

# 14.472 Public Finance II

Asymmetric Information: Welfare analysis if there is no market

---

Amy Finkelstein

Fall 2024

- Testing for selection [done]
- Empirical welfare analysis I: Using choices and claims [done]
- Empirical welfare analysis II: When can't use choices
  - Don't accept revealed preference [done]
  - Markets don't exist [**up next**]

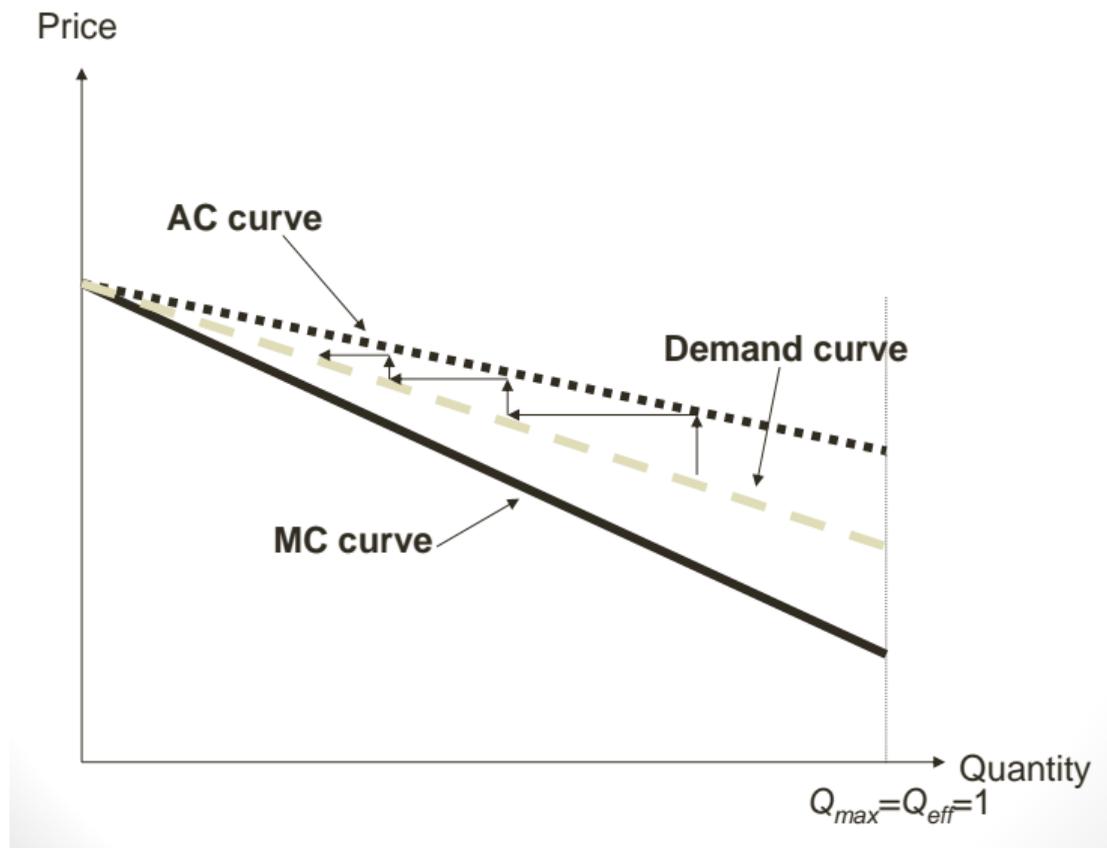
## Looking where the light is

- If require random variation in prices to trace out demand, do we only observe this where cost of mispricing is low?
- Looking only at welfare cost of price distortions of existing contracts, not distortions in contract space
- The ultimate contract distortion: markets that have completely unraveled
  - Empirical work (behavioral and non-behavioral) we have discussed requires that we observe market choices

## Markets that don't exist

- American Airlines lifetime pass
- Health insurance for young men in certain occupations in West Hollywood in the 1980s
- Divorce insurance
- Layoff insurance
- Dental insurance (max benefit  $\leq$  \$2,000)

# How do we empirically study markets that don't exist?



## How do we empirically study markets that don't exist?

- Need new techniques to study private information and welfare in markets that don't exist
- Will briefly describe several possible approaches
  - Randomized experiments (to estimate demand and costs for products that don't exist in equilibrium)
  - Calibrated utility models (e.g. Hosseini JPE 2015; Brown and Finkelstein AER 2008)
  - Eliciting private information about risk without observing choices - Hendren (EMA 2013)
  - Using behavioral responses to shocks to elicit value of insurance

## Randomized experiments

- If market has unravelled completely cannot observe demand - nothing offered in equilibrium
- An RCT however can estimate demand (and AC) curve by offering a product at randomized prices
- Example: health insurance in rural Pakistan (Fischer, Frolich, Landmann 2018)

