Climate Risk and the U.S. Insurance Gap: Measurement, Drivers and Implications

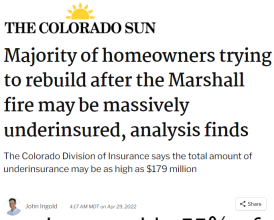
Pari Sastry (Columbia GSB)
Tess Scharlemann (FRB)
Ishita Sen (HBS)
Ana-Maria Tenekedjieva (FRB)

September 2024
Yale Junior Finance Conference

*Disclaimer: The views expressed do not represent the views of the Federal Reserve System.

Motivation

- Homeowners insurance is ubiquitously used by households and lenders to hedge climate losses.
- Yet, it is widely believed that U.S. households are under-insured.
- Under-insurance also thought to play a key role in household recovery after natural disasters.


THE COLORADO SUN

Majority of homeowners trying to rebuild after the Marshall fire may be massively underinsured, analysis finds

The Colorado Division of Insurance says the total amount of underinsurance may be as high as $179 million

John Ingold 4:17 AM MDT on Apr 29, 2022

Share


The New York Times

As Home Insurance Bills Go Up, Owners' Coverage Is Going Down

Frequent natural disasters and high inflation have led insurers to raise premiums, and forced many customers to pare back their policies.

By Emily Flitter

Feb. 16, 2024

- CO DOI estimates that roughly 55% of those hit by the Marshall fire were under-insured. The total underinsurance was $\approx$ 100mn for 1,084 claims.
- Despite its importance, there are limited studies of under-insurance because of the absence of data.

This paper

New data on insurance coverage:

- We develop a novel method to *estimate* insurance coverage from mortgage escrow data.
- We validate our estimates using a new dataset on homeowners insurance from McDash.

Key Findings:

- Under-insurance on the intensive margin is a significant problem (too little coverage).
  - Under-insurance worst for high climate risk, low FICO, and high LTV households
- Drivers of under-insurance:
  - Rising premiums & liquidity constraints
  - Behavioral inertia.
  - Lender requirements.
- Under-insured households face worse outcomes after climate shocks.
  - Mortgage default

Roadmap

1. Estimation methodology & validation
2. Drivers of under-insurance (using our imputed coverage data)
3. Implications of under-insurance (using McDash Insurance module data)

Data

1. **Credit Risk Insights McDash (CRISM):** Homeowner escrow payments as reported by servicers.
   - Escrow payments often include debt payment, homeowners insurance premiums, and property taxes
2. **CoreLogic Deeds:** Property tax payments and other structure characteristics.
3. **CoreLogic Climate:** Property replacement costs (as of 2021) and climate risk exposure.
4. **Quadrant:** Insurer-by-ZIP code level prices
   - Pricing by ZIP, coverage, deductible, age of the property, and insurance credit score.
   - Fix: coverage
5. **NAIC Aggregate Insurance Data**: Insuer-state-business line data on premiums and policies underwritten
6. **McDash Insurance Module:** Individual mortgages linked to homeowners insurance.
   - Data from 2022
   - Historical data going back to 2013 *just* released (!)

Sample selection

- We start with the mortgage payment reported by the servicer in McDash for the month of May
  - This ensures property tax and insurance payments are included
- We omit borrowers with private mortgage insurance (PMI)
  - PMI cannot be separated from HO premiums.
  - Nearly 3/4 of loans originated without PMI escrow homeowners insurance
- We estimate FHA mortgage insurance payment based on their origination date.

Estimating insurance coverage from mortgage escrow and insurance prices

$$\text{Coverage Ratio}_{pt} = \frac{\text{Estimated coverage}_{pt}}{\text{Estimated replacement cost}_{pt}}.$$

Step 1: estimating insurance payments from mortgage escrow:

- Est. insurance payment = Total amount in Escrow − Mortgage payment − Property taxes.

