

Economic Regulation and the Climate Transition

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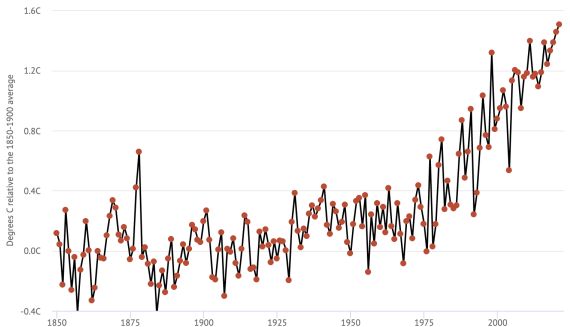
December 6, 2022

The window of climate opportunity is closing

- Limiting global average warming to 1.5°C would avoid the most destabilizing and irreversible climate impacts.
- This will require aggressive near-term emission reductions and net-zero CO2 emissions globally by 2050.

2021 saw the warmest summer land temperatures since records began

Berkeley Earth average June, July, and August land temperatures



Northern-hemisphere summer (June, July, August) average land surface temperatures from [Berkeley Earth](#). Anomalies plotted with respect to a 1850-1900 baseline. Chart by Carbon Brief using [Highcharts](#).

How do we get (close?) to net zero from here?

A transition to a low-carbon, more sustainable economy will require new technology investments and physical infrastructure transformation...



We will also need transformative innovation in economic regulation!

What does economic regulation have to do with the climate transition?

- Key industries on the front lines of climate change are subject to economic regulation limiting how firms can operate/what prices they can charge/what investments they can recover.
- Economic regulatory regimes will significantly determine what climate change mitigation/adaptation will cost and who will pay for it.
- **Question:** Are existing economic regulatory regimes (focusing in particular on price regulation) up to the task of coordinating an equitable and efficient climate transition?

Point of departure: Regulatory reform will be key to an equitable and efficient clean energy transition. Consider examples from three key industries:

- 1 Electricity
- 2 Natural gas
- 3 Property insurance

Three framing questions:

- 1 Why do we regulate prices in these sectors?
- 2 How is climate change interacting with these price regulations?
- 3 Challenges and regulatory innovations going forward?

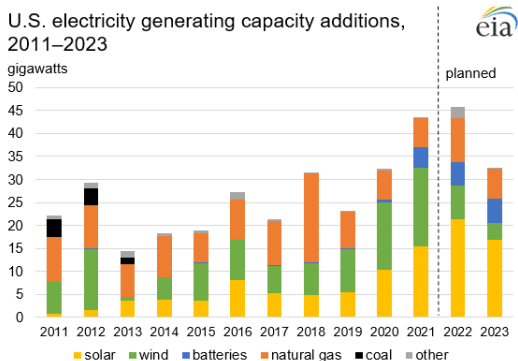
1. The electricity sector

- **The Plan:** Green the grid and electrify almost everything!
- For this to work, we need to build a cleaner and bigger power system.
- We also need to invest in making the power system more resilient to more frequent extreme weather events.



This will require massive investments in clean generation

- Accelerate the displacement of fossil fuels in our current electricity generation mix with zero carbon sources.
- Build 40-65 GW new wind/solar per year to accommodate forecast demand increases (demand is forecast to increase significantly by 2050).



This will require massive investments in grid infrastructure

- U.S. utilities are investing $> \$25B$ /year improving the resilience of existing grid infrastructure (EEI, 2021).
- DOE (2021) estimates we need to expand transmission systems by 60% by 2030 and possibly triple transmission capacity by 2050.



Retail price regulation in the electricity sector?

