

Flooded House or Underwater Mortgage?

The Implications of Climate Change and Adaptation on Housing, Income & Wealth

By Yasmine van der Straten

Discussion by Pierre Mabilie

INSEAD

CEPR European Conference on Household Finance

October 5, 2023

This Paper

► Question: *how does climate change affect household wealth?*

- Housing: 30% of all HH assets and 2/3 for top 50-90% HH, worth \$41 tn in 2023 US (Kuhn-Schularick-Steins, JPE 2020; Goetzmann-Spaenjers-Van Nieuwerburgh, RFS 2021)
- Mortgages: 70% of HH debt, worth \$12 tn (NY Fed Consumer Credit Panel/Equifax)
- Climate *regulation* tends to hurt wealth, especially poor HH ✓

This Paper

- ▶ **Question:** *how does climate change affect household wealth?*
 - Housing: 30% of all HH assets and 2/3 for top 50-90% HH, worth \$41 tn in 2023 US (Kuhn-Schularick-Steins, JPE 2020; Goetzmann-Spaenjers-Van Nieuwerburgh, RFS 2021)
 - Mortgages: 70% of HH debt, worth \$12 tn (NY Fed Consumer Credit Panel/Equifax)
 - Climate *regulation* tends to hurt wealth, especially poor HH ✓

This Paper

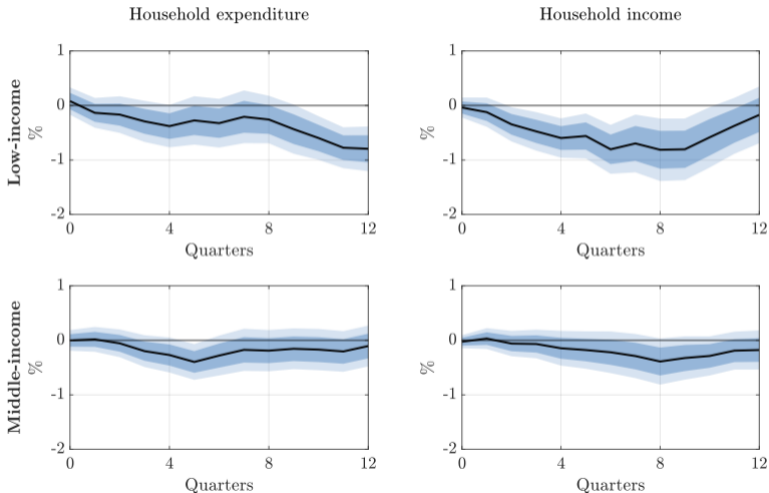
- ▶ **Question:** *how does climate change affect household wealth?*
 - Housing: 30% of all HH assets and 2/3 for top 50-90% HH, worth \$41 tn in 2023 US (Kuhn-Schularick-Steins, JPE 2020; Goetzmann-Spaenjers-Van Nieuwerburgh, RFS 2021)
 - Mortgages: 70% of HH debt, worth \$12 tn (NY Fed Consumer Credit Panel/Equifax)
 - Climate *regulation* tends to hurt wealth, especially poor HH ✓

Climate *Regulation* Hurts Household Wealth (Yellow Vests)



Climate Regulation Hurts Household Wealth (Känzig, 2023)

- ▶ Response to positive carbon pricing shock by HH income



This Paper

- ▶ **Question:** *how does climate change affect household wealth?*
 - Housing: 30% of all HH assets and 2/3 for top 50-90% HH, worth \$41 tn in 2023 US (Kuhn-Schularick-Steins, JPE 2020; Goetzmann-Spaenjers-Van Nieuwerburgh, RFS 2021)
 - Mortgages: 70% of HH debt, worth \$12 tn (NY Fed Consumer Credit Panel/Equifax)
 - Climate *regulation* tends to hurt wealth, especially poor HH ✓
 - What about *climate change = risk + shock realization*? ✗
 - * Empirical evidence on sea level rise, flooding, hurricanes, wildfires (Giglio-Kelly-Stroebel, ARFE 2021), but little theory guidance
- ▶ **Approach:** OLG model with low- and high-skilled HH + *climate change*