Step 2: estimating coverage using pricing functions based on price quotes:

- Premiums $= f(\text{coverage}, \underbrace{\text{property risk}}_{ZIP}, \underbrace{\text{household risk}}_{\text{insurance score}}) \rightarrow$ premium per \$ of coverage | ZIP and ins. score.
- Est. coverage $= \dfrac{\text{Insurance Payment}}{\text{Premium per \$ of coverage}}$

Step 3: estimating replacement costs:

- Estimated Replacement Cost $= \dfrac{\text{Replacement Cost in 2021}}{\text{Construction Inflation}}$

Validation: Comparing our estimates to McDash insurance module

Figure 1: Premiums

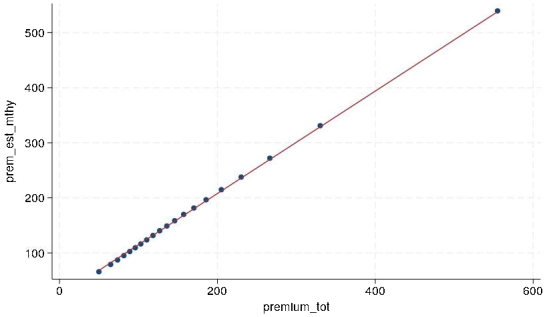
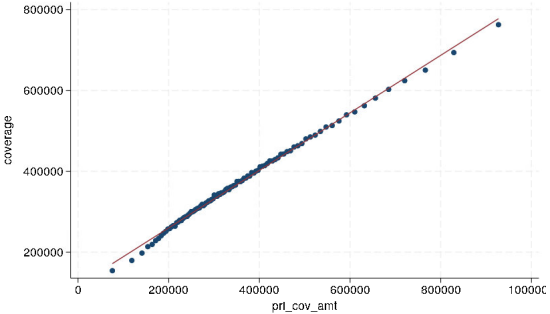


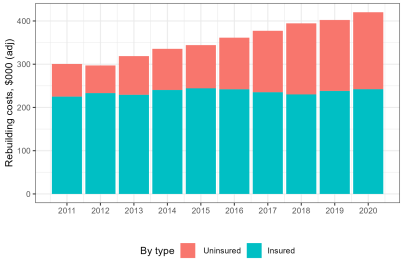
Figure 2: Coverage



- Imputed premiums align closely with the official measures from McDash ($\approx$ 95% correlation)
- Imputed coverage has $\approx$ 60% correlation, is over under-estimated at the high end

Descriptive facts: Under-insurance is a severe problem

- Full HO-3 coverage represents the majority of policies; however in Texas it is less than 60%.
- Nearly 60% of households have **actual cash value coverage** rather than full replacement cost
- Coverage ratios have declined. In 2011, average coverage ratio was 70%. In 2020 it was 50%.



Drivers of under-insurance: Rising premiums

- Insurers raise premiums because of rising costs & climate damages (Mulder and Keys, 2024)
- Do households respond by reducing coverage, to limit the financial burden?

$$log(Q_{l,z,f,t}) = \beta log(P_{z,f,t-1}) + \alpha_{z,f} + \alpha_{z,t} + \gamma' X_{l,z,f,t} + e_{l,z,f,t} \quad (1)$$

  - loan l, zip z, credit score category f, year t.
  - Q = imputed coverage; P = insurance premiums per dollar of coverage (Quadrant).

