

RISK MISPERCEPTIONS AND CONTRACT DISTORTIONS IN INSURANCE MARKETS

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PF Lunch

November, 2020

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First 10 minutes: Core model, then in 5 pictures the essence of the project.

Later: Details

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- Firm profits depend on **objective** p_i .

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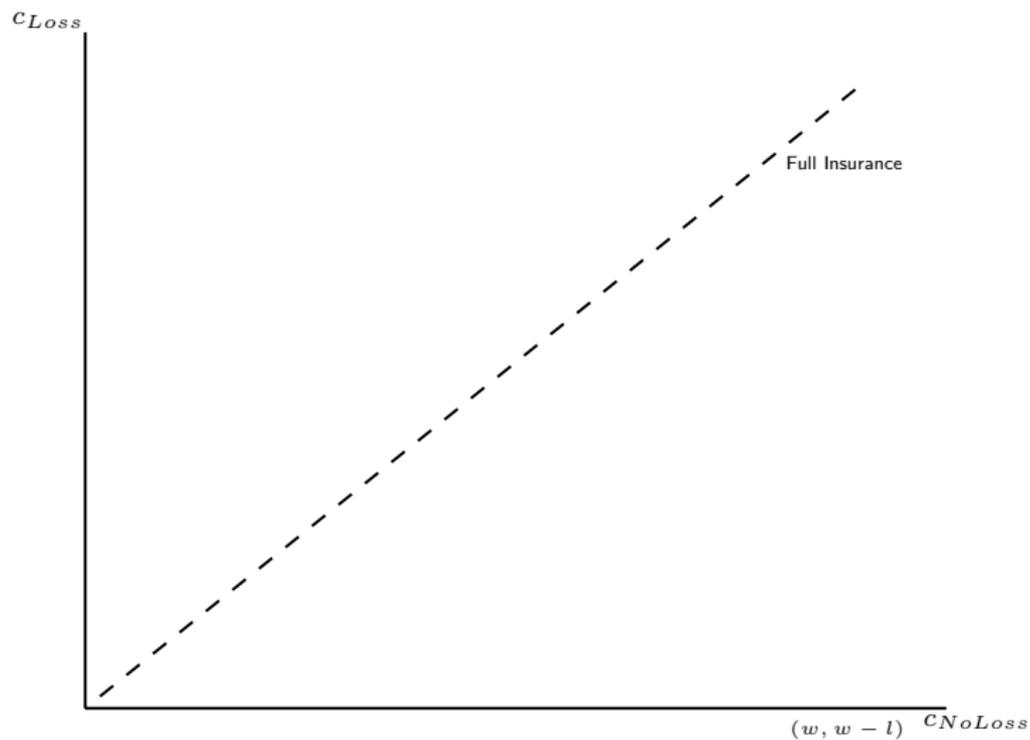
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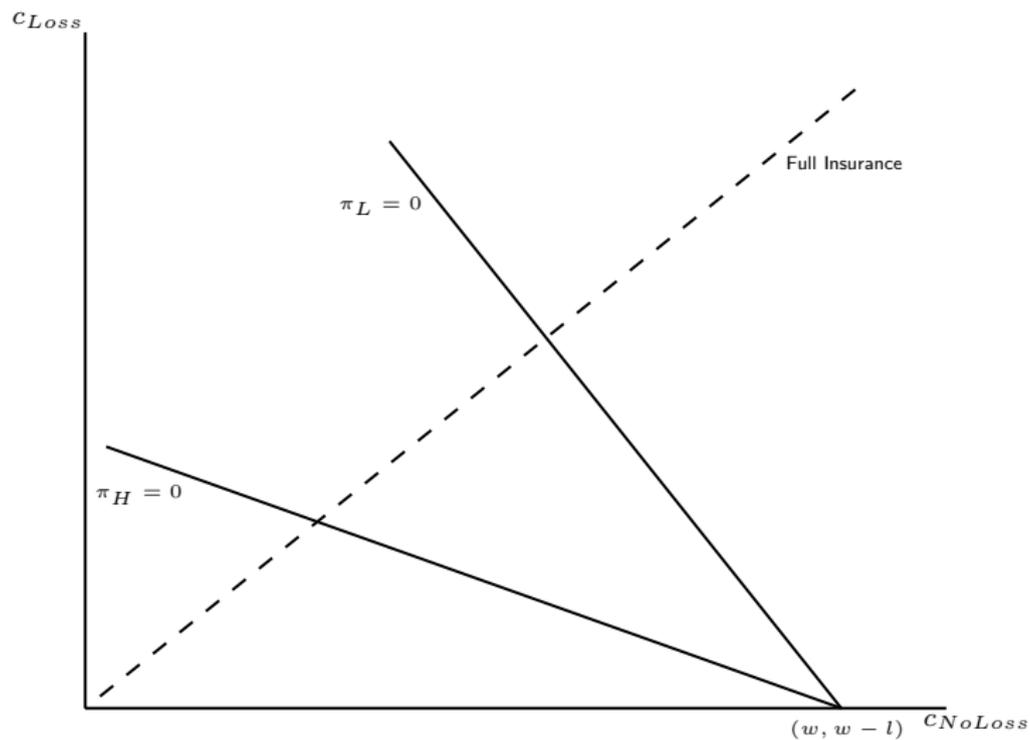
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- The equilibrium notion is local Nash Equilibrium, equivalent to Riley or Azevedo Gottlieb in this setting.