The electric utility is a textbook example of a natural monopoly:

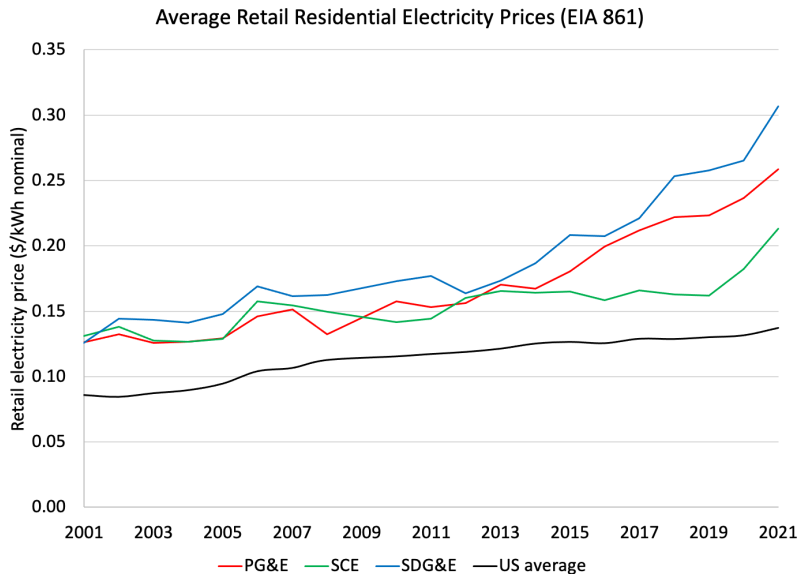
- High fixed/capital costs.
- One firm is able to supply the market at lower cost than two or more firms.
- But a single firm can exercise market power... so natural monopolies are subject to economic regulation.

Regulatory commissions set the retail prices that electric utilities can charge to recover capital investment and operating costs.

Fair. Just. Reasonable

- Utilities should be able to recover costs that are prudently incurred, and earn a reasonable return on investment.
- A standard approach to meeting this revenue requirement: Increase the prices that households pay for their electricity (i.e. retail residential prices).
- As power sector investment costs escalate (driven in part by climate change mitigation/adaptation) this standard regulatory practice is driving up retail prices.

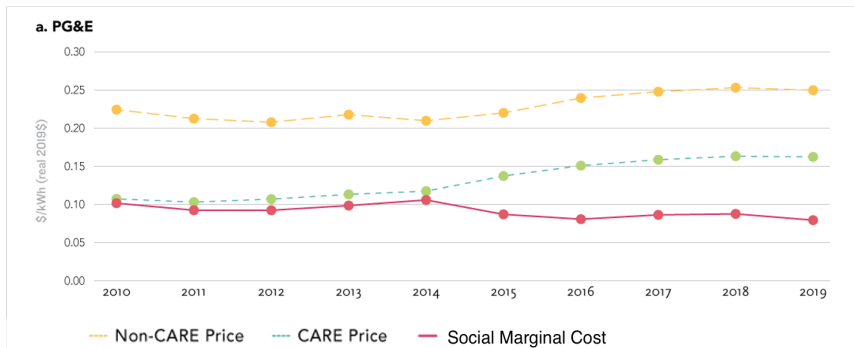
We study the important case of California



Are these retail electricity prices too high?

- Social marginal cost (SMC) captures all the incremental costs that electricity consumption imposes, including fuel costs, pollution impacts, etc.
- If the retail price is set equal to the SMC, consumers can trade off their own usage value versus full societal costs.
- We estimate hourly SMCs for the 3 major IOUs over the last decade and contrast these with the retail prices households pay.

Residential prices versus SMC(\$/kWh) in PG&E



- The gap between the retail price and the efficient price is widening.
- The non-CARE price is now more than 3 times the average SMC.

