Pricing of Climate Risk Insurance: Regulatory Frictions and Cross-Subsidies

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Homeowners' (climate risk) insurance

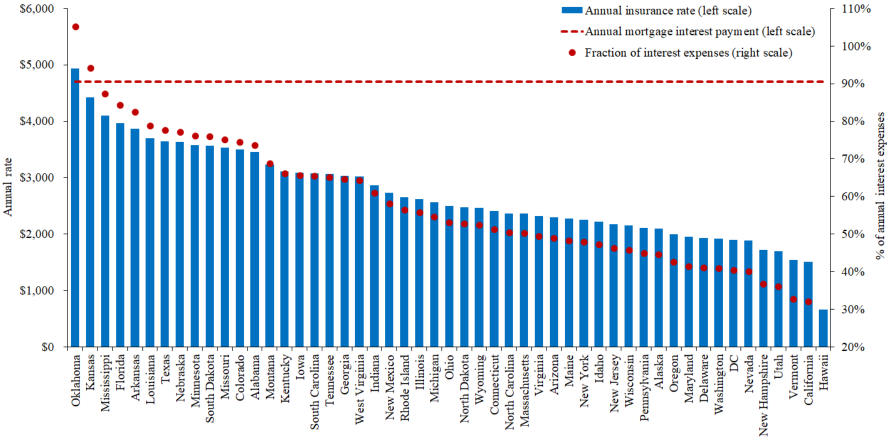
- Homeowners' insurance provides home owners financial protection against "insured events".
  - HO insurance $= \underbrace{\text{Climate losses}}_{\text{Hurricanes, Windstorms, Wildfires}} + \underbrace{\text{Liabilities}}_{\text{Vandalism, Theft}}$

	Climate losses	Liabilities	
		✓	(mid-20th century)
	85%	15%	(last two decades)

- Salient way by which households protect themselves against climate risk.
  - HO is the second largest and fastest growing P&C line.
  - Written premia of $104 billion in 2019.
- HO insurance is mandatory to get a mortgage loan from banks.

Significance of HO for household finance

- Large share of households' expenses: 58% of mortgage interest expenses in the average state*.



*Based on a $400k home with a $300k insurance liability and a $300k mortgage loan (30 years term) for a consumer with an average FICO score (= 660-679).

Regulatory frictions and climate risk insurance

- Regulatory frictions in rate setting:
  - Rate setting is subject to stringent and binding state-level regulation in many states.
- Why matters? Climate disasters have been on an unprecedented rise.
  - Loss distribution is evolving and unknown and frequent rate revisions may be necessary.
  - Rate regulation makes it hard for insurers to set rates.
- Potential consequences for insurers' climate risk exposures, pricing and supply of climate risk insurance, and household finances.
- **This paper:** We study the implications of regulatory frictions on the pricing and market structure of the U.S. homeowners' insurance market.

Empirical challenges

1. **Measurement of regulatory frictions**
   - **Challenge**: existing measures based on filing process, may not reflect the true extent of the frictions.
   - **New data**: **all** rate filings made to individual states.
     - We observe insurers' **target rate changes** and **what regulators approve**.
     - We construct a new measure of rate-setting frictions for individual states.
     - Large variability in states' strictness.
2. **Identification**
   - **Challenge**: typically, one firm is regulated by one regulator, thus making it hard to do within firm comparisons.
   - **New setting**: same firm operates in multiple states, thus price setting is regulated by multiple regulators.
     - This allows us to study the same firm's pricing behavior in different states.

Main findings

1. **Frictions bind**: rate setting frictions are binding and large, especially in high friction states which are also more exposed to climate losses.
2. **Cross-subsidization**: insurers subsidize their business in high friction states with their business in low friction states.
3. **Long run decoupling of prices and risk:** over time, rates grow faster in states with low pricing frictions, despite lower risk exposure.
4. **Insurance availability**: small insurers exit high friction states and there is growth in residual insurance markets (preliminary).