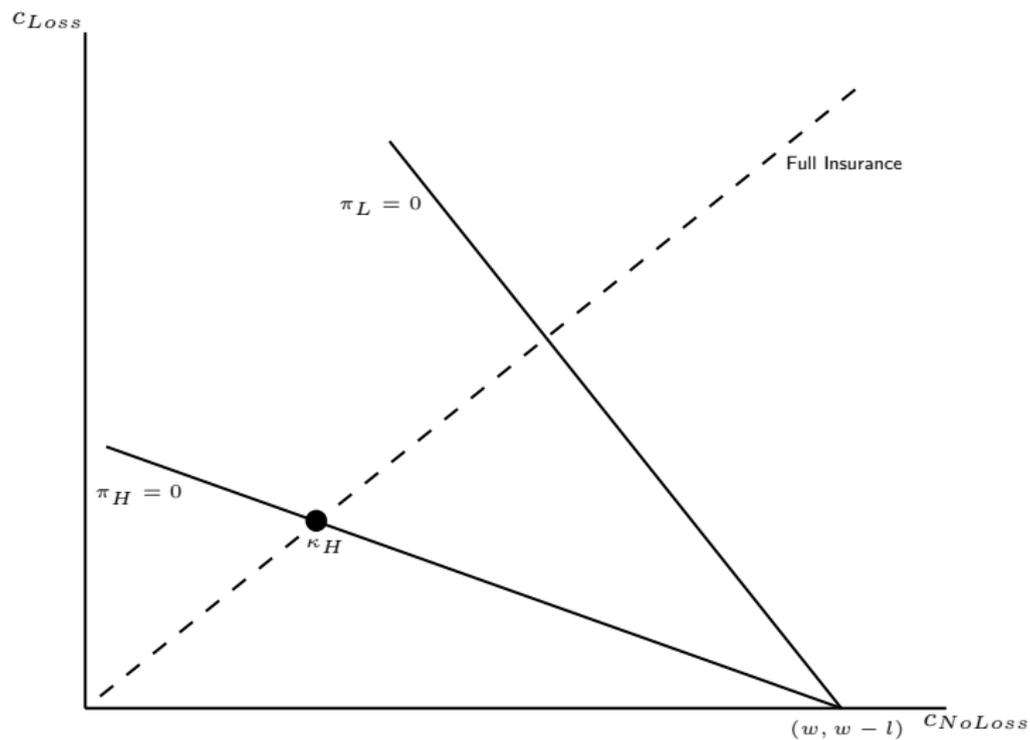
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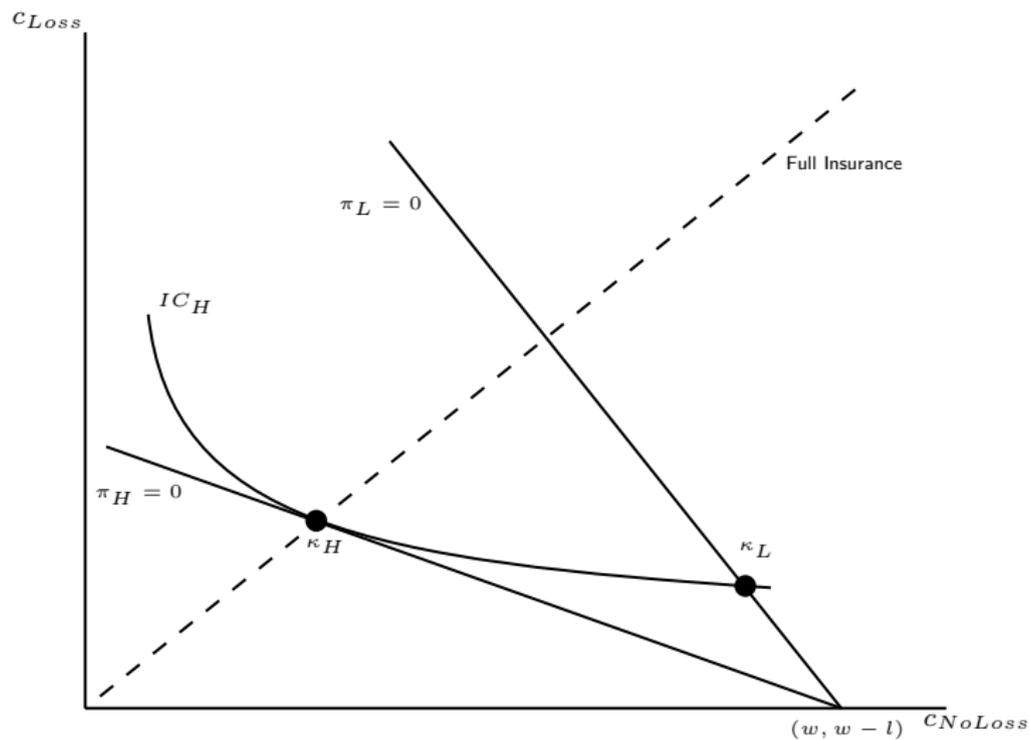
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