Weathering the Storm: The Effects of Natural Disasters on Households under Universal Insurance

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Motivation and Research Question

- Increasing climate instability is a global concern
- → Environmental risks and challenges to those directly exposed
- **What is the economic impact of natural disasters on households?**

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  - Administrative, third-party reported data on income and wealth
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- Comprehensive, high quality household-level data over long time period
  - Administrative, third-party reported data on income and wealth
  - Transaction-based consumption data
- We estimate the effects of natural disasters on household economic outcomes
  - Households in Norway are fully insured against direct damages
  - Enables us to isolate the *indirect* effects

Indirect Effects

- What do we mean by indirect effects?

> *"Indirect losses include all losses that are not provoked by the disaster itself, but by its consequences; they span over a longer period of time than the event, and they affect a larger spatial scale or different economic sectors"* (World Bank, 2015)

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- Why are indirect effects important to study?

  "Why were the losses from Hurricane Katrina so much greater than anyone expected?"

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- Income and consumption effects are concentrated among homeowners and firm events
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What can we learn from Norway?

- Universal and full insurance
  - A valuable point of reference
  - Clean estimates of *indirect* effects of natural disasters
- Detailed and comprehensive data
  - Several outcome variables
  - Heteregenous effects

Data

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  - Date of damage, affected municipality, compensation amount, insurance type (household vs. firm), and damage type (storm, storm surge, flood, landslide, or other)

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- Qualitative information, to ensure quality of events
  - From various sources, such as The Norwegian Water Resources and Energy Directorate, Norwegian Meteorological Institute, and local newspapers

Our Severity Metric

- For each municipality m in year t:

$$damage_{m,t} = \frac{total\ insurance\ payouts_{m,t}}{total\ labor\ income_{m,t}}$$

  - ✓ Enables comparison of municipalities
  - ✓ Works as a deflator

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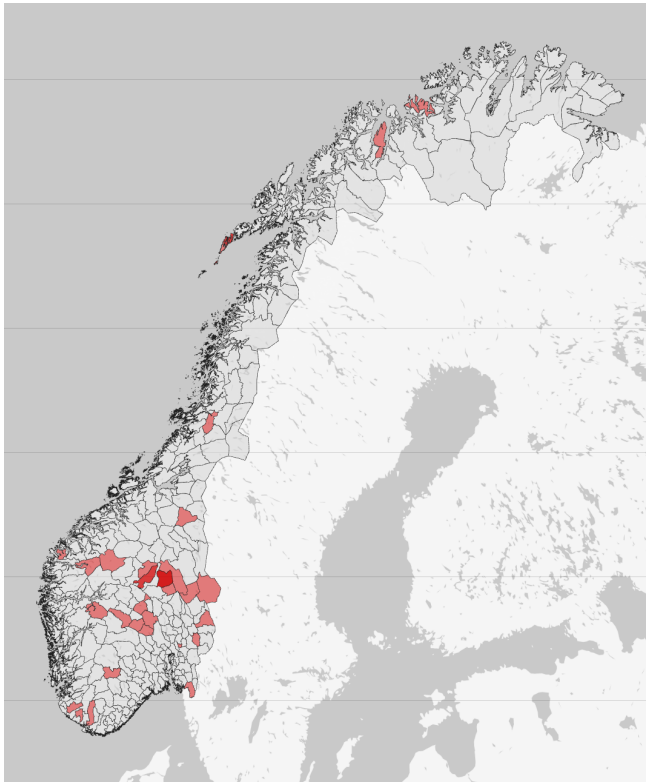

Figure. Natural Disasters in Norway at the municipality level, 38 events, 1993-2023.