## Setting: Little formal insurance / safety net

- Little formal insurance
  - Government pays for one-third of healthcare expenditures
  - Most (87%) of private expenditures are paid for out of pocket
- Limited informal safety net
  - Free public health facilities provide very few treatments and quality is perceived as poor
- Government spends less than 1% of GDP on health

## Setting: Implementing partner

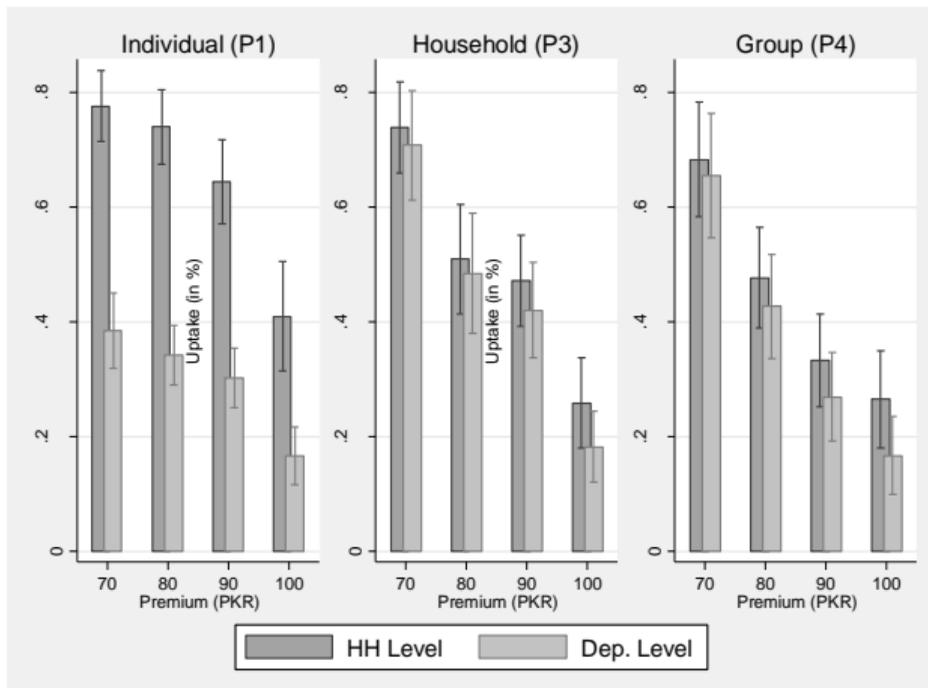
- National rural support program (NRSP)
  - NGO in rural Pakistan providing micro credit
  - Loans to community organizations (12-15 households) or credit groups (3-6 households)
  - Loans have joint liability at group level
- Loans come with (mandatory) hospital and disability insurance for its credit clients and their spouses

# Intervention

- Expand mandatory insurance by offering voluntary coverage for additional dependents
- Randomize three policies (or status quo - control group) at village level:
  - Within each village, randomize premium discounts across clients (so can trace out demand and cost curves for the policy)
- Three policies
  - Individual policy (P1): clients can enroll any number and combination of dependents
  - Household Policy (P3): client is required to enroll all dependents in household to obtain additional insurance
    - Question: Motivation?
  - Group Policy (P4): requires 50% takeup within the group to get policy
    - Question: Motivation?

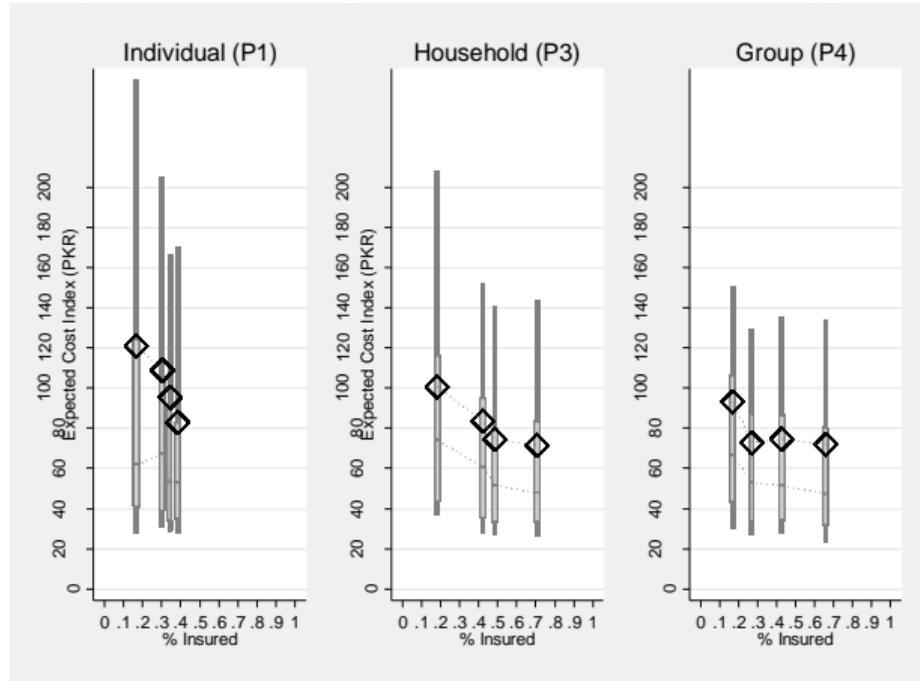
- 502 villages (6,461 client households)
- Partner provides data on enrollment and insurance claims
- Household survey measures SES and health indicators (health status, prior health care utilization)
- Choose to measure cost curves based on expected claims
  - Regress claims on baseline demographic and health characteristics
  - Question: Why not use observed claims rather than predicted claims?

