Old, frail and uninsured: Accounting for features of the U.S. long-term care insurance market

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*These are our personal views and not those of the Federal Reserve System.

Motivation

- How does private information about risk exposure distort insurance arrangements?
- Since Rothschild and Stiglitz (1976) the focus of both theoretical and empirical research has been on coverage and pricing of the *insured*.
- Examples include Chiappori and Salanié (2000), Finkelstein and McGarry (2006), Hellwig (2010), Lester et al. (2017), Fang et al. (2008).

More Motivation: No-Trade Contracts

- Private information can also affect who is offered insurance and who is denied coverage.
- In particular, adverse selection when combined with other frictions can be so severe that there are no gains to trade between an insurer and *all* individuals in a particular risk group.

- Hendren (2012) describes a specific case where an entire risk group is denied coverage. Provides empirical evidence that private information is concentrated in rejected risk groups.
- Chade and Schlee (2017) conduct a theoretical analysis that illustrates how adverse selection in conjunction with administrative costs and monopoly power can produce no-trade contracts.

Motivation

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- Since Rothschild and Stiglitz (1976) the focus of both theoretical and empirical research has been on coverage and pricing of the *insured*.
- Examples include Chiappori and Salanié (2000), Finkelstein and McGarry (2006), Hellwig (2010), Lester et al. (2017), Fang et al. (2008).

Motivation

- How does private information about risk exposure distort insurance arrangements?
- However, Hendren (2012) and Chade and Schlee (2017) suggest that private information also affects the extensive margin: who is offered insurance and who is denied coverage.
- They describe settings where adverse selection is so severe that there are no gains to trade between an insurer and all individuals in a particular risk group.

Extensive margin is inactive in the classic adverse selection model.

- Consider Stiglitz (1977)
  1. monopoly issuer,
  2. one risk group,
  3. two private risk exposures.
- Classic result: optimal menu has two contracts.
  1. High-risk type self-selects into the full-coverage contract.
  2. Low-risk type self-selects into the partial or possibly zero coverage contract (lower premium).
- Extensive margin is inactive: at least one type in the risk group (the high-risk type) is always insured!

This paper

- Develops an adverse selection model featuring an active extensive margin. Monopolist insurer decides:
  1. which risk groups to insure and which to reject.
  2. pricing and coverage of insured risk groups.
- In the model, low insurance take-up can arise due to:
  1. Choice: Low-risk types in a given risk group are offered and choose a no-coverage contract.
  2. No Trade: Individuals in some risk groups are offered a single contract of no coverage.
- Investigate the *quantitative* significance of the two margins in the U.S. market for long-term care insurance (LTCI).
- Our main finding: Extensive margin is the central screening device in U.S. LTCI market.

Why the LTCI market?

1. NH risk is large
   - Lifetime probability of a long-term NH stay (over 100 days) is 30%, average duration $\approx$ 3 years, and annual cost $\approx$ \$85,000.
2. Yet, LTCI ownership rates are low.
   - Only about 10% of 65+ own LTCI.
3. Evidence of adverse selection in the market. details
   - Individuals have private information about their NH entry risk.
   - They act on their beliefs: high risk types are more likely to buy LTCI (Finkelstein and McGarry, 2006).
4. Evidence of active extensive margin (insurer rejections).
   - Industry surveys find that 20% of applications are withdrawn or rejected by underwriters.
   - We estimate that 36–56% of 55–66 year olds would be rejected due to health if they applied for LTCI. details

How we activate the extensive margin

To activate the extensive margin we model two important features of the LTCI market:

1. Insurer administrative costs.
   - Fees paid to insurance brokers exceed 100% of first year's premium.
   - Underwriting and claims processing expenses average 20% of present-value premium.
2. Public insurance provided by Medicaid.
   - Medicaid is means-tested and a secondary payer.
   - Brown and Finkelstein (2008) find that it has a large crowding out effect on demand for private NH insurance.

Other features of the LTCI market

1. Highly concentrated: 66% of new policies in 2013 were written by three largest insurance companies.
2. Coverage is incomplete:
   - Provides indemnity, not a service benefit.
   - Comprehensiveness ranges from 34 to 66% of expected losses.
3. Loads ($1 - \frac{\text{E benefits}}{\text{E premia}}$) are high relative to other insurance lines:
   - Longterm care insurance: 0.18 to 0.51.
   - Life annuity insurance: 0.15 to 0.25.
   - Group health insurance: 0.04 to 0.15.
4. Profits are low. Industry has experienced lots of exit.

Overview of rest of the talk

1. Simple Model: Illustrate the key economic mechanisms underlying our results using a simple theoretical model.
2. Quantitative model: Summarize the additional details in our quantitative model and explain why each feature has been added.
3. Parameterization: Discuss our identification strategy, calibration and assessment of the parameterization.
4. Results: Show how our model accounts for the features of this market that I have described.

Simple Model Motivation

Use a simple adverse selection model to show that when administrative costs on the insurer and/or Medicaid are present:

1. Low LTCI take-up rates can arise in two different ways:
   - Choice menus: Separating equilibria in which good-risk types self-select into the no-coverage contract and bad-risk types choose the positive-coverage contract.
   - No-trade menus: Pooling menus where the entire risk group is offered a single no-coverage contract.
2. The optimal menu can feature partial coverage contracts for all individuals in the risk group.

Simple Model

- Consider first a single risk group.
- Continuum of individuals.
- Individuals have private type $i \in \{g, b\}$ and risk exposure (NH entry probability) θ^i with $0 < \theta^g \leqslant \theta^b < 1$.
- Fraction of good risk individuals is $\psi \in (0, 1)$.
- Timing:
  - Agents receive endowment w_o and then purchase LTCI with premium π^i and indemnity ι^i.
  - Then the NH event is realized and $\eta \equiv \psi\theta^g + (1-\psi)\theta^b$ individuals enter a NH and incur expenses m.

Individual's Problem

An individual of type i solves

$$\max_{c^i_{NH}, c^i_o, \pi^i, \iota^i} \theta^i u(c^i_{NH}) + (1-\theta^i) u(c^i_o)$$

where

$$c^i_o = w_o - \pi^i,$$
$$c^i_{NH} = w_o + TR(w_0, \pi, \iota, m) - \pi^i - m + \iota^i,$$
$$TR(w_o, \pi, \iota, m) = \max\left\{0, c_{NH} - \left[w_o - \pi - m + \iota\right]\right\}.$$

- Medicaid is a means-tested and a secondary payer (higher ι means lower Medicaid benefits).

Firm's Problem

Single monopolist insurer who faces

- variable cost of paying claims with constant of proportion $\lambda - 1 \geqslant 0$ and,
- fixed cost $k \geqslant 0$ of paying claims,

solves

$$\max_{\{\pi^i, \iota^i\}_{i \in \{g,b\}}} \psi\Big\{\pi^g - \theta^g\left[\lambda\iota^g + kI(\iota^g > 0)\right]\Big\} + (1-\psi)\Big\{\pi^b - \theta^b\left[\lambda\iota^b + kI(\iota^b > 0)\right]\Big\}$$

subject to

$$(PC_i) \quad U(\theta^i, \pi^i, \iota^i) - U(\theta^i, 0, 0) \geqslant 0, \quad i \in \{g, b\},$$

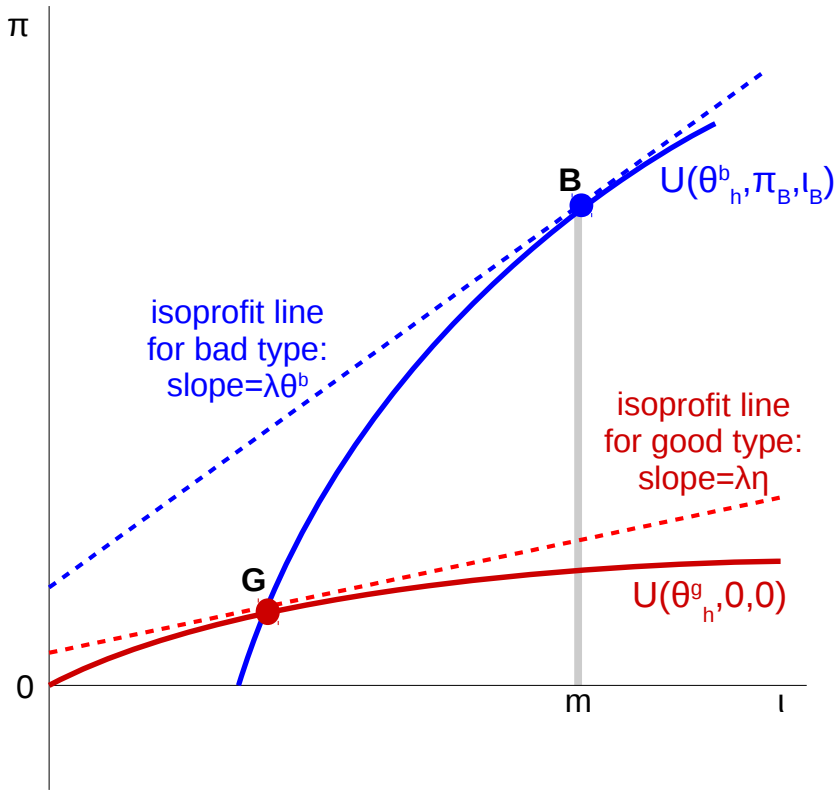
$$(IC_i) \quad U(\theta^i, \pi^i, \iota^i) - U(\theta^i, \pi^j, \iota^j) \geqslant 0, \quad i, j \in \{g, b\},\ i \neq j,$$

where $U(\theta^i, \pi^i, \iota^i) \equiv \theta^i u(c^i_{NH}) + (1-\theta^i)u(c^i_o)$.

Classic Properties of the Model: Standard Setup

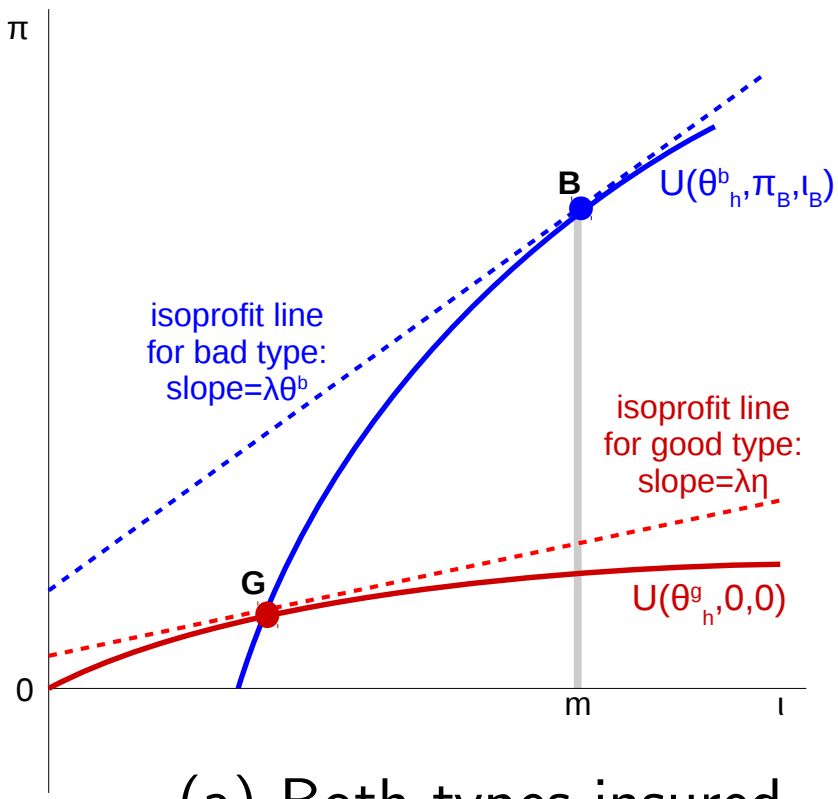
If $\lambda = 1$, $k = 0$, and $\underline{c} = 0$ the model generates the *classic* findings (Stiglitz, 1977 or Chade and Schlee, 2012):

1. *Separating equilibria.*
2. *Full insurance at the top.*
3. *Downward distortion for good risks.*

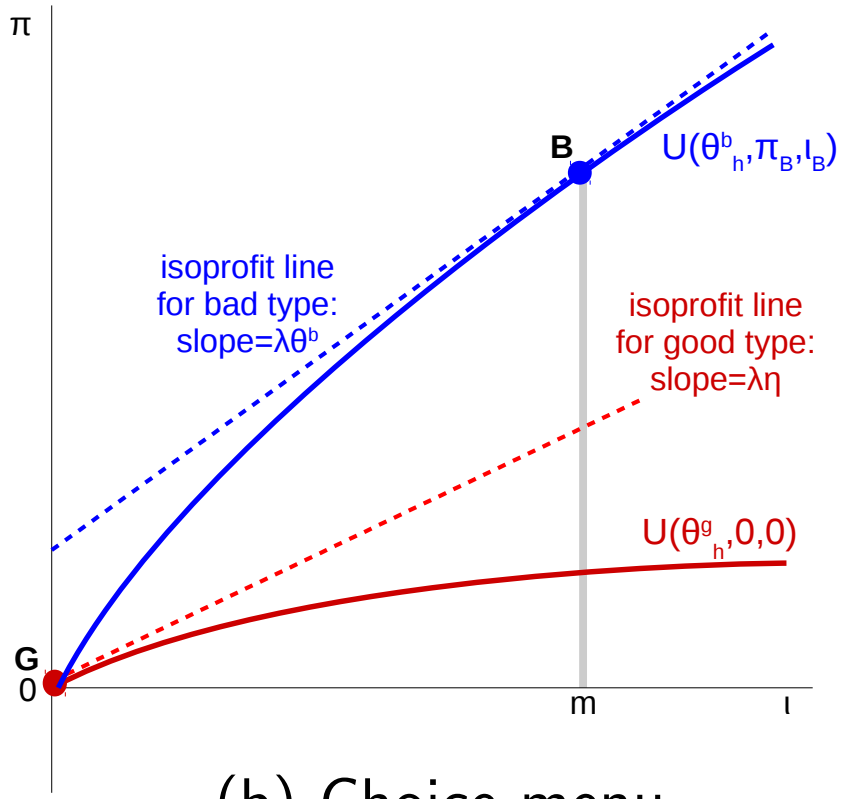


Generating low take-up rates: Standard Setup

- Menu (a): LTCI take-up rate is 100%. Good types cross-subsidize bad types.
- Menu (b): Take-up rate $<$ 100%. Choice menu occurs if
  - fraction of good types (ψ) is sufficiently low or,
  - NH entry dispersion (θ^b/θ^g) is sufficiently high.



(a) Both types insured



(b) Choice menu

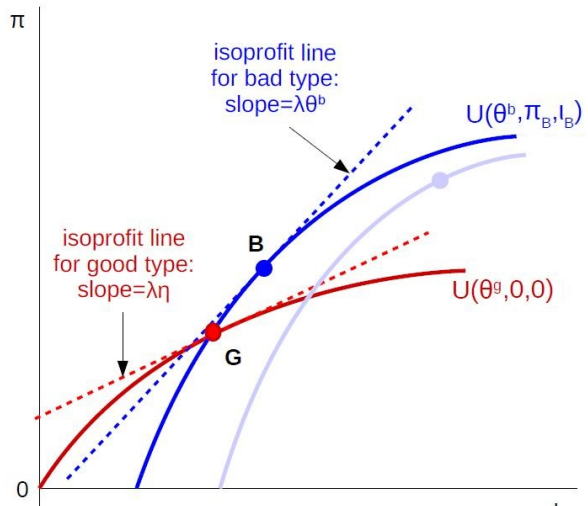
Activating the extensive margin: Proportional administrative costs

With proportional administrative costs, $\lambda > 1$, the model can generate:

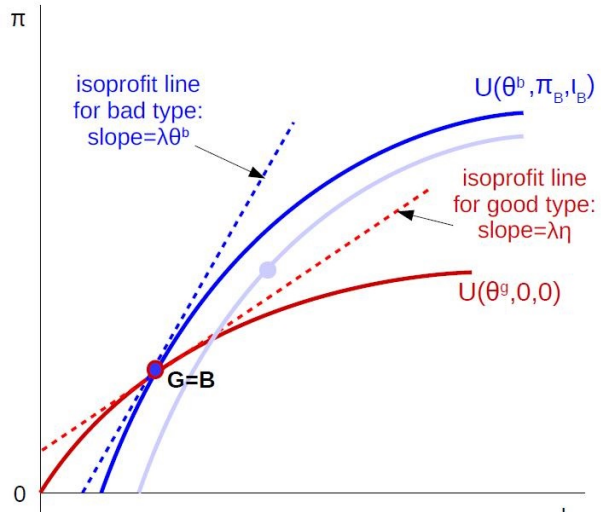
- *Pooling.* Good and bad types offered same contract.
- *Low LTCI take-up rates by either choice or no trade (rejections).*
- *Incomplete insurance even at the top.*

Equilibria w/proportional admin. costs

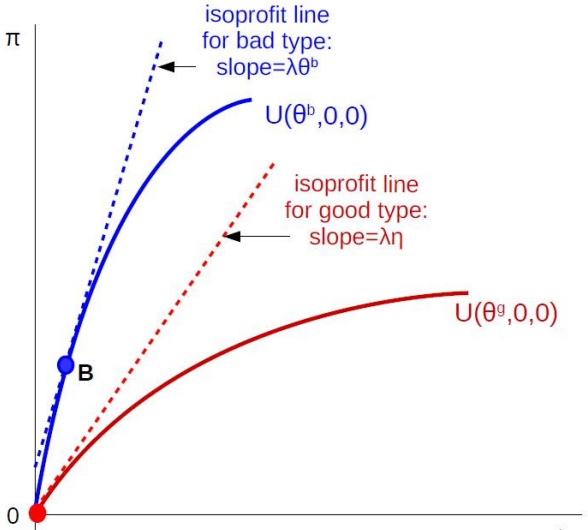
With proportional admin. cost, $\lambda > 1$, the following menus can occur:



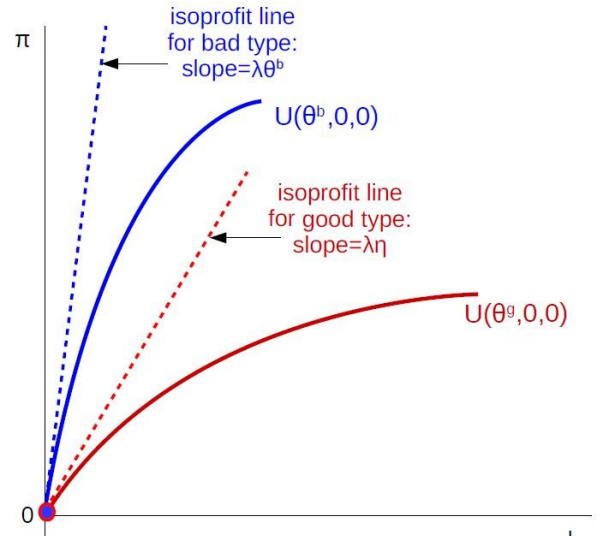
(a) 100% insured, separating



(b) 100% insured, pooling

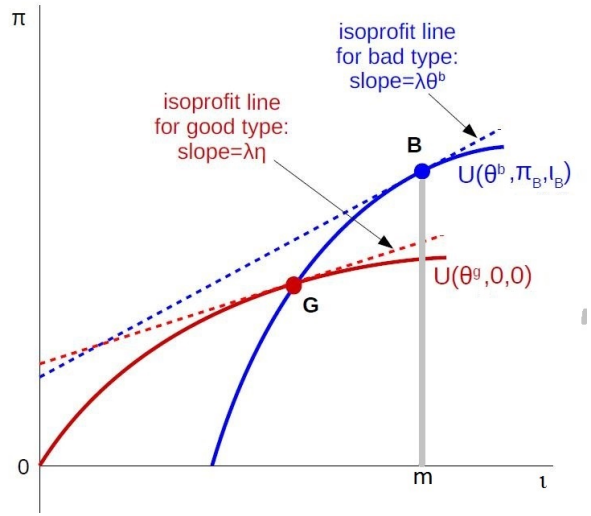


(c) Bad types insured, choice

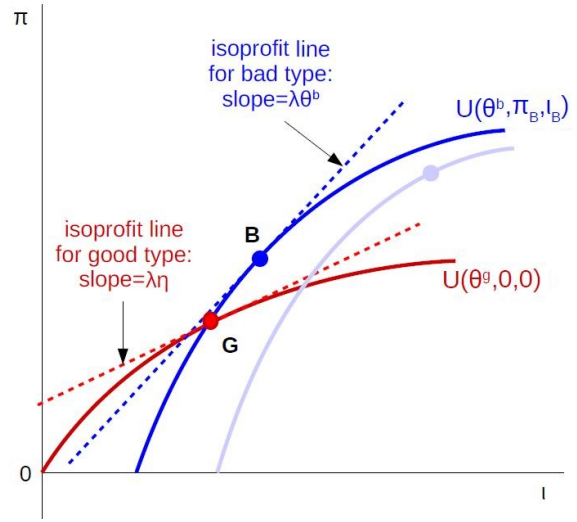


(d) Zero insured, no trade

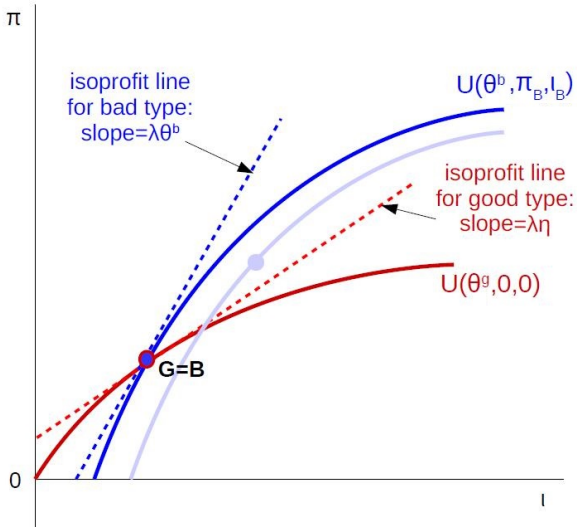
Intuition: Increasing λ



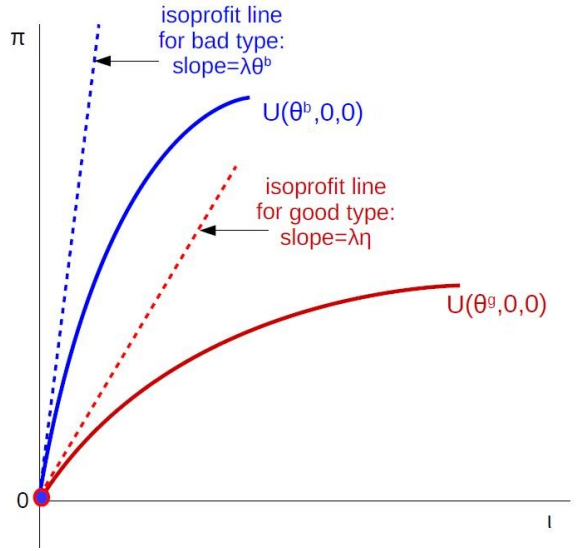
(a) $\lambda = 1$



(b) Separating eqm $\lambda > 1$



(c) Pooling eqm $\lambda > 1$



(d) No trade eqm $\lambda > 1$

Intuition: Increasing λ

- Increasing λ increases MC of providing insurance.
- Premia and indemnity decline.
- Because the MC of insuring bad types is larger, bad types premia and indemnity decline more than good types.
- Eventually the insurer can no longer increase profits by offering a separating menu.
- As λ increases further pooling contract moves along good types PC constraint to $(0, 0)$.

details

Activating the extensive margin: Fixed administrative costs

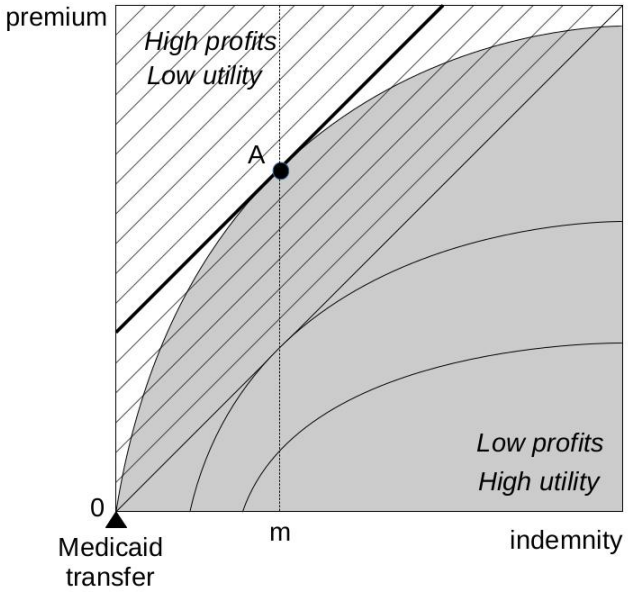
- Fixed administrative costs, $k > 0$, reduce the insurer's profits and can also generate no-trade (rejections).

Activating the extensive margin: Medicaid

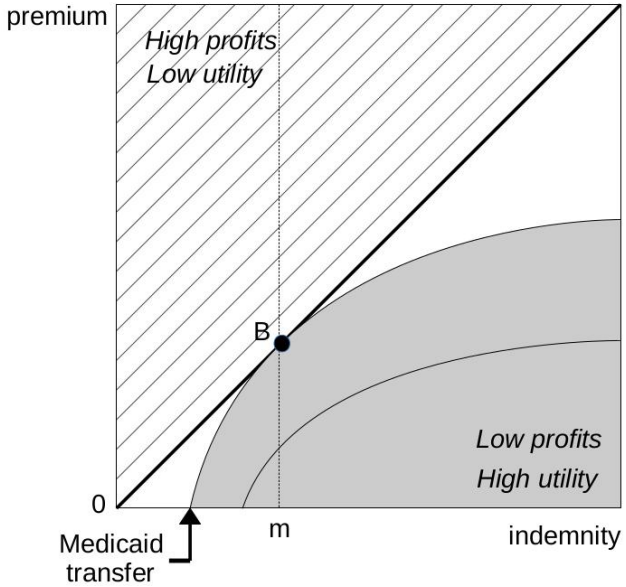
With Medicaid, $\underline{c}_{NH} > 0$, the model can generate:

- *Low LTCI take-up rates by either choice or no trade (rejections).*
- *Incomplete insurance even at the top* under particular conditions that I will describe.

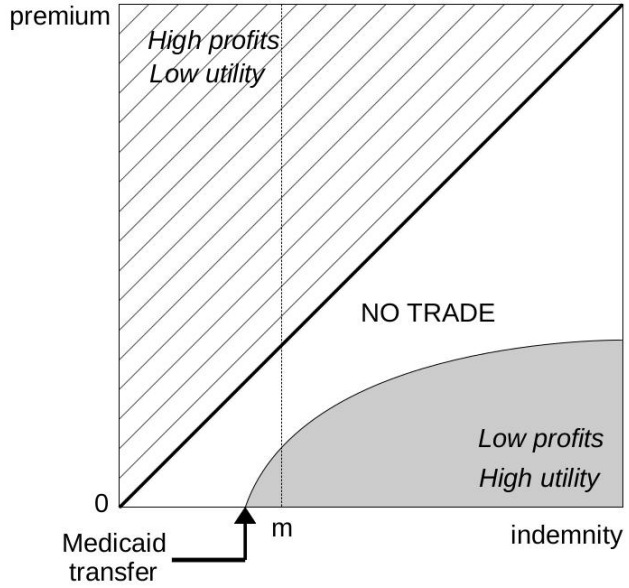
Intuition: Increasing Medicaid Cons. Floor $\underline{c}_{NH}$



(a) $\underline{c}_{NH} = 0$



(b) Low $\underline{c}_{NH}$



(c) High $\underline{c}_{NH}$

- When $\underline{c}_{NH} > w_o - \pi - m + \iota$, marginal increases in ι are offset by reductions in Medicaid transfers.
- In (b), because the agent's outside option has improved, insurer must reduce premium to satisfy PC.
- In (c), there is no profitable contract that is attractive to the agent.

Intuition: Increasing Medicaid cons. floor $\underline{c}_{NH}$

- Thus Medicaid can generate rejections of poorer individuals for which $\underline{c}_{NH}$ is large relative to w_o.
- When w_o is uncertain, Medicaid generates partial coverage contracts.
  - Suppose individual is eligible for Medicaid under some realization of w_o but not others.
  - He is partially insured against NH risk in expectation $\Rightarrow$ prefers partial private LTCI coverage.

The Quantitative Model: Multiple risk groups

We assume:

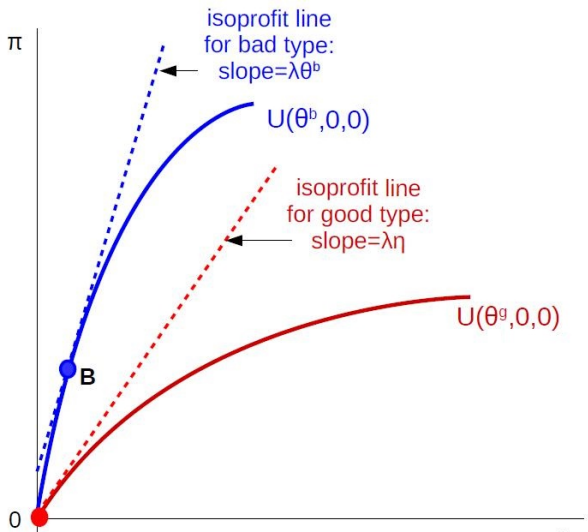
- Agents vary by
  - Endowments $\mathbf{w}$,
  - Frailty f,

  in addition to private type i.
- The insurer observes these noisy indicators, $(\mathrm{f}, \mathbf{w})$, of an individual's true NH risk exposure: $\theta^{\mathrm{i}}_{\mathrm{f},\mathbf{w}}$ and sorts agents into risk groups.
- The extent of private information, $\{\theta^{\mathrm{g}}_{\mathrm{f},\mathbf{w}}, \theta^{\mathrm{b}}_{\mathrm{f},\mathbf{w}}\}$, varies across the risk groups.

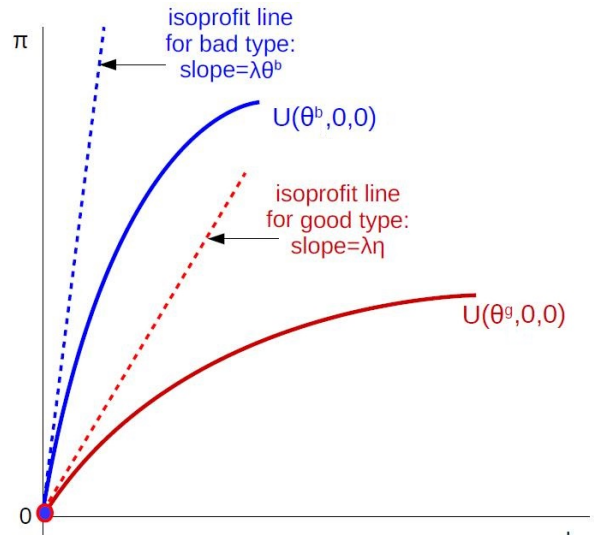
When there are multiple risk groups, low LTCI take-up rates occur due to a combination of choice and no-trade menus.

The Quantitative Model: Choice v. no-trade menus

- No-trade menus are more likely to arise when dispersion in private information, $(\theta^{b}_{f,w}/\theta^{g}_{f,w})$, is high and $\theta^{b}_{f,w}$ is close to one. Why?
  - High $(\theta^{b}_{f,w}/\theta^{g}_{f,w})$ makes cross-subsidizing menus unattractive.
  - High $\theta^{b}_{f,w}$ makes choice menus unattractive.



(c) Bad types insured, choice



(d) Zero insured, no trade

The Quantitative Model: Additional features

- Before contracting, agents make a consumption—savings decision.
  - Expectations about public and private insurance impact savings.
  - Savings impacts optimal contracts.
- After contracting, agents incur a consumption demand shock.
  - Captures, in a parsimonious way, uncertainty faced between LTCI purchase and NH entry.
  - Produces partial coverage contracts under Medicaid.
- Agents face survival risk between LTCI purchase and NH event.
  - Survival is correlated with frailty and wealth and impacts likelihood of NH entry.

The Model: Timing of events

- Period 1: Individuals observe their frailty status f, endowments w, and menu of contracts.
- Receive w_y, choose consumption (c_y) and savings (a).
- Period 2: Individuals draw type $i \in \{g, b\}$ with $prob(i = g) = \psi$.
- Receive w_o, and purchase private LTCI at a premium $\pi^i_{f,w}(a)$.
- Then experience a consumption demand shock $\kappa \in [\underline{\kappa}, \overline{\kappa}]$.
- With prob. $1 - s_{f,w}$ they get transfers, consume their wealth and die.
- Period 3: Survivors realize NH shock.
- NH entrants pay cost m, get indemnity $\iota^i_{f,w}(a)$ and Medicaid transfers, and consume.
- Non-entrants get welfare transfers and consume.

The Model: Individual's Problem

An individual of type $\{f, w\}$ solves

$$\max_{a \geqslant 0, c_y, c_{NH}, c_o} u(c_y) + \beta \int_{\underline{\kappa}}^{\overline{\kappa}} u(\kappa w_y) q(\kappa) d\kappa$$

$$+\beta\alpha \Big\{ \psi \int_{\underline{\kappa}}^{\overline{\kappa}} \left[s_{f,w} \theta^g_{f,w} u(c^{g,\kappa}_{NH}) + (1 - s_{f,w}\theta^g_{f,w}) u(c^{g,\kappa}_o) \right] q(\kappa) d\kappa$$

$$+(1-\psi) \int_{\underline{\kappa}}^{\overline{\kappa}} \left[s_{f,w} \theta^b_{f,w} u(c^{b,\kappa}_{NH}) + (1 - s_{f,w}\theta^b_{f,w}) u(c^{b,\kappa}_o) \right] q(\kappa) d\kappa \Big\}$$

subject to

$$\begin{aligned}
c_y &= w_y - a, \\
c^{i,\kappa}_o + \kappa w_y &= w_o + (1+r)a - \pi^i(a), \quad i \in \{g, b\} \\
c^{i,\kappa}_{NH} + \kappa w_y &= w_o + (1+r)d + TR(a, \pi, \iota, m, \kappa) \\
&\qquad - \pi^i_{f,w}(a) - m + \iota^i(a), \quad i \in \{g, b\}.
\end{aligned}$$

The Model: Government transfers

- The Medicaid transfer is means-tested:

$$TR(a, \pi, \iota, m, \kappa) = \max\Big\{0, \underline{c}_{NH} - \big[w_o + (1+r)a - \pi - m + \iota - \kappa w_y\big]\Big\}$$

  - Medicaid is a secondary payer: higher ι means lower Medicaid benefits.
- The welfare consumption floor for non-NH entrants is $\underline{c}_o$.
  - If the agent prefers, we assume he saves nothing, does not purchase LTCI, and consumes at the consumption floors: $\underline{c}_{NH}$ in the NH state and $\underline{c}_o$ in the non-NH state.

The Model: Insurer's Problem

For each observable risk group $\{f, w\}$ insurer solves

$$\max_{\{\pi^i_{f,w}, \iota^i_{f,w}\}_{i\in\{g,b\}}} \psi\left\{\pi^g_{f,w} - s_{f,w}\theta^g_{f,w}\left[\lambda\iota^g_{f,w} + kI(\iota^g_{f,w} > 0)\right]\right\}$$
$$+(1-\psi)\left\{\pi^b_{f,w} - s_{f,w}\theta^b_{f,w}[\lambda\iota^b_{f,w} + kI(\iota^b_{f,w} > 0)]\right\}$$

subject to

$$u_2(\theta^i_{f,w}, \pi^i, \iota^i) \geqslant u_2(\theta^i_{f,w}, \pi^j, \iota^j), \quad \forall i, j \in \{g, b\}, \quad i \neq j \qquad (IC_i)$$
$$u_2(\theta^i_{f,w}, \pi^i, \iota^i) \geqslant u_2(\theta^i_{f,w}, 0, 0), \quad \forall i \in \{g, b\}, \qquad (PC_i)$$

where

$$u_2(\theta^i_{f,w}, \pi^i, \iota^i) \equiv$$
$$\int_{\underline{\kappa}}^{\overline{\kappa}} \left[s_{f,w}\theta^i_{f,w}u(c^{i,\kappa}_{NH}) + (1 - s_{f,w}\theta^i_{f,w})u(c^{i,\kappa}_{o})\right] q(\kappa)d\kappa.$$

Parameterization of the Model: Overview

- We compute optimal contracts for 750 risk groups that vary by frailty, PE (and wealth).
- Some parameters are set directly using data and others are set by minimizing the distance between data moments and model counterparts.
- Many of our data moments are constructed using 1992–2012 HRS data.
- We construct a frailty index for HRS respondents that summarizes underwriting criteria used by LTC insurers.
- Lifetime NH entry probabilities for HRS respondents are estimated using an auxiliary simulation model.

Parameterization of the Model: Highlights

The importance of the extensive margin (no-trade menus) in generating low LTCI take-up rates depends on

- the scale of the Medicaid program,
- the size of administrative costs,
- the extent of private information.

How do we parametrize these key components of the model?

