28** |
| Total Population$_{t-1}$/1000 | 154 | 40.6 | 150 | 40.8 | .929 |
| Metro Area, Central City (= 1) | .052 | .161 | .048 | .164 | .340 |
| Metro Area, Non-central City (= 1) | .12 | .285 | .131 | .311 | .209 |
| Central City Status Unknown (= 1) | .211 | .389 | .154 | .351 | 1.44 |
| Median Property Insurance$_{t-1}$ (1982-84 $) | .322 | .081 | .311 | .071 | 1.33 |
| Median Property Taxes$_{t-1}$ (1982-84 $) | .294 | .065 | .303 | .077 | 1.18 |
| Median Gross Rent$_{t-1}$ (1982-84 $) | 10.0 | 6.13 | 10.8 | 6.19 | 1.22 |
| Percent Population on Farm Land (%) | .130 | 0.183 | .138 | .170 | .420 |
| No. of Obs. | | 180 | | 171 | |

Note: Only locations that are treated in a certain year are included. The number of migrant households refers to the number of households that migrated to the current location one year ago from a non-contiguous state.

Table A2: Impacts of Disasters on Housing Supply

| Panel A: Mean Monthly Housing Supply (as % of Total Housing Stock) | | | | | |
|---|---|---|---|---|---|
| Lag (Years) | 0 | 1 | 2 | 3 | 4 |
| Treatment | -1.79 | -.540 | 1.01 | -.776 | -.185 |
| | (1.32) | (1.26) | (1.33) | (1.33) | (1.33) |
| Observations | 714 | 714 | 714 | 714 | 714 |
| R-squared | .860 | .859 | .859 | .859 | .860 |

| Panel B: Ratio of Inventory to Population×1000 | | | | | |
|---|---|---|---|---|---|
| Lag (Years) | 0 | 1 | 2 | 3 | 4 |
| Treatment | -.136 | 2.07 | 4.07** | .135 | .384 |
| | (2.09) | (1.93) | (2.08) | (1.99) | (2.14) |
| Observations | 6,114 | 6,114 | 6,114 | 6,114 | 6,114 |
| R-squared | .859 | .859 | .859 | .859 | .859 |

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. The unit of analysis is county-year. The dependent variable is the average monthly share of total housing stock on sale (measured in percentage points) in Panel A and the ratio of housing inventory to population (×1000) in Panel B, respectively. Robust standard errors are clustered at the county level and reported in parentheses. All the specifications control for year fixed effects and county fixed effects. The treatment is defined as having one or more severe natural disasters $n$ years before, with $n$ being the number of years specified in a column.

Table A3: Disasters and Home Ownership: Full Set of Coefficients

| | Full Sample | Trimmed Sample | |
|---|---|---|---|
| | | 25% Cutoff | 5% Cutoff |
| Variables | (1) | (2) | (3) |
| Treatment | -.037** | -.046** | -.044* |
| | (.016) | (.018) | (.025) |
| Age | .006*** | .006*** | .006*** |
| | (.000) | (.000) | (.001) |
| Years of Schooling | .011*** | .013*** | .012** |
| | (.001) | (.002) | (.006) |
| Male Householder, No Wife Present (= 1) | -.081*** | -.087*** | -.041 |
| | (.010) | (.025) | (.084) |
| Female Householder, No Husband Present (= 1) | -.120*** | -.117*** | -.091** |
| | (.007) | (.016) | (.036) |
| Male Householder, Living Alone (= 1) | -.165*** | -.175*** | -.174*** |
| | (.007) | (.015) | (.046) |
| Male Householder, Not Living Alone (= 1) | -.128*** | -.152*** | -.141** |
| | (.008) | (.018) | (.055) |
| Female Householder, Living Alone (= 1) | -.142*** | -.164*** | -.182*** |
| | (.007) | (.015) | (.047) |
| Female Householder, Not Living Alone (= 1) | -.121*** | -.131*** | -.167*** |
| | (.008) | (.019) | (.049) |
| Balck (= 1) | -.027*** | -.026* | -.006 |
| | (.006) | (.015) | (.033) |
| Hispanic (= 1) | -.046*** | -.077*** | -.067** |
| | (.010) | (.016) | (.030) |
| Asian (= 1) | -.056*** | -.094*** | -.086** |
| | (.009) | (.016) | (.035) |
| Other Race (= 1) | -.077*** | -.055*** | -.059*** |
| | (.005) | (.011) | (.021) |
| Household Income/1000 | .000*** | .000*** | .000*** |
| | (.000) | (.000) | (.000) |
| No. of People in Household | .016*** | -.003 | -.011 |
| | (.002) | (.008) | (.021) |
| No. of Workers in Household | -.021*** | -.036*** | -.041*** |
| | (.003) | (.006) | (.014) |
| Having Children under 18 (= 1) | -.034*** | -.016 | -.036 |
| | (.007) | (.016) | (.039) |
| Immigrant (= 1) | -.026*** | -.025* | -.025 |
| | (.006) | (.014) | (.030) |