Figure 2 - Insurance Demand, by product type



*Notes:* The bars indicate average uptake ratios on the household and dependent level. The depicted 95% confidence intervals account for clustered standard errors at the village level. Small differences between dependent and household level uptake in policies P3 and P4 occurs because of the smaller size of insured households.

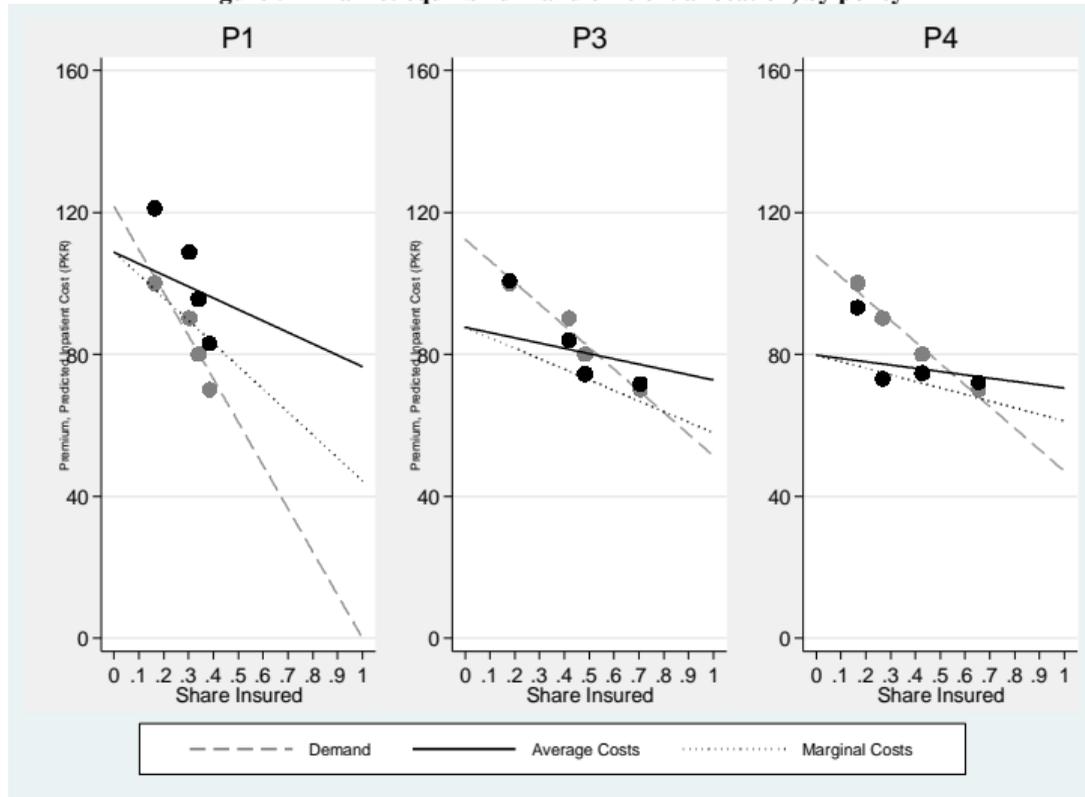
**Figure 4 - Distribution of expected cost index of insured over demand, by policy**



*Notes:* The box plot illustrates the interquartile range (IQR), with the median indicated by the line separating the box. The lower (upper) adjacent line shows the 90<sup>th</sup> (10<sup>th</sup>) percentile, respectively. The diamond indicates the value of the mean.

