Economics of Property Insurance

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The paper in two slides: slide 1

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- incentives / moral hazard (preventing careless behavior)

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- property-level disaster risk metrics (CoreLogic)
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Model and estimation

- optimal insurance contract between
  - risk-neutral insurer
  - risk-averse household with moral hazard
- Use micro-data and model moments to recover
  - contract-level HH risk aversion and effort costs
  - contract-level cost of moral hazard
  - contract-level risk-premia

The paper in two slides: slide 2

Stylized facts

- coverage limits rarely bind
- deductibles are
  - small vs property value
  - large vs. expected loss
- large risk premium
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- Cost of moral hazard small (0.7% of RP)
- Contract exposes household to substantial risk (29% of EL)
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Counterfactual: full insurance mandate

- removing deductibles $\rightarrow$ market collapses
- 46% of households lose access to insurance

Theory

- For any function ψ, introduce the moment generating function

$$M_{\psi,a}(\rho) := \mathbb{E}\left[e^{\rho\psi(X)}|a\right]$$

- Define retained loss under insurance $r(x) := x + p - I(x)$
- Contracting problem can be re-written

$$\begin{aligned} \max_{r(\cdot)} \quad & \mathbb{E}_1\left[r(X)\right] \\ \text{s.t.} \quad & M_{r,1}(\rho) && \leq M_{\text{id},1}(\rho) && \text{participation} \\ & e^{\rho\phi} M_{r,1}(\rho) && \leq M_{r,0}(\rho) && \text{incentives} \end{aligned}$$

Theory

- Denote likelihood ratio $\ell(x) := f_0(x)/f_1(x)$
- Assumption: zero damage identifies effort: $\ell(0) \approx 0$
- Outcome with moral hazard

$$r(x) = -\frac{1}{\rho}\left[\ln(\rho) + \ln\left(\lambda + \mu\left(e^{\rho\phi} - \ell(x)\right)\right)\right]$$

$$p = r(0)$$

$$\phi = \frac{1}{\rho}\ln\left(\frac{1 - e^{\rho p} M_{\mathrm{id},1}(\rho)}{1 - e^{\rho p} M_{r,1}(-\rho)}\right)$$

- First best

$$r^{fb}(x) = p^{fb}$$

$$p^{fb} = \frac{1}{\rho}\ln M_{\mathrm{id},1}(\rho)$$

- Risk premium π collected by insurers $\pi := \mathbb{E}_1[r(X) - X]$
- Cost of moral hazard (to insurer): difference between π and π^{fp}

Stylized facts: comment/question

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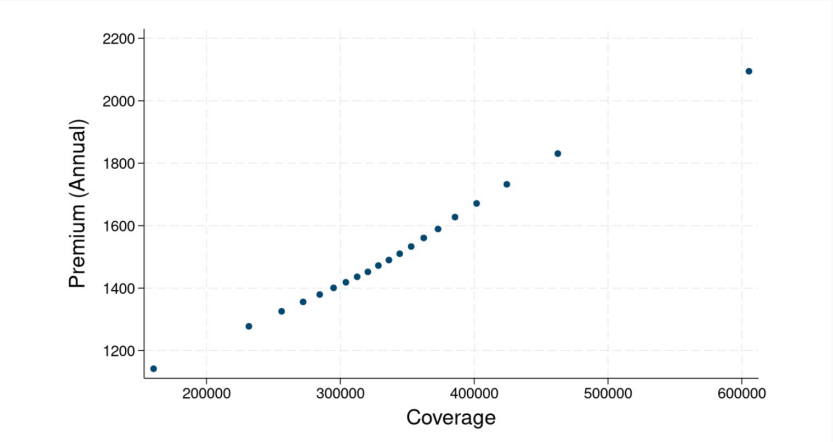

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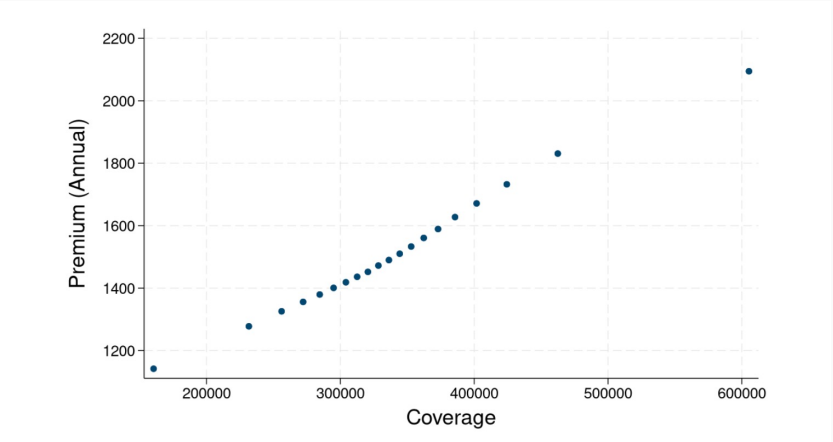