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Table A3: Disasters and Home Ownership: Full Set of Coefficients (Cont.)

| | Full Sample | Trimmed Sample | |
|---|---|---|---|
| | | 25% Cutoff | 5% Cutoff |
| Variables | (1) | (2) | (3) |
| Metro Area, Central City (= 1) | -.033 | -.063 | -.091 |
| | (.025) | (.046) | (.110) |
| Metro Area, Non-central City (= 1) | .026 | -.008 | -.042 |
| | (.024) | (.046) | (.105) |
| Central City Status Unknown (= 1) | -.009 | -.060 | -.100 |
| | (.023) | (.045) | (.103) |
| Median Property Insurance$_{t-1}$/1000 | -.134*** | -.185** | -.090 |
| | (.033) | (.081) | (.144) |
| Median Property Taxes$_{t-1}$/1000 | -.030** | -.115*** | -.098** |
| | (.012) | (.024) | (.040) |
| Median Gross Rent$_{t-1}$/1000 | .077 | .289** | .482 |
| | (.055) | (.139) | (.302) |
| Percent Population on Farm Land (%) | -.791 | -6.456 | -6.138 |
| | (2.940) | (8.088) | (42.824) |
| Observations | 92,594 | 17,730 | 3,545 |
| R-squared | .249 | .254 | .329 |

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors are clustered at the county/PUMA level and reported in parentheses. All the specifications control for the household characteristics, housing market characteristics, year fixed effects, and county/PUMA fixed effects.

Table A4: Disasters and Home Ownership: Robustness Checks

| Panel A: | Logit Model | | | Matching by Disaster History | | |
|---|---|---|---|---|---|---|
| Variable | (1) | (2) | (3) | (4) | (5) | (6) |
| Treatment | -.248** | -.341** | -.487** | -.037** | -.026 | -.418** |
| | (.119) | (.145) | (.248) | (.016) | (.021) | (.198) |
| *Marginal Effect* | -.034** | -.044** | -.056** | | | |
| | (.017) | (.019) | (.030) | | | |
| Sample Trimming | | 25% | 5% | | 25% | 5% |
| Observations | 92,524 | 17,404 | 3,030 | 92,594 | 8,605 | 627 |
| R-squared | .237 | .244 | .294 | .249 | .262 | .394 |

| Panel B: | Excluding Hurricane Katrina | | | Non-Construction Householders | | |
|---|---|---|---|---|---|---|
| Variable | (1) | (2) | (3) | (4) | (5) | (6) |
| Treatment | -.037** | -.043** | -.038 | -.052*** | -.058** | -.062** |
| | (.016) | (.019) | (.026) | (.016) | (.024) | (.025) |
| Sample Trimming | | 25% | 5% | | 25% | 5% |
| Observations | 92,563 | 17,500 | 3,497 | 89,286 | 6,626 | 3,307 |
| R-squared | .249 | .253 | .323 | .252 | .290 | .340 |