- Estimate demand and average cost curves based on raw data just shown
  - Assume linearity (visually assess / try alternatives)
- Impose two additional restrictions:
  - Average costs equal mean cost index at 100% takeup (seems reasonable)
  - Demand curve yields full coverage at zero price (a priori less clear; but can assess fit)

Figure 5 – Market equilibrium and efficient allocation, by policy



**Table 4 – Welfare Analysis**

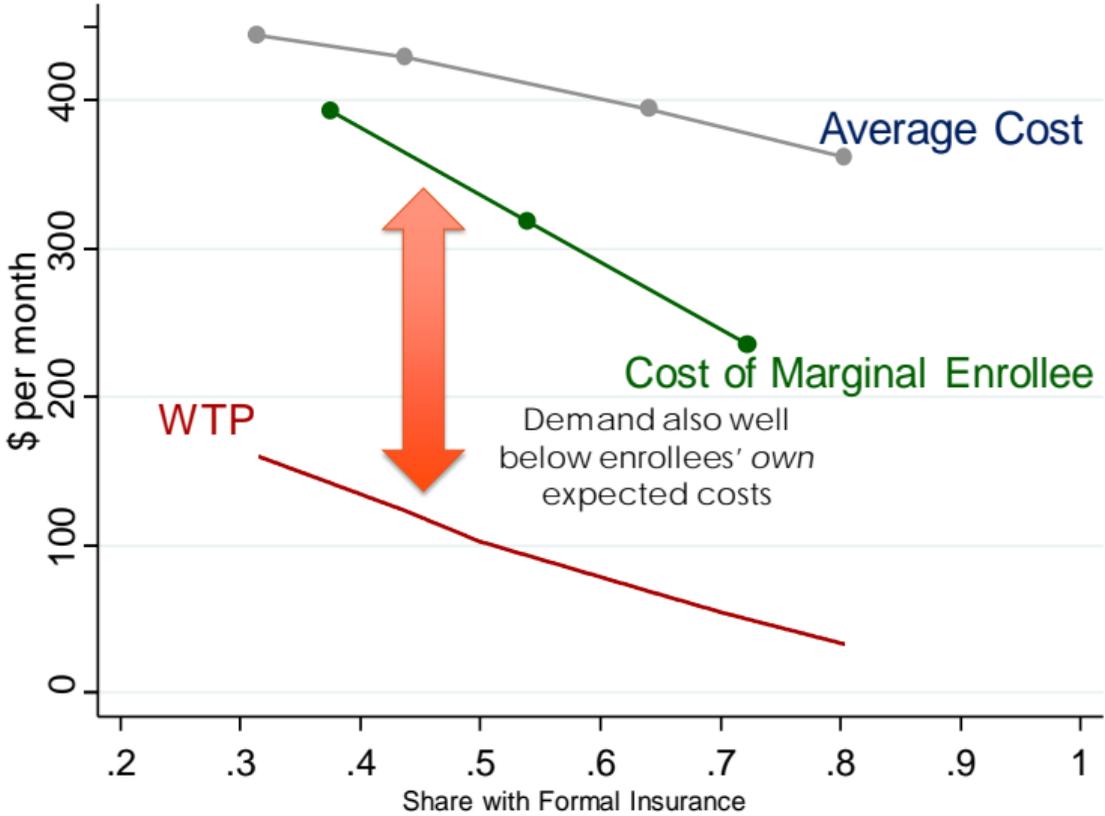
	Individual (P1)	Household (P3)	Group (P4)
<i>Equilibrium</i>			
Price	103,41	79,48	75,02
Quantity	0,15	0,54	0,54
Welfare	1,31	8,84	8.95
<i>Efficient</i>			
Price	93,67	64,22	67,11
Quantity	0,23	0,79	0,67
Welfare	1,49	9,83	9,29
<i>Loss</i>			
Quantity	0.08	0.25	0.13
Welfare	0,18	0.99	0,34
% Welfare	11,75	10,06	3,67

- Demand curves slope down
- Adverse selection exists
- Individual market almost unravels due to selection
  - Eyeballing: looks like mandates would be welfare reducing?
- Both equilibrium and efficient coverage higher for household or group policy
  - Eyeballing: Mandate for group policy may be welfare improving?

## Comment 1: the outside option is always key

- A really nice feature of this study is it takes place in a setting where there is little formal or informal insurance
- May explain why selection plays a bigger role than in low income Massachusetts market
  - Demand way below marginal costs
  - Presence of substantial uncompensated care
- One reason may see limited costs of adverse selection in US is that policy has responded
  - Alternative conjecture (Chicago school): selection only exists because of regulation that has created it
  - Hard to make that case for Pakistan setting.

# Reminder: Massachusetts low income exchange



## Comment II: Bundling as a way to reduce adverse selection

- Potential benefits and costs of bundling
  - Benefit: reduced selection
  - Costs: Preference heterogeneity / potential reduced demand
- Private Sector Example: Medicare advantage offered with free gym memberships (Cooper and Trivedi NEJM 2012)
- Public Sector Example: Tax exclusion to employer provided health insurance
  - Employer contributions to health insurance exempt from federal income tax
  - Largest federal tax expenditure (\$172.8 billion in 2019)
  - Potential benefit: create workplace based pools (reduce selection)
  - Potential costs... many

## Road Map: Studying Markets that Don't Exist

- Randomized experiments (to estimate demand and costs for products that don't exist in equilibrium) [Done]
- Calibrated utility models (e.g. Hosseini JPE 2015; Brown and Finkelstein AER 2008) **[Up Next]**
- Eliciting private information about risk without observing choices - Hendren (EMA 2013)
- Using behavioral responses to shocks to illicit value of insurance

## WTP for non traded goods

- Fundamental challenge for a lot of public finance welfare analysis which (almost by construction) analyses WTP in markets where prices are not observed
  - Insurance markets that don't exist
  - public goods (Samuelson condition)
  - publicly provided in-kind benefits (food stamps, housing, health care, health insurance)
- This is an exciting (and challenging) opportunity for more work
- Current tool kit:
  - Hypothetical willingness to pay
  - RCT ("create a market")
  - Calibrated life-cycle utility models (up next)
  - Use behavioral responses to infer value (hold that thought...)

