Beyond the Storm

Climate Risk and Homeowners Insurance

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Maryland Juniors Conference, March 2025

Homeowners Insurance Markets Are In Dire Straights

- Home insurance markets have reported heavy losses in recent years (S&P Global)
  - **In 2023:** 110% industry-level combined loss ratio

- A variety of research has documented the fallout on several dimensions
  - Increasing ownership gaps (Keys & Mulder, 2024; Sastry et. al, 2025)
  - Mortgage delinquencies (Ge et. al, 2025; Sastry et al 2024)
  - Exits from risky states (Sastry et. al, 2024; various news sources)

⋆ **Result:** The industry is increasingly relying on state-run **insurers of last resort**
  - Non-profit, taxpayer-backed institutions that "insure the uninsurable"
  - Now exist in $\sim$ 30 US states, including CA, LA, FL, TX, etc.

This Paper: An Exploration of Citizens Property Insurance Corporation

- **Data:** Information on **every policy** and **every claim** written by Citizens, 2002-2023
  - Premium, coverage, deductible, address, housing characteristics
  - Claim result, claim amount, subsequent litigation & appraisals
- **Strategy:** Stacked DiD using hurricanes as events
  - Treated counties: above median loss from event (SHELDUS)
  - Sample: all counties with losses above median at some point between 2002-2023
- Explore heterogeneity along time, location, and pass-through channel
  - **Premiums** (Oh et. al, 2024) vs. **Claims Management** (Jotikasthira et. al, 2025)
  - Low vs. high income areas
  - "Competitive" vs. "Uncompetitive" periods

Results: Citizens Uses Premiums and Claims to Pass Through Costs...

- ...but the results are very nuanced!

Premiums	Claims Rejections
Affected + **unaffected** locations	Only **unaffected** locations
Only **high-income** (unaff.) locations	Only **low-income** locations
Only **less competitive** time periods	Only **more competitive** time periods

- Additional evidence of household response through **litigation** & **appraisals**

A Simple Motivating Model

An Insurer of Last Resort's Decision Problem

- Minimize capital losses and hit price targets by choosing **premium** and **rejection** rates:

$$\max_{\{P_{\ell t}, \chi_{\ell t}\}_\ell} \overbrace{F(K_t, K_{t-1})}^{\text{cost of capital losses}} + \sum_{\ell \in \mathcal{L}} \overbrace{H(\boldsymbol{P_{\ell t}}, \widehat{P}_{\ell t})}^{\substack{\text{cost of deviating} \\ \text{from price targets}}}$$

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$$\text{subject to} \quad K_t = \underbrace{R_t^K K_{t-1}}_{\text{legacy returns}} + \sum_{\ell \in \mathcal{L}} \underbrace{(\boldsymbol{P_{\ell t}} - V_{\ell t}) Q_{\ell t}(\boldsymbol{P_{\ell t}}, \boldsymbol{\chi_{\ell t}})}_{\text{local accounting profits}}$$

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$$R_t^K K_{t-1} = R_t A_{t-1} + \sum_{\ell \in \mathcal{L}} \underbrace{(R_t P_{\ell t-1} - (1 - \boldsymbol{\chi_{\ell t}}) C_{\ell t}) Q_{\ell t-1}}_{\text{local realized losses}}$$

Result 1: Spillovers Occur During Periods with Capital Losses

- In periods in which $R_t^K \geq 1$: $\boldsymbol{P_{\ell t}} = V_{\ell t} = \widehat{P}_{\ell t}$ and $\boldsymbol{\chi_{\ell t}} = 0$

Result 1: Spillovers Occur During Periods with Capital Losses

- In periods in which $R_t^K \geq 1$: $\boldsymbol{P_{\ell t}} = V_{\ell t} = \widehat{P}_{\ell t}$ and $\boldsymbol{\chi_{\ell t}} = 0$
- In periods in which $R_t^K < 1$:

$$\boldsymbol{P_{\ell t}} \in (V_{\ell t}, \boldsymbol{\mu_{\ell t}} V_{\ell t}), \qquad \boldsymbol{\chi_{\ell t}} = g\left(\frac{\text{Losses}_{\ell t}}{\text{Profits}_{\ell t}} \bigg|_{\chi_{\ell t}=0} \right), \; g'(\cdot) > 0$$

Insight: Pricing spillovers ↑ when $\boldsymbol{\mu_{\ell t}}$ ↑ (e.g. due to a distressed private market)
Rejections ↑ when local profits ↓ (e.g. due to high demand elasticities)

Result 2: Heterogeneity in Spillovers Across Time, Locations, and Channels

- **When are markups $\mu_{\ell t}$ high?**
  1. When Citizens has a high market share (and/or: when private insurers are under distress)
  2. When demand elasticities are low (e.g. high income households)

$\rightarrow$ **Pricing spillovers greater in periods of distress and for high-income areas**

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- **When are local profits low?**
  1. When private markets are competitive (e.g. when when the market is financially stable)
  2. When demand elasticities are high (e.g. low income households)