This Paper

- ▶ **Question:** *how does climate change affect household wealth?*
- ▶ **Approach:** OLG model with low- and high-skilled HH + climate change
 - Stochastic depreciation shock to supply of housing and physical capital with increasing probability over time and idiosyncratic loss given shock
 - Long-run simulation for next 30 years and beyond

Short- And Long-Run Climate Risk (Stroebe & Wurgler, JFE 2021)

	Role			
	Pooled	Faculty	Public Sector	Private Sector
Top Risks Next 5 Years (Average Rank)				
Regulatory	1.9	1.7	2.1	2.1
Stakeholder	2.9	3.0	3.2	2.7
Physical	3.1	3.3	2.8	2.9
Technological	3.4	3.4	3.1	3.6
Legal	3.6	3.6	3.8	3.6
Top Risks Next 30 Years (Average Rank)				
Physical	2.2	2.3	1.9	2.2
Regulatory	2.6	2.5	2.6	2.7
Technological	3.0	2.8	3.0	3.3
Stakeholder	3.5	3.7	3.8	3.2
Legal	3.7	3.7	3.7	3.6

This Paper

- ▶ **Question:** how does climate change affect households' wealth?
- ▶ **Approach:** climate change + overlapping generations model with low- and high-skilled HH
- ▶ **Result:** climate change **increases** income and wealth inequality
 - *Direct effect:* low-skilled HH more exposed because their labor is complementary to destroyed physical capital
 - *Equilibrium:* house prices increase while asset prices decrease
 - *Amplification:* lack of adaptation by low-skilled HH increases their exposure, which makes it even harder to adapt as their assets lose value and credit is harder to obtain
- ▶ Useful theory guidance on complex and timely quantitative question!

This Paper

- ▶ **Question:** how does climate change affect households' wealth?
- ▶ **Approach:** climate change + overlapping generations model with low- and high-skilled HH
- ▶ **Result:** climate change **increases** income and wealth inequality
- ▶ Useful theory guidance on complex and timely quantitative question!

Comments

1. Climate change and house prices
2. Geography
3. Aggregate risk

#1: Model

► Households

$$\begin{aligned} & \max_{L_{i,t}, x_{i,t}, s_{i,t}, c_{i,t+1}} v(L_{i,t}) + \mathbb{E}_t [c_{i,t+1}] \\ \text{s.t.} \quad & y_{i,t} \leq \left(p_t + \frac{\theta}{2} x_{i,t}^2 \right) L_{i,t} + s_{i,t} e_t + S_{i,t} \\ & c_{i,t+1} \leq \max \{ y_{i,t+1} + p_{t+1} (1 - \xi_{i,t+1}) L_{i,t} + d_{t+1} S_{i,t} + (1 + \hat{r}_{t+1}) S_{i,t}, 0 \} \\ & L_{i,t}, x_{i,t}, c_{i,t+1} \geq 0 \end{aligned}$$

► Firms

$$\tilde{Y}_t = A \left[\eta \left(H_t \alpha h_t^{1-\alpha} \right)^\rho + (1 - \eta) \left(\tilde{K}_t \alpha l_t^{1-\alpha} \right)^\rho \right]^{\frac{1}{\rho}}$$

► Climate change

$$\begin{aligned} L_{i,t+1} &= (1 - \xi_{i,t}) L_{i,t} & \text{and} & & \mathbb{E} [\xi_{i,t+1}] &= (1 - x_{i,t}) \mu_L \gamma_{t+1} \\ \tilde{K}_t &= (1 - \xi_{f,t}) K_t & \text{and} & & \mathbb{E} [\xi_{f,t}] &= \mu_K \gamma_t \end{aligned}$$