Related Literature

Studies on link between climate risk and household finance:

- Negative implications of climate risk: Bernstein et al. (2019); Baldauf et al. (2020); Murfin and Spiegel (2020); Issler et al. (2020); Goldsmith-Pinkham et al. (2020); Kruttli et al. (2020); Giglio et al. (2020)
- This paper: climate risk has financial consequences for HHs through insurance availability and pricing.

Studies which assess the costs and benefits of regulating consumer financial products:

- Costs/benefits of fin. regulation: (Bar-Gill and Warren, 2008; Campbell et al., 2011; Agarwal et al., 2015)
- Effects of price control in rent-control (Autor et al., 2014), in utilities (Faulhaber, 1975), and in telecommunications (Curien, 1991)
- Price regulation impact on health (Finkelstein et al., 2009; Ericson and Starc, 2015; Simon, 2005) and LTC insurance markets (Liu and Liu, 2020)
- This paper: (1) first to document the wedge between insurers' target and received rate changes; (2) to formally study the cross-subsidization effects of price setting frictions.

Climate change effects on financial institutions studies:

- Central banks warn of property damage and transition risks (Rudebusch, 2019; Scott et al., 2017; Battiston, 2019)
- Academic research confirms this view (Krueger et al., 2020; Battiston et al., 2017)
- Insurers' ability to absorb losses is critical to preserving financial stability (Scott et al., 2017)
- This paper: suggests that the current insurance regulatory system may put a strain on insurers' preparedness.

Insurance pricing and regulatory frictions

- In standard insurance pricing models, insurance prices depend on three key ingredients: (Froot and O'Connell, 1999; Koijen and Yogo, 2015)

$$P = \underbrace{\eta}_{\text{Demand elasticity}} \times \underbrace{E[L]}_{\text{Marginal cost}} \times \underbrace{\Phi}_{\text{Financing frictions}}$$

- Shifts in loss distribution (climate disasters) can lead to **increase in prices** through all channels:
  - **Marginal cost** $\uparrow$: insurers update their beliefs about the frequency/severity of losses.
  - **Financing frictions** $\uparrow$**:** losses can worsen insurers' financing conditions.
  - **Demand** $\uparrow$**:** losses increase households' propensity to buy insurance.

- Our empirical tests study the how responsive are prices to losses:
  - In theory, HO contracts have short maturities can be repriced frequently in response to losses.
  - However, **regulatory frictions may be restrictive**: insurers may be unable to increase prices as much or as often as they would like to.

Institutional background

- Rate regulation has been in practice since the 20^{th} century in the U.S..
- Why are rates regulated?
  - To prevent "excessive" rates, and assure affordable insurance coverage for consumers.
  - HO insurance is mandatory to have a mortgage loan.
- All rate change requests have to be filed with and approved by state regulators:
  - Long and onerous process, e.g., a typical filing is 76 pages long.
  - Insurers have to provide detailed explanations of why a rate change is requested.
  - Regulators may not approve the full extent of the rate change requested.
- Different states exercise varying degrees of regulatory oversight.
  - Extent to which approvals are granted, execution times etc.
  - Filing and approval systems vary across states considerably.

Institutional background

Allstate Wins 30% Rate Hike: **Homeowners with Allstate** Insurance policies **will face a 30% increase** in 2002 after approval of a base rate increase at Thursday's meeting of the State Board for Property and Casualty Rates. Although it will be little consolation, the increase could have been worse. **Allstate had asked for a 48.6% increase** yielding more than $22 million. However, from the time Allstate filed its request in August, **approval of such a large rate hike appeared unlikely** -- the board has a long-standing policy of not granting rate increases of more than 25 percent. Allstate officials said a changing marketplace has left the company with no other option than to ask for a huge increase. Although the company has a goal of making a 5 percent underwriting profit each year, Allstate has failed to do so "for years" in Oklahoma, officials said. **For five of the last six years, Allstate has lost money on homeowners underwriting in Oklahoma**, officials said, with losses of more than $70 million. *Source: The Journal Record, November 2001*