| Panel C: | Metropolitan Areas | | | Excluding Coastal Areas w/ Fast Population Growth | | |
|---|---|---|---|---|---|---|
| Variable | (1) | (2) | (3) | (4) | (5) | (6) |
| Treatment | -.039** | -.035* | -.035* | -.029** | -.034* | -.048 |
| | (.017) | (.019) | (.019) | (.015) | (.018) | (.044) |
| Sample Trimming | | 25% | 5% | | 25% | 5% |
| Observations | 72,897 | 13,314 | 2,694 | 84,114 | 17,393 | 2,423 |
| R-squared | .243 | .246 | .312 | .248 | .241 | .376 |

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors are clustered at the county/PUMA level and reported in parentheses. All the specifications control for the household characteristics, housing market characteristics, year fixed effects, and county/PUMA fixed effects. The cutoffs to trim the sample are the $25^{th}$ percentile and the $5^{th}$ percentile of the distance distribution derived in the baseline regressions in Table 4. For the logit regressions in Panel A, the marginal effects are calculated using the Delta-method, and the reported R-squared is the pseudo R-sqaured. In Panel C, areas (metropolitans or non-metropolitan area within a state) with an above national-average annual population growth rate are considered as areas with fast population growth.

Table A5: Summary Statistics of Disaster Measures: Household Level

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| *Fatality* | | | | | |
| No. of Fatalities | 92,847 | .328 | 1.33 | 0 | 97 |
| Fatalities per Capita×1000 | 92,847 | .002 | .009 | 0 | .888 |
| *Damage* | | | | | |
| ln(Total Damage + 1) | 85,981 | 9.11 | 6.50 | 0 | 20.6 |
| ln(Property Damage + 1) | 85,949 | 9.04 | 6.45 | 0 | 20.6 |
| ln(Total Damage per Capita + 1) | 85,981 | 1.38 | 1.79 | 0 | 9.12 |
| ln(Property Damage per Capita + 1) | 85,949 | -1.33 | 1.75 | 0 | 9.12 |

Note: Damage is expressed in the 1982-84 US dollars.

Table A6: Continuous Measures of Disasters

Panel A: Fatality

| | No. of Fatalities | Per Capita No.×1000 |
|---|---|---|
| Variables | (1) | (2) |
| Disaster Measure | -.003* | -.509** |
| | (.002) | (.224) |
| Observations | 92,847 | 92,847 |
| R-squared | .249 | .249 |

Panel B: Damage

| | ln(Overall No.+1) | | ln(Per Capita No.+1) | |
|---|---|---|---|---|
| | Total | Property | Total | Property |
| Variables | (1) | (2) | (3) | (4) |
| Disaster Measure | -.001** | -.001** | -.005*** | -.005*** |
| | (.001) | (.001) | (.001) | (.001) |
| Observations | 85,981 | 85,949 | 85,981 | 85,949 |
| R-squared | .249 | .249 | .249 | .249 |

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors are clustered at the county/PUMA level and reported in parentheses. All the specifications control for the household characteristics, housing market characteristics, year fixed effects, and county/PUMA fixed effects.

Table A7: The Impacts of Disasters over Time: Coastal Areas

| Lag (Years) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Treatment | -.063*** | -.036** | -.030 | -.046* | .019 | .083*** | .023 | -.007 | -.022 |
| | (.013) | (.017) | (.019) | (.024) | (.023) | (.008) | (.016) | (.013) | (.014) |
| Observations | 40,948 | 40,948 | 40,948 | 40,948 | 40,948 | 40,948 | 40,948 | 40,948 | 40,948 |
| R-squared | .252 | .252 | .252 | .252 | .252 | .252 | .252 | .252 | .252 |

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors are clustered at the county/PUMA level and reported in parentheses. All the specifications control for the household characteristics, housing market characteristics, year fixed effects, and county/PUMA fixed effects.