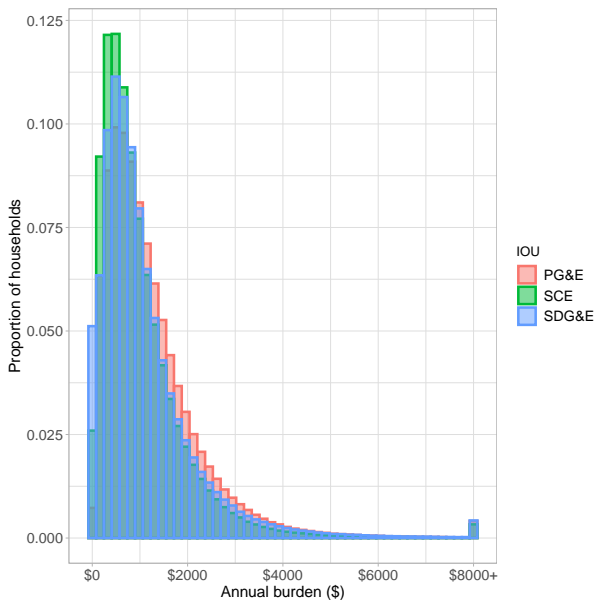
Why worry about high electricity prices?

Efficiency: Burdening electricity prices with costs that are not going-forward incremental expenses of supplying electricity discourages efficient substitution from other energy sources towards electricity.

- Using Davis (2022), we estimate that building electrification rates would have been 33% if $P = SMC$.
- Using Bushnell et al. (2022), we estimate EV adoption rates in California (2014-2018) would have been 30% higher if $P = SMC$.

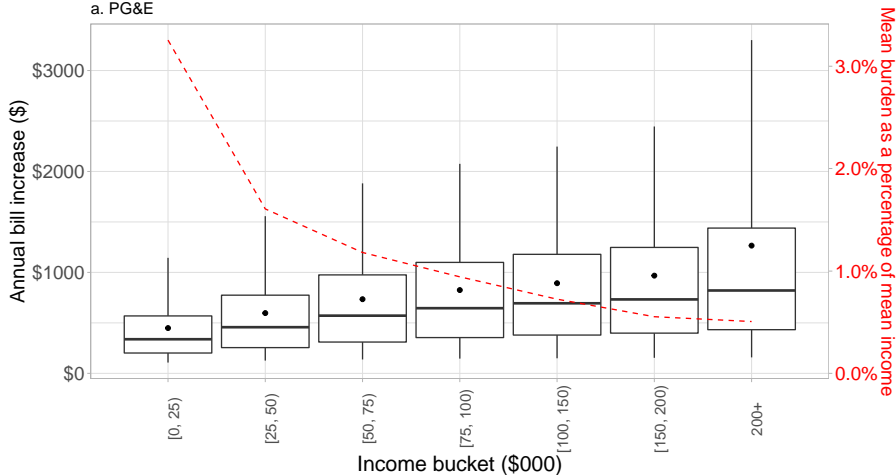
Equity: Higher electricity prices can impose a large economic burden on lower-income households in an increasingly unequal economy.

Household electricity tax burden (\$/year in 2019)

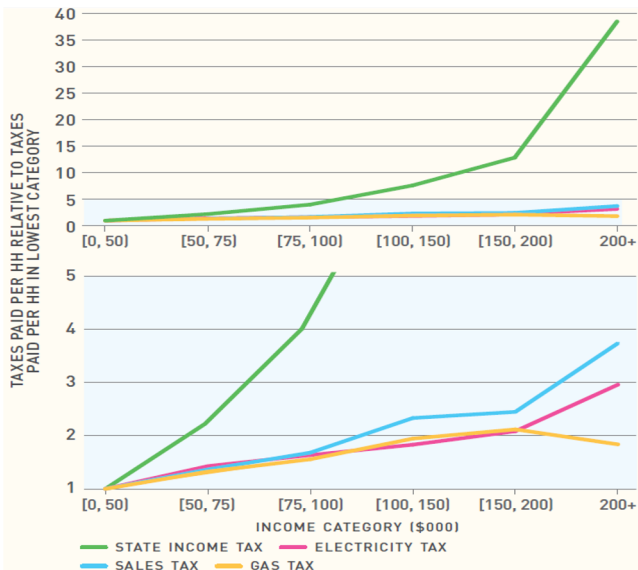


How is the tax burden allocated across income groups?