  → **Rejection rates are greater in periods of stability and for low-income areas**

Data and Empirical Setting

Data Construction

- **Citizens:** Policy-level home insurance contracts and claims
  - All contracts and claims issued by Citizens from 2002 to September 2023
  - 18.6m policy-year observations, 4.1m properties
- **SHELDUS:** Climate event related loss data at county level
- **IRS:** Zip-code-level income data
- **FEMA:** Flood risk data from the Federal Emergency Management Agency
- **Regulatory filings:** Surplus, assets, and FL premiums for all private insurers

Citizens Property Insurance Corporation

1. Florida's **largest provider** of multi-peril home insurance policies
   - Market share: 23% at peak, 15% in 2023

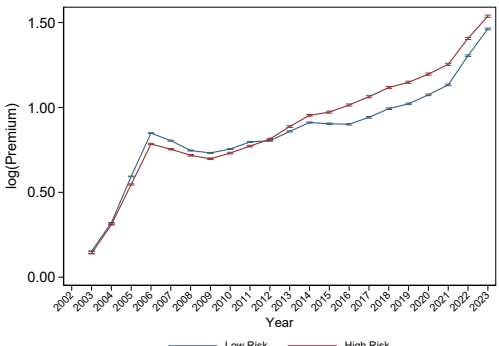
2. **Insurer of Last Resort:** provides coverage to those "uninsurable" by private market
   (Conversations with Citizens agents suggest they also provide insurance to others)

3. *Despite this role*, offers coverage at **competitive premiums**
   (CEO recently complained that they would like to raise prices more than they do)

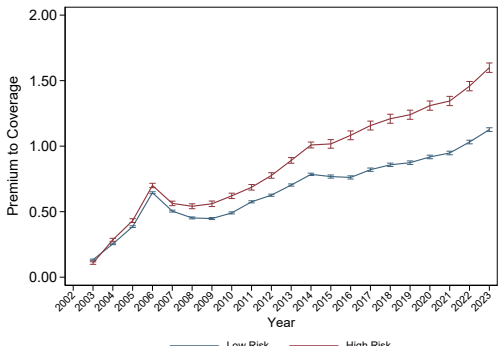
Example: Premium for a $300k Replacement Value Home Built in 2005

Company	Average Premium ($)
Stillwater Property and Casualty	1601.87
Tower Hill Preferred	2302.63
First Protective	2802.78
Citizens	**3595.43**
State Farm Florida	3783.90
ASI Preferred	3861.19
Liberty Mutual	4143.36
People's Trust	4505.46
Florida Farm Bureau	4809.79
Southern Oak	6162.97

Validation: Premiums Have Increased Over Time for all Locations



(a) Premiums



(b) Premium-to-Coverage Ratio

(Note: Residualizes property fixed effects to account for compositional changes)

Identification Strategy: Stacked DiD around Hurricane Events

- Stacked DiD approach using hurricanes as treatment events
  - Helps address concerns regarding staggered DiD with 2WFE (Callaway and Sant'Anna, 2021; Cengiz et al., 2019; Goodman-Bacon, 2021; Gormley and Matsa, 2011; Sun and Abraham, 2021)

- Identify **hurricane-affected** counties using SHELDUS data
  - Cutoff: Hurricane-specific losses exceeding $2m (sample median)
  - Similar results hold using distance from hurricane path (but fewer events – 9 vs 16)

- Compare counties with **relatively similar** risk profiles
  - Only "ever-treated" counties – mitigates concerns about diff's b/w treatment & control
  - Leverage variation in hurricane *timing* (earlier vs. later exposure)

Empirical Specification: Stacked DiD

$$Y_{pct} = \underbrace{\gamma Post_{ct}}_{\substack{\text{Effect on} \\ \textbf{Control} \text{ Units}}} + \underbrace{\beta Post_{ct} \times Treated_{pc}}_{\substack{\text{Relative Effect on} \\ \textbf{Treatment} \text{ Units}}} + \alpha_{pc} + \varepsilon_{pct}$$

Y_{pct}	(Δ) Pricing and claims outcome variables
$Post_{ct}$	Indicator for post-hurricane event for cohort c
$Treated_{pc}$	Indicator for counties with $>$ \$2m in hurricane losses for cohort c
α_{pc}	Policy-cohort fixed effect (within-policy variation to eliminate composition effects)

Empirical Specification: Stacked Event Study

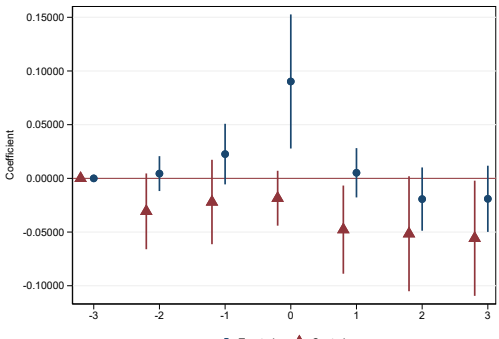
$$Y_{pct} = \sum_{h=-2}^{3} \gamma_t D_{ct+h} + \alpha_{pc} + \varepsilon_{pct} \qquad (h = -3 \text{ omitted})$$