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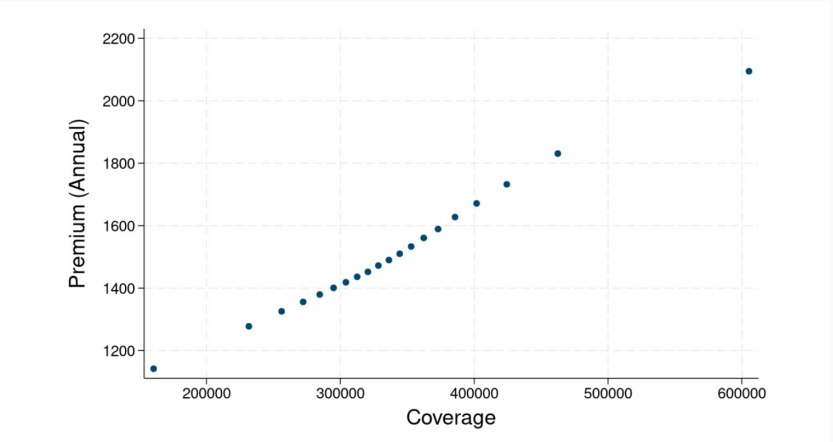

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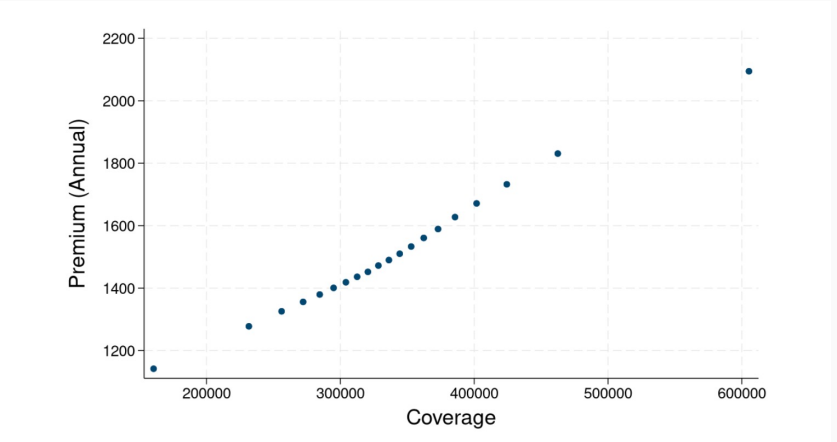

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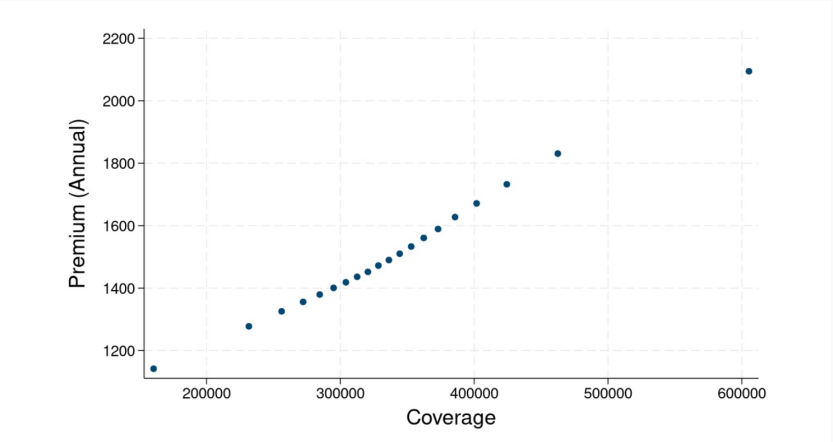

Punchline

- coverage seems to play a limited role in shaping insurers' payouts...
- ... but a big role in shaping pricing
- why? this is intriguing and deserves a longer discussion
  - Recovery value appropriately measured?
  - Insurer capital requirements?

Estimation: comments

Point Identification

- Estimate damage distribution under effort f_1
  - from Corelogic loss moments, and
  - functional form restriction (3-parameter distribution)

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  - CARA utility
  - Specific loss distribution
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- Results driven by functional form?

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Contract

- Actual contract $I_{\text{data}}(x)$ characterized by
  - premium p, deductible D, max coverage C
  - $I_{\text{data}}(x) = \min(C, \max(x - D, 0))$

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Contract

- Actual contract $I_{\text{data}}(x)$ characterized by
  - premium p, deductible D, max coverage C
  - $I_{\text{data}}(x) = \min(C, \max(x - D, 0))$
- Optimal contract $I(x)$
  - log-affine function of likelihood ratio $\ell(x)$
  - necessarily increasing in x? Only if

$$\ell'(x) \leq \frac{\rho\lambda}{\mu} + \rho\left(e^{\rho\phi} - \ell(x)\right)$$

    - restriction on how fast likelihood ratio rises with x
    - insurer gives less insurance in states more indicative of negligence.
    - condition is, by construction, satisfied in data
  - What happens to optimal contract if instead we restrict the set of contracts to
    - monotone contracts?
    - piecewise affine contracts?

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Model vs. Data

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    - construction type (masonry?)
    - age of plumbing and electrical systems
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- Suggestion 1: introduce a role for competition amongst insurers
- Suggestion 2: relate estimated effort costs $\hat{\phi}$ to costs of loss-mitigating systems

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- Tests of over-identifying restrictions (reject model?)
- Richer alternative:
  - assume ρ and ψ are functions of a small number of observable demographic and property characteristics
  - estimate gradient of ρ and ψ to such observable characteristics
  - obtain standard errors and possible test of over-identifying restrictions