Distribution of the Natural Disasters over the years

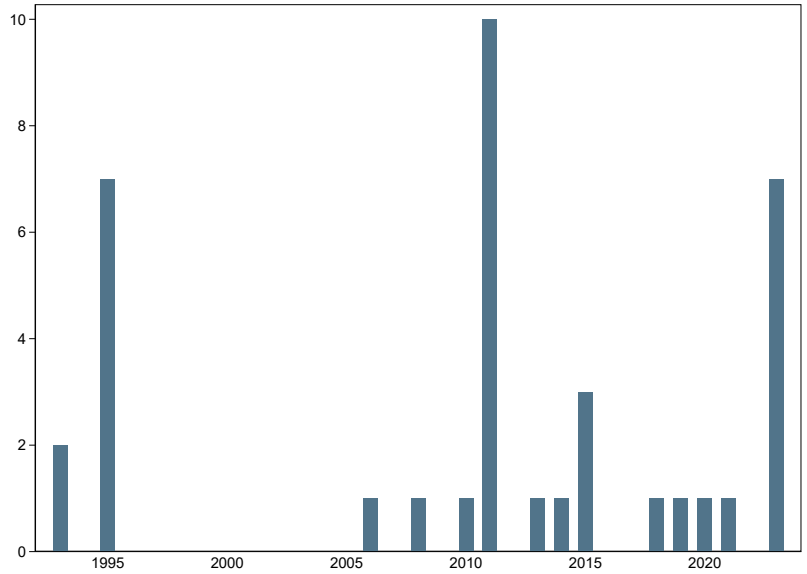

Figure. Count of Natural Disasters using our Severity Metric, 1993 – 2023

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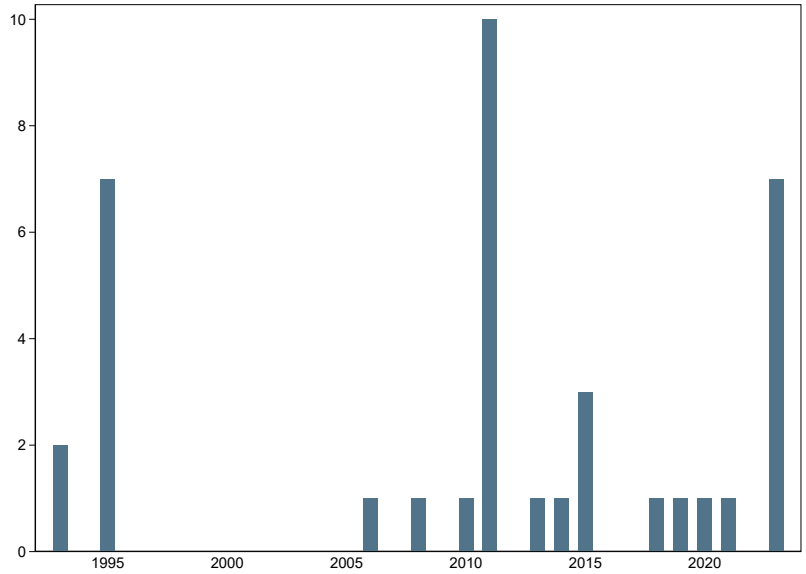

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- Rising insurance payouts align with our measured increase in natural disasters
- Our sample period: 2006 – 2018

Research Design: The Set-Up

- *Treated* are households that resided in a municipality in year it was hit
- *Controls* similar households in never-hit municipalities, not in same county
- Exact and Interval-Based Matching (CEM) on:
  - (exact) home ownership, ownership of risky assets, self-employment status, children below 18, maximum education level within household
  - (interval-based) age, total consumption, household income after tax, debt level, liquid assets, and municipality population

Research Design: Diff-in-Diff

- Event-study design:

$$Y_{i,m,t} = \sum_{\substack{k=-4 \\ k \neq -1}}^{3} \beta_k 1_{i,k,t} T_i + \sum_{k=-4}^{3} \delta_k 1_{i,k,t} + \eta_m + \varepsilon_{i,t}$$