Parametrization: The scale of Medicaid

- The Medicaid NH consumption floor $\underline{c}_{NH}$ is set to the value of consumption transfers to Medicaid NH residents: \$6,540 a year in 2000 $\times$ the average duration of a long-term NH stay: 2.98 years. details
- This is the same value as used by Brown and Finkelstein (2008).
- Consumption demand shock distribution chosen to match the wealth distribution at NH entry. details

Parametrization: The size of administrative costs

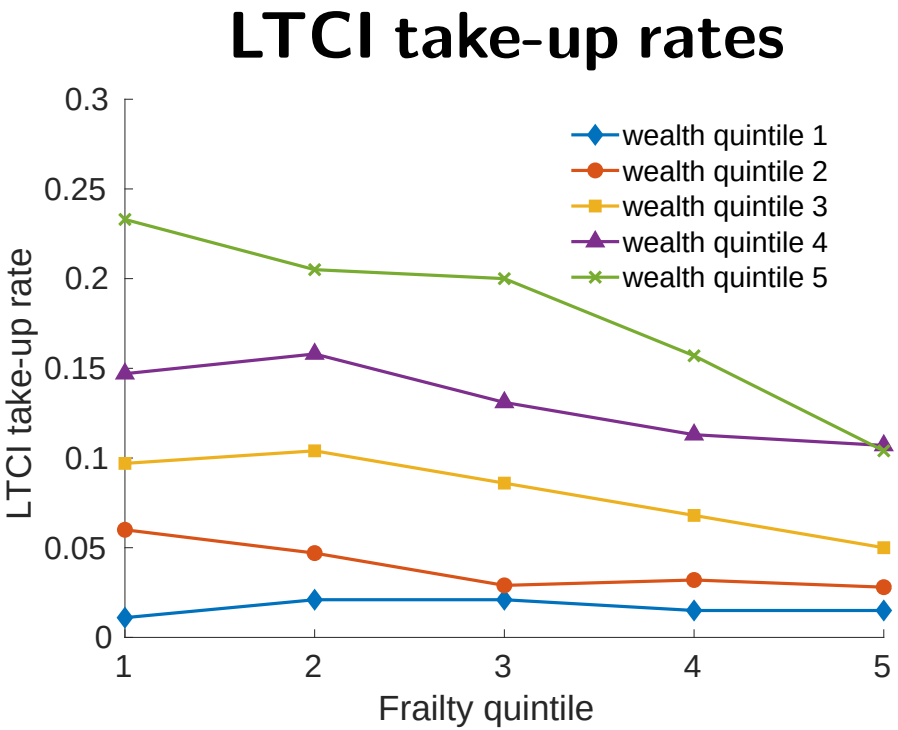
- We attribute underwriting costs and costs of paying claims to fixed costs.
  - These costs are 20% of premia.
  - The fixed cost parameter, k, is set match this target.
- We attribute commissions paid to agents and brokers to variable costs.
  - These costs are 12.6% of premia.
  - The variable cost parameter, λ, is set match this target.
- Source: LTCI industry average costs from Society of Actuaries. (Based on year 2000 costs.)

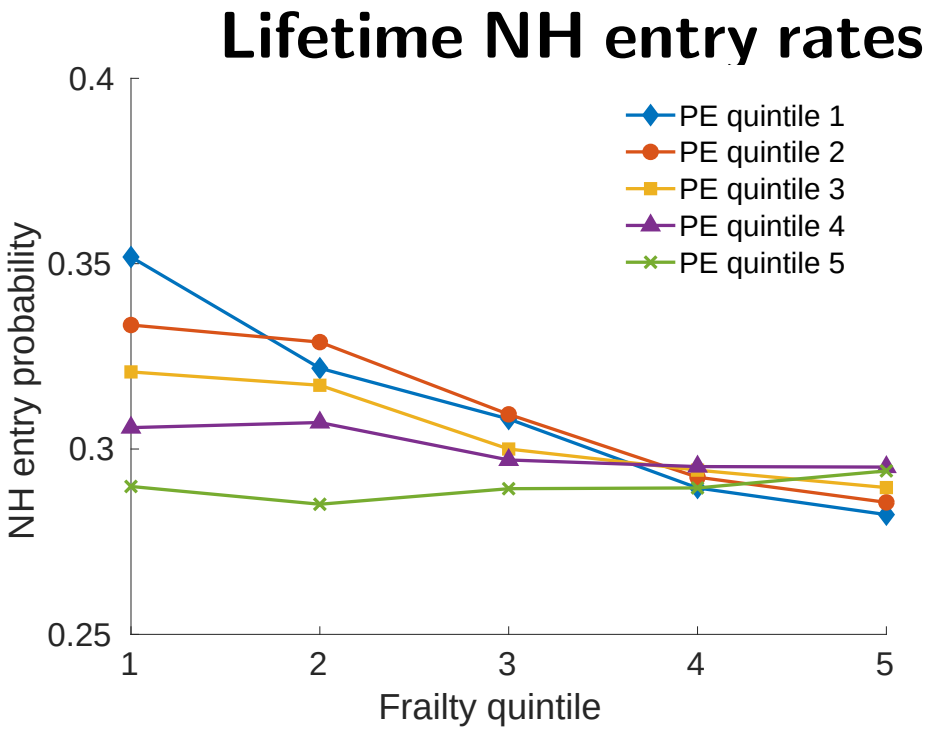
Parametrization: The extent of private information

$$\eta_{f,w} \equiv \psi\theta^{g}_{f,w} + (1-\psi)\theta^{b}_{f,w}$$

- The fraction of good types, ψ, is set such that the overall dispersion of private information in the model reproduces the dispersion of self-reported NH entry probabilities in our HRS data.
- $\{\theta^{g}_{f,w}, \theta^{b}_{f,w}\}$ by (f, w) target LTCI take-up rates and NH entry rates by frailty and wealth/PE quintiles.

Pattern of LTCI take-up and NH entry in the data

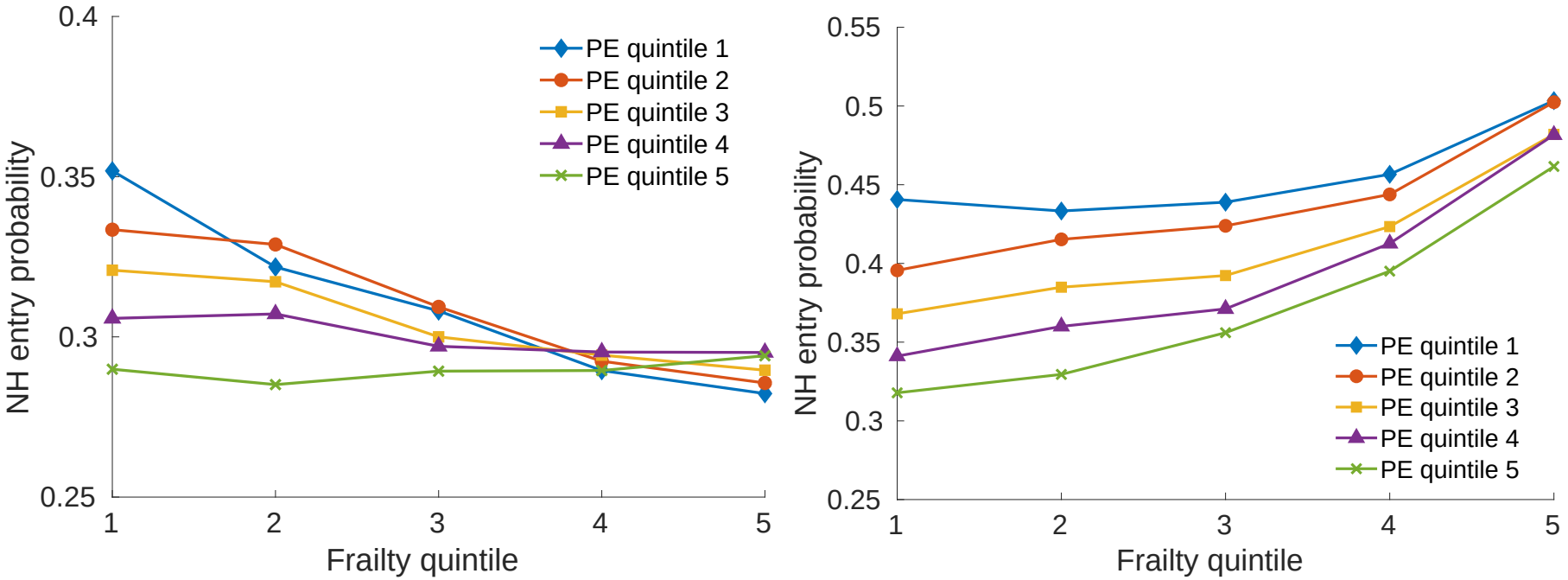




- LTCI take-up rates decline with frailty and increase with wealth.
- Lifetime NH entry risk slightly decreases with frailty and varies little with PE!

NH entry: unconditional v. conditional

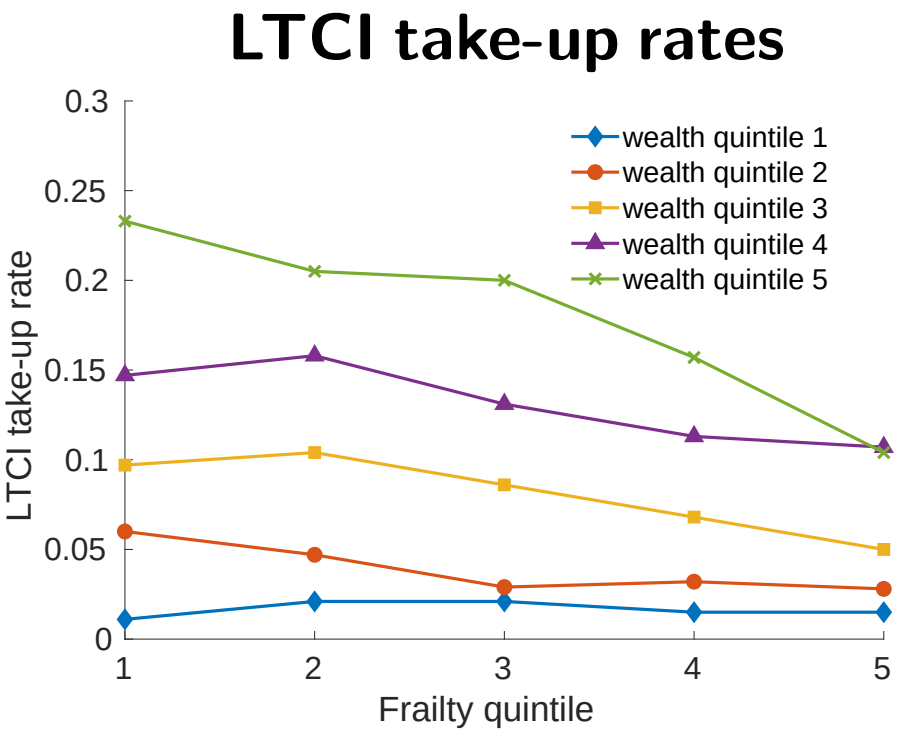
Lifetime NH entry rates by frailty and PE quintiles

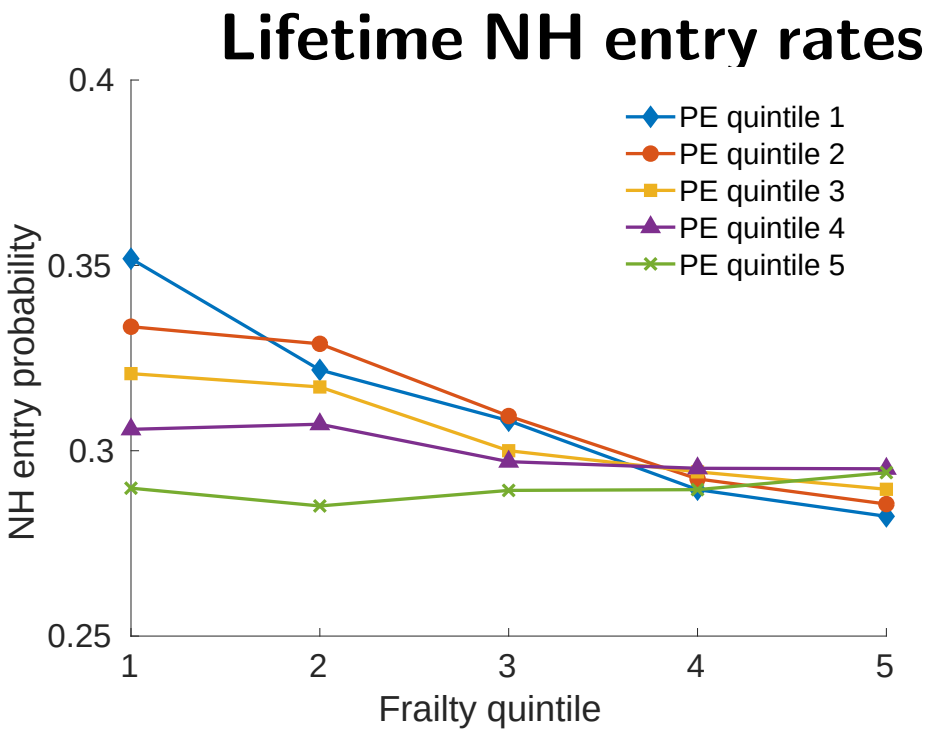


Why do NH entry patterns look this way?

- Offsetting effect: Probability of dying increases with frailty and decreases with PE.

Pattern of LTCI take-up and NH entry in the data

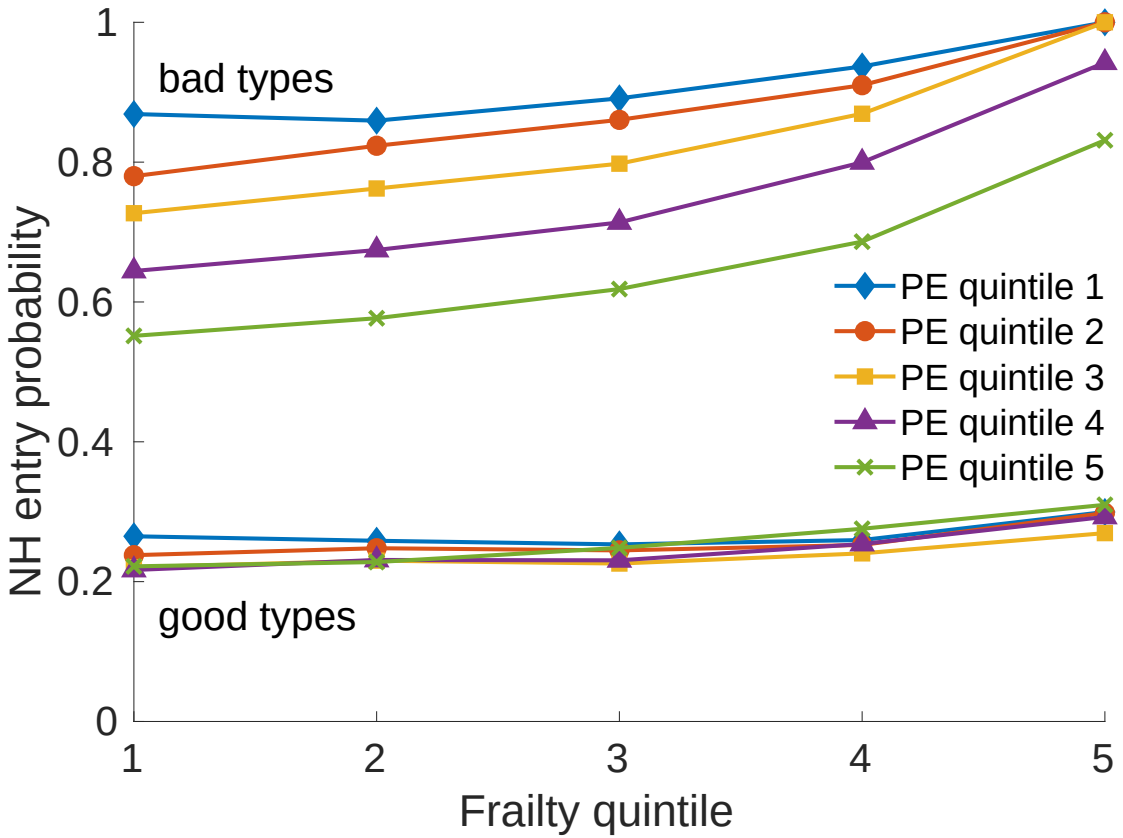




- Implication: Dispersion of private NH entry risk has to increase in frailty and decrease in PE/wealth.
  $\eta_{f,w} \equiv \psi\theta^{g}_{f,w} + (1-\psi)\theta^{b}_{f,w}$

Resulting pattern of private information

- Fraction of good types $\psi = 0.709$.
- Nursing home entry probabilities conditional on surviving in the model:



Assessment: Dispersion of Private Information

Standard deviation of self-reported (private) NH entry probabilities by frailty and PE quintile: data and model.

	Frailty quintile				
	1	2	3	4	5
Data	1.00	1.00	1.03	1.27	1.47
Model	1.00	1.08	1.20	1.31	1.47
	Permanent earnings quintile				
	1	2	3	4	5
Data	1.00	0.92	0.85	0.79	0.76
Model	1.00	0.96	0.91	0.78	0.59

The s.d.'s of frailty and PE quintile 1 are normalized to 1. Data values are s.d.'s of self-reported probs. of entering a NH in the next 5 years excluding observations where the probability is 0, 100% or 50%.

- Dispersion of private information increases with frailty and decreases with PE in both the data and model.

Assessment: Comprehensiveness

	Wealth Quintile				
	1	2	3	4	5
Good risks (θ^g)					
Fraction of NH costs covered	NA	NA	0.507	0.507	0.514
Bad risks (θ^b)					
Fraction of NH costs covered	NA	NA	0.711	0.711	0.816
	Frailty Quintile				
	1	2	3	4	5
Good risks (θ^g)					
Fraction of NH costs covered	0.514	0517	0.518	0.492	0.487
Bad risks (θ^b)					
Fraction of NH costs covered	0.763	0.753	0.774	0.739	0.736

- Model: A LTCI contract covers 58% of NH costs on average.
- Data: Representative policies cover 34% – 66% of expected lifetime LTC expenses.
- Coverage varies by private type but not much by wealth or frailty.

Assessment: Loads

	Wealth Quintile				
	1	2	3	4	5
Good risks (θ^g)					
Average load	NA	NA	0.631	0.605	0.558
Bad risks (θ^b)					
Average load	NA	NA	-0.082	-0.046	0.056
	Frailty Quintile				
	1	2	3	4	5
Good risks (θ^g)					
Average load	0.514	0.517	0.518	0.492	0.487
Bad risks (θ^b)					
Average load	-0.004	-0.005	-0.017	-0.020	-0.031

- Model: Average load is 0.41.
- Data: Average loads range from 0.18 to 0.5 depending on whether or no adjustments are made for policy lapses.
- Loads vary by private type but not much by wealth or frailty.

Quantitative results: Rejections v. Choice

- Fraction of each type of contract:
  - Rejections: 90.1% of individuals are offered a single contract of $(0, 0)$.
  - Choice: Only 0.11% of individuals are offered two contracts and choose the $(0, 0)$ one.
- Rejections in the model are **not** equivalent to rejections in data.
- Model rejections are a no-trade result.
- Data rejections are mainly due to poor health (lower bound on model rejections).
- Survey evidence from Ameriks et al. (2016) finds many individuals do not buy LTCI because it is too expensive.

Quantitative results: LTCI ownership and NH entry

- Our finding that the extensive margin is important has implications for the widely used "correlation" test for adverse selection proposed by Chiappori and Salanié (2000).
- The test is based on the standard adverse selection model.
- In our context, if adverse selection is present, then the correlation between NH entry and LTCI ownership should be *positive*.
  - LTCI holders should have higher NH entry rates than non-holders,

Quantitative results: LTCI ownership and NH entry

Finkelstein and McGarry (2006) empirical findings:

1. Positive correlation between self-assessed NH entry risk and NH entry within risk groups.
2. Positive correlation between self-assessed NH entry risk and LTCI ownership.
3. *Negative or zero correlation* between NH entry and LTCI ownership depending on controls.

Baseline economy:

- 1 is true by definition of bad type.
- 2 is true: LTCI take-up rate of bad types is 9.5%, good types is 9.2%. Holds no matter how we condition on observables.

