Income Diversification to Manage Climate Risk

Motivation

Climate Vulnerability is Critical in Kyrgyzstan

- ~60% rural population
- Droughts in 2014 & 2021 caused crop yields to drop by 30–40%
- Also floods, landslides, cold spells

Household Coping Strategies

- Rural households (HH) hit by adverse shocks often diversify away from farming
- Documented in Brazil, Mexico, Ethiopia, and other African countries

Individual traits matter: Do more risk-averse or climate-aware HH diversify more?

Trade-off: Does diversifying lower average earnings?

Hypotheses

H1. Climate Shocks → Diversification

Expected: Yes

Do households add income sources after climate shocks?

- **Method:** Panel fixed-effects to identify within-household change; IV regression using weather anomalies (rainfall, temperature) as instruments for shock exposure.

H2. Risk Aversion ↗ Effect

Expected: Stronger

Do risk-averse households diversify more post-shock?

- **Method:** Interaction term (Shock × Risk Aversion) in the regression to see if cautious households respond more.

H3. Awareness ↗ Effect

Expected: Stronger

Do climate-aware households diversify more post-shock?

- **Method:** Interaction term (Shock × Climate Change Awareness) to test if those informed about climate risks adapt more.

H4. Shocks → Awareness

Expected: Yes

Does experiencing climate shocks increase climate risk perception?

- **Method:** Regressions of climate-change concern on shock history (current and past 5 years) to see if shocks raise awareness (with household FE, year FE for causality).

Data

LiK: Tracking ~3,000 HH (8,000 people), 7 waves, 16 years: 2010–13, 16, 19, 25.

Climate Shock Exposure

- **Survey-reported shocks**
- **Weather anomalies** – e.g., rainfall anomalies, extreme temperature

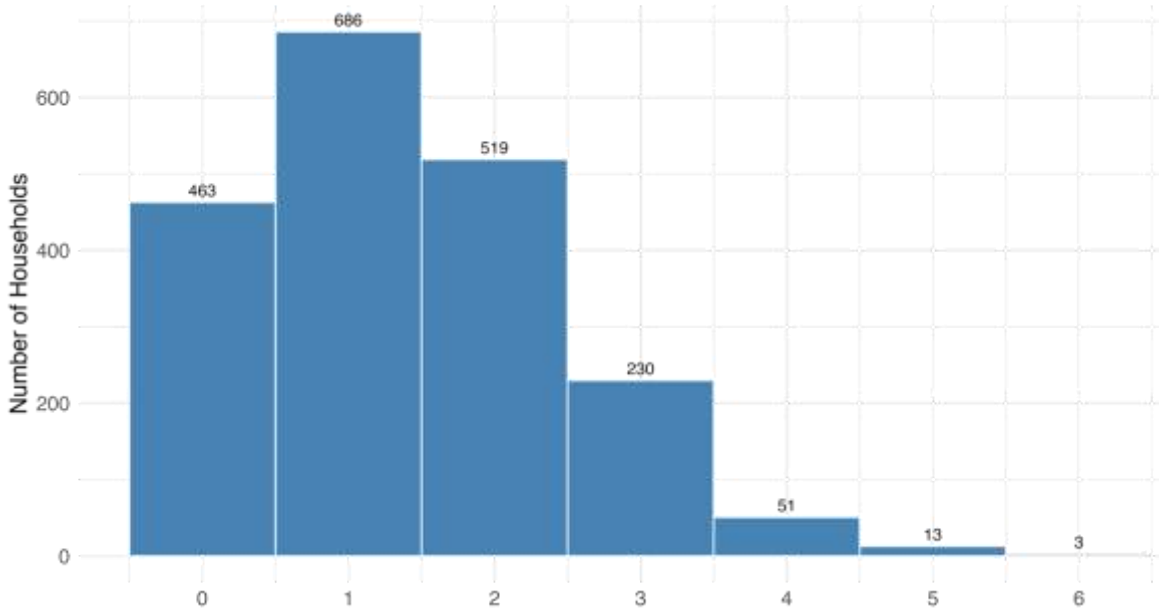
Income Diversification

- **Number of income sources** – farming, wages, self-emp., remittances (or added source)
- **Diversification index** (1 – income share Herfindahl index) =1 when income is split evenly
- What about diversification within agriculture?