  - Matching group m: one treated household and its controls, household i, year t
  - $Y_{i,m,t}$ – different outcome variables, such as income, wealth, debt, consumption, employment, housing transactions, and relocations
  - T_i – treatment indicator
  - $1_{i,k,t}$ – indicates k years relative to event year
  - β_k – differences between treated and controls over time, relative to period -1
  - δ_k – time effects that affect both treated and controls
  - η_m – matching group fixed effects
  - $\varepsilon_{i,t}$ – error term, clustered at matching group level

Treatment Validation

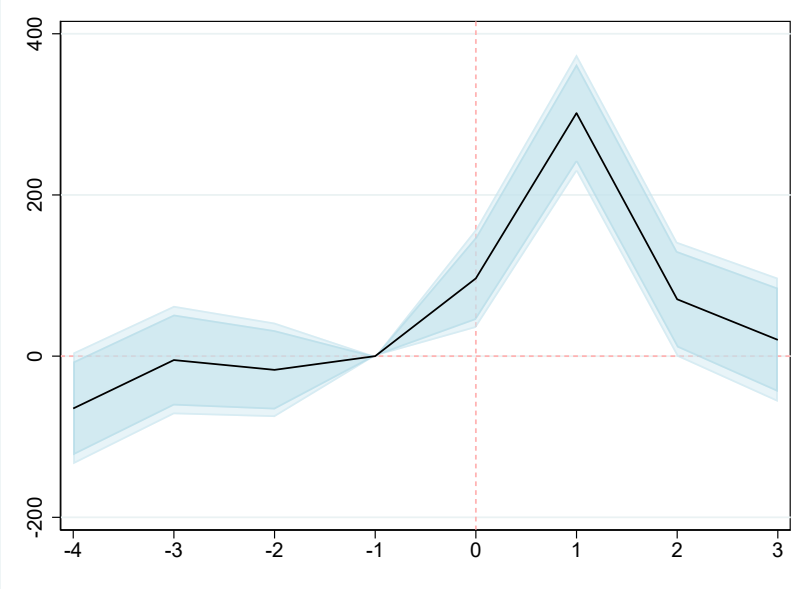


Figure. Transfers from insurance companies to households. Real USD in 2018 Prices.

- Marked increase in transfers from insurance companies to households following a natural disaster
- Treatment effectively captures affected households
- Confirmation particularly important because of treatment at municipality level

Persistent negative effects on income

- 720 USD over 4y, ≈20% of direct damages
- ↓ Labor Income falls more, ↑ Self-Employment

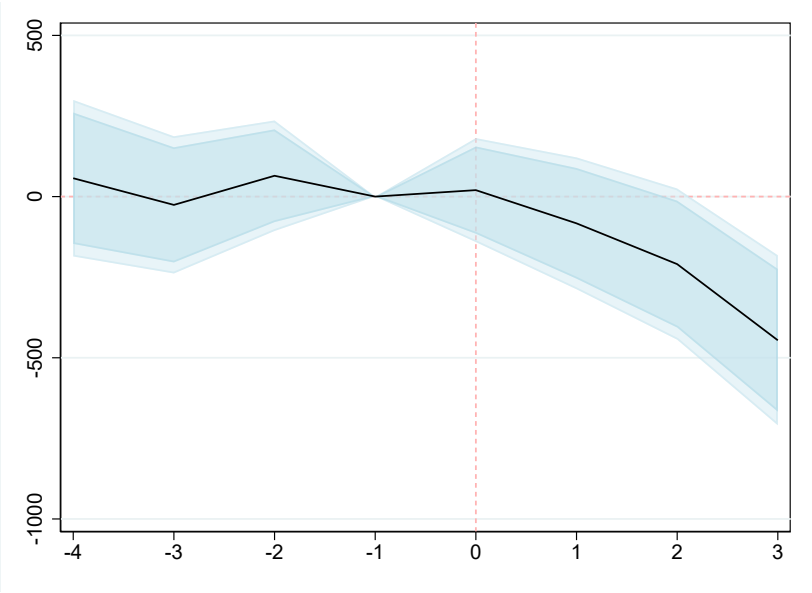


Figure. Income After Tax. Real USD in 2018 Prices.