## Calibrated life cycle utility models

- Useful to have in your tool kit
- Idea: write down and calibrate a utility maximizing model
  - NB: this was done “within” EFS (2010) on welfare cost of adverse selection in annuity markets
  - For a given set of parameters solved for individual’s EPDV utility with and without annuity, assuming choose optimal consumption path given (each) budget set
- Useful for calculating WTP for insurance that isn’t privately traded
  - Medicaid (De Nardi et al. AER 2016 “Medicaid Insurance in Old Age”)
  - Annuities (Hosseini JPE 2015)
  - Long-term care insurance (Brown and Finkelstein AER 2008)
  - High Deductible health insurance (Mahoney AER 2015)
- NB: Hosseini (2015) explores adverse selection with this approach. Other papers look at other reasons for markets non-existing.

## Calibrated life cycle utility models (con't)

- Useful for calculating WTP for insurance that isn't privately traded
  - Medicaid (De Nardi et al. AER 2016 "Medicaid Insurance in Old Age")
  - Annuities (Hosseini JPE 2015)
  - Long-term care insurance (Brown and Finkelstein AER 2008)
  - High Deductible health insurance (Mahoney AER 2015)
- Also useful for questions of whether consumers are behaving optimally
  - e.g. is saving for retirement "too low"?
  - Optimal savings problems (e.g. Scholz et al. JPE 2006 "Are Americans Saving Optimally For Retirement?")
- These exercises also highlight key parameters in calibration for which one might like more empirical estimates

## Road Map: Studying Markets that Don't Exist

- Randomized experiments (to estimate demand and costs for products that don't exist in equilibrium) [Done]
- Calibrated utility models (e.g. Hosseini JPE 2015; Brown and Finkelstein AER 2008) ["Done"]
- Eliciting private information about risk without observing choices - Hendren (EMA 2013) **[Up Next]**
- Using behavioral responses to shocks to illicit value of insurance

## Eliciting private information without choices

- Hendren (EMA, 2013)
  - Very nice example of using theory to guide empirical analysis
- Motivating observation: Insurance rejections
  - In many non-group insurance settings, insurance companies reject applicants with certain observable (often high risk) conditions despite absence of restrictions on charging a higher price
  - e.g. In non-group health insurance, 1 in 7 applications to large insurance companies rejected
  - e.g. in long-term care insurance, up to 25% of 65 year olds may have health conditions that trigger automatic rejections
- Paper overview:
  - Develops theory for why markets may unravel given private information (and endogenous contracts)
  - Provides testable empirical predictions which he implements to see if private information can explain observed rejections

# The rejection puzzle

- Why reject on observables vs. charge a higher price?
- Potential explanations include
  - Liquidity constraints / cannot “afford” insurance
  - Agency problems with insurance agents
  - Political economy (bad pr; threat of regulaton)
  - Private information “greater” among those rejected
- Hendren considers private information
  - Does not rule out role for other explanations
  - Interesting area for more work!

## Motivating theory (loosely described)

- Shows how you can get rejections (“no trade”, “unravelling”) in market with endogenous contracts
  - Previously only shown w fixed contracts (Akerlof 1970)
- Market unravels when wtp for small amount of insurance is less than pooled cost of providing this insurance to those of equal or higher risk, for all risk levels
  - Provides a precise way of defining what we mean by “more private information”
- Characterizes barrier to trade imposed by distribution of types in terms of implicit tax (or markup) individuals would have to pay on insurance premiums in order for market to exist
  - Implicit tax for a given risk type depends on the expected risk type of all those of higher risk type (whom he would have to pool with)
  - Key comparative static: implicit tax higher for rejectees than non-rejectees, and high enough to explain absence of trade for “plausible” values of WTP for insurance

## Agents' environment

- endowed with nonstochastic wealth  $w > 0$
- face a potential loss of size  $l > 0$ , with privately known probability  $p$ , distributed w cdf  $F(p|X)$ 
  - $X$  is whatever observed information insurers could use to price (can abstract from)
- expected utility:  $pu(c_L) + (1 - p)u(c_{NL})$ 
  - where  $c_L(c_{NL})$  denotes consumption in event of loss (no loss)
- An Allocation  $A = \{c_L(p), c_{NL}(p)\}$  consists of consumption in each state
  - one allocation is the endowment (i.e. what happens with no trade):  $\{w - l, w\}$