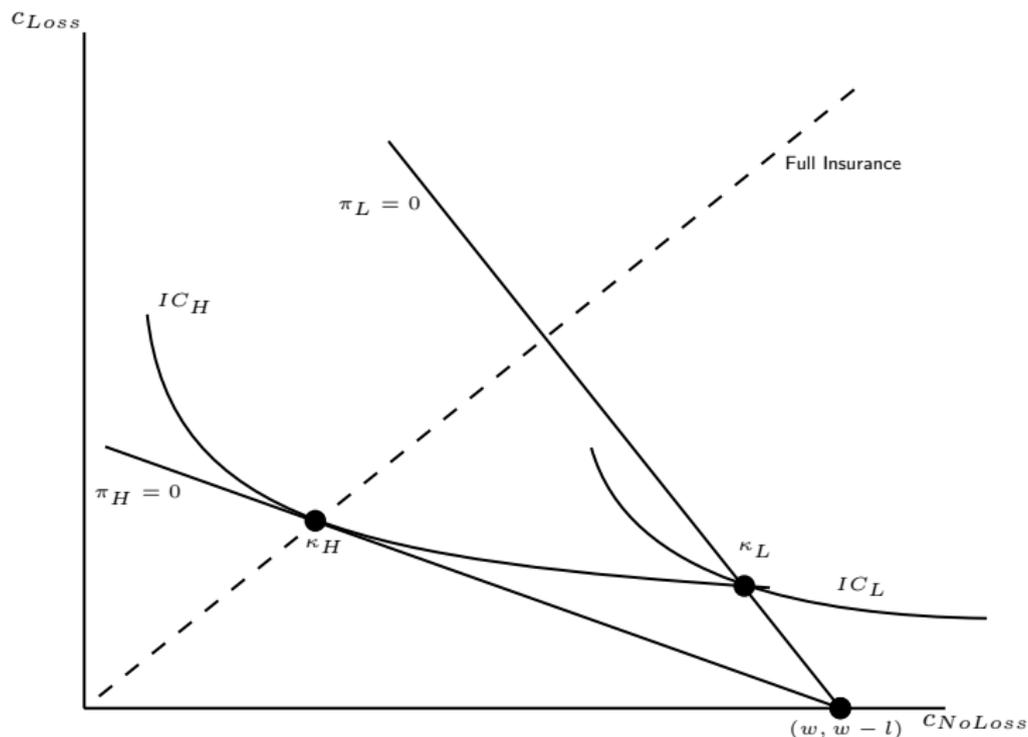
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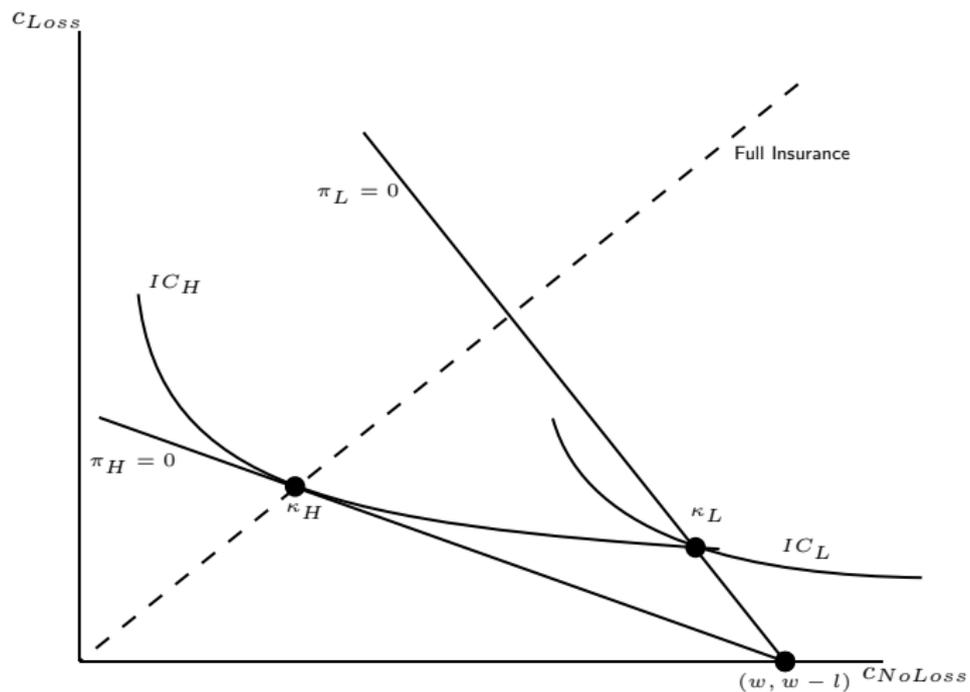