Institutional background

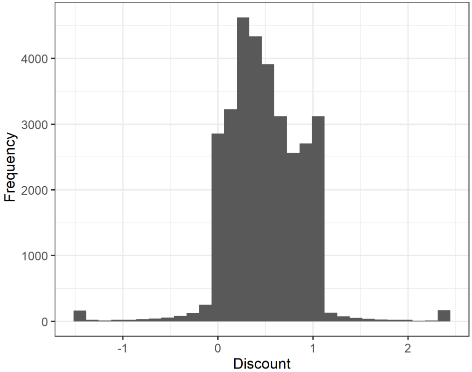
Allstate spikes Illinois homeowners insurance rates: **The second largest home insurer in the state is raising rates by 8%** in early 2020. Allstate will be increasing its Illinois homeowners insurance rates by the largest amount the state has seen in several years. By early next year, policyholders will be paying an average of 8 percent more for their coverage than they are this year. As of yet, **Allstate has not** officially **announced** specifically **why the premiums** for home coverage were **increased** to that extent in the state. That said, **Illinois is a state in which homeowners insurance rates are unregulated.** This gives **insurers complete control over when and why their rates change.** The Illinois homeowners insurance rates are far from the only ones in the country to rise. **Many states** are watching their home insurers **increase their premiums** as a result of many factors, **particularly weather events linked with climate change. California's wildfires provides a clear example of this trend.** *Source: The Journal Record, November 2019*

Data

- **Rate change requests**:
  - All rate change filings for insurer i operating in state s at time t from 2009 to 2019 from Insurance Statutory Product filings.
  - States: full filings in 46 states; partial filings in 4 states.
  - Filing level variables: number of filings, filing date, decision date, state of filing, premium affected.
  - Target rate change for each filing: $\text{Rate}\Delta\text{Target}_{ist}$
  - Rate change actually received (approved): $\text{Rate}\Delta\text{Received}_{ist}$
- **Loss experience**:
  - Losses experienced by insurer i operating in state s at time t.
  - Compute: $\text{Loss ratio}_{ist} = \frac{\text{Losses}_{ist}}{\text{Premium}_{ist}}$. When losses go up, we expect more rate change requests.
- **Insurers' characteristics**:
  - Assets, RBC, reinsurance, losses in other lines at insurer level etc.

Measurement of regulatory frictions

$$Discount_{i,s,t} = \frac{\text{Rate}\Delta\text{Received}_{i,s,t}}{\text{Rate}\Delta\text{Target}_{i,s,t}}$$



- Large wedge between target and received rate changes for most filings.
- $Friction_s = -\overline{Discount}_{i,s,t}$
  - Top 20 largest insurers in a state (75% of market share).
  - Discount varies by firm size and we want a homogeneous measure across states.
  - Robust to alternative definitions.
- Split states in three terciles by $Friction_s$: **High**, **Medium**, and **Low** friction

Are the frictions binding? (1)

1. **Frictions predict lower future profits**:
   Lower the discount (friction↑), the greater the future loss ratio (profitability↓)

	loss ratio$_{i,s,t+1}$			
	(1)	(2)	(3)	(4)
Discount$_{i,s,t}$	-1.486^{**}	-1.659^{*}	-0.895^{*}	-1.984^{***}
	(0.695)	(0.850)	(0.523)	(0.632)
rank	$\leq$50	$\leq$30	$\leq$20	$\leq$10
Fixed Effects	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$
Observations	11,309	7,599	5,365	2,953
R^2	0.619	0.708	0.771	0.834
Adjusted R^2	0.582	0.668	0.733	0.785

2. **High friction states have higher regulatory approval times.** Approval times
3. **Longer wait times are correlated with higher requests.** Wait times

Are the frictions binding? (2)

4. **Insurers' filing behavior is relatively less responsive to losses in high friction states.**
   - Lower number of filings.
   - Future target rate changes respond more to losses than do future received rate changes.

	n rate filings$_{i,s,t+1}$			Discount$_{i,s,t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
own st loss$_{i,s,t}$	0.198	0.011	0.143**	−0.059*	−0.040*	0.060
	(0.141)	(0.052)	(0.055)	(0.031)	(0.023)	(0.043)
State friction	High	Medium	Low	High	Medium	Low
E[LHS]	1.2	1.5	1.1	0.4	0.5	0.5
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$
Observations	5,984	6,508	6,538	2,928	3,822	3,136
Adjusted R^2	0.358	0.394	0.321	0.178	0.173	0.092