Quantitative results: LTCI ownership and NH entry

NH entry *rates* for LTCI holders and non-holders in the Baseline economy

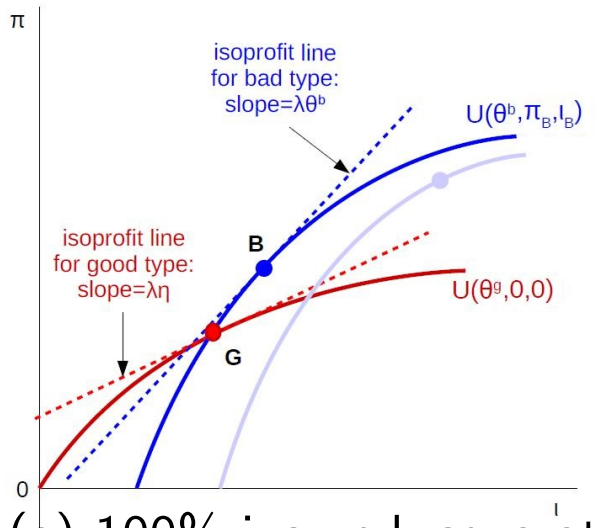
		Frailty Quintile				
	Average	1	2	3	4	5
LTCI holders	36.9	33.4	36.0	37.2	41.2	47.5
Non-holders	40.7	35.9	37.9	40.1	43.0	49.1

Numbers are percent of survivors to the very old stage of life who enter a NH.

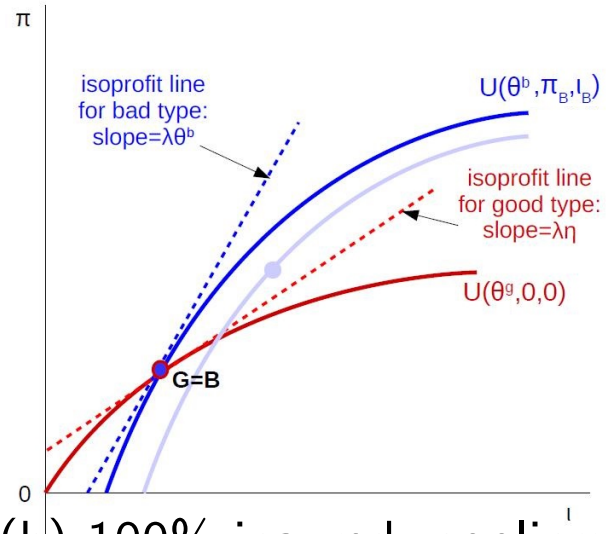
3 is true:

- Correlation is negative if no controls.
- Negative if only control for frailty.
- If we control for both wealth quartile and frailty get essentially zero correlation. (Average differential is 0.03%.)

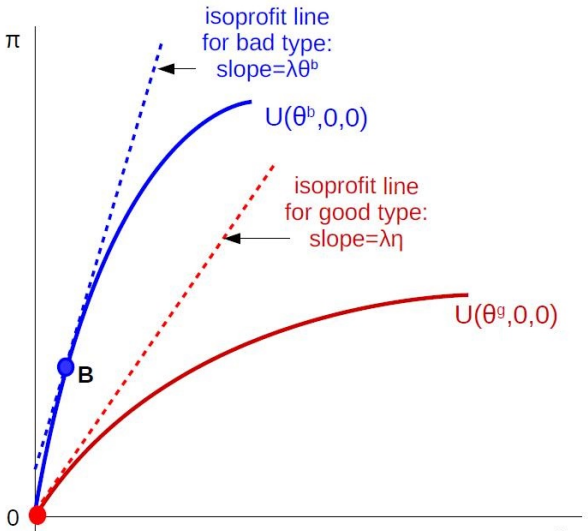
Why do we get neg./zero correlations?



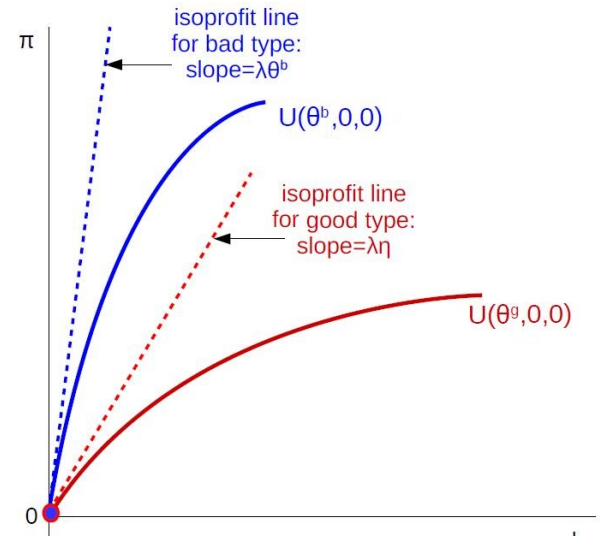
(a) 100% insured, separating



(b) 100% insured, pooling



(c) Bad types insured, choice



(d) Zero insured, no trade

Summary: Why do we get neg./zero correlations?

- Two offsetting effects:
  1. If perfectly control for observables, ownership-entry correlation is positive but small (only tiny fraction of risk groups have non-zero correlation).
  2. Due to rejections, ownership is negatively correlated with average NH entry across risk groups.
- When risk groups are bunched together, 2 can easily dominate 1. details
- Implication: Tests for adverse selection that use ownership rates have low power.
- Extent of coverage may be better way to test if data is available.

Role of demand and supply-side frictions

Rejection Rates (%)

Scenario Description	Baseline	No Administrative Costs $\lambda = 1$, $\kappa = 0$	No Medicaid $\underline{c}_{nh} = 0.001$	Full Information θ_f^i public
Average	90.1	38.7	9.4	62.5
By PE Quintile				
1	100	100	27.4	100
2	100	93.4	0.0	99.6
3	85.7	0.0	0.0	54.1
4	83.9	0.0	0.0	29.1
5	81.2	0.0	19.8	29.7
High PE				
top 10	75.1	0.0	39.5	30.4
top 5	58.8	0.0	76.2	31.7
top 1	100	0.0	100	100

- Medicaid generates rejections of poorer individuals.
- Administrative costs and adverse selection generate rejections of richer individuals.
- All three factors are important for those in PE Q3–Q4.

Impact of adverse selection on LTCI take-up rates

- Removing either private information or administrative costs has a big impact on rejections among more affluent individuals.
- Do we need private information?
- Yes! The full information model:
  - overstates LTCI take-up rates,
  - produces an incorrect pattern of LTCI take-up rates by frailty quintile among more affluent individuals. Details
- Even if we try to reparameterize the full information model by raising the administrative costs it cannot match the pattern of LTCI take-up among affluent.

Impact of Medicaid on LTCI take-up rates

- The crowding out effect of Medicaid on private LTCI has been documented in Brown and Finkelstein (2008).
- They find that bottom 66% of wealth dist. would not purchase a full-coverage, actuarially-fair contract due to Medicaid.
- The crowding-out effect of Medicaid in our model is much smaller.
- We find in an economy with Medicaid but
  - no private information
  - no administrative costs
  - average load of 0.35 (monopoly power)

  only 39% do not purchase LTCI.
- Why is crowding out effect so much smaller in our setup?

Crowding-out effects of Medicaid on private LTCI

Most purchasers only want partial coverage.

Economy with no private information and no admin. costs

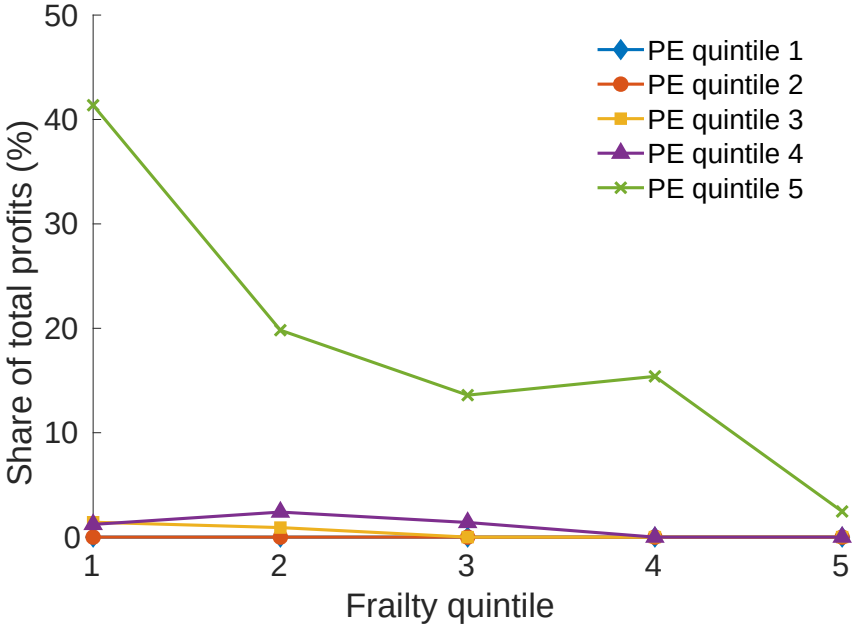
	Wealth Quintile				
	1	2	3	4	5
LTCI take-up rates	0	0.04	1	1	1
Fraction of loss covered	NA	0.50	0.61	0.88	0.97
Average load	NA	0.16	0.30	0.41	0.38

- Only wealth quintile 5 buys full coverage contract.
- Individuals in quintile 2–4 prefer partial coverage.

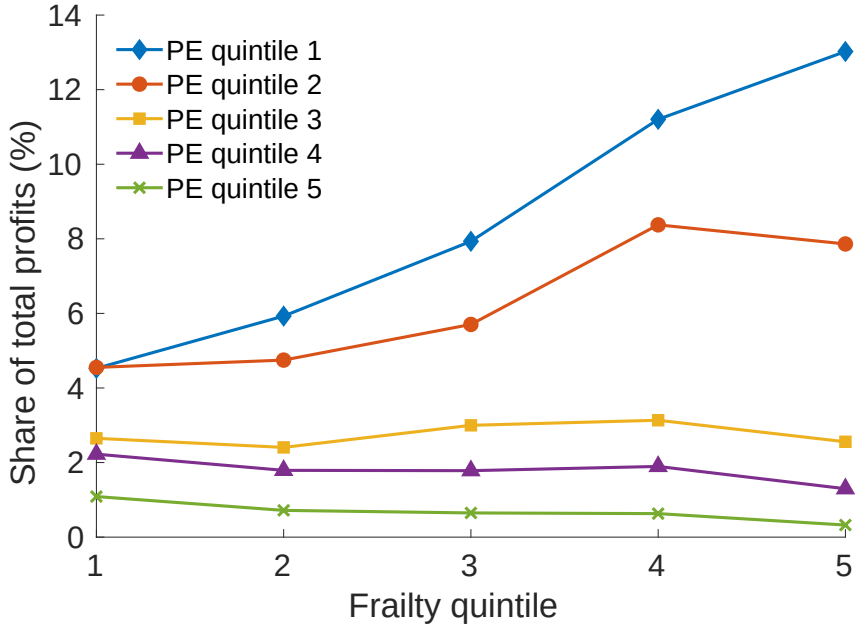
Conclusion: Abstracting from supply-side can distort inference about the role of demand-side distortions.

Quantitative Results: Profits

Baseline



No Medicaid



- Baseline: Profits are low (2.3% of revenues) and obtained from healthy, rich individuals.
- Medicaid has largest impact: removing increases profits to 28.5% of revenues.
- Without Medicaid profits are obtained mostly from poor.

Conclusion

Model provides several new insights:

- Demonstrates that an optimal contracting model with active screening along the extensive margin can account for the main features of the U.S. LTCI market:
  - low take-up rates,
  - rejections and partial coverage contracts,
  - failure of positive correlation property,
  - high loads but low profits.
- Demonstrates the importance of endogenous optimal contracts.
- Provides a resolution to what Ameriks et al. (2016) refer to as the "LTCI puzzle" (demand for ideal LTCI product is high but ownership of actual products is low).

Empirical Evidence of Adverse Selection

- Finkelstein and McGarry (2006) find that individuals' self-assessed NH entry risk is positively correlated with both actual NH entry and LTCI ownership even after controlling for characteristics observable by insurers.
- Hendren (2012) finds that self-assessed NH entry risk is more predictive of a NH event for individuals who would likely be rejected by LTC insurers.
- We repeat logit regression analysis of Hendren (2012) for stays of 100 days or more. Find:
  - Strong evidence of private information at a 10 year horizon for reject sample.
  - Much weaker evidence of private information using the sample who pass underwriting.

Back

Round 1: Pre-screening

Common questions include:

1. Do you require human assistance to perform any of your activities of daily living?
2. Are you currently receiving home health care or have you recently been in a nursing home?
3. Have you ever been diagnosed with or consulted a medical professional for the following: a long list of diseases that includes diabetes, memory loss, cancer, mental illness, heart disease?
4. Do you currently use or need any of the following: wheelchair, walker, cane, oxygen, etc.?
5. Do you currently receive disability benefits, social security disability benefits, or Medicaid?

Source: 2010 Report on the Actuarial Marketing and Legal Analyses of the Class Program

The HRS contains enough information to more or less answer each of these questions for HRS respondents.

Round 1: Pre-screening

Percentage Answering "Yes" to at Least One Question

	Age		
	55–56	60–61	65–66
All	41.8	43.7	49.5
Top Half of Wealth Distribution Only			
All	30.8	33.6	39.3

- The percentage answering "Yes" to at least one question is large even for the youngest age group and the top half of the wealth distribution.

Round 1: Pre-screening

Percentage Answering "Yes" to at Least One Question

	Age		
	55–56	60–61	65–66
All	41.8	43.7	49.5
Top Half of Wealth Distribution Only			
All	30.8	33.6	39.3

- Q3 was answered "Yes" with highest frequency.
- If Q3's yes's are not counted $\Rightarrow$ Round 1 declination rates range from 17.5–22.5%.

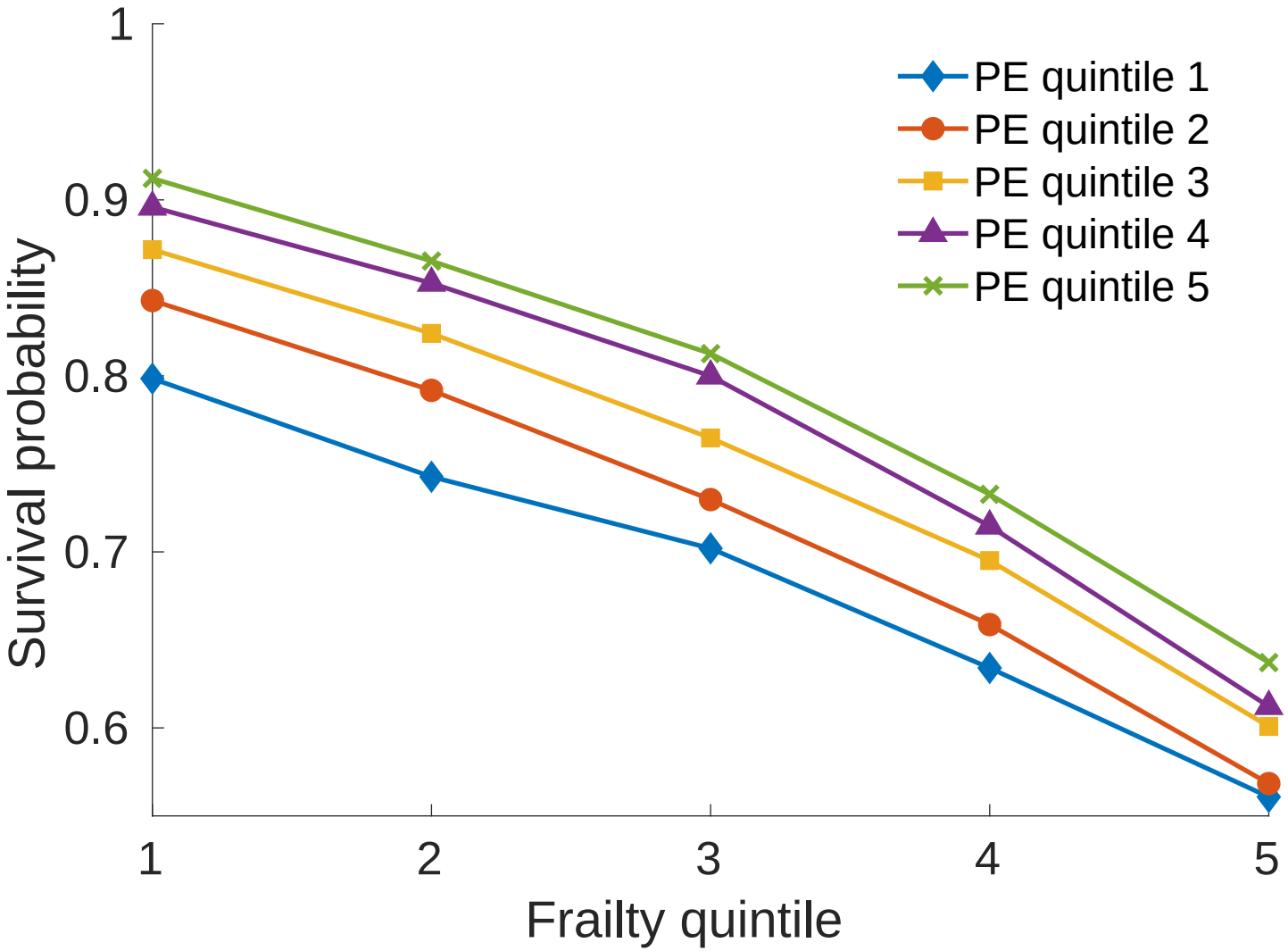
Round 2: Formal application

- Conditional on passing round 1, individuals are invited to make a formal application.
- One in five formal applicants are denied coverage. (Source: American Association for Long-Term Care Insurance)
- Assuming the declination rate is 20% in each round $\Rightarrow$ roughly 36–56% of 55–66 year-old HRS respondents would be unable to obtain LTCI.

Back

Calibration: Survival probabilities

Survival probabilities in the data and model. Based on auxiliary model estimated using HRS data.



Generating zero or negative correlations

If $\lambda > 1$ or $\underline{c}_{NH} > 0$, the correlation between LTCI ownership and NH entry in our setup can be zero, positive, or negative.

- Within a risk group:
  - Either both types have LTCI, neither type, or only bad types.
  - So correlation between LTCI ownerhip and NH entry is either zero or positive.
- However, due to rejections, ownership can be negatively correlated with average NH entry across risk groups.
- If econometrician does not fully control for information set of insurer
  - The negative correlation across risk groups can dominate positive correlation within risk groups

  and the econometrician can find a negative correlation.

Back

Calibration: Parameters

- Preferences CRRA with risk aversion coefficient of 2.
- Annual discount factor (β) is 0.94. Target is ave. wealth at retirement/ave. lifetime earnings.
- Retirement discount factor $\alpha = 0.20$. Target is ave. wealth at NH entry/ave. lifetime earnings.
- Annual interest rate r is 0.0.
- NH cost m set to care cost of average long-term NH stay: \$100,351 in 2000.
- Administrative costs $\lambda = 1.195$ and $k = 0.019$ set to get total costs/total premia $= 30\%$ and average load on individuals of 0.40.
- Consumption floors $\underline{c}_{NH} = \underline{c}_o = 0.01855$ set to \$7,053 a year based on estimates in literature.