Annual bill increase from charging current rates rather than SMC
a. PG&E



This electricity tax is relatively regressive



- Another way to assess regressivity: Consider the tax burden *relative* to that born by the lowest income category.
- By this metric the effective electricity tax is more regressive than income and sales tax.

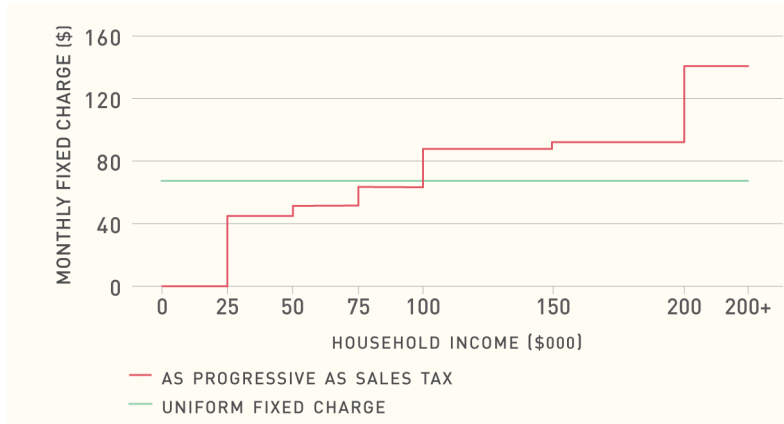
Introducing the income-based fixed charge (IBFC)

We evaluated rate reform alternatives using the following criteria:

- **Efficiency:** Set volumetric prices = social marginal cost
- **Cost recovery:** Take revenue requirement as given.
- **Fairness:** Aim to shift some cost burden off of low income households.
- **Feasible:** Works within administrative, legal, and political limitations.

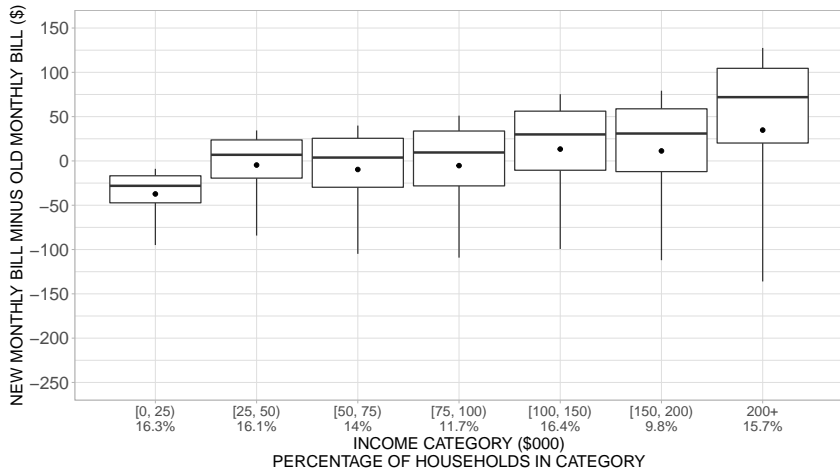
We propose an income-based fixed charge (IBFC) that sets the volumetric price equal to SMC (i.e. $\tau=0$) and structures the fixed cost schedule to match the progressivity of sales tax.

An IBFC that is as progressive as sales tax (PG&E)



- In PGE, the uniform monthly fixed charge required to cover residual revenue requirements in 2019: \$67/household (green line).
- Red line shows an income-based fixed charge (IBFC) that matches progressivity of sales tax.

Bill impacts of moving to this IBFC (PG&E 2019)



- Volumetric prices are much lower, so net bill impacts depends on both consumption and the IBFC (negative number in figure indicates bill reduction under IBFC approach).

