

Natural Disasters and FHA Claim Costs

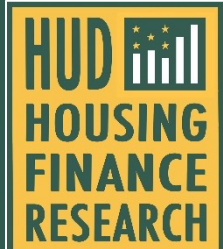
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Do Disasters Affect FHA Claims?

- FHA guards against disaster-related costs through requirements for casualty insurance (transfer of risk to counter-parties) and “preservation and protection” (maintenance and repair). This analysis tests whether, despite these protections, differential claims correlate with disasters.
- This study uses a 2-stage simulation to statistically isolate the effects of disasters and finds additional claims between **\$0.8 billion and \$2.0 billion over 2004 to 2019.**
- These costs **are in addition to** other federal disaster housing costs: FHA loss mitigation, HUD and FEMA disaster assistance, FEMA flood insurance and SBA disaster loans.



2-Stage Methodology

- Stage 1: Estimate general purpose logit regression for conditional probability of claims. Add disaster exposure as an explanatory variable.
- Stage 2: Simulate FHA claims costs through a competing-hazard survival analysis. Perform simulation with disaster effects neutralized to isolate disaster-associated claims.



Stage 1: Claim Logit Model

$$\text{Prob}(\text{Mortgage Insurance Claim}) = f(\text{Borrower Credit Characteristics, Economic Conditions})$$

- There are many such models in literature and practice. Prominent examples are the FHA Actuarial Review and reporting of financial results in the Annual Report on the Mutual Mortgage Insurance Fund.
- Variables include Credit Score, Source of Down Payment, Ability to Pay, Economic Stress measures, Amount of Home Equity and Mortgage Rates.



Expanding the Explanatory Variables

$$\text{Prob}(\text{Mortgage Insurance Claim}) = f(\text{Borrower Credit Characteristics, Economic Conditions, Disaster Exposure})$$

- What is Disaster Exposure?
 - Living/working in an area affected by storm causing prolonged economic disruptions/loss of income
 - Home damaged by storm
- FEMA has disaster declaration and individual household aid data available to create zip code level exposure variables. Options include:
 - Binary indicators, intensities, quantiles, etc.
 - Event category indicators (hurricane, flood, wildfire, etc.)
 - Event specific indicators (hurricane Katrina, hurricane Harvey, etc.)



Timing of Exposure

- Timeline from disaster exposure to claim is not uniform across borrowers
 - Several factors at play, including severity, financial resources and access to recovery programs
 - First round of analysis uses a three-year performance window



First Round Exposure Variables

- Three exposure specifications were modeled:
 - Disaster aid eligibility – was a home in a zip code eligible for FEMA’s Individual Household Program?
 - Multiple Disaster – does recurrence of aid eligibility compound claim risk?
 - Severely impacted – did this zip code have at least 20 registrations for individual aid (threshold set from Kousky, Palin and Pam 2020)?



Disaster Effect on Claims

- All three specifications exhibit statistically significant increases on claims as summarized by these odds ratios:

| Odds Ratios for Disaster Exposure Variables | | |
|---|----------------------|----------------------|
| All Exposure | | |
| Undifferentiated | Multiple Disasters | Severe Exposure Only |
| Any Exposure | First Disaster | 1.194 |
| 1.227 | 1.165 | |
| | Second Disaster | |
| | 1.349 | |
| | Subsequent Disasters | |
| | 1.069 | |



Disaster Effects on Claims

- All three specifications exhibit statistically significant increases on claims. Simulating the effects yields these estimates of cumulative claim rates through the first 8 years of the loans.

| Undifferentiated Specification | Year of Endorsement | | | | | | | | | Total |
|-------------------------------------|---------------------|-------|-------|-------|-------|------|------|------|------|-------|
| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | |
| Rate with Disaster Effect Estimates | 14.3% | 17.9% | 19.6% | 21.2% | 12.0% | 7.0% | 4.9% | 3.1% | 2.7% | 5.9% |
| Rate with Neutralized Effects | 13.6% | 17.1% | 18.7% | 20.3% | 11.6% | 6.8% | 4.7% | 3.0% | 2.7% | 5.7% |
| Estimated Effect of Disasters | 0.7% | 0.8% | 0.8% | 0.9% | 0.4% | 0.2% | 0.1% | 0.1% | 0.1% | 0.2% |



Stage 2: Survival Analysis Simulations

- The logit model generates estimates of claim probability. In combination with probabilities of mortgage re-finance and payment to term, these arrays simulate FHA claim costs.
- By neutralizing (zeroing) disaster exposure variables, a simulation removes the statistical effects of disasters upon claims. A comparison with the non-neutralized simulation yields an estimate of disaster effects.

| Population Estimates of Claim Effects 2004-2019 | |
|--|---------------|
| Indicator | |
| Undifferentiated | \$1.5 billion |
| Multiple Disaster Effects | \$2.0 billion |
| Severe Filter | \$0.8 billion |