Number and types of income sources

Number of Income Sources

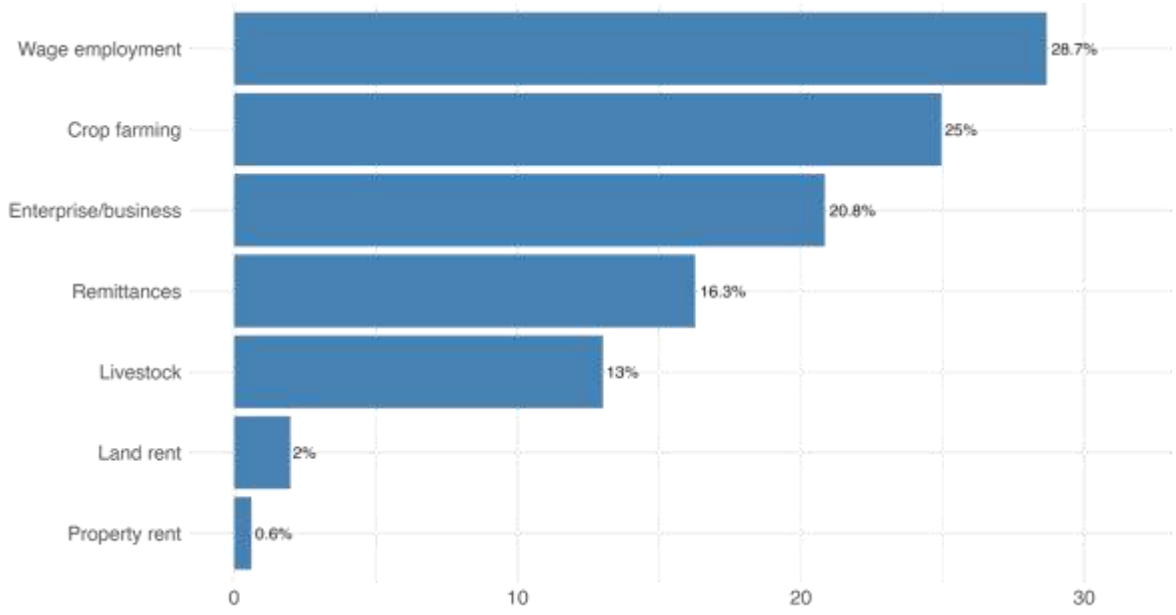
Most households rely on 1–2 sources of income.



Source: LiK 2025 wave.

Types of Income Sources

Farming and livestock grazing are significant income sources.



Source: LiK 2025 wave.

Relevant LiK Questions (2025)

Shock Exposure

- **H701:** In the last 12 months, has any of these extreme natural, infrastructural, social, family or personal shocks occurred in your household?
  - Drought | Insufficient water supply for farming or gardening | Fire
  - Extreme cold winter | Frosts
  - Too much rain or flood | Landslides
- **H702:** To what extent did this shock affected your household? [1–4]