## An "Implementable Allocation" must satisfy

1. Allocation  $A$  is resource feasible:

$$\int [w - pl - pc_L(p) - (1 - p)c_{NL}(p)] dF(p) \geq 0.$$

2. Allocation  $A$  is incentive compatible:

$$\begin{aligned} & pu(c_L(p)) + (1 - p)u(c_{NL}(p)) \\ & \geq pu(c_L(\tilde{p})) + (1 - p)u(c_{NL}(\tilde{p})) \quad \forall p, \tilde{p} \in \Psi. \end{aligned}$$

3. Allocation  $A$  is individually rational:

$$\begin{aligned} & pu(c_L(p)) + (1 - p)u(c_{NL}(p)) \\ & \geq pu(w - l) + (1 - p)u(w) \quad \forall p \in \Psi. \end{aligned}$$

## No trade condition

- If endowment is the only implementable allocation, no one can obtain any insurance
- Key friction: if type  $p$  prefers an insurance contract relative to her endowment, then the pool of risks  $P \geq p$  will also prefer this insurance contract relative to their endowment
- Therefore, unless some type is willing to pay the pooled cost of all worse risks so as to be able to obtain insurance, there can be no trade

THEOREM 1—No Trade: *The endowment,  $\{(w - l, w)\}$ , is the only implementable allocation if and only if*

$$(1) \quad \frac{p}{1-p} \frac{u'(w-l)}{u'(w)} \leq \frac{E[P|P \geq p]}{1 - E[P|P \geq p]} \quad \forall p \in \Psi \setminus \{1\},$$

where  $\Psi \setminus \{1\}$  denotes the support of  $P$ , excluding the point  $p = 1$ . Conversely, if (1) does not hold, then there exists an implementable allocation that strictly satisfies resource feasibility and individual rationality for a positive mass of types.

## No trade condition: intuition

- LHS is MRS between  $c_{NL}$  and  $c_L$  evaluated at the endowment
- RHS cost of this transfer  $\frac{E[P|P \geq p]}{1 - E[P|P \geq p]}$ 
  - Actuarially fair isocost for type  $p$ :  $pc_L + (1 - p)c_{NL} = \Pi$  (for some constant  $\Pi$ )
  - Actuarially fair relative price of  $c_L$  (in units of  $c_{NL}$ ) for type  $p$  is  $\frac{p}{1-p}$
- If  $MRS <$  price ratio, consumer doesn't buy even \$1 of insurance
- All risk averse agents WTP for actuarially fair insurance
  - But will they be willing to pay more?
- Because of binding IC constraint, offering a contract that reallocated from  $c_{NL}$  to  $c_L$  requires also doing it for all  $P \geq p$ 
  - Expected loss for all these types is  $E[P|P \geq p]$
- Therefore the relative price of  $c_L$  for type  $p$  that respects implementability is  $\frac{E[P|P \geq p]}{1 - E[P|P \geq p]}$

## Quantification: Pooled Price Ratio $T(p)$

- Rearrange no trade condition to yield:

$$\frac{u'(w-l)}{u'(w)} \leq \frac{E[P|P \geq p]}{1-E[P|P \geq p]} \frac{1-p}{p} \equiv T(p)$$

- $T(p)$  denotes markup a type  $p$  would have to be willing to pay in order to cover the pooled cost of worse risks adverse selecting their insurance contract
- No trade condition says: unless someone in the economy is WTP the pooled cost of worse risks in order to obtain some insurance, there can be no profitable insurance market

## Corollary: quantifying barriers to trade

DEFINITION 2: For any  $p \in \Psi \setminus \{1\}$ , the *pooled price ratio at  $p$*  is given by

$$(3) \quad T(p) = \frac{E[P|P \geq p]}{1 - E[P|P \geq p]} \frac{1 - p}{p}.$$

Given  $T(p)$ , the no-trade condition has a succinct expression.

COROLLARY 2—Quantification of the Barrier to Trade: *The no-trade condition holds if and only if*

$$(4) \quad \frac{u'(w - l)}{u'(w)} \leq \inf_{p \in \Psi \setminus \{1\}} T(p).$$

## Quantifying barriers to trade: Interpretation

- Whether or not there can be trade depends on:
  - Agent's underlying value of insurance (i.e. LHS of corollary  $\frac{u'(w-l)}{u'(w)}$ )
  - Cheapest cost of providing that insurance (i.e. RHS of corollary "minimum pooled price ratio")
- "Minimum pooled price ratio" can be interpreted as a implicit tax

The minimum pooled price ratio has a simple tax rate interpretation. Suppose for a moment that there were no private information, but instead a government levies a sales tax of rate  $t$  on insurance premiums in a competitive insurance market. The value  $\frac{u'(w-l)}{u'(w)} - 1$  is the highest such tax rate an individual would be willing to pay to purchase any insurance. Thus,  $\inf_{p \in \mathcal{P} \setminus \{1\}} T(p) - 1$  is the implicit tax rate imposed by private information. Given any distribution of risks,  $F(p)$ , it quantifies the implicit tax individuals would need to be willing to pay so that a market could exist.