Empirical methodology: cross-subsidization across states

$$Y_{i,s,t} = \beta OwnStLoss_{i,s,t-1} + \gamma OtherStLoss_{i,\bar{s},t-1} + \theta X_{i,t} + \alpha_i + \alpha_{s,t} + \epsilon_{i,s,t}$$

- $OtherStLoss_{i\bar{s},t-1}$: is the lagged loss ratio (losses/premiums) for insurer i in all states other than state s

To understand how price setting frictions impact behavior, we proceed in two steps:

1. **Split own (filing) state s by friction:** Which states respond to out-of-state losses?
2. **Split other states' $\bar{s}$ losses by friction:** Does the insurers' response to out-of-state losses vary depending on whether the losses come from low, medium, or high friction states? eq

Step 1: Split filing state s by friction

	n rate filings$_{i,s,t+1}$				
	(1)	(2)	(3)	(4)	(5)
own st loss$_{i,s,t}$	0.114**	0.176	0.015	0.139**	0.114**
	(0.044)	(0.138)	(0.052)	(0.057)	(0.044)
other st loss$_{i,\bar{s},t}$	0.088***	0.078	0.069*	0.304***	0.057
	(0.031)	(0.056)	(0.034)	(0.077)	(0.056)
other st loss$_{i,\bar{s},t} \times$ $\mathrm{I}_s^{\text{Med Fric}}$					0.009
					(0.072)
other st loss$_{i,\bar{s},t} \times$ $\mathrm{I}_s^{\text{Low Fric}}$					0.171*
					(0.093)
E[LHS]	1.3	1.2	1.5	1.1	1.3
State friction	All	High	Medium	Low	All
Controls	Yes	Yes	Yes	Yes	Yes
Fixed Effects	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$
Observations	18,727	5,891	6,418	6,418	18,727
Adjusted R^2	0.362	0.360	0.395	0.328	0.362

$\Rightarrow$ **In low friction states s, insurers request <u>more</u> rate changes after out-of-state losses.**

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	rate Δ received$_{i,s,t+1}$				
	(1)	(2)	(3)	(4)	(5)
own st loss$_{i,s,t}$	2.134***	1.721***	2.270***	2.129***	2.132***
	(0.294)	(0.552)	(0.407)	(0.478)	(0.295)
other st loss$_{i,\bar{s},t}$	0.616***	0.192	0.686**	1.884***	0.240
	(0.184)	(0.187)	(0.296)	(0.437)	(0.193)
other st loss$_{i,\bar{s},t} \times \mathrm{I}_s^{\text{Med Fric}}$					0.375
					(0.320)
other st loss$_{i,\bar{s},t} \times \mathrm{I}_s^{\text{Low Fric}}$					1.406***
					(0.377)
E[LHS]	3.7	3.3	4.4	3.2	3.7
State friction	All	High	Medium	Low	All
Controls	Yes	Yes	Yes	Yes	Yes
Fixed Effects	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$	$s \times t + i$
Observations	18,727	5,891	6,418	6,418	18,727
Adjusted R^2	0.245	0.264	0.295	0.178	0.246

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Step 2: Split out-of-state losses by friction

eq

	n rate filings$_{i,s,t+1}$	rate Δ received$_{i,s,t+1}$
	(1)	(2)
own st loss$_{i,s,t}$	0.140**	2.135***
	(0.057)	(0.479)
other st loss$^{\text{High Fric}}_{i,\bar{s},t}$	0.235***	1.728***
	(0.051)	(0.265)
other st loss$^{\text{Med Fric}}_{i,\bar{s},t}$	0.280***	1.597***
	(0.064)	(0.429)
other st loss$^{\text{Low Fric}}_{i,\bar{s},t}$	0.039	−0.040
	(0.084)	(0.602)
E[LHS]	1.1	3.2
State friction	Low	Low
Controls	Yes	Yes
Fixed Effects	$s \times t + i$	$s \times t + i$
Observations	6,418	6,418
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$\Rightarrow$ **In low friction s, insurers respond more to out-of-state losses from higher friction states $\bar{s}$.**

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$\Rightarrow$ **In low friction s, insurers respond more to out-of-state losses from higher friction states $\bar{s}$.**

After a large $\uparrow$ in out-of-state losses in high friction states, the average insurer increases rates by 36% and number of filings by 13%.

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State friction	Low	Low
Controls	Yes	Yes
Fixed Effects	$s \times t + i$	$s \times t + i$
Observations	6,418	6,418
Adjusted R^2	0.328	0.178

⇒ **In low friction s, insurers respond more to out-of-state losses from higher friction states $\bar{s}$.**

After a large ↑ in out-of-state losses in high friction states, the average insurer increases rates by 36% and number of filings by 13%.

Step 2: Split out-of-state losses by friction

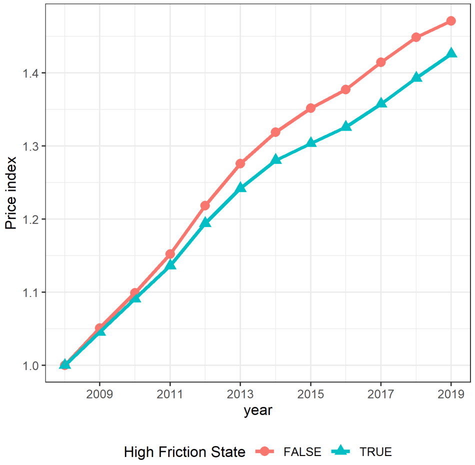
eq

	n rate filings$_{i,s,t+1}$	rate Δ received$_{i,s,t+1}$
	(1)	(2)
own st loss$_{i,s,t}$	0.140**	2.135***
	(0.057)	(0.479)
other st loss$^{\text{High Fric}}_{i,\bar{s},t}$	0.235***	1.728***
	(0.051)	(0.265)
other st loss$^{\text{Med Fric}}_{i,\bar{s},t}$	0.280***	1.597***
	(0.064)	(0.429)
other st loss$^{\text{Low Fric}}_{i,\bar{s},t}$	0.039	−0.040
	(0.084)	(0.602)
E[LHS]	1.1	3.2
State friction	Low	Low
Controls	Yes	Yes
Fixed Effects	$s \times t + i$	$s \times t + i$
Observations	6,418	6,418
Adjusted R^2	0.328	0.178

$\Rightarrow$ **In low friction s, insurers respond more to out-of-state losses from higher friction states $\bar{s}$.**

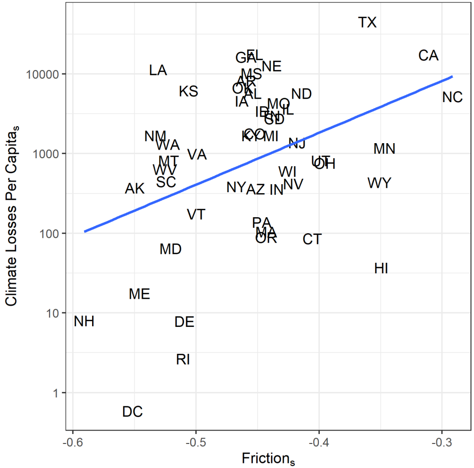
After a large $\uparrow$ in out-of-state losses in high friction states, the average insurer increases rates by 36% and number of filings by 13%.

Long run insurance prices



- Construct cumulative price index $P_{s,T} = \Pi_{t=2009}^{T}(1 + \Delta \text{Rate}_{s,t})$.
- Aggregate insurance prices grow 5pp slower in high friction states relative to low and medium friction states.

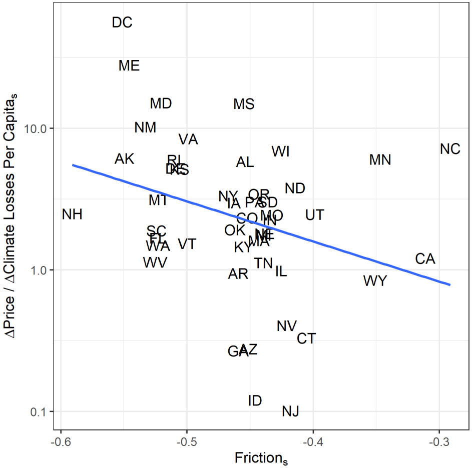
Climate risk and regulatory friction



*Climate losses data from SHELDUS

- High friction states have higher exposure to climate risk (measured as climate losses per capita).
- Yet high friction states are less likely to approve rate change requests.

Decoupling of insurance prices from risk



- Y-axis: price growth relative to long-run growth in climate losses.
- High (low) friction states have low (high) price growth relative to growth in losses.
- Long-term, prices get disjoint from historical loss estimates.

Insurance availability: insurer exits

	is exit year$_{i,s,t}$		
	(1)	(2)	(3)
own st loss$_{i,s,t-1}$	-0.014	0.0001	-0.023^{*}
	(0.010)	(0.003)	(0.013)
$I_s^{\text{High Fric}} \times$ own st loss$_{i,s,t-1}$	0.035^{**}	0.001	0.059^{**}
	(0.016)	(0.003)	(0.024)
E[LHS]	0.0027	0.0015	0.0047
Firms	all	large	small
Controls	Yes	Yes	Yes
Fixed Effects	$s \times t + i$	$s \times t + i$	$s \times t + i$
Observations	12,042	7,538	4,504
Adjusted R^2	0.190	0.253	0.193

- Insurers are more likely to exit high friction states in response to losses.
- Exits are largely driven by small insurers.
  - $\rightarrow$ Large insurers cross-subsidize more, and thus appear to adjust on a different margin.

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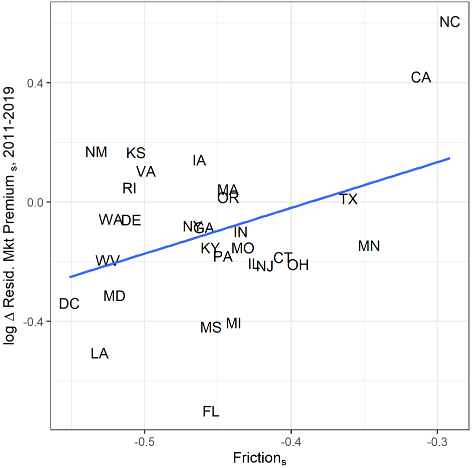
Growth of residual markets



- States set up **residual markets** to help homeowners who are deemed uninsurable in the voluntary market.
- The residual market policies tend to have low coverage of insured risks.
- The size of the residual markets increased faster for higher friction states, implying worsening availability.

Alternative explanations and robustness

- **Low average *Discount*: high friction or insurers reporting inflated target?**
  - Low *Discount* predicts lower profits, so not solely due to insurers inflating their targets. go
  - We show several facts consistent with regulatory price suppression:

    (a) *Discount* is persistent; go (b) regulators take longer to approve larger requests; go (c) more than 70% of insurers request a rate increase each year. go
- **A necessary condition for cross-subsidization is inelastic demand.**
  - Homeowners insurance market appears highly concentrated. go
  - Cross-subsidization findings are more pronounced for large (i.e. higher market power) firms. go
- **Fixed effects and control variables**
  - State × Year FEs control for time-varying unobserved state characteristics and local demand shocks.
  - Firm FEs control for firm idiosyncrasies.
  - Size (total assets) and regulatory ratios control for time-varying insurer characteristics that may drive rate change requests, e.g., due to financial constraints.
  - Fraction of premia re-insured controls for shocks to reinsurance supply following climate losses (Froot and O'Connell, 1999).

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Conclusion and next steps

- We study the prevalence of rate setting frictions for the homeowners' insurance market and construct a new way to measure the extent of these frictions across states.
- We find evidence of mispricing and cross-subsidization across states, and distortions in insurance availability.
- **Next steps:**
  - Study distributional consequences with granular data.
  - Assess welfare implications for home owners.