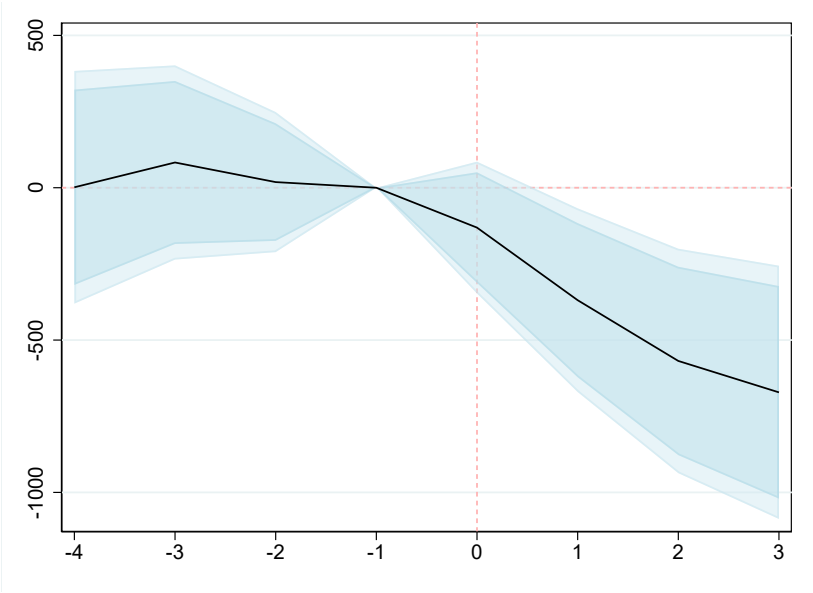


Figure. Labor Income. Real USD in 2018 Prices.

Income response strongest when firms are hardest hit

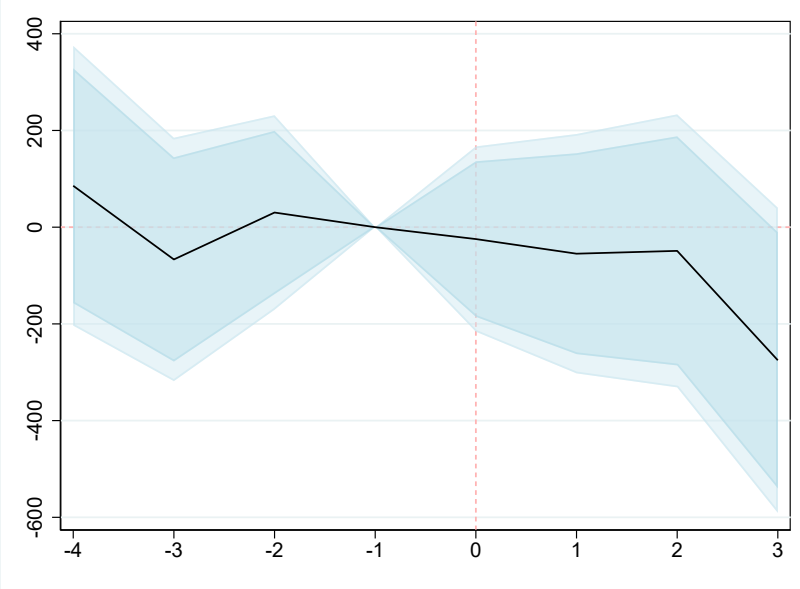


Figure. Household Damage: Income After Tax. Real USD in 2018 Prices.