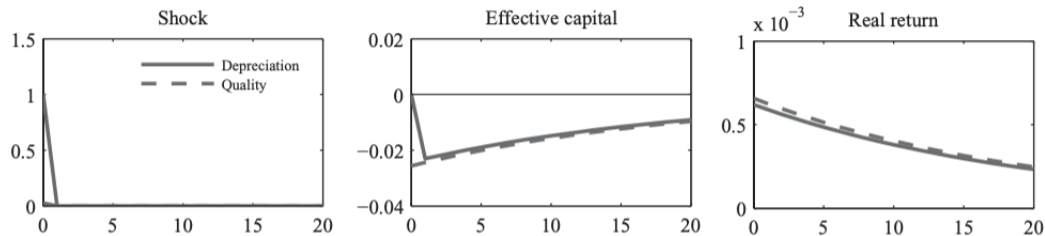
New: Climate Change Can *Increase* House Prices

- ▶ Model (long run) \neq data (short run): sea level rise, flooding, hurricanes, wildfires *decrease* house prices (Giglio-Kelly-Stroebel, ARFE 2021)
- ▶ House prices **increase** due to lower supply of housing (+) vs. cash flows and discount rate (-)
 - Supply effect dominates when high MU from housing
 - Similar to **stochastic depreciation** or negative investment shock
 - Wealth inequality increases

$$p_t = \frac{p_{t+1} (1 - (1 - x_{i,t}) \mu_L \gamma_{t+1}) + v'(\bar{L}_t)}{1 + r_{t+1}} - \frac{\theta}{2} x_{i,t}^2$$

Climate Change As Stochastic Depreciation Shock

- ▶ Response to shock to the rate of capital depreciation (Furlanetto & Seneca, MD 2014)



- ▶ What happens here?

- Housing instead of physical capital
- Real estate developers *do not* increase housing supply in response to higher prices

$$\bar{L}_{t+1} = \int_0^1 (1 - \zeta_{i,t}) di \times \bar{L}_t = (1 - \mu_L \gamma_{t+1}) \times \bar{L}_t \xrightarrow{t \rightarrow \infty} 0$$

- ▶ Empirical evidence? **Housing supply elasticity** (here ≈ 0) key for impact of climate change

Climate Change As Stochastic Depreciation Shock

- ▶ Response to shock to the rate of capital depreciation (Furlanetto & Seneca, MD 2014)
- ▶ What happens here?
 - Housing instead of physical capital
 - Real estate developers *do not* increase housing supply in response to higher prices

$$\bar{L}_{t+1} = \int_0^1 (1 - \xi_{i,t}) di \times \bar{L}_t = (1 - \mu_L \gamma_{t+1}) \times \bar{L}_t \xrightarrow{t \rightarrow \infty} 0$$

- ▶ Empirical evidence? **Housing supply elasticity** (here ≈ 0) key for impact of climate change
 - Worse in inelastic areas, which are also more exposed to climate risk

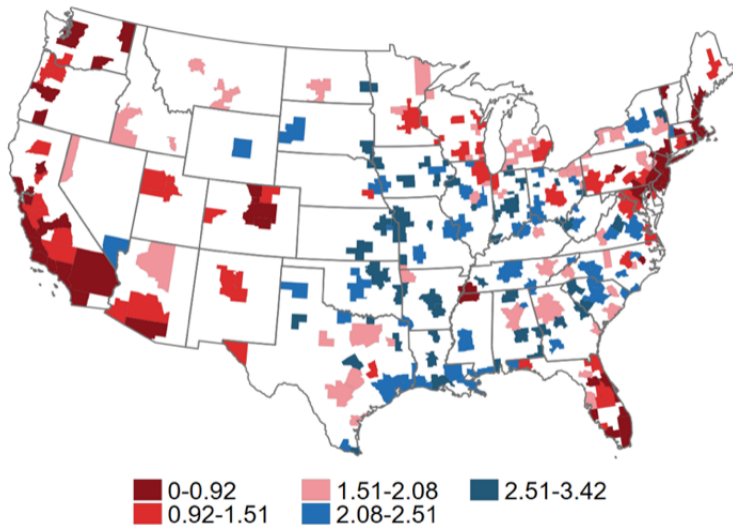
Climate Change As Stochastic Depreciation Shock