Assembly Bill 205 was signed by Governor Newsom in July:

“This bill would eliminate the cap on the amount of the fixed charge that the PUC may authorize. The bill would require the fixed charge to be established on an income-graduated basis, as provided, with no fewer than 3 income thresholds so that low-income ratepayers in each baseline territory would realize a lower average monthly bill without making any changes in usage. The bill would require the PUC, no later than July 1, 2024, to authorize a fixed charge for default residential rates. ”

2. Natural gas

- In 2021, natural gas was the source of about 23% of the U.S. residential sector's total energy consumption.
- Building electrification is seen as a “linchpin solution for decarbonization” (NASEM 2021)
- Policies and programs to accelerate building electrification are driving down residential natural gas demand.



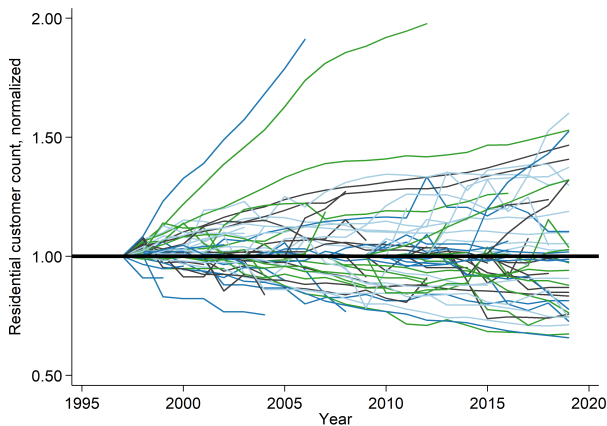
Building electrification → natural gas death spiral?

- Natural gas is another textbook natural monopoly!
- Regulators set the rates that natural gas utilities charge at a level that covers fixed and variable costs.
- As the customer base starts shrinking, significant fixed/sunk/legacy costs must be recovered from fewer customers.

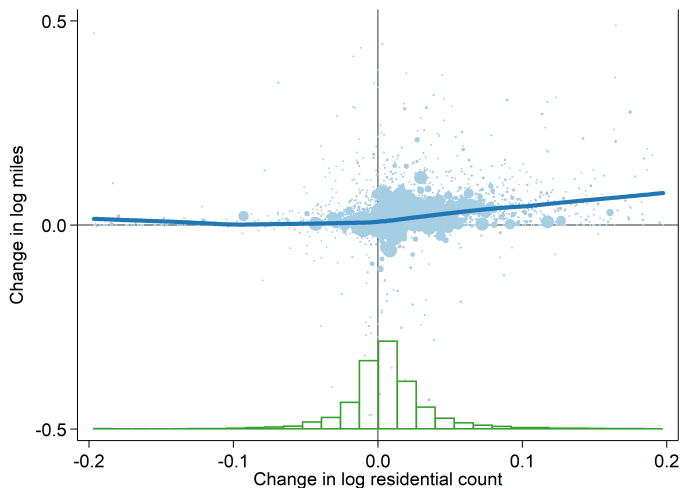


Davis and Hausman(2021)

Authors use historical evidence from US natural gas utilities to understand the cost recovery implications of a shrinking customer base.