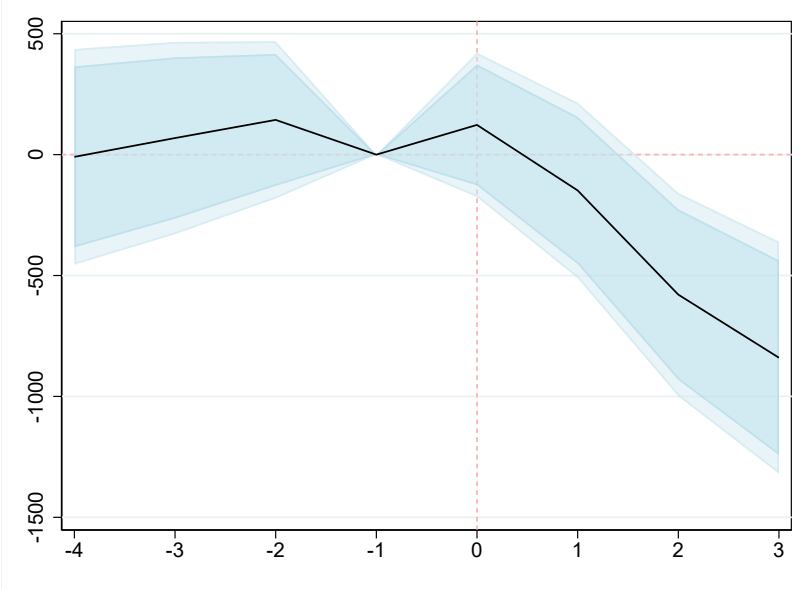


Figure. Firm Damage: Income After Tax Real USD in 2018 Prices.

...and larger unemployment effects when firms are hardest hit

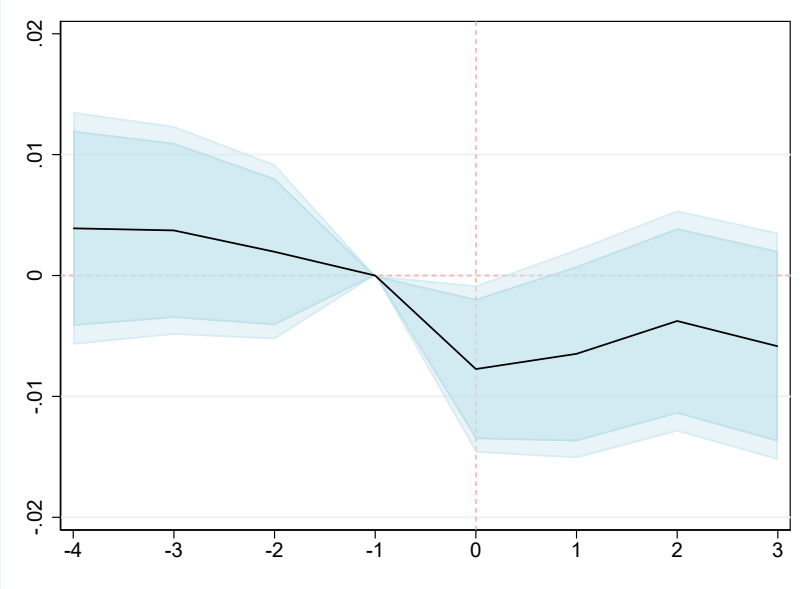
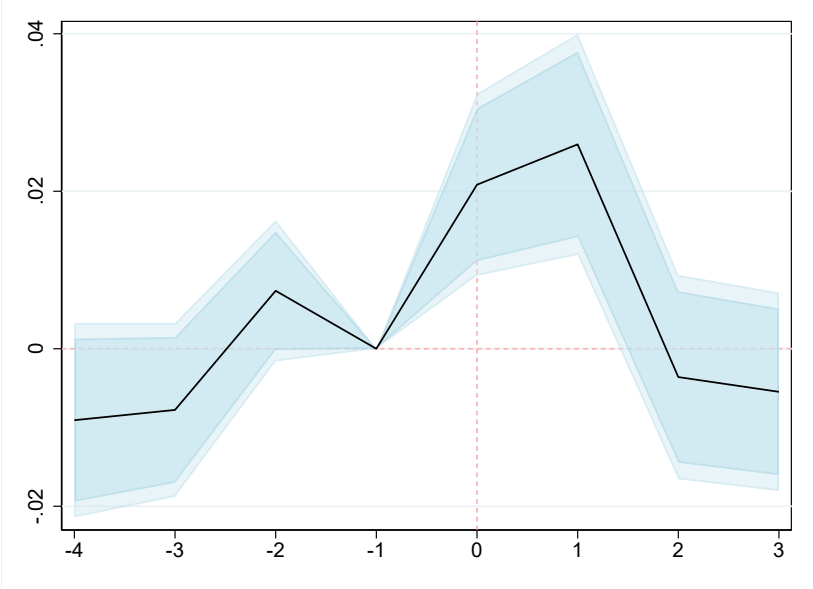