Back

Calibration: Frailty and Earnings Distributions

- Joint distn. of $\{f, w_y\}$ is Gaussian copula.
- Marg. distn. of f is beta. Target is the frailty distribution of 62–72 year-olds in HRS.
- Marg. distn. of w_y is log-normal. Target is permanent earnings distribution of HRS retirees.
- Correlation $\rho = -0.29$. Target is:

  Mean frailty by permanent earnings quintile in HRS data

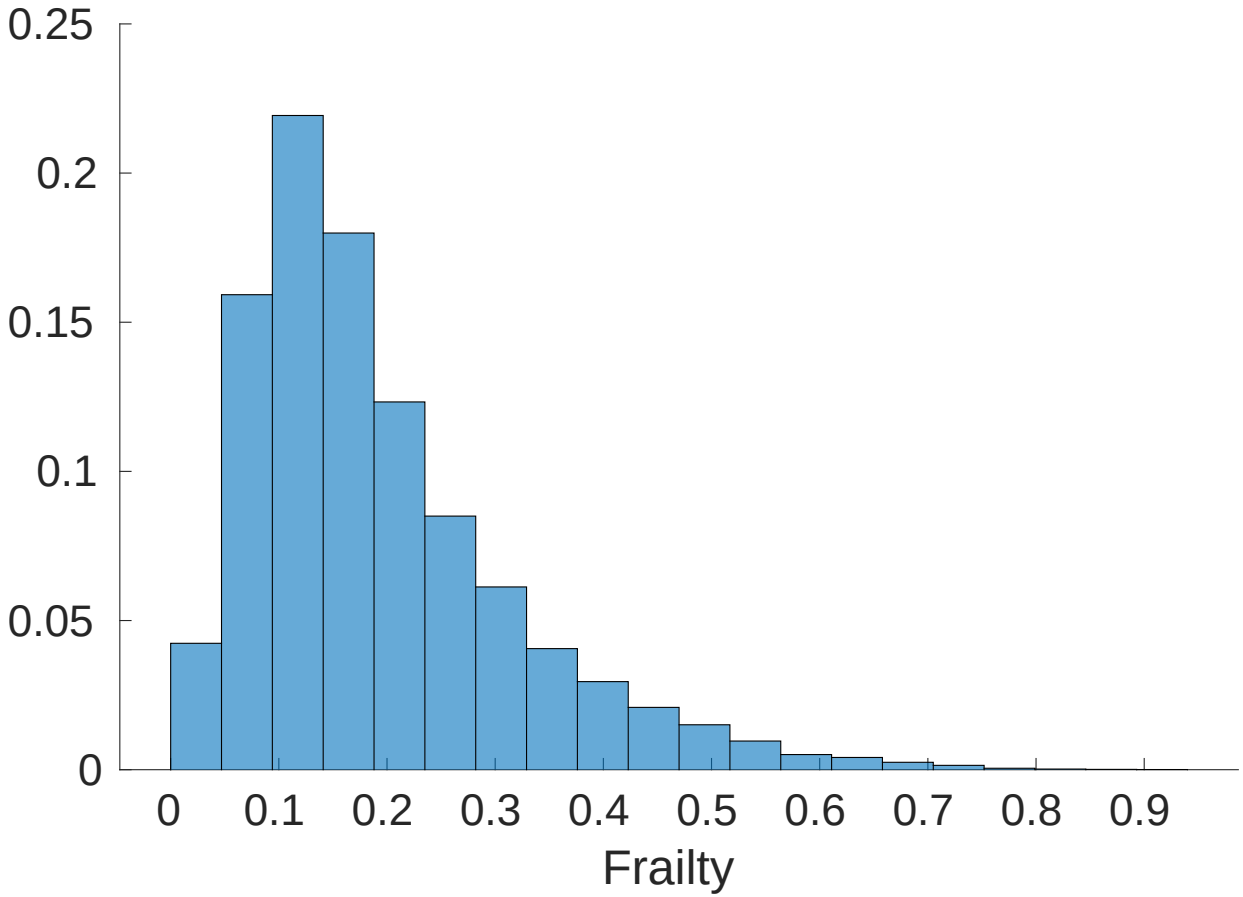
Q1	Q2	Q3	Q4	Q5
0.23	0.22	0.19	0.16	0.15

- Old income $w_o \in [0.60w_y, 0.40w_y]$. Targets are variation in wealth and average SS replacement rate.
- Consumption shock distn. $1 - \kappa$ is log-normal. Target is wealth distribution of NH entrants in period before NH entry.

Calibration: Distributions

- We construct a frailty index for HRS respondents that summarizes underwriting criteria used by LTC insurers.

Frailty distribution for 62–72 year-old HRS respondents



Assessment: Insurance Distribution

Distribution of insurance across NH residents: data and model

	LTCI	Medicaid	Both	Neither
Data	8.2	45.6	2.7	43.4
Model	9.2	47.6	0.3	42.6

- Distribution of insurance across NH residents in model and data are similar.
- Model understates fraction with both public and private insurance.

Simple Model: FONC's

$$MRS(\theta^g, \pi^g, \iota^g) \approx \lambda\eta,$$
$$MRS(\theta^b, \pi^b, \iota^b) = \lambda\theta^b,$$
$$U(\theta^g\pi^g, \iota^g) - U(\theta^g, 0, 0) = 0,$$
$$U(\theta^b, \pi^b, \iota^b) - U(\theta^b, \pi^g, \iota^g) = 0,$$

where

$$\eta = \psi\theta^g + (1-\psi)\theta^b,$$

and

$$MRS(\theta^i, \pi^i, \iota^i) = \frac{\theta^i u'\left(\max\left[\underline{c}, w_o - \pi^i - m + \iota^i\right]\right)}{\theta^i u'\left(\max\left[\underline{c}, w_o - \pi^i - m + \iota^i\right]\right) + (1-\theta^i)u'\left(w_o - \pi^i\right)}.$$

Conditions for rejections with $\lambda > 1$

The pool will be rejected if and only if

$$\text{MRS}(\theta^b_{f,w}) = -\frac{u_{2,NH}(\theta^b_{f,w}, 0, 0)}{u_{2,o}(\theta^b_{f,w}, 0, 0)} \leqslant \lambda s_{f,w} \theta^b_{f,w}, \qquad (1)$$

and

$$\text{MRS}(\theta^g_{f,w}) = -\frac{u_{2,NH}(\theta^g_{f,w}, 0, 0)}{u_{2,o}(\theta^g_{f,w}, 0, 0)} \leqslant \lambda s_{f,w} \eta_{f,w}, \qquad (2)$$

hold where $\eta_{f,w} = \psi\theta^g_{f,w} + (1-\psi)\theta^b_{f,w}$, is the fraction of individuals with frailty f and endowments w who will enter a NH.

Basic intuition:

- (1) rules out separating contracts where only bad types get insurance.
- (2) rules out pooling contracts and separating contracts where both types get insurance.

Back

The U.S. private LTCI market: the industry

- Market has experienced a boom – bust cycle.
  - Boom years: late 1980s – 1990s. Sales more than doubled. Over 100 companies in 2003.
  - Bust years: 2003 – present. Massive exit. Most companies have stopped writing policies. In 2013, 66% of all new policies were sold by three insurers.

LTCI take-up rates by frailty and wealth quintiles

	Data		
Frailty Quintile	Wealth Quintiles 1–3	4	5
1	0.071	0.147	0.233
2	0.065	0.158	0.205
3	0.049	0.131	0.200
4	0.037	0.113	0.157
5	0.025	0.107	0.104

LTCI take-up rates increase with wealth and decline with frailty in the data.

Nursing Home (NH) Risk

- NH expense risk in US is significant:
  - In 2015 the average annual cost of a NH stay was \$80,300 for a semi-private room. (Genworth 2015 Cost of Care Survey)
  - Lifetime probability of a long stay (over 100 days) for 65-year-old is 0.30. Average duration $\approx$ 3 years. (HRS data)
- Who pays for care?
  - Medicare pays 18%. Partially covers the first 100 days of rehabilitative stays.
  - Medicaid pays 37%. Means-tested. Asset test threshold about \$2000.
  - 37% is paid for out-of-pocket.
  - Private insurance only pays 4%.

Source: Federal Interagency Forum on Aging-Related Statistics, 2003.

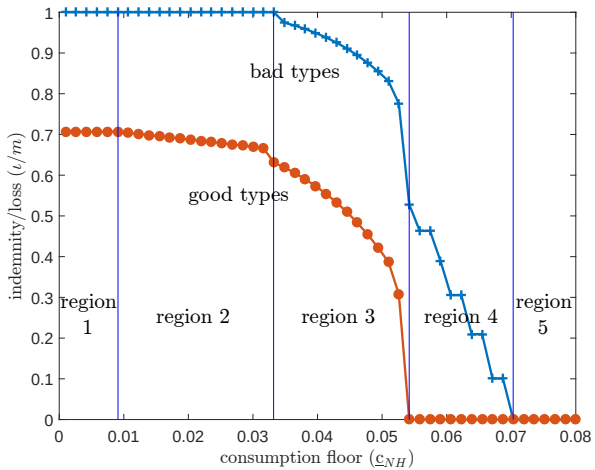
Insurance in different settings.

	Perfect Comp.		Monopoly	
Risk	Complete Info.	Priv. Info.	Complete Info.	Priv. Info.
θ_b	Complete insurance, actuarially fair	Complete Insurance, actuarially fair	Insurer extracts entire surplus	Complete insurance, not actuarially fair
θ_g	Complete Insurance, Actuarially Fair	Partial Insurance, Actuarially fair	Insurer extracts entire surplus	Partial or no insurance, not actuarially fair

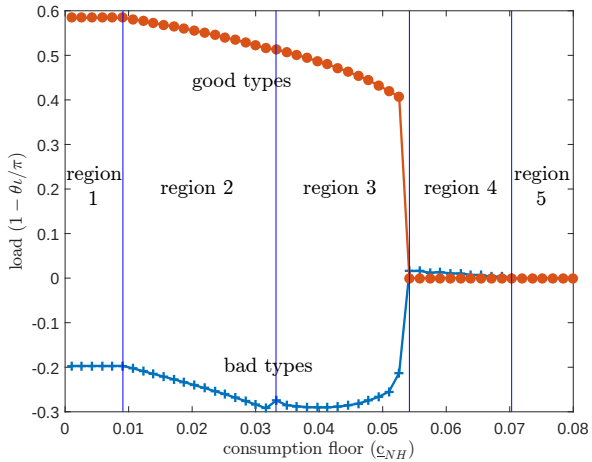
Properties of the Model: Pooling intuition

- $\theta^b = 1$ or $\lambda > 1$ and large enough:
  - Complete information optimal contract of bad type is lower than that of good type.
  - But to get a separating eqm. with private information, incentive compatibility requires contracts to be increasing in loss chance.
  - Best bet for positive profits is a pooling contract.
- $\underline{c} > 0$ case:
  - Both on Medicaid for sure: only optimal contract is (0,0).

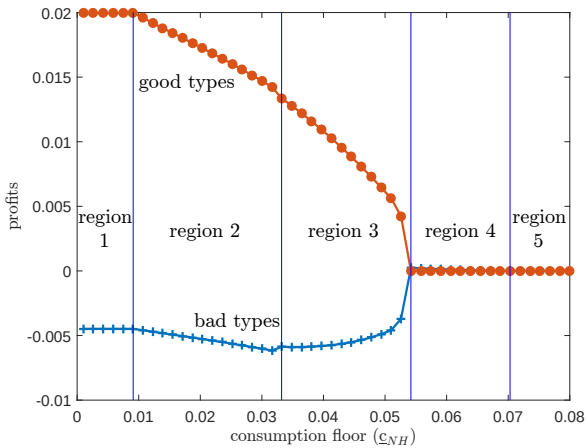
Optimal contracts with Medicaid and ω uncertain



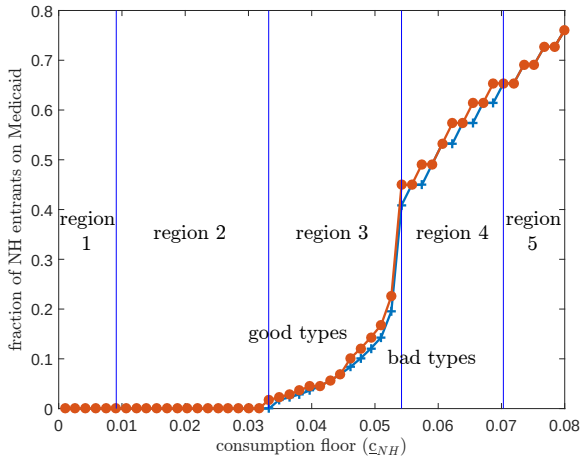
(a) Indemnity-loss ratio



(b) Loads



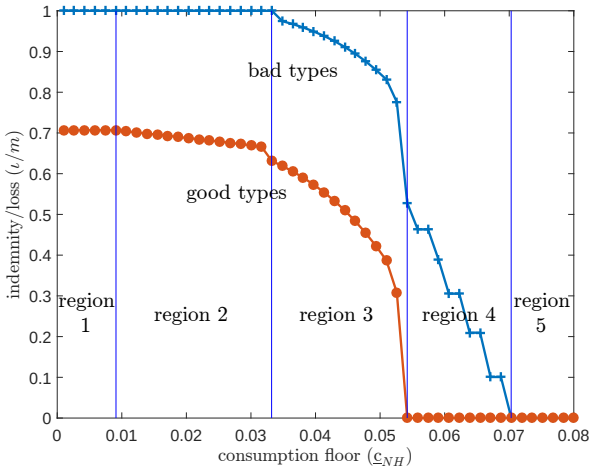
(c) Profits



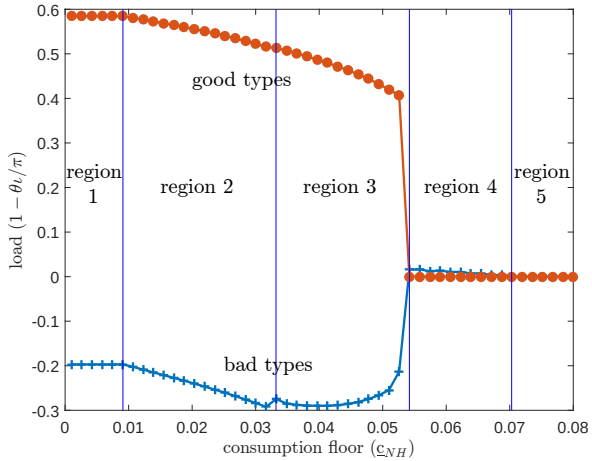
(d) Medicaid recipients

- Region 1: $\underline{c}_{NH}$ so small that even with no LTCI not eligible for Medicaid.

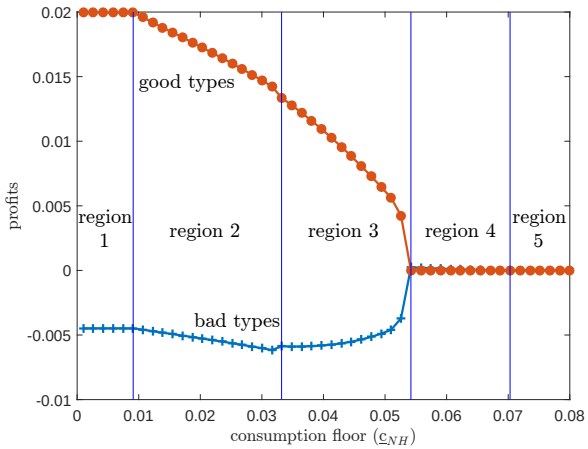
Optimal contracts with Medicaid and ω uncertain



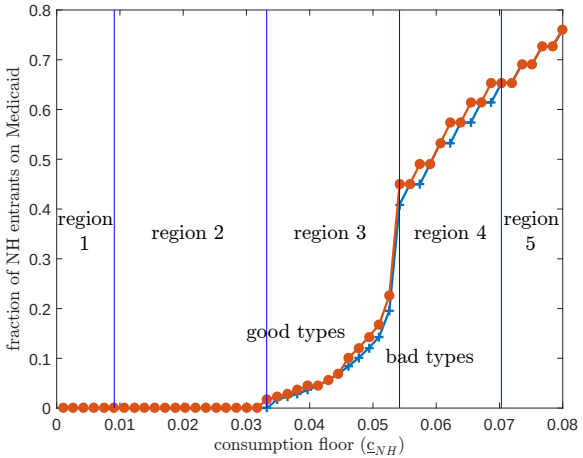
(b) Indemnity-loss ratio



(c) Loads



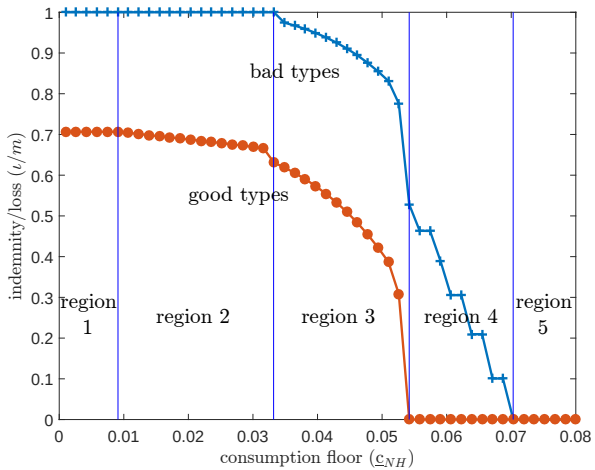
(d) Profits



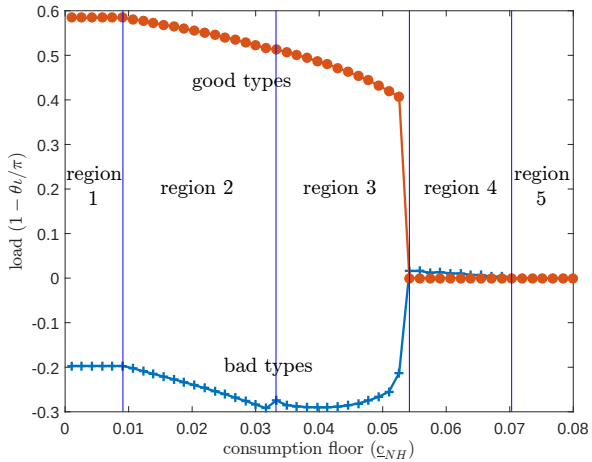
(e) Medicaid recipients

- Region 2: Can get Medicaid if no LTCI $\Rightarrow$ loads fall.