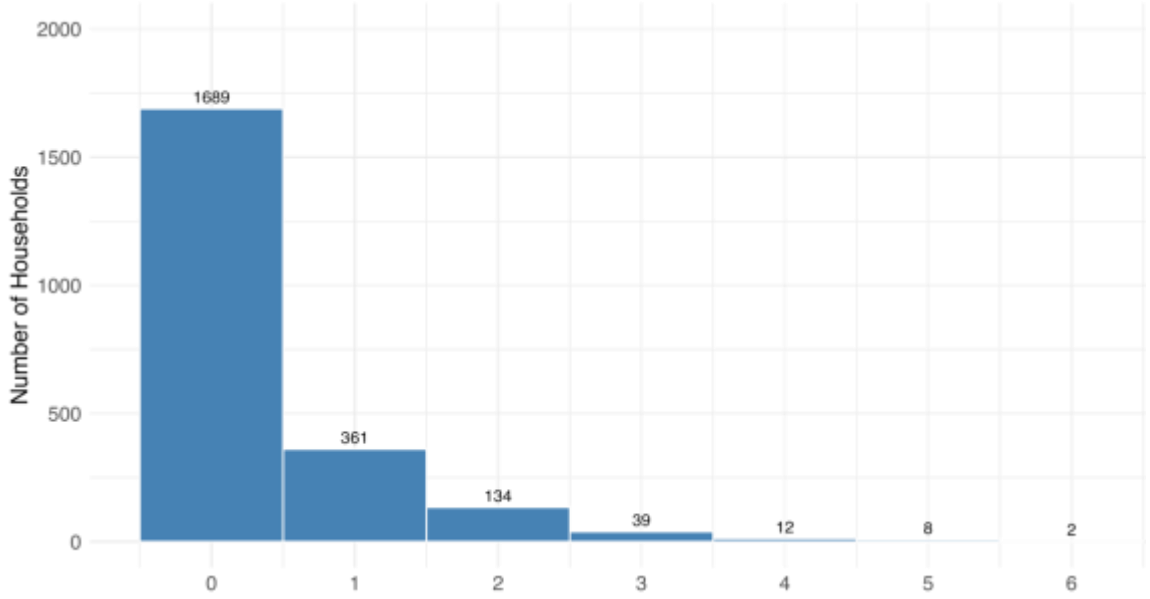
Risk Aversion [0–10]

- **I240:** How do you see yourself, are you generally a person who is fully willing to take risks or do you avoid taking risks?
- **I241:** How would you rate your willingness to take risks in the following areas?
  - Financial matters | Career decisions

Adverse Shock distribution and prevalence

Number of Shocks Experienced in Last 12 Months

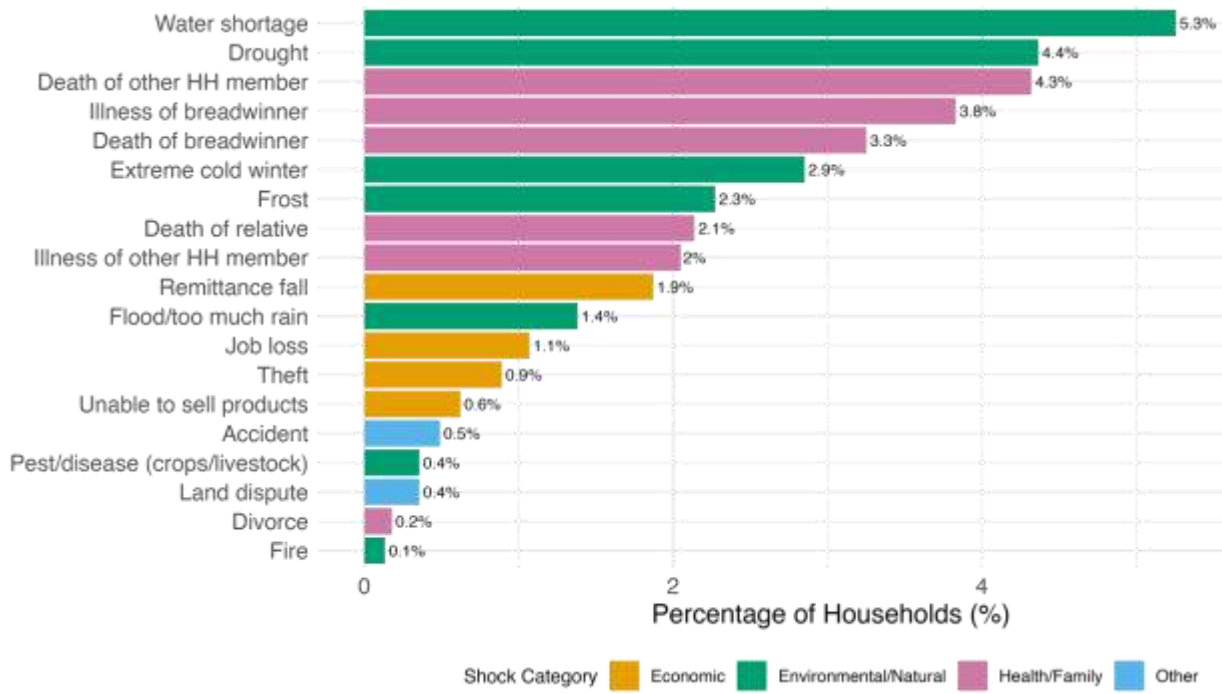
25% of households experienced a shock in the past year.