Figure. Household Damage: Unemployment. Real USD in 2018 Prices.



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Persistent negative effect on total consumption

Consumption

- Includes positive direct effect for households that receive insurance payouts (reconstruction, replacement, etc.)
- Indirect consumption response is larger than income response (≈2.8x), likely due to housing market

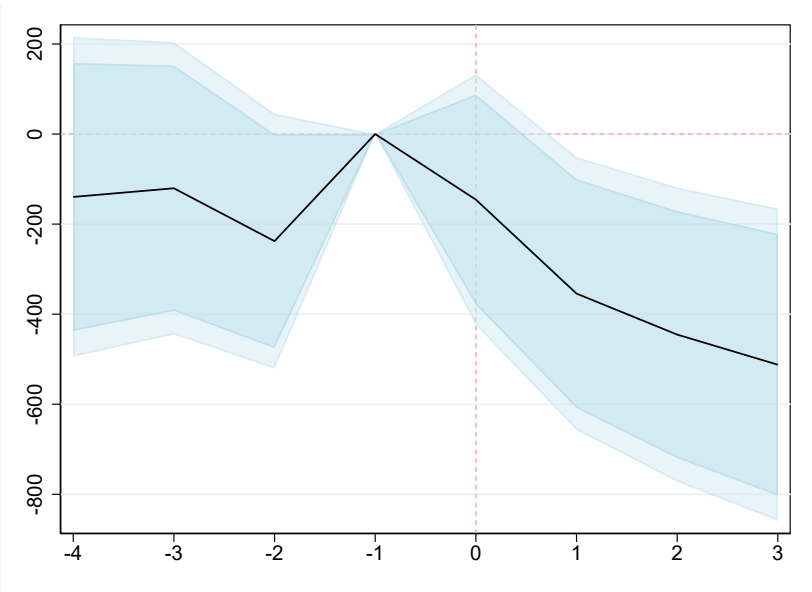
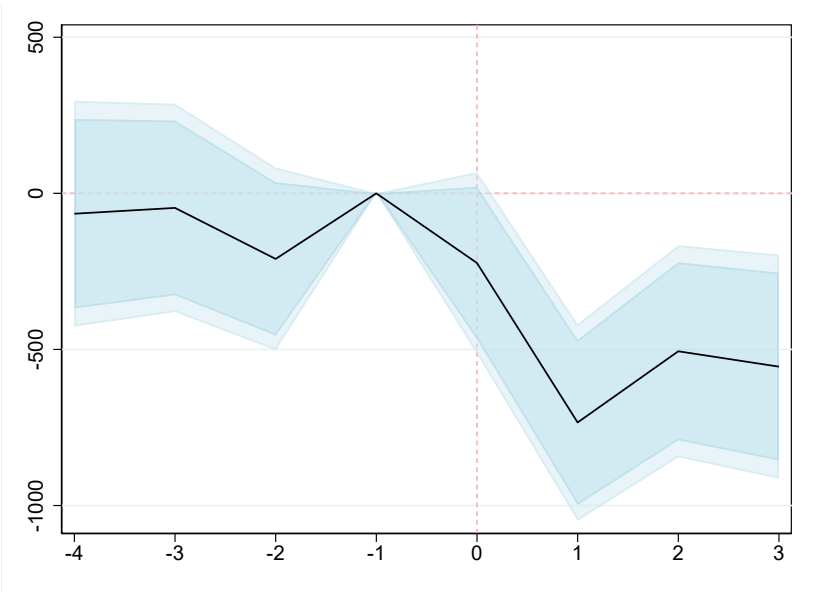


Figure. Total Consumption (**incl**. positive direct effect). Real USD in 2018 Prices.