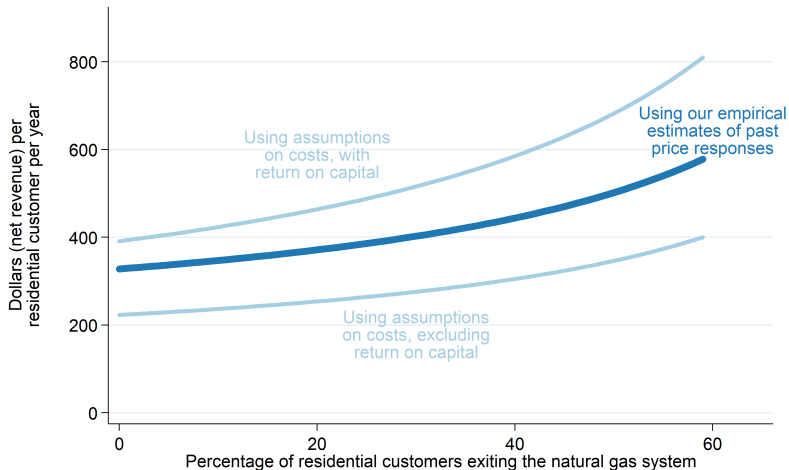


Relationship between physical pipeline network and number of customers



Changes in customer counts have asymmetric impact on infrastructure (and associated costs).

Retail prices rise non-linearly with customer defection



An unsustainable retail price path?

- Accelerated building electrification efforts pose major challenges for natural gas utility financing/cost recovery.
- Under retail rate regulations, natural gas prices will keep rising (well above social marginal cost).
- This could disproportionately impact low income households who (a) spend a larger share of income on energy costs and (b) may be less capable of making capital investments in home electrification.

Solutions? Another California experiment in progress...

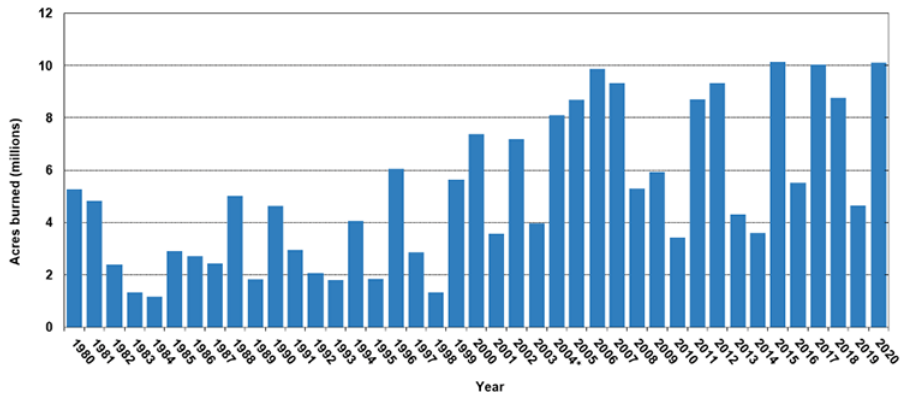
- Strategic decommissioning involves identifying portions of the natural gas distribution system due for upgrades or repairs and taking that portion of the distribution system offline instead.
- This involves immediately converting all customers served by that part of the system to electric only so the gas line can be capped off.



3. Property insurance!

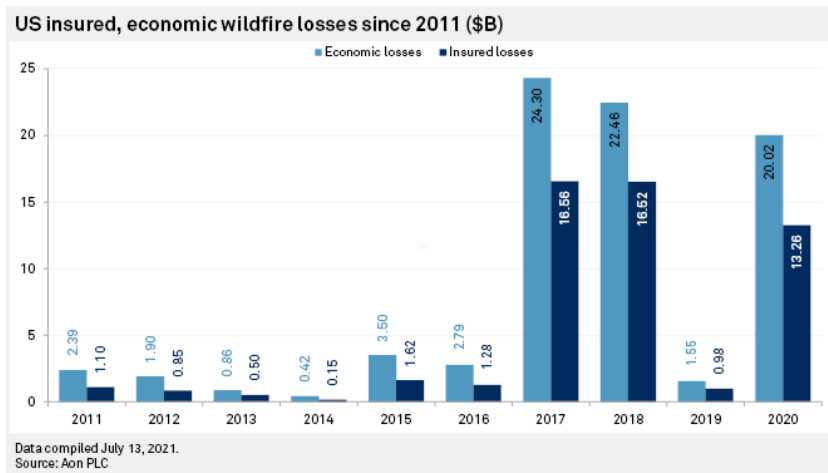
- Mortgage lenders require home owners to purchase insurance as a loan precondition.
- The insurance market is subject to significant regulations that determine/limit the prices that insurers can charge these 'captive' customers.
- Regulatory objectives include:
 - Ensuring the fair and equitable treatment of insurance consumers.
 - Promoting the reliability, solvency and financial solidity of insurance institutions.
 - Rate transparency and stability.
 - Availability of insurance for all home owners.