Source: LiK 2025 wave.

Share of Households Who Faced Specific Shocks

Climate shocks are the most prevalent.



Source: LiK 2025 wave.

Relevant LiK Questions (2025)

Climate awareness

- **H801:** In your view, how important is climate change in general? [1–4]
- **H802:** How strongly does climate change affect your life at the moment? [1–10]
- **H803:** Looking ahead, how strongly do you think climate change will affect your life in the next five years? [1–10]
- **H804:** Looking ahead, how likely is it that you will be affected by each of these events in the next five years? [1–10]
  - Drought | High temperature / Heat wave
  - Extreme cold winter | Autumn/spring frosts
  - Too much rain or floods

Empirical Methodology

H1: Climate Shocks Induce Income Diversification:

$$D_{it} = \beta_1 Shock_{it} + X_{it} + \mu_i + \delta_t + \varepsilon_{it},$$

Empirical Methodology

H2: Shocks-induced Diversification is Stronger for **Risk-averse** HH:

$$D_{it} = \beta_1 Shock_{it} + \beta_2 (Shock_{it} \times RiskAverse_i) + \beta_3 RiskAverse_{i(t)} + \mu_i + \delta_t + \varepsilon_{it},$$

H3: Shocks-induced Diversification is Stronger for **Climate-aware** HH:

$$D_{it} = \beta_1 Shock_{it} + \beta_2 \left(Shock_{it} \times Aware_{i(t)}\right) + \beta_3 Aware_{i(t)} + X_{it} + \mu_i + \delta_t + \varepsilon_{it},$$

Concerns

- No time variation for risk aversion > Fully captured by HH FE
- Climate awareness AND diversification are driven by common unobservables (e.g., education, risk aversion)

Empirical Methodology

H4: Climate Shocks Increase Climate Awareness

$$Aware_{it} = \beta + \alpha_o\, Shock_{it} + \alpha_1\, Shock_{it-1-5} + X_{it} + \mu_i + \delta_t + \varepsilon_{it}, \quad \textbf{(1)}$$

$$Aware_{it} = \beta + \alpha_o\, Shock_{it} + \alpha_1\, Shock_{it-1} + \alpha_2\, Shock_{it-2} + \alpha_3\, Shock_{it-3} + \alpha_4\, Shock_{it-4} + \alpha_5\, Shock_{it-5} + X_{it} + \mu_i + \delta_t + \varepsilon_{it}, \quad \textbf{(2)}$$

Robustness

- **Placebo** (other adverse shocks)
- **Alternative income diversification measures**
  - = 1 if added at least 1 source
  - # of sources
  - Herfindahl index of income diversification
- **Community v. household strategies**
  - Fewer diversification opportunities when shock hits entire communities
  - Large impact for individual shocks (e.g., landslide)?
  - Add village fixed effects
- **Persistence:** Impact of lagged shocks

Discussion

- **Research questions**
  - What else could climate shock exposure trigger?
- **Empirical strategy**
  - How to address endogeneity?
- **How to fully exploit 16-year panel?**
- **Policy implications**