- ▶ Response to shock to the rate of capital depreciation (Furlanetto & Seneca, MD 2014)
- ▶ What happens here?
 - Housing instead of physical capital
 - Real estate developers *do not* increase housing supply in response to higher prices

$$\bar{L}_{t+1} = \int_0^1 (1 - \xi_{i,t}) di \times \bar{L}_t = (1 - \mu_L \gamma_{t+1}) \times \bar{L}_t \xrightarrow{t \rightarrow \infty} 0$$

- ▶ Empirical evidence? **Housing supply elasticity** (here ≈ 0) key for impact of climate change
 - Worse in inelastic areas, which are also more exposed to climate risk

House Price Impact Of Climate Shock Depends On Supply Elasticity



Low (brown) to high (blue) housing supply elasticity (Aastveit-Albuquerque-Anundsen, JMCB 2023)

#2: Geography

- ▶ This paper: household finance meets climate change
 - Household finance → housing → location and climate change → location
 - There is a *single location* in the model
- ▶ Climate risk exposure differs by location
 - Rich HH in flood-prone areas because of coastal amenity values → dampens effect of climate change on inequality
 - Rich HH more mobile across areas → amplifies effect of climate change on inequality
- ▶ Does it matter?
 - **External validity**: maybe not in the Netherlands, but probably in countries like the US

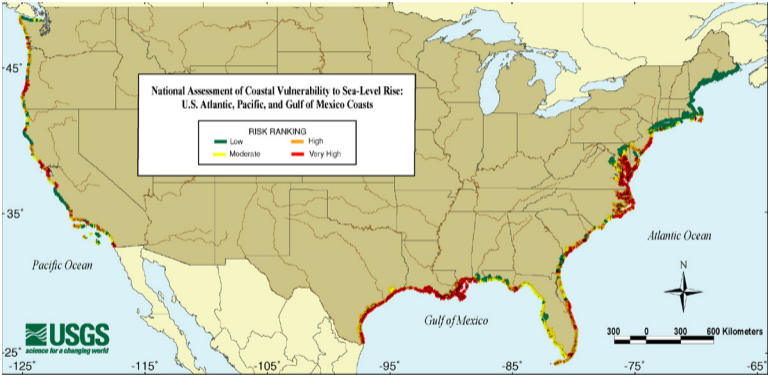
#2: Geography

- ▶ This paper: household finance meets climate change
 - Household finance → housing → location and climate change → location
 - There is a *single location* in the model
- ▶ Climate risk exposure differs by location
 - Rich HH in flood-prone areas because of coastal amenity values → dampens effect of climate change on inequality
 - Rich HH more mobile across areas → amplifies effect of climate change on inequality
- ▶ Does it matter?
 - **External validity**: maybe not in the Netherlands, but probably in countries like the US

#2: Geography

- ▶ This paper: household finance meets climate change
 - Household finance → housing → **location** and climate change → **location**
 - There is a *single location* in the model
- ▶ Climate risk exposure differs by location
 - Rich HH in flood-prone areas because of coastal amenity values → dampens effect of climate change on inequality
 - Rich HH more mobile across areas → amplifies effect of climate change on inequality
- ▶ Does it matter?
 - **External validity**: maybe not in the Netherlands, but probably in countries like the US

Sea Level Rise Risk: Netherlands vs. US



Geography + Moving

- ▶ Moving rates in 2021
 - 5.3% Dutch movers (Statistics Netherlands)
 - 8.4% American movers (US Census Bureau)
- ▶ Moving allows HH to adapt to regional shocks
 - **Equilibrium effects** on “climate-proof” areas where some HH will move
- ▶ Does it matter for HH wealth and inequality?