- Show how this varies for states with high insurer pricing frictions (Oh et al., 2021)

Rising premiums associated with lower coverage

	(1) ln_coverage	(2) ln_coverage	(3) ln_coverage	(4) ln_coverage	(5) ln_coverage	(6) ln_coverage
Ln(price)	-0.814***	-0.749***	-0.856***	-0.751***	-0.779***	-0.747***
	(0.000552)	(0.000489)	(0.000875)	(0.000783)	(0.000715)	(0.000630)
Log change in construction price	0.263***	0.121***	0.193***	0.109***	0.309***	0.120***
	(0.00245)	(0.00135)	(0.00377)	(0.00201)	(0.00322)	(0.00183)
ln(required coverage at origination)	0.457***	0.488***	0.459***	0.475***	0.455***	0.498***
	(0.000263)	(0.000284)	(0.000406)	(0.000436)	(0.000345)	(0.000375)
Standardized climate risk	0.0375***	0.0424***	0.0332***	0.0375***	0.0416***	0.0474***
	(0.000103)	(0.000107)	(0.000151)	(0.000153)	(0.000141)	(0.000150)
Sample	All states/young loans	All states/old loans	High-friction/young loans	High-friction/old loans	Med/low friction/young loans	Med/low friction/old loans
Zipcode FE	Yes	Yes	Yes	Yes	Yes	Yes
Credit x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	42725087	33345907	19337806	14946982	23387280	18398925
R^2	0.324	0.377	0.314	0.366	0.334	0.382

Standard errors in parentheses

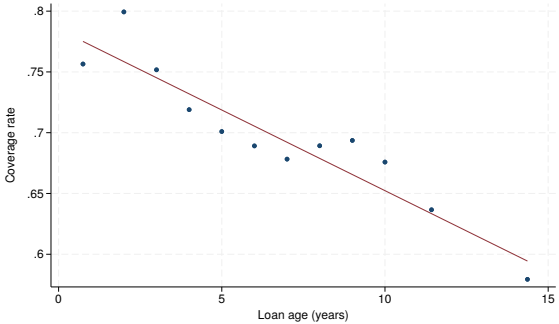
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- A 1% increase in insurance prices $\rightarrow$ 0.75%-0.8% decline in coverage

Drivers of under-insurance: Behavioral inertia

- Hypothesis: Coverage amounts are set at mortgage origination, but do not update over time
- Should update because of inflation, changing construction costs, rising risks

Coverage rates decline as the loan ages



Results: Loan age drives coverage ratios

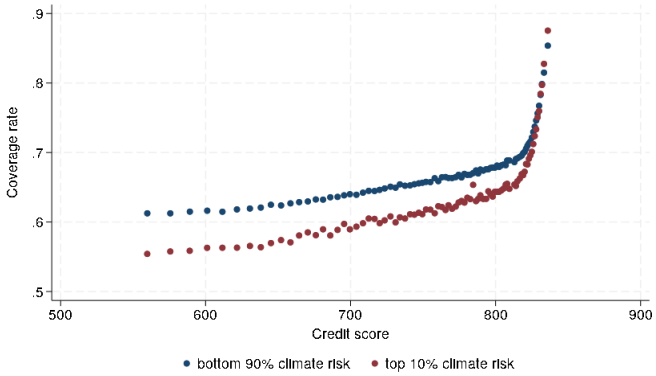
	Dependent variable:			
	Coverage rate (Coverage/Rebuild cost)			
	(1)	(2)	(3)	(4)
Climate risk (std)	0.0395***			0.0021***
	(0.00872)			(0.0001)
Credit score (std)	0.0504***	0.0647***	0.0683***	0.020 ***
	(0.0128)	(0.0102)	(0.0108)	(0.0001)
Loan age (std)	-0.0295**			-0.0084 ***
	(0.00875)			(0.0001)
Year		-0.00604***	-0.0174***	
		(0.00147)	(0.00219)	
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No
Inflation-adjusted	Yes	No	Yes	No
Loan FE	No	Yes	Yes	No
N	73685527	73209723	67626620	4,421,573
R^2	0.0453	0.743	0.747	0.14

Standard errors in parentheses, clustered at the state level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