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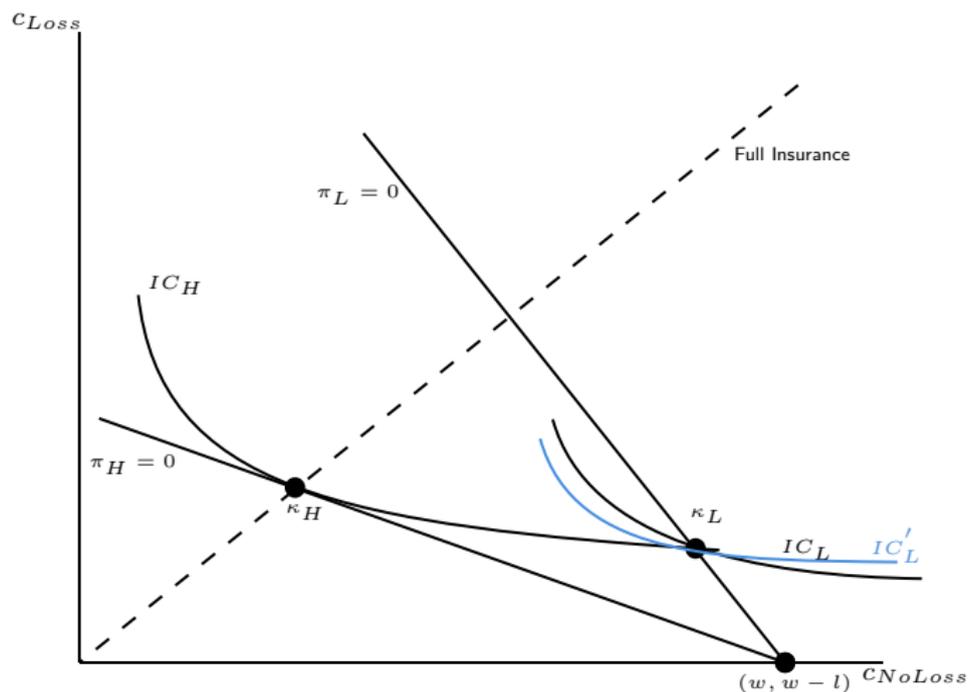