Geography + Moving

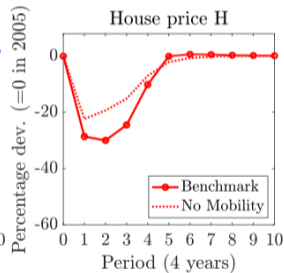
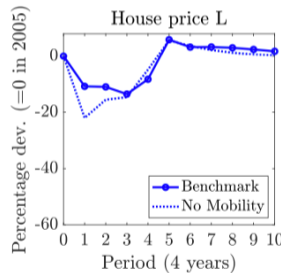
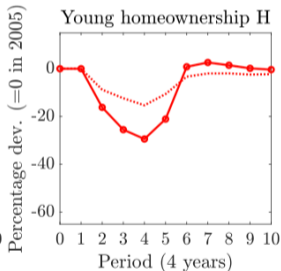
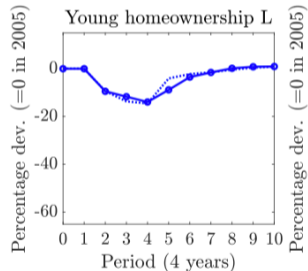
- ▶ Moving rates in 2021
 - 5.3% Dutch movers (Statistics Netherlands)
 - 8.4% American movers (US Census Bureau)
- ▶ Moving allows HH to adapt to regional shocks
 - **Equilibrium effects** on “climate-proof” areas where some HH will move
- ▶ Does it matter for HH wealth and inequality?

Geography + Moving

- ▶ Moving rates in 2021
 - 5.3% Dutch movers (Statistics Netherlands)
 - 8.4% American movers (US Census Bureau)
- ▶ Moving allows HH to adapt to regional shocks
 - **Equilibrium effects** on “climate-proof” areas where some HH will move
- ▶ Does it matter for HH wealth and inequality?

Geography + Moving \rightarrow HH Wealth (Mabile, RFS 2023)

- ▶ Response to negative credit supply shock in low-price (blue) and high-price areas (red), with and without moving

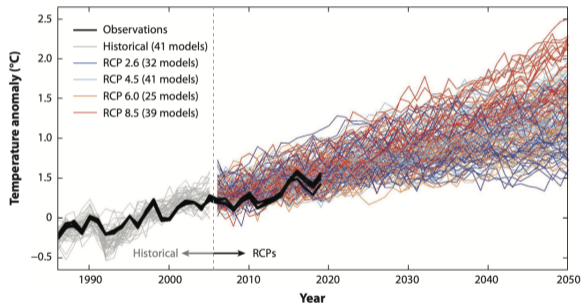


#3: Climate Risk

- ▶ In paper, climate change = deterministic shock $\gamma_t \uparrow$ + idiosyncratic risk $\zeta_{i,t} \stackrel{iid}{\sim} \text{Beta}$
 - Model is deterministic on average \rightarrow no aggregate risk
- ▶ In data, dispersion across scenarios (Giglio-Kelly-Stroebel, ARFE 2021) \rightarrow aggregate risk
- ▶ Does it matter?
 - Effect of climate risk depends on HH expectations and preferences (e.g., EZ+LRR)
 - Comparing climate change with other risks

#3: Climate Risk

- ▶ In paper, climate change = deterministic shock $\gamma_t \uparrow$ + idiosyncratic risk $\zeta_{i,t} \stackrel{iid}{\sim} \text{Beta}$
 - Model is deterministic on average \rightarrow no aggregate risk
- ▶ In data, **dispersion across scenarios** (Giglio-Kelly-Stroebele, ARFE 2021) \rightarrow aggregate risk



- ▶ Does it matter?
 - Effect of climate risk depends on HH expectations and preferences (e.g., EZ+LRR)
 - Comparing climate change with other risks

#3: Climate Risk

- ▶ In paper, climate change = deterministic shock $\gamma_t \uparrow$ + idiosyncratic risk $\zeta_{i,t} \stackrel{iid}{\sim} \text{Beta}$
 - Model is deterministic on average \rightarrow no aggregate risk
- ▶ In data, **dispersion across scenarios** (Giglio-Kelly-Stroebel, ARFE 2021) \rightarrow aggregate risk
- ▶ Does it matter?
 - Effect of climate risk depends on HH expectations and preferences (e.g., EZ+LRR)
 - Comparing climate change with other risks

Conclusion

- ▶ Useful theory guidance that helps us think about economics of climate change
 - “A good model is one from which you remove as many ingredients as possible”
- ▶ What about geography and aggregate risk?
- ▶ Timely implication: how do we help low-income HH adapt to climate change?
 - Financing adaptation (Pisani-Ferry & Mahfouz 2023 report), political economy of Green parties...