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Decrease in debt and housing purchases

- ↓ Debt, ↓ Housing Purchases for homeowners
  - Qualitatively consistent with a stronger effect on consumption than income

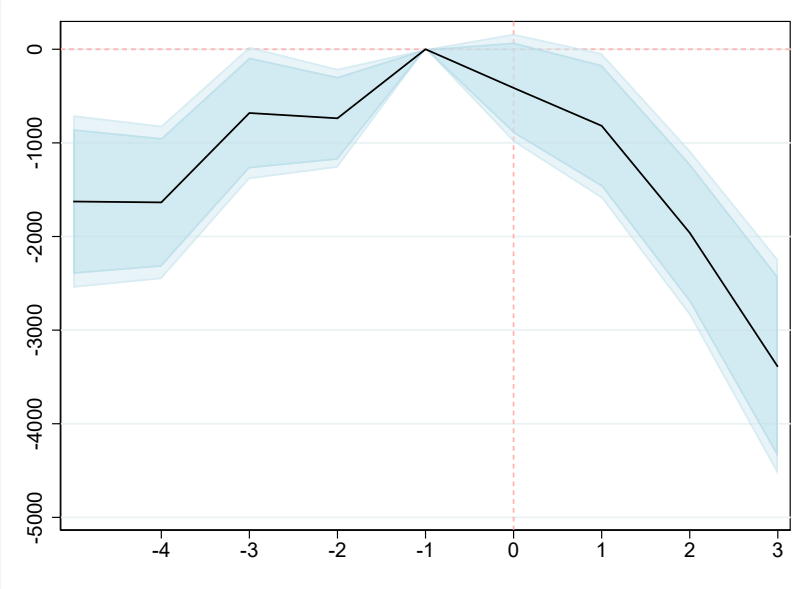

Figure. Debt. Real USD in 2018 Prices.

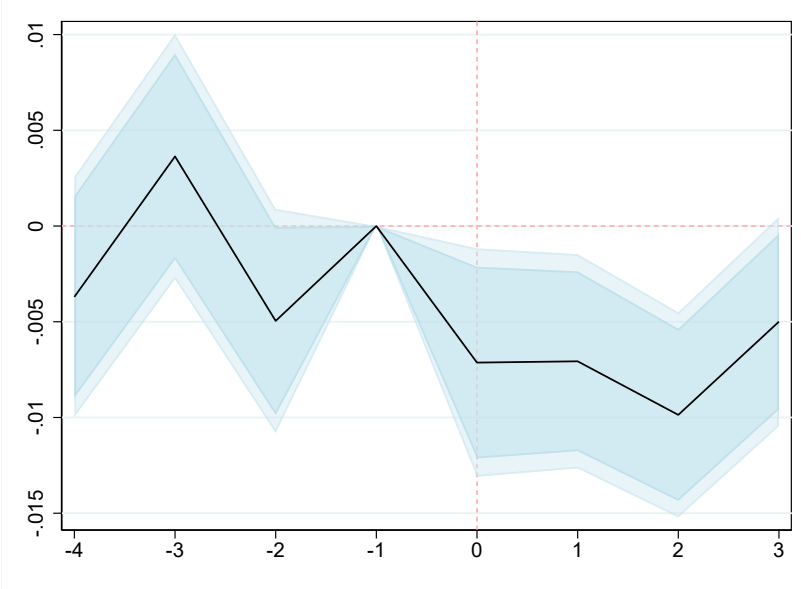

Figure. Housing Purchases. Real USD in 2018 Prices.