Wildfire activity complicates this regulatory exercise!



Source: US National Interagency Fire Center.

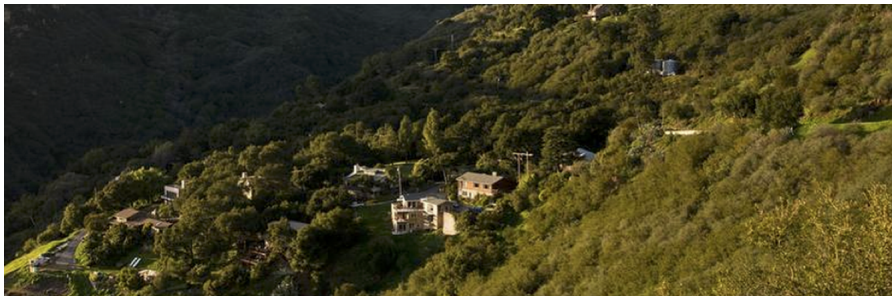
Losses have been devastating (2020 \$M)



Source: Munich Re, NatCatSERVICE.

Key drivers

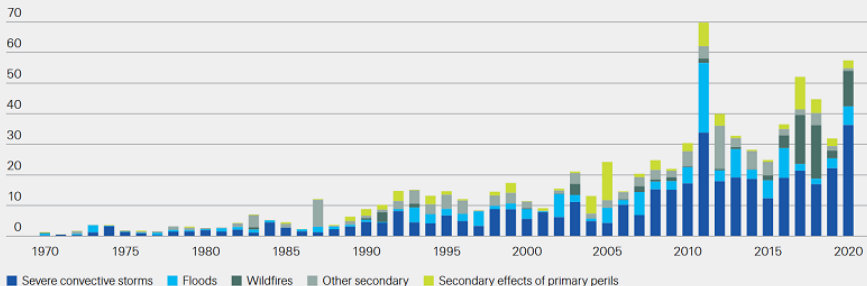
- **Climate change:** Higher temperatures, longer fire seasons, drier fuels, increase in extreme weather conditions.
- **Fire suppression:** Years of suppression has caused fuels to build up, resulting in more catastrophic wildfires.
- **Development in the Wildland Urban Interface (WUI):** More houses in the WUI increase both ignition risks and fire damages.



Wildfires are the fastest growing source of insurance losses

Global insured losses from secondary perils since 1970, in USD billion (2020 prices)

Insured losses from secondary perils have been growing steadily. Among them, losses from severe convective storms represent the biggest component. However, in recent years losses from wildfires have been growing fastest.



Source: Swiss Re Institute

An efficient insurance market can play a critical role to play in wildfire risk adaptation/management:

- Mitigate the economic impacts of climate-driven disasters.
- Insurance costs that are reflective of risk send clear price signals to home buyers/owners.
- Efficient insurance markets could play a critical role in coordinating wildfire risk adaptation/management.

Is the current insurance market regulatory regime up to the task?

Performance of this regulatory regime?