## No trade condition: more intuition

- Relationship to EFC graph:
  - LHS of no trade condition is demand
  - RHS is average cost curve
  - the "markup" is the vertical distance between AC and MC
  - unravelling occurs demand is everywhere below AC
- Core ideas are the same but new framework allows
  - for endogeneous contracts
  - for getting empirical traction on adverse selection costs when market outcomes not observed

**COROLLARY 3**—Comparative Static in the Minimum Pooled Price Ratio: Consider two market segments, 1 and 2, with pooled price ratios  $T_1(p)$  and  $T_2(p)$ , and common von Neumann–Morgenstern (vNM) preferences  $u$ . Suppose

$$\inf_{p \in \Psi \setminus \{1\}} T_1(p) \leq \inf_{p \in \Psi \setminus \{1\}} T_2(p).$$

*Then if the no-trade condition holds in segment 1, it must also hold in segment 2.*

Higher values of the minimum pooled price ratio are more likely to lead to no trade. Because the minimum pooled price ratio characterizes the barrier to trade imposed by private information, Corollary 3 is the key comparative static on the distribution of private information provided by the theory.

## Provides way to quantify "magnitude of private information"

DEFINITION 3: For any  $p \in \Psi$ , define the *magnitude of private information at  $p$*  by

$$(5) \quad m(p) = E[P|P \geq p] - p.$$

The value  $m(p)$  is the difference between  $p$  and the average probability of everyone worse than  $p$ . Note that  $m(p) \in [0, 1]$  and  $m(p) + p = E[P|P \geq p]$ . The following comparative static follows directly from the no-trade condition (1).

COROLLARY 4—Comparative Static in the Magnitude of Private Information: *Consider two market segments, 1 and 2, with magnitudes of private information  $m_1(p)$  and  $m_2(p)$ , and common support  $\Psi$  and common vNM preferences  $u$ . Suppose*

$$m_1(p) \leq m_2(p) \quad \forall p \in \Psi.$$

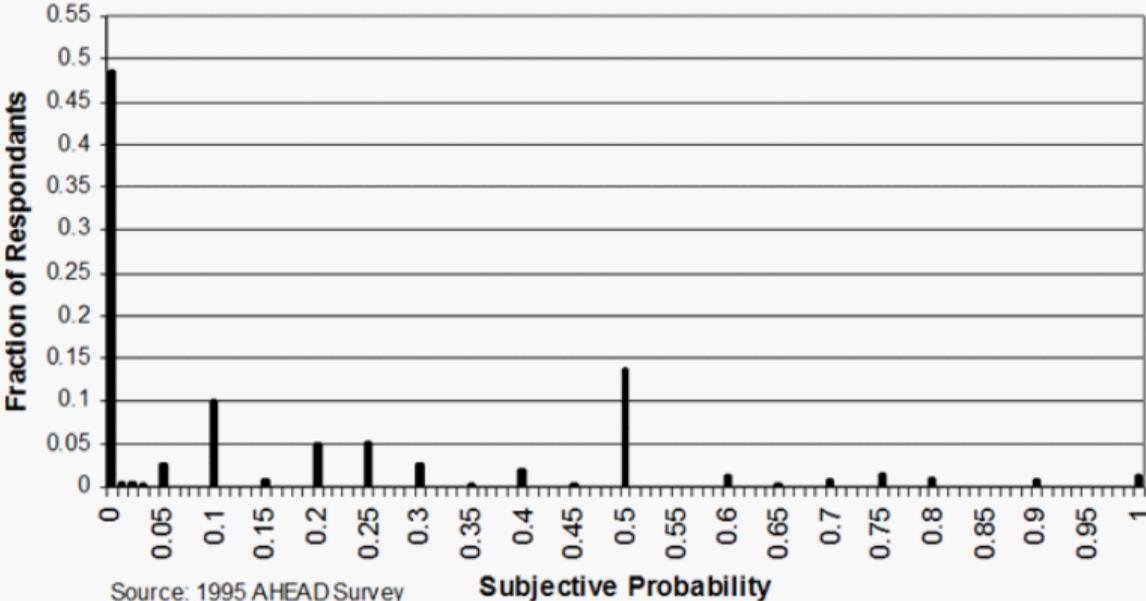
*Then if the no-trade condition holds in segment 1, it must also hold in segment 2.*