- High types receive full insurance; low types receive partial insurance
- The low types contract is distorted by H type IC constraints
- Low types IC constraints are irrelevant

Misperception by L types

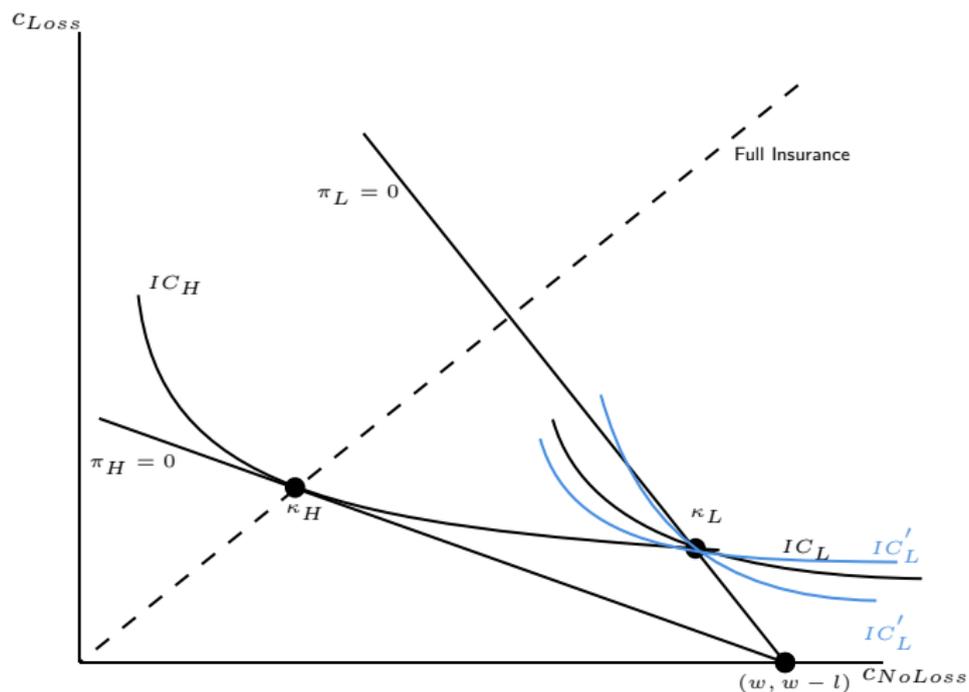


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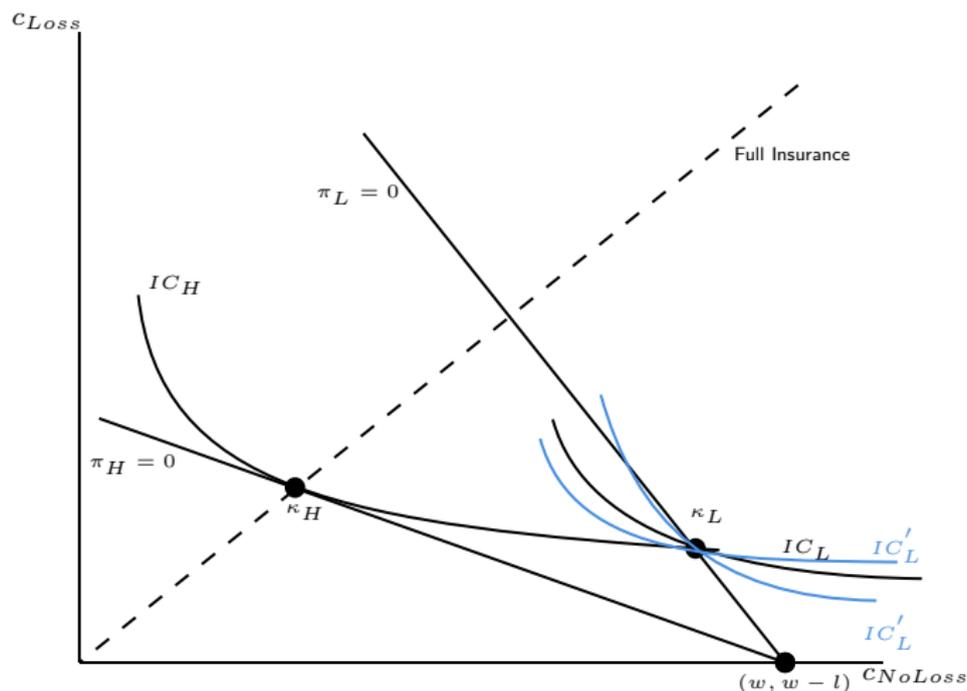
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