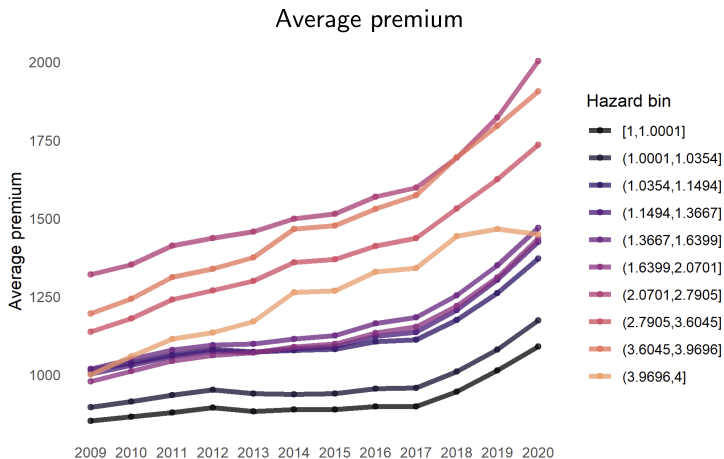
Regulator perspective:

The California homeowners' market of admitted insurers overall can be considered a stable, competitive, and vibrant market... Despite this generally favorable situation, the Department of Insurance is very aware that consumers are having availability issues in the current marketplace.

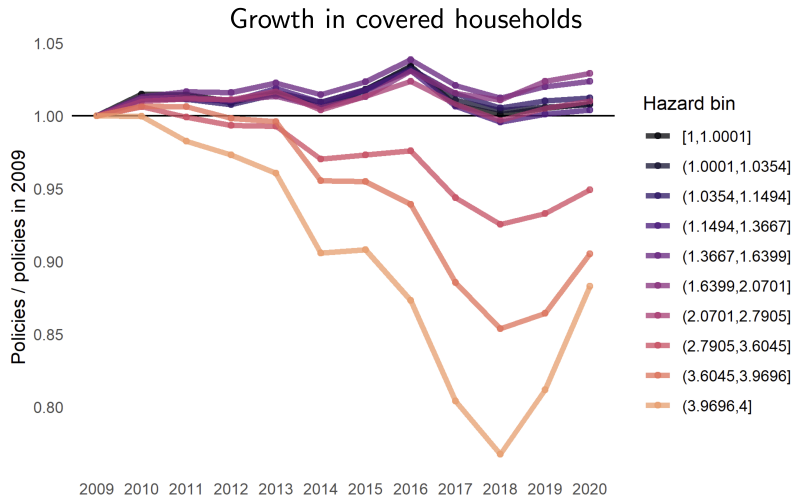
Industry perspective:

The immense wildfire-related losses are colliding with decades of institutional history among CDI, intervenors, and insurers, resulting in a profound difference between approved rate levels and the much higher indicated rates that are needed to allow insurer to maintain solvency while serving the growing number of homeowners living in high fire-threat communities.

Statewide admitted market premia (by risk category)

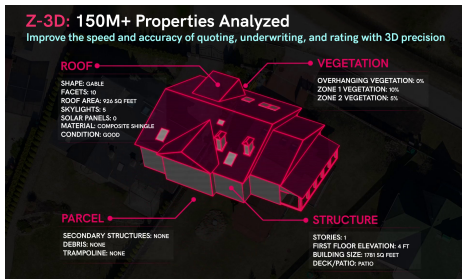


Statewide admitted market policies (by risk category)



How do regulators ensure affordability AND availability AND solvency in the face of climate change pressures?

- Under standard insurance pricing, premiums do not vary with/reward private investments in wildfire risk reduction.
- California just introduced new insurance pricing regulations that require insurance companies to provide discounts to consumers who invest in defensible space/risk reduction.



Concluding thoughts

- The climate transition will require innovation in every arena.. including economic regulation!
- Existing regulatory regimes were not designed with climate pressures in mind.
- **Bad news:** In many respects, current regulatory approaches are not well-suited to navigating the climate challenge.
- **Good news:** In many cases, innovative reforms and improvements are within existing regulatory authority.

Let's get innovating! How we design and implement economic regulation in key sectors will significantly determine what the clean energy transition costs – and who pays the price.

Research referenced today was a team effort!

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- This work is in collaboration with my excellent co-authors: Severin Borenstein, Judson Boomhower, Jacob Gellman, Andrew Plantinga, James Sallee.
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