## Empirical exercises

- Goal: can no-trade condition explain rejections
- First, do individuals who are rejected have private information (conditional on public information)?
  - i.e. is  $F(p|x)$  a non-trivial distribution?
- Second, do individuals who are rejected have more private information than non-rejects?
  - Precise definition of “more” private information given by theory (Corollaries 3 and 4)
- Third, per corollary 2, is quantity of private information (measured by minimum price ratio) large (small) enough to explain (the absence of) rejections for “plausible values” of agents’ wtp  $\frac{u'(w-l)}{u'(w)}$

- Health and Retirement Survey (HRS) panel survey (1993-2008) of older individuals (55+)
- Studies three markets: long-term care insurance, life insurance, and non group health insurance
- Rich set of health and demographic information (including what would be used to price or reject), insurance coverage, and (subsequent) realized losses
- Key data element: self-reported subjective probabilities on losses incurred in each market
  - e.g Long-term care: "What is the percent change (0-100) that you will move to a nursing home in the next five years?"
  - Uses it to infer distributions of beliefs
- Key challenge: substantial elicitation error in subjective probabilities
  - uses information on joint distribution of elicitations and realized events corresponding to these elicitations to deal with potential errors in elicitations

## Figure 2: Distribution of Subjective Probability of Entering NH within Five Years



## Summary of results

- Rejectees have private information
  - Subjective probabilities are predictive of realized loss conditional on observable characteristics
- Rejectees have more private information
  - Subjective probabilities are more predictive for the rejectees than the non rejectees (conditional on observables)
- Once he has characterized the distribution of types he can estimate the implicit tax (i.e. expected risk type of all those of higher risk type relative to own risk type)
  - Estimates on order of 40-80% for rejectees (depending on market), much smaller for non rejectees
- For “plausible” wtp, these magnitudes of implicit taxes can explain why market doesn't exist
  - Key step: don't observe choices so calibrate (vs estimate) a WTP

## Additional Applications

- Hendren (2017) applies same approach to asking whether private UI can exist (will discuss in next section)
- Hendren and Herbst (2021) apply approach to asking if market for college loan contracts could exist
  - eg earnings equity contracts (Friedman 1955); employment-contingent loans; limited liability loans
  - using Beginning Postsecondary Students survey, show students have private information about future earnings
  - but also a lot of residual earnings uncertainty (hence value of insurance)
  - using a calibrated utility model, calculate that adverse selection causes this market to unravel and that government creating or subsidizing this market would have considerable welfare benefits

## Aside: Credit Markets

- Market for equity-based college loans unravelling is an extreme version of incomplete markets for borrowing
  - measured as a share of lifetime income, there is almost no **uncollateralized** lending
  - Collateralized lending (e.g. mortgage) with down payment
- Will often come up under the rubric of “liquidity constraints’: not able to borrow at (relevant-risk adjusted) market interest rate
  - NB: not to be confused with poverty (low EPDV of resources)
  - Contrast: can’t “afford” unemployment insurance vs. health insurance
- Public finance applications include: credit market regulation, mortgages, student loans, unemployment insurance (coming up)
  - recall: additional subtleties to welfare analysis of asymmetric information (e.g. deFusco et al. 2021)

- Heavy lifting in Hendren (2013) is to characterize the distribution of private information using self-reported subjective probabilities (and ex post experience)
- Compares estimate of implicit tax to “willingness to pay” from other estimates (e.g. Brown and Finkelstein 2008 for ITCs)
- Key challenge: How do we come up with willingness to pay when market doesn't exist? (see prior discussion!)

## Road Map: Studying Markets that Don't Exist

- Randomized experiments (to estimate demand and costs for products that don't exist in equilibrium) [Done]
- Calibrated utility models (e.g. Hosseini JPE 2015; Brown and Finkelstein AER 2008) ["Done"]
- Eliciting private information about risk without observing choices - Hendren (EMA 2013) [Done]
- Using behavioral responses to shocks to illicit value of insurance [Coming next]

## Studying Markets That Don't Exist: Recap

- Randomized experiments [Done]
- Eliciting private information from beliefs (Hendren EMA) [done]
- Calibrated utility models [“done”]
- Using behavioral responses to elicit value of insurance [Coming next: Optimal design of social insurance]

## Using Behavioral Responses for Welfare Analysis

- Work thus far has taken an ex-ante approach to welfare analysis:
  - Estimate willingness to pay for health insurance relative to costs and use it to back out welfare consequences of lack of insurance
- Challenges for studying welfare of insurance products that aren't traded
  - E.g. Medicaid - public health insurance provided for free to uninsured low income individuals
  - e.g. Unemployment insurance in the US (no private market)
- Can we use behavioral responses to risk (or risk realization)?
  - Bridge to upcoming topic: welfare analysis of optimal social insurance level (Bailey-Chetty model)
    - Use behavioral responses to unemployment to derive optimal unemployment insurance benefit level
  - Will return to when we study value of Medicaid
    - Finkelstein, Hendren, Luttmer (2019) try to use ex-post impacts of Medicaid from Oregon HIE for welfare analysis