Non-owners more likely to move than home-owners

- ↑ Relocations for non-homeowners
  - Lock-in effect for home-owners?

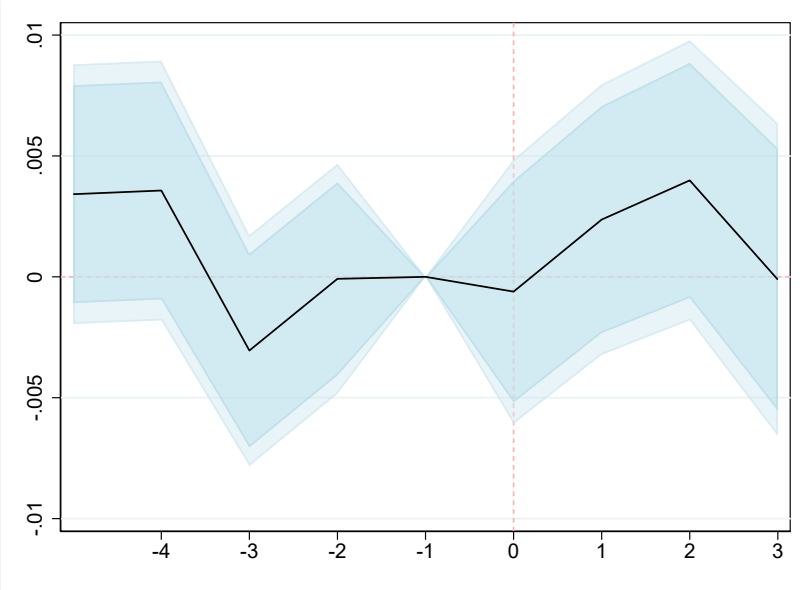

Figure. Homeowners: Moves. Real USD in 2018 Prices.

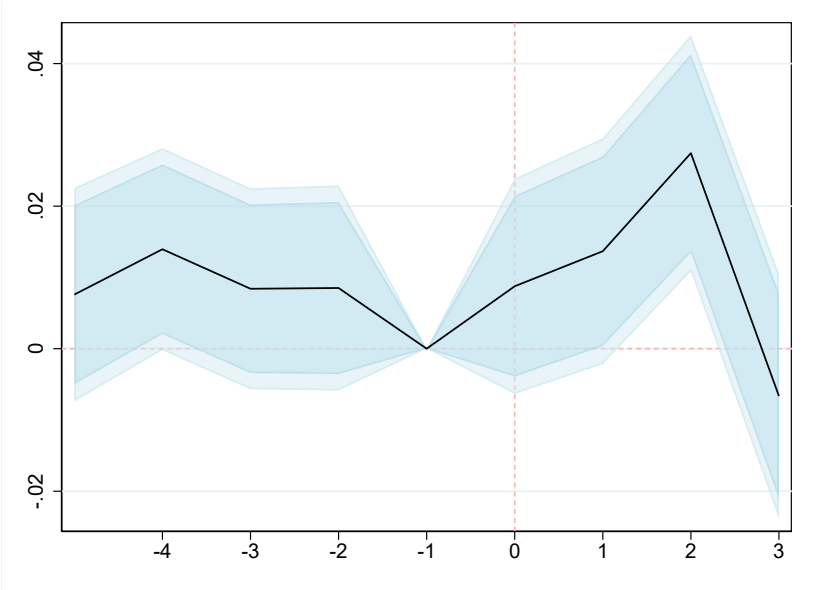

Figure. Non-owners: Moves. Real USD in 2018 Prices.

Conclusions

- Households are significantly affected by natural disasters due to broader economic repercussions
- While damages to property and other physical assets are fully compensated, coverage does not extend to reductions in labor income or declines in housing values
- Aligns with new generation of macro studies (Bilal and Känzig, 2024; Kotz et al, 2024) that report dramatically larger economic losses than earlier findings, even in developed regions like Norway
  - → Even with universal insurance, in high latitudes, the indirect economic consequences are significant and overall negative