Y_{pct}	(Δ) Pricing and claims outcome variables
D_{ct+h}	Indicator for event for cohort c, h periods relative to hurricane event
α_{pc}	Policy-cohort fixed effect

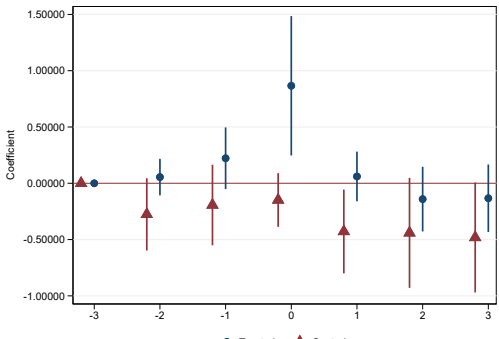
Estimate regression separately for treated & untreated counties

Empirical Results

Validating the Design: Claims (Losses) Spike only in Treated Counties

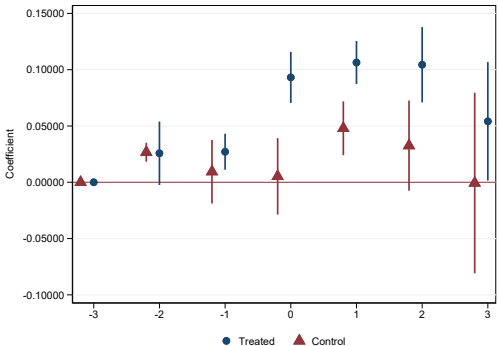


(a) Claim Indicator

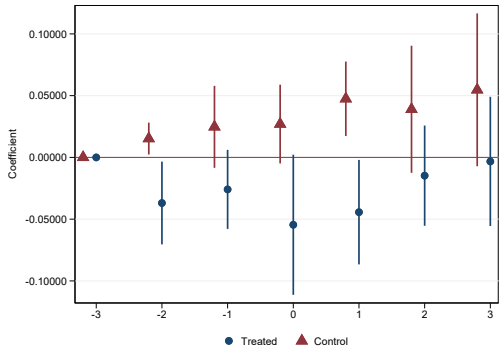


(b) Claim Amount

Citizens Pulls Price and Rejection Levers in Response to a Hurricane



(a) Δ(Premium-to-Coverage Ratio)



(b) Share of Claims Rejected

Rejections Used During Stable Times, Price Spillovers During Distress

	Increasing Private Surplus		Decreasing Private Surplus	
	Δln(Premium)	Rejection Rate	Δln(Premium)	Rejection Rate
	I	II	III	IV
$Post_t$	-0.027	0.039***	0.058***	-0.008
	(0.021)	(0.011)	(0.007)	(0.013)
$Post_t \times Treated_p$	0.101***	-0.038***	0.023**	-0.040**
	(0.021)	(0.013)	(0.011)	(0.019)
Observations	5,362,097	175,143	4,726,003	100,839
R-squared	0.27	0.50	0.31	0.51

($\rightarrow$ Consistent with Citizens responding to private market competition)

Low-Income Face More Rejections, High-Income Face Price Spillovers

	Low Income Zip Codes		High Income Zip Codes	
	ΔIn(Premium)	Rejection Rate	ΔIn(Premium)	Rejection Rate
	I	II	III	IV
$Post_t$	-0.029*	0.039***	0.040***	-0.008
	(0.014)	(0.005)	(0.009)	(0.018)
$Post_t \times Treated_p$	0.113***	-0.047***	0.036***	-0.037*
	(0.016)	(0.012)	(0.013)	(0.020)
Observations	4,300,618	165,993	5,602,322	98,961
R-squared	0.25	0.49	0.35	0.51

(→ Consistent with low-income having higher price elasticities)

Households Respond Through Litigation and Appraisals

	Low Income Zip Codes		High Income Zip Codes	
	Litigation Rate	Appraisal Rate	Litigation Rate	Appraisal Rate
	I	II	III	IV
$Post_t$	0.025**	0.042*	-0.011	0.002
	(0.012)	(0.023)	(0.007)	(0.012)
$Post_t \times Treated_p$	-0.004	0.015	-0.007	0.053***
	(0.004)	(0.013)	(0.007)	(0.011)
Observations	165,993	165,993	98,961	98,961
R-squared	0.57	0.52	0.60	0.52

($\rightarrow$ Appraisals suggestive of another Citizens' lever: *underestimating damages*)

Conclusion

Conclusion

- We show that insurer(s) of last resort use multiple levers to address climate damages
  - Prices + claims management
  - Act similar to private insurers in the wake of a disaster
- Results are timely as private insurers continue to retreat from high risk markets
  - Important for policymakers to understand the mechanisms of these institutions!
  - Nuanced results should help guide where to look
- **Stay Tuned:** A quantitative model of Citizens with welfare analysis

Thank you!

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