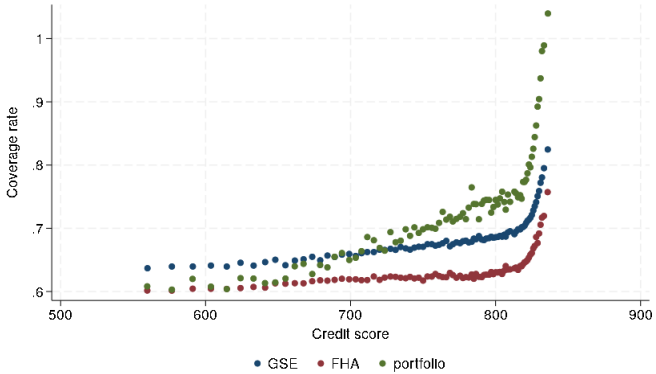
- Holds after controlling for climate damage, credit score, year FE, loan FE

Descriptive Facts: Coverage Rates by Credit Score & Climate Risk (NEW!)



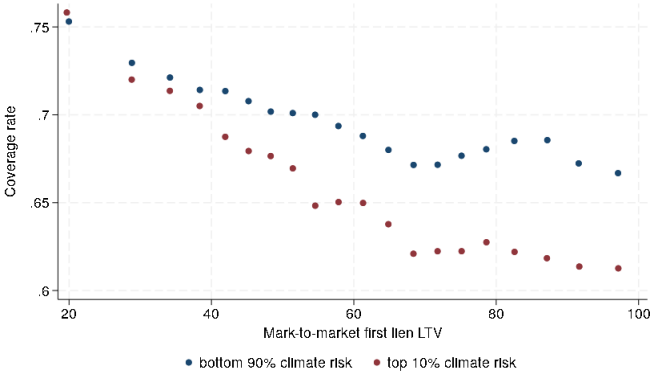
- Climate risk defined using the parcel-level First Street Foundation expected losses
- Low credit score, high climate risk, have the least insurance

Descriptive Facts: Coverage Rates by Investor Type (NEW!)



- Government/GSE mortgages most exposed to under-insurance.
- GSE rules require a minimum of 80% – suggests significant noncompliance

Descriptive Facts: Coverage Rates by LTV For Young Loans (NEW!)



- High LTV households have less coverage, particularly in high climate risk areas

Effect of Under-Insurance on Household Outcomes

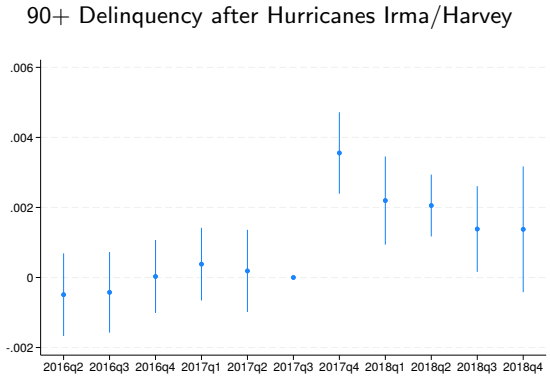
- Want to know if under-insurance matters for household outcomes
- Test: Exploit the landfall of Hurricanes Irma & Harvey in 2017 Q3
- See whether household 90+-day delinquency varies with under-insurance

Empirical Specification:

$$Y_{l,z,t} = \alpha + \beta(PostHurricane_t \times UnderInsured_l) + \alpha_{zt} + \gamma' X_{lt} + \epsilon_{l,z,t} \quad (2)$$

- $UnderInsured_{l,t} = 1$ if household has below-median coverage ratio in 2016 (47%)
- Controls: Fico-quarter FE, LTV-quarter FE, Principal balance - quarter FE
- **Data:** McDash Insurance Module, households hit by Irma/Harvey in FL or LA

Delinquency Dynamics After Irma/Harvey By Under-Insurance (NEW!)



- Under-insured households default increases by 38bp relative to the more insured households
- Default rates remain elevated for following year

Conclusion

- First national estimates of household under-insurance for HO insurance (to our knowledge)
- We show that under-insurance is driven by both rising premiums and borrower inertia
- Under-insurance has real effects on household recovery after disasters