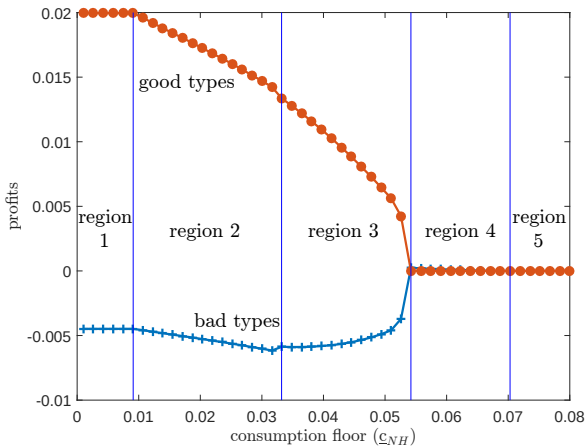
Optimal contracts with Medicaid and ω uncertain



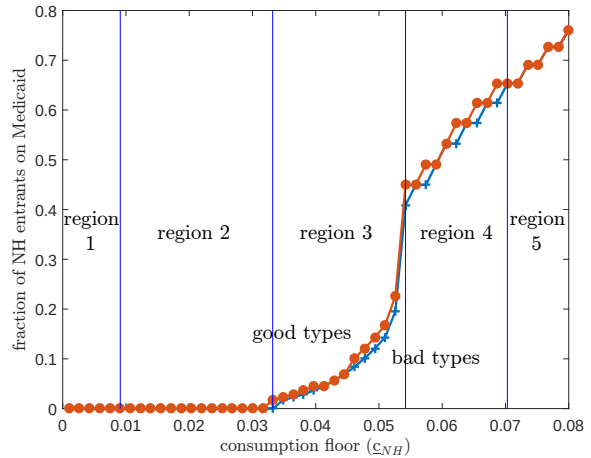
(c) Indemnity-loss ratio



(d) Loads



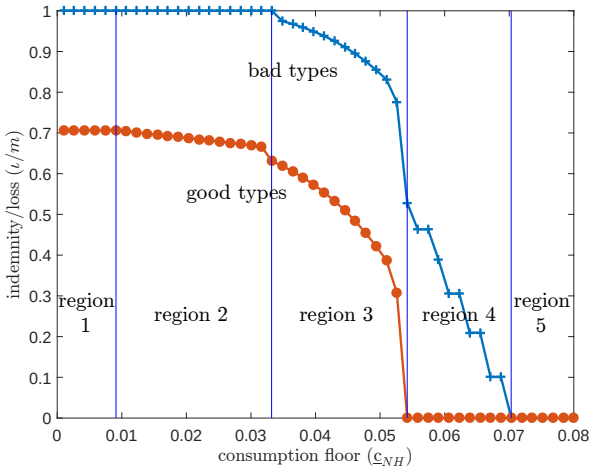
(e) Profits



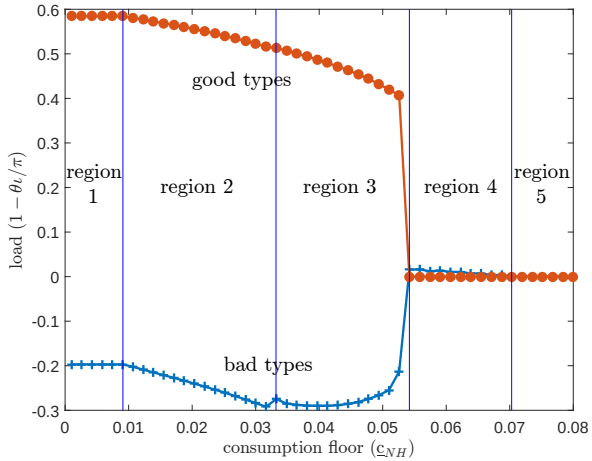
(f) Medicaid recipients

- Region 3: Can get Medicaid in eqm for some realizations of $\omega \Rightarrow$ partial coverage preferred.

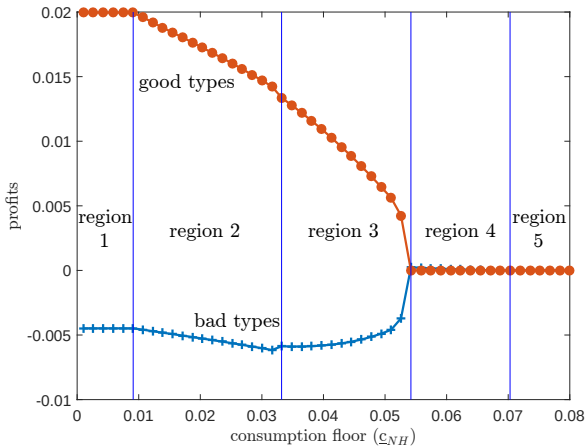
Optimal contracts with Medicaid and ω uncertain



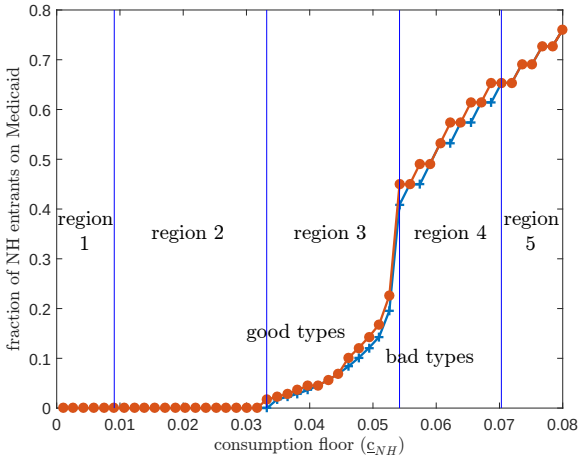
(d) Indemnity-loss ratio



(e) Loads



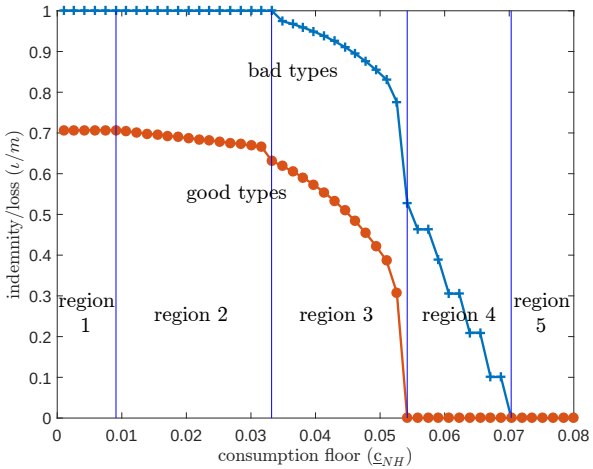
(f) Profits



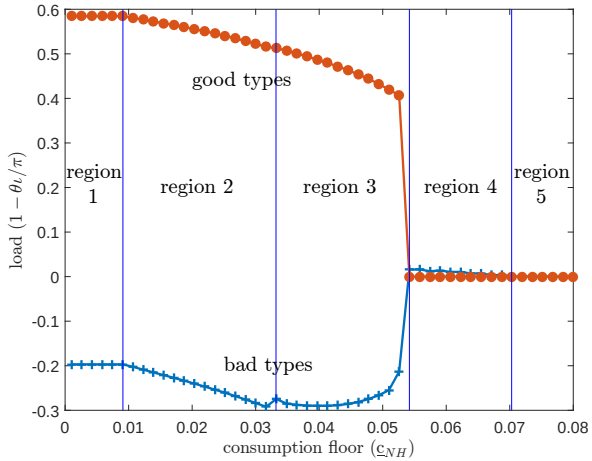
(g) Medicaid recipients

- Region 4: Good types drop out of market.

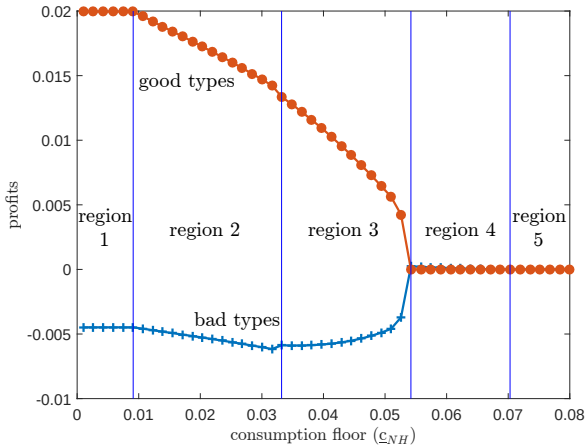
Optimal contracts with Medicaid and ω uncertain



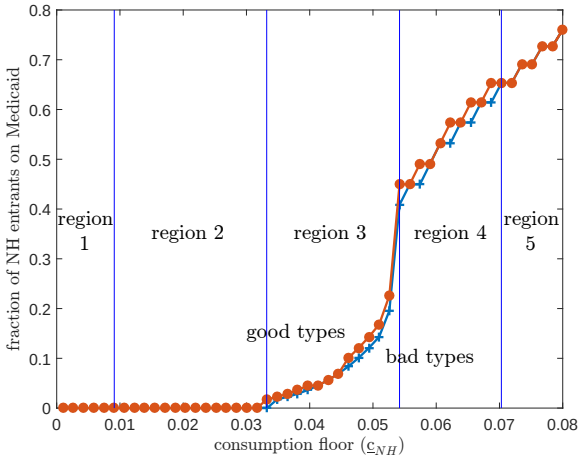
(e) Indemnity-loss ratio



(f) Loads



(g) Profits



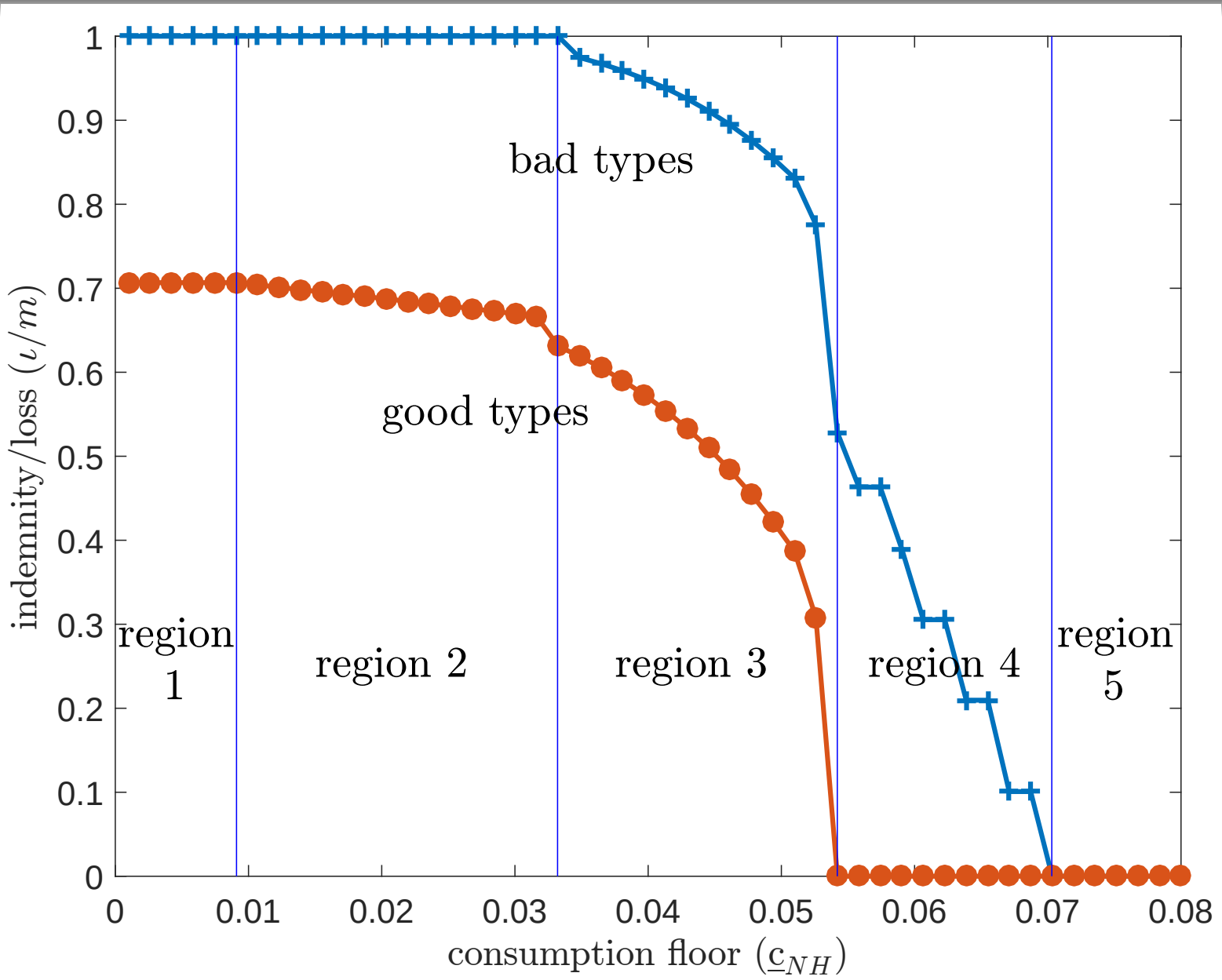
(h) Medicaid recipients

- Region 5: No profitable positive contracts $\Rightarrow$ rejections.

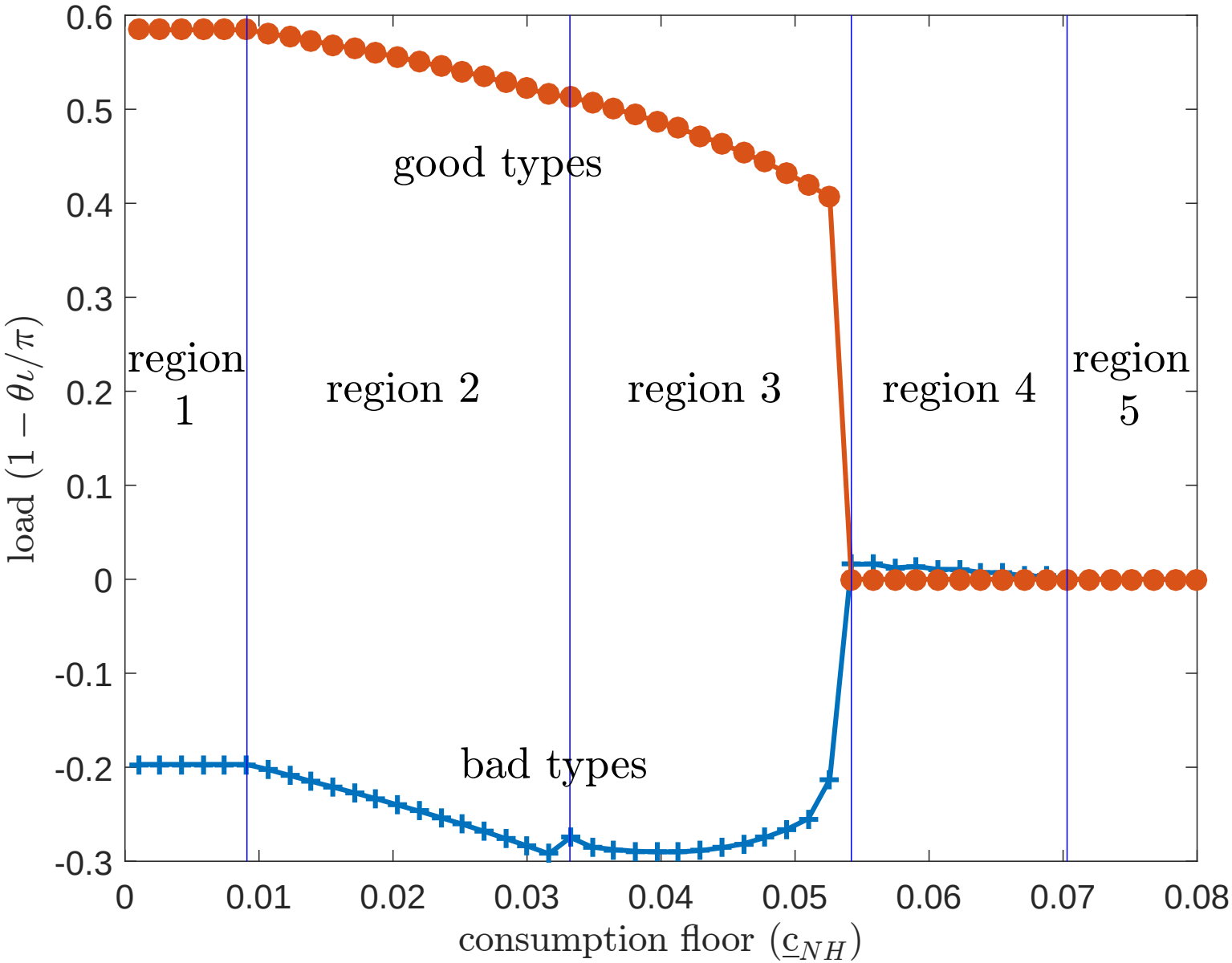
Optimal contracts with Medicaid and ω uncertain

- In regions 4 and 5, Medicaid crowds-out demand for LTCI but still leaves agents exposed to NH risk.
- Crowding-out effect similar to that in Brown and Finkelstein (2008) which study effect of Medicaid on demand for LTCI insurance in setup with exogenous contracts.
- However, because contracts in our setup adjust to changes in Medicaid $\Rightarrow$ crowding-out effect is smaller.

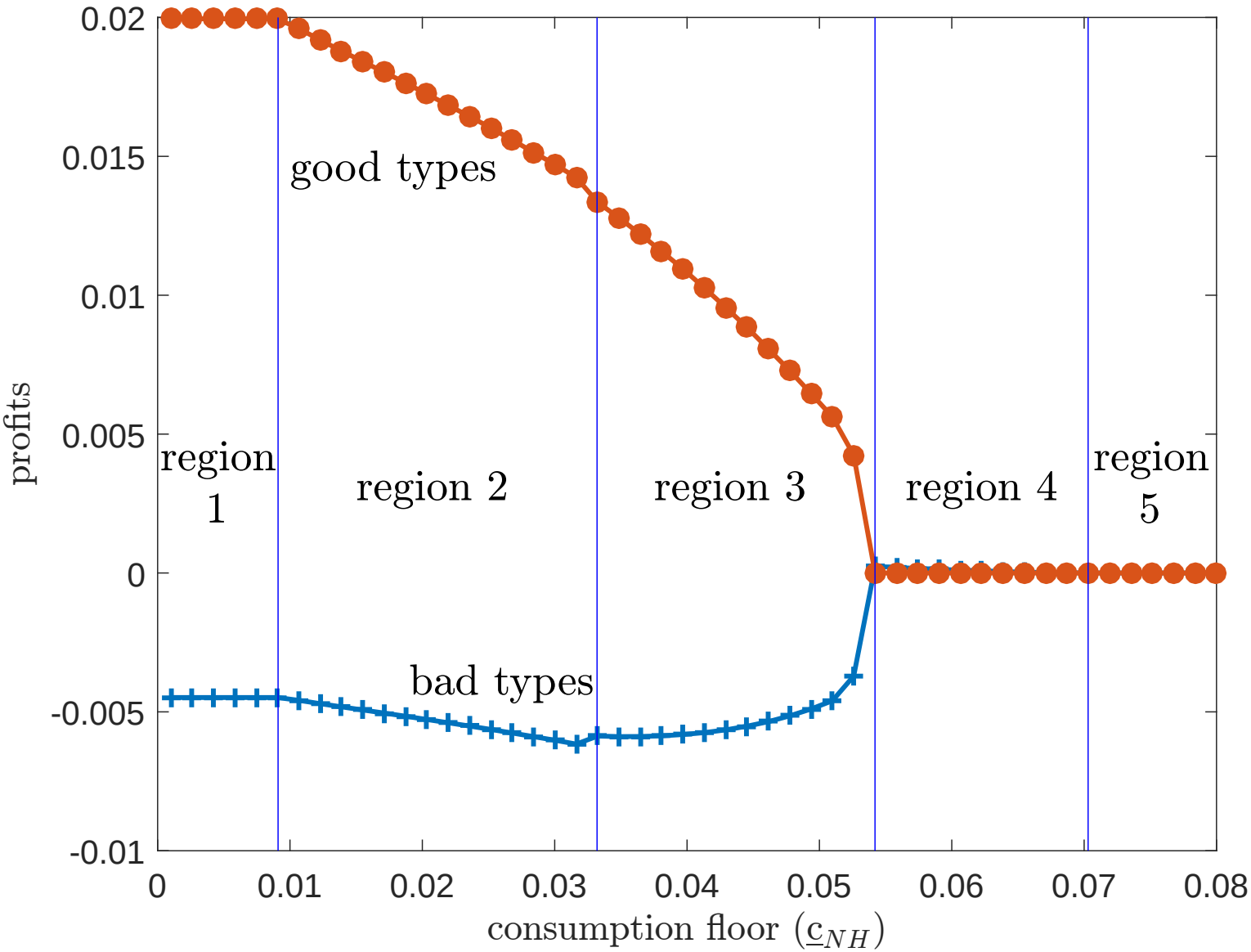
Increasing Medicaid: Indemnity



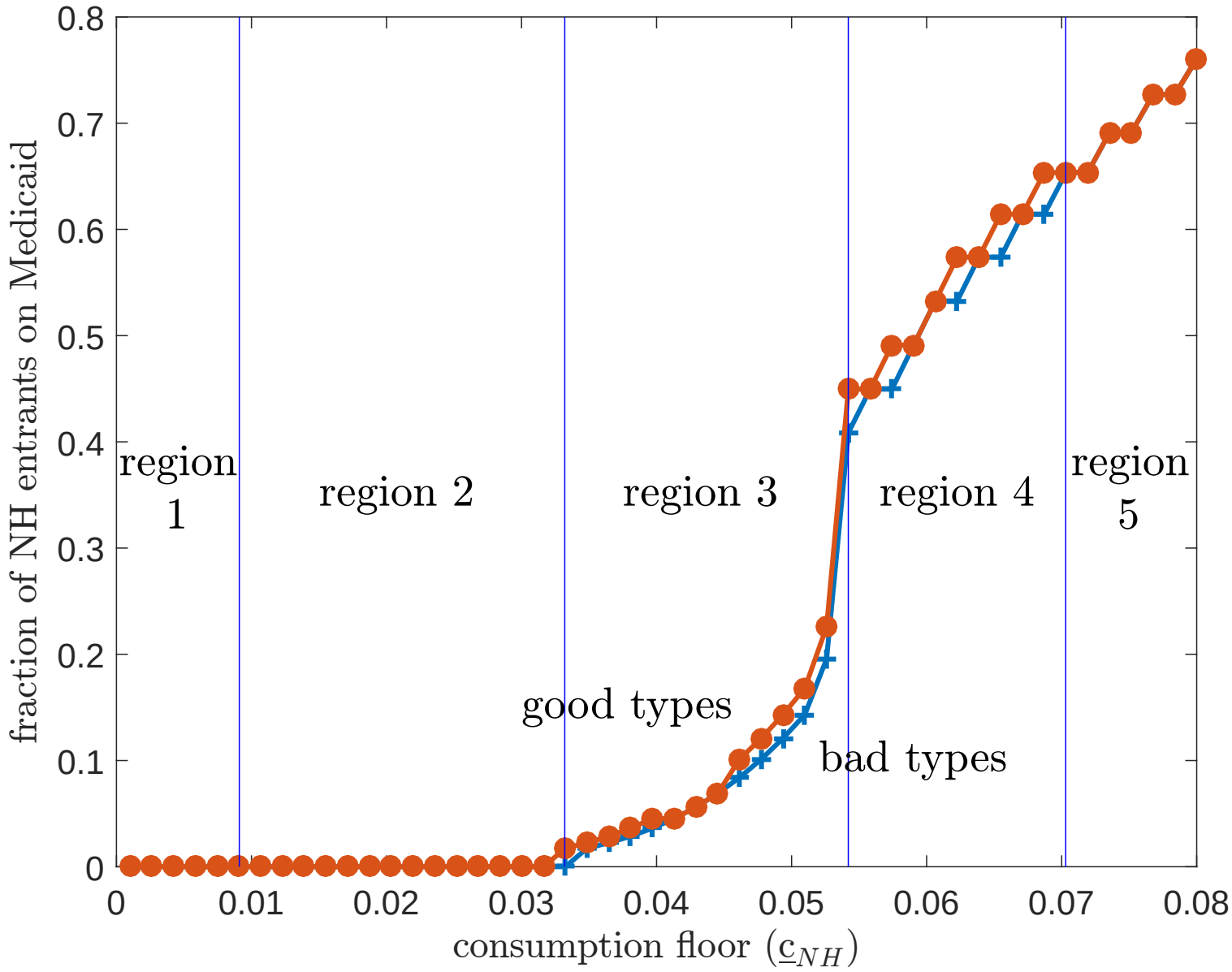
Increasing Medicaid: Loads



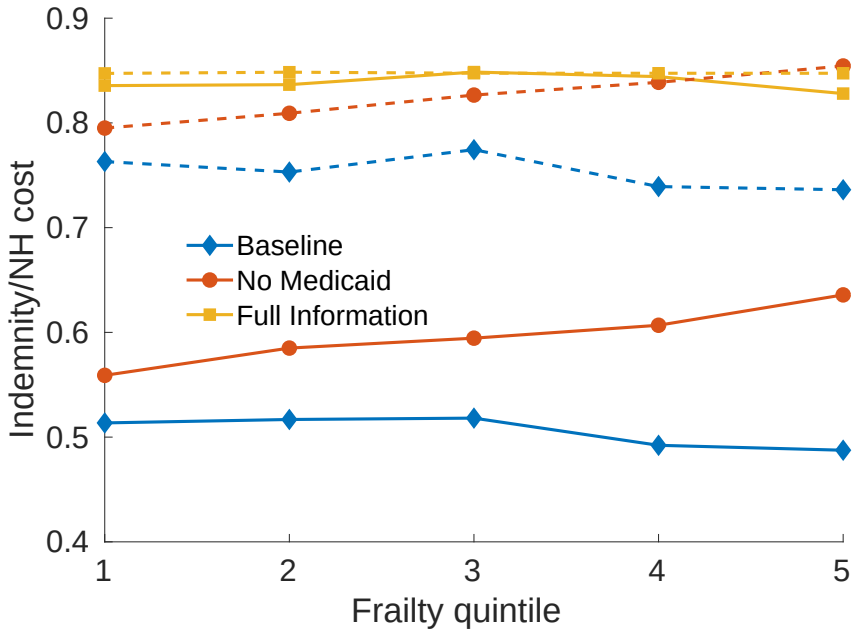
Increasing Medicaid: Profits

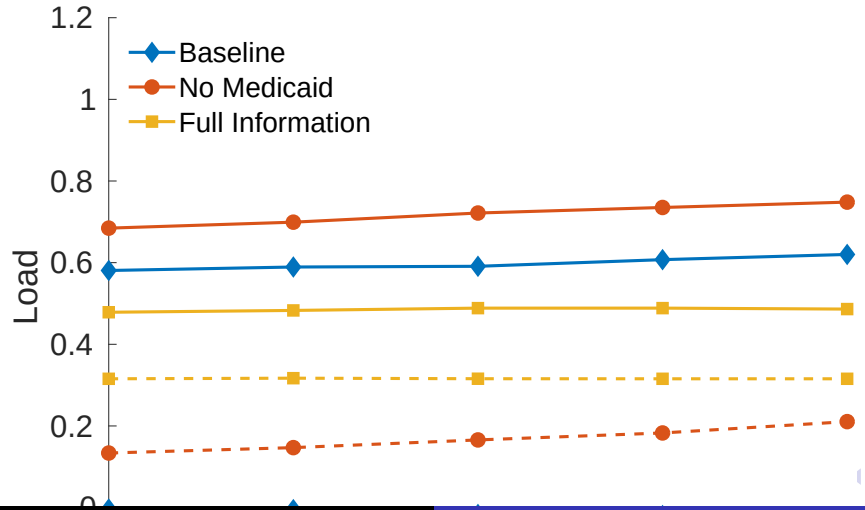


Increasing Medicaid: Medicaid Recipients

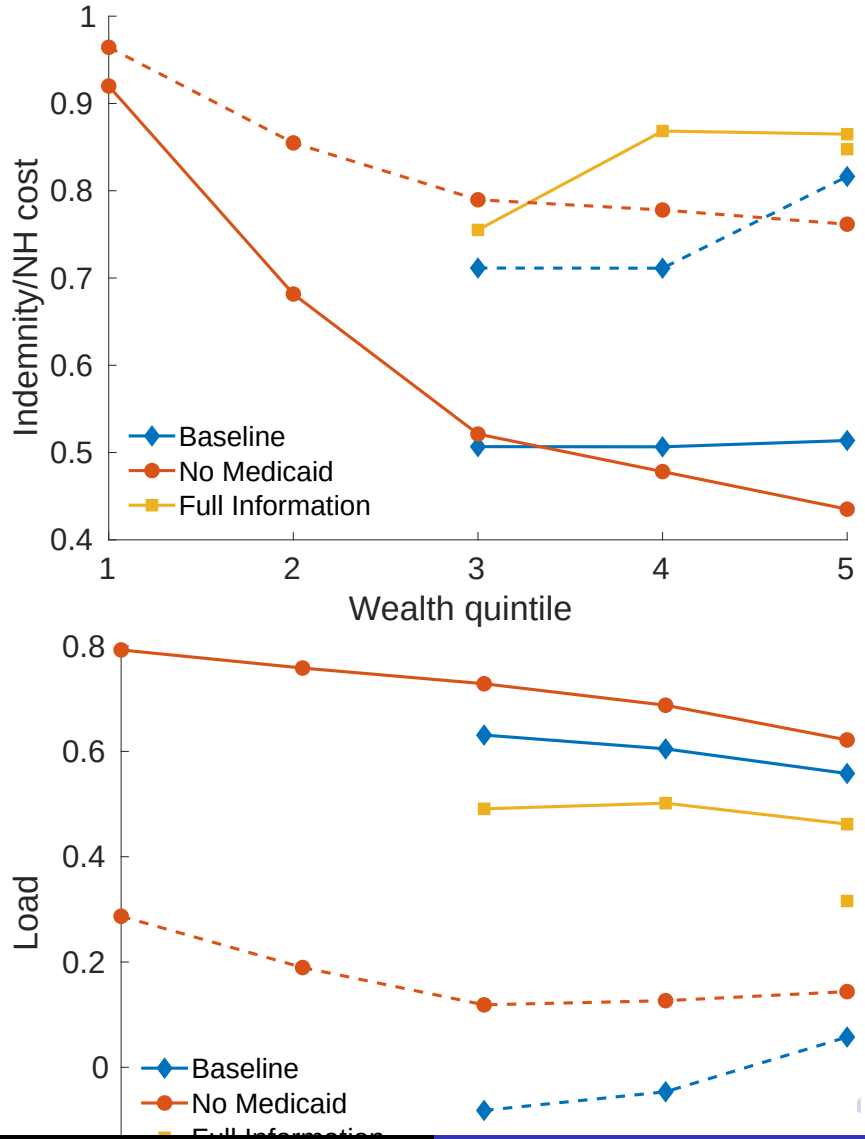


Loads and Coverage in Three Specifications by Frailty

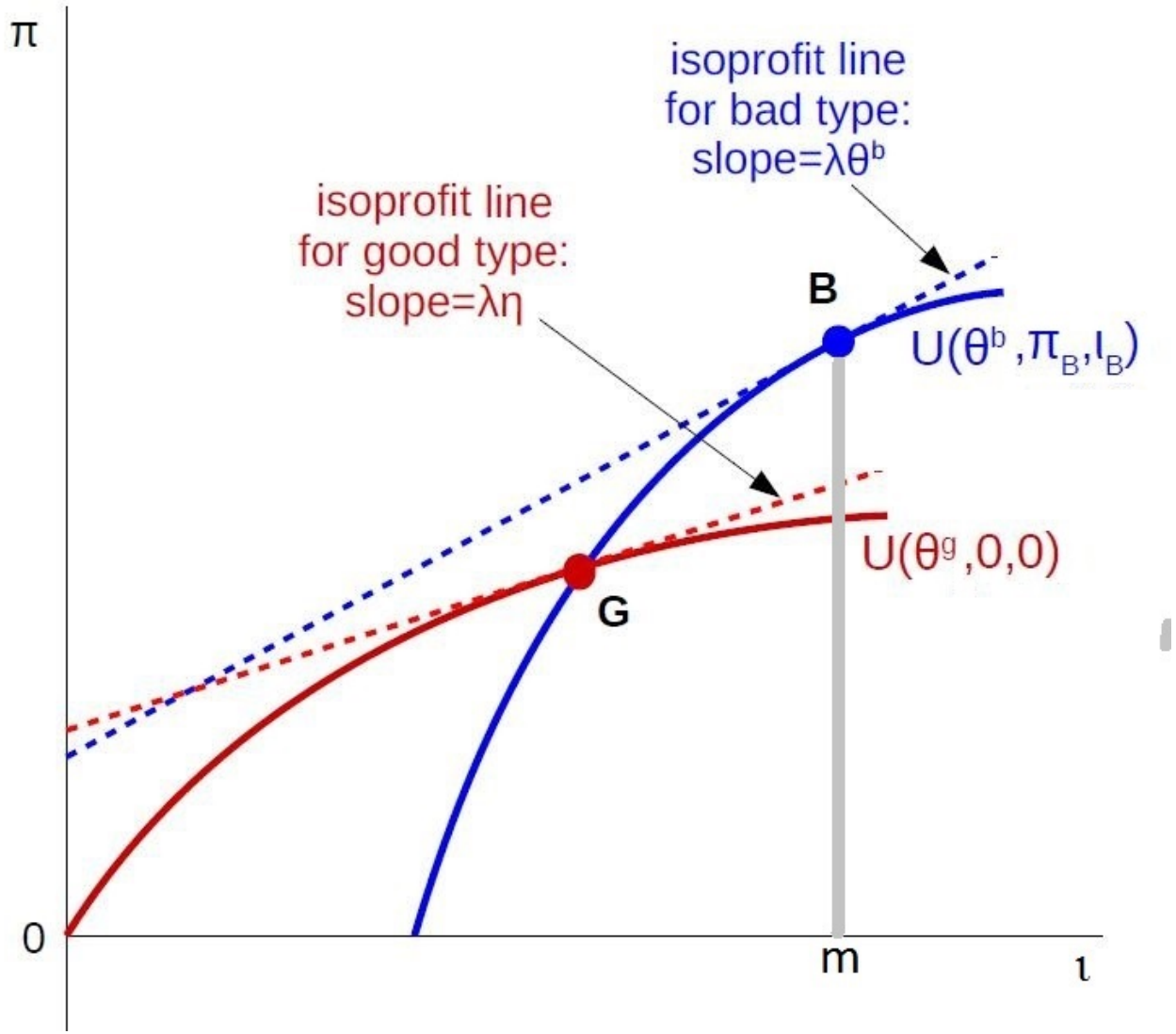




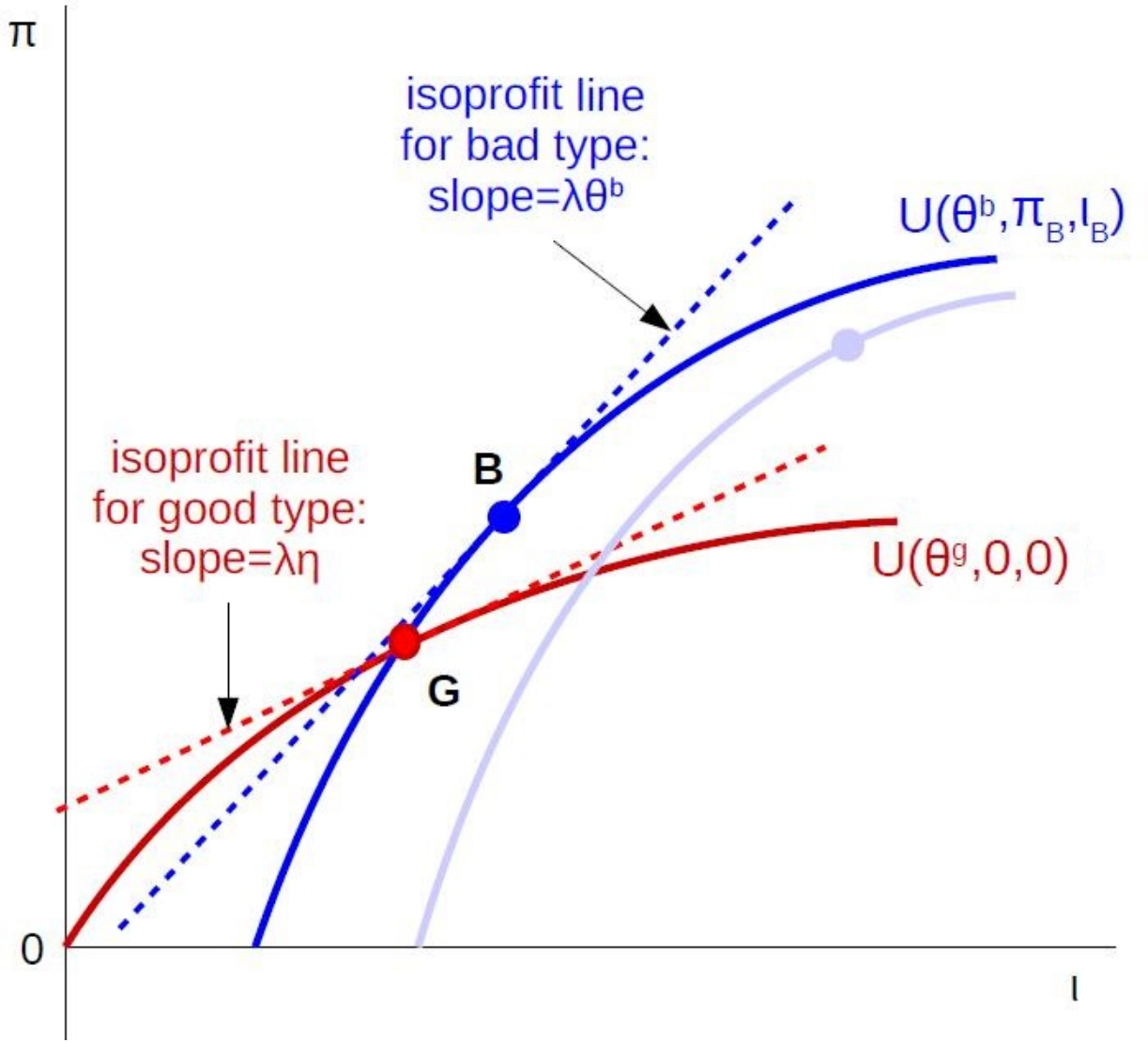
Loads and Coverage in Three Specifications by Wealth



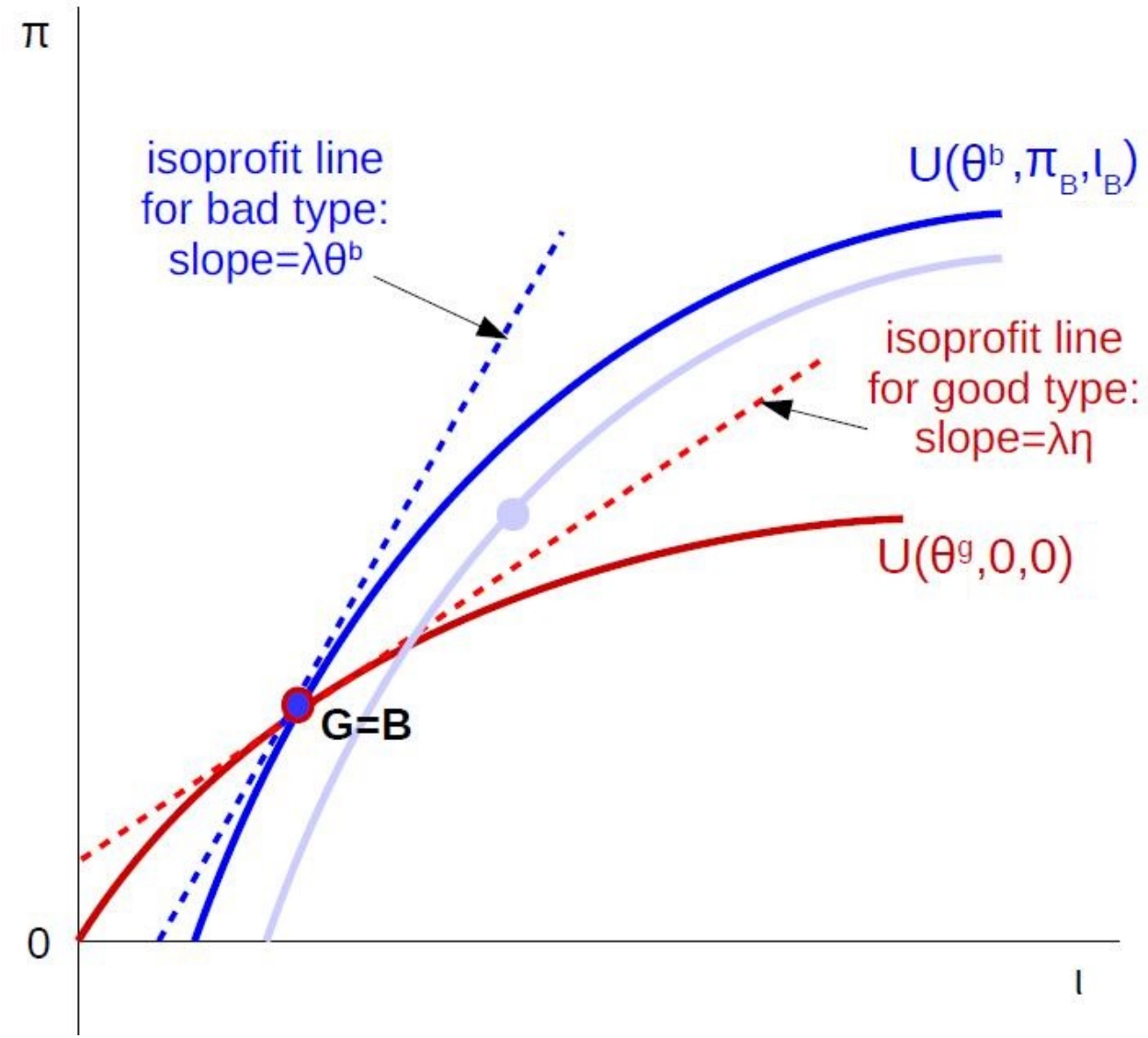
Optimal Contract with Load: $\lambda = 1$



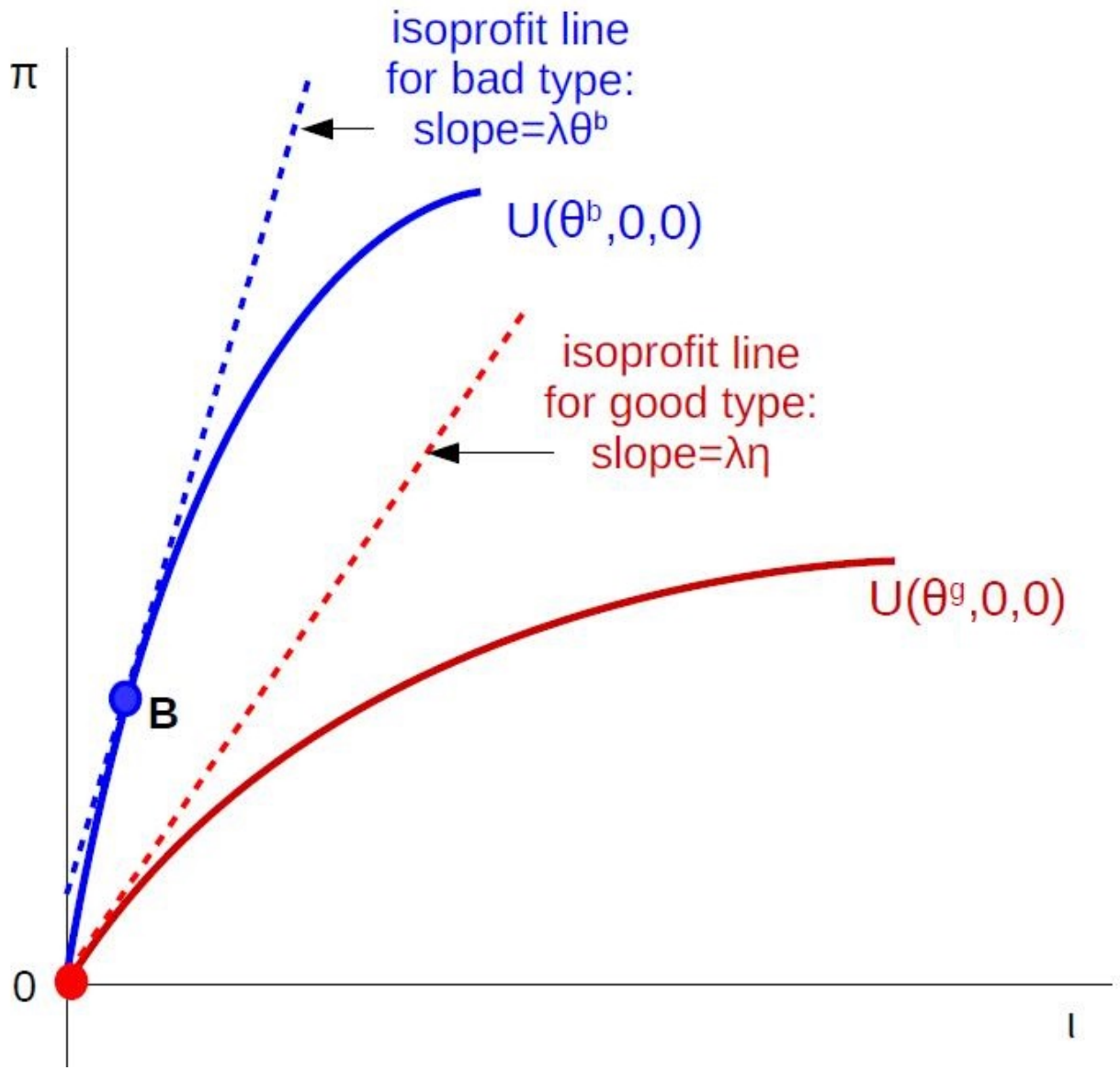
Optimal Contract with Load: $\lambda > 1$



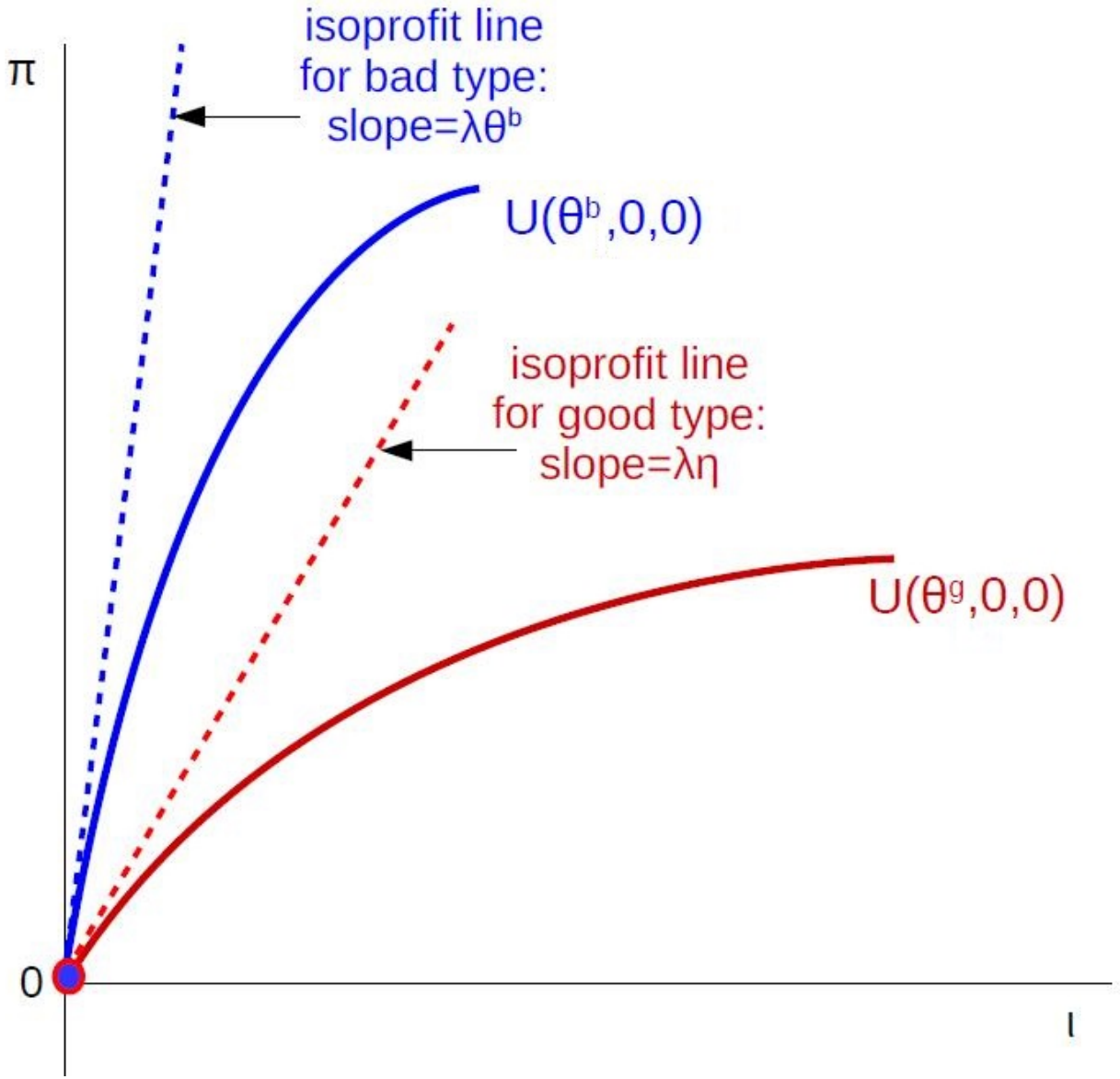
Optimal Contract with Load: Pooling



Optimal Contract with Load: Good Rejected



Optimal Contract with Load: Both Rejected



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Generating pattern of LTCI take-up rates

When $\theta^{b}_{f,w}$ is sufficiently large and either $\lambda > 1$ or $\underline{c} > 0$: a risk group is (weakly) more likely to rejected if

- the distribution of NH entry probabilities $\theta^{i}_{f,w}$, $i \in \{g, b\}$ becomes more polarized with $\eta_{f,w} = \psi\theta^{g}_{f,w} + (1-\psi)\theta^{b}_{f,w}$ not declining too much.

- We calibrate the $\theta^{i}_{f,w}$'s such that the model generates the pattern of LTCI take-up rates by frailty and wealth observed in the data.

Properties of the Model: Standard Setup

If $\theta^g < \theta^b < 1$, $\lambda = 1$, and $\underline{c} = 0$ the model generates the *classic* findings in Stiglitz (1977) and Chade and Schlee (2012):

1. *Separating equilibria.* Agents are offered two contracts. Type θ^b prefers one of the contracts and type θ^g prefers the other contract.
2. *Full insurance at the top.* Type θ^b agents get full insurance but the contract is not actuarially fair (single issuer).
3. *Downward distortion for good risks.* The indemnity for type θ^g agents is distorted downward.
4. *Positive correlation property.* Correlation between LTCI ownership and NH entry is positive (only θ^g agents may have no insurance).

Impact of Medicaid on LTCI take-up rates

Scenario Description	Baseline	No Administrative Costs $\lambda = 1,\ \kappa = 0$	No Medicaid $\underline{c}_{nh} = 0.001$	Full Information θ_f^i public
Good risks (θ^g)				
LTCI take-up rate	0.097	0.609	0.906	0.524
Bad risks (θ^b)				
LTCI take-up rate	0.099	0.613	0.906	0.012

- Thus both have a big impact on take-up rates.
- However, the crowding-out effect of Medicaid is smaller in our model than Brown and Finkelstein (2008).

Adverse Section: Theory v. Data

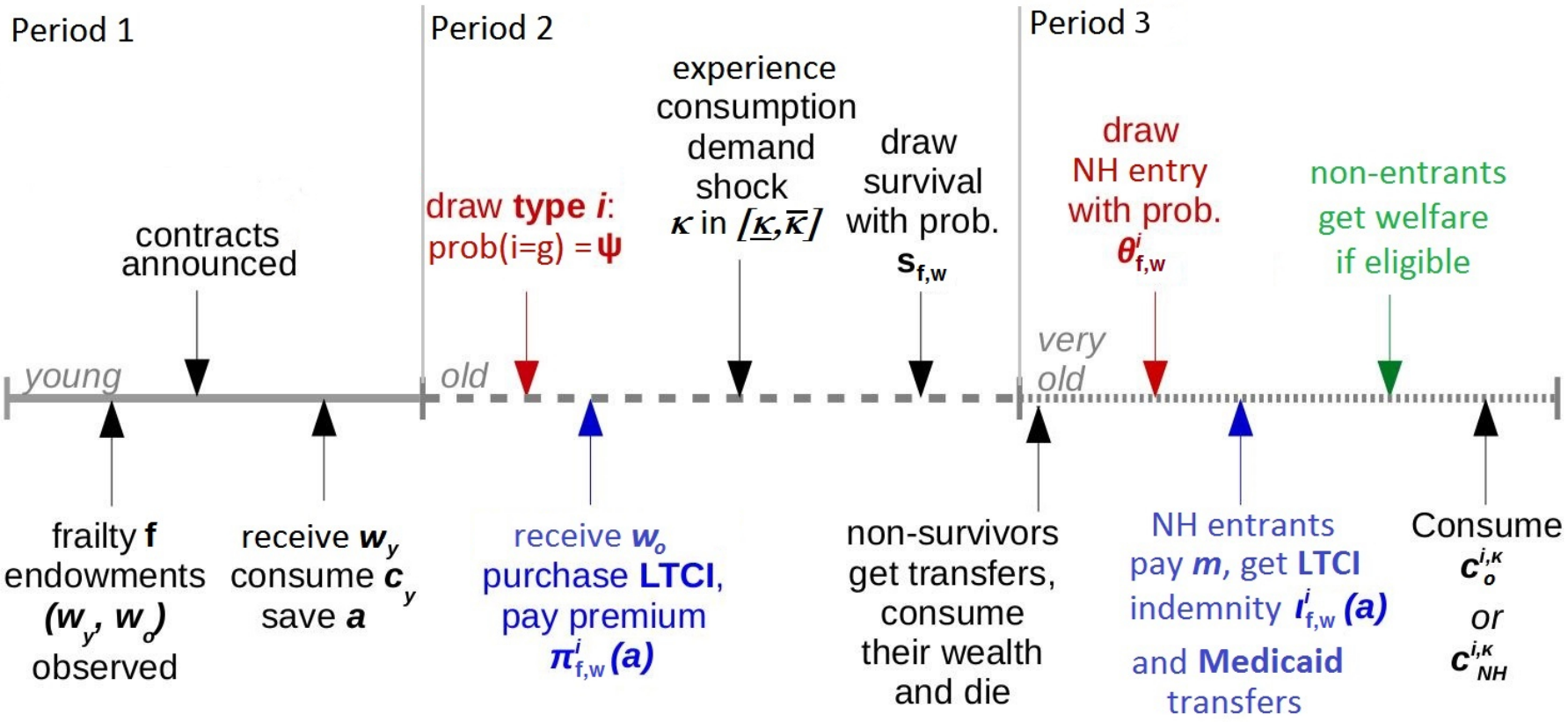
Recent research suggests how to bridge the gap between theory and data.

1. Rejections can arise due to private information if:
   - Some agents know that they incur the loss w.p. 1 (Hendren, 2013).
   - The insurer has monopoly power and faces administrative costs (Chade and Schlee, 2014).
2. Empirical evidence that private information is more severe among the frail (Hendren, 2013). details

Our Findings

1. LTCI take-up rates are low due to rejections.
2. Supply side frictions due to adverse selection, market power and administrative costs generate rejections and thus low LTCI take-up rates of wealthy individuals.
3. Demand side frictions due to Medicaid generate rejections and low LTCI take-up rates of poor individuals.
4. Both factors are important for the middle class.
5. Model also accounts for the other features of this market we described above.

Model Timeline



Parametrization of Medicaid consumption floor

- Consumption floor is \$6,540 a year (year 2000 dollars).
- Consists of a consumption allowance of \$30 per month and housing and food expenses of \$515 per month.
- The former number is Medicaid consumption allowance to NH residents and the latter is the monthly amount that SSI paid to single elderly individuals in 2000.
- Number of years is 2.976. (average duration of long-term NH stay).
- Resulting value of $\underline{c}_{NH}$ is 1.855% of mean permanent earnings.

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Parametrization of demand shock distribution

- $1 - \kappa$ is truncated log-normal over $[0.2, 0.8]$.
- Target for mean is average wealth of NH entrants relative to average wealth of 62–72 year-olds: 0.62 in data and 0.68 in model.
- Target for variance is the ratio of average wealth in quintile 5 of NH entrants immediately before entering the NH relative to the average wealth in quintile 5 at age 62–72: 0.70 in data and 0.66 in model.
- The resulting mean and standard deviation of κ are 0.60 and 0.071.
- So, on average, individuals lose 60% of wealth between retirement and NH entry.

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Calibrating NH entry probability distributions

	Data			Model		
Frailty	Wealth Quintiles			Wealth Quintiles		
Quintile	1–3	4	5	1–3	4	5
1	0.071	0.147	0.233	0.073	0.145	0.245
2	0.065	0.158	0.205	0.069	0.165	0.202
3	0.049	0.131	0.200	0.048	0.128	0.245
4	0.037	0.113	0.157	0.032	0.122	0.151
5	0.025	0.107	0.104	0.029	0.102	0.118

LTCI take-up rates increase with wealth and decline with frailty in model and data.

Identification of choice versus no-trade contracts

- Our strategy for parameterizing ψ also pins down choice versus no-trade contracts.
  - No-trade contracts are more common when ψ is large.
  - If we lower ψ and reparameterize $\{\theta^{g}_{f,w}, \theta^{b}_{f,w}\}$ to fit NH entry and LTCI take-up rate data choice menus become more common.
  - However, the overall dispersion of private information also falls.

LTCI Take-up Rates: Data, Baseline and Full Information Models

	Data		Baseline		Full Info.	
Frailty	Wealth Quintile		Wealth Quintile		Wealth Quintile	
Quintile	4	5	4	5	4	5
1	0.147	0.233	0.145	0.245	0.709	0.694
2	0.158	0.205	0.165	0.202	0.709	0.709
3	0.131	0.200	0.128	0.245	0.709	0.708
4	0.113	0.157	0.122	0.151	0.709	0.711
5	0.107	0.104	0.102	0.118	0.709	0.699

For frailty (rows) Quintile 5 has the highest frailty and for wealth (columns) Quintile 5 has the highest wealth.

- Data and Baseline Model: LTCI take-up rates decline with frailty.
- Full Information Model: LTCI take-up rates are constant or hump-shaped in frailty.

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Robustness

- A lower value of $\psi = 0.609$ produces more contracts that feature choice, but this specification no longer reproduces the correlation puzzle and understates the dispersion of private information in our dataset.
- Private information and administrative costs continue to be important in accounting for low LTCI take-up rates among affluent individuals if the size of the Medicaid consumption floor is increased by a factor of 1.76.
- Administrative costs are also important if the model is to reproduce the low LTCI take-up rates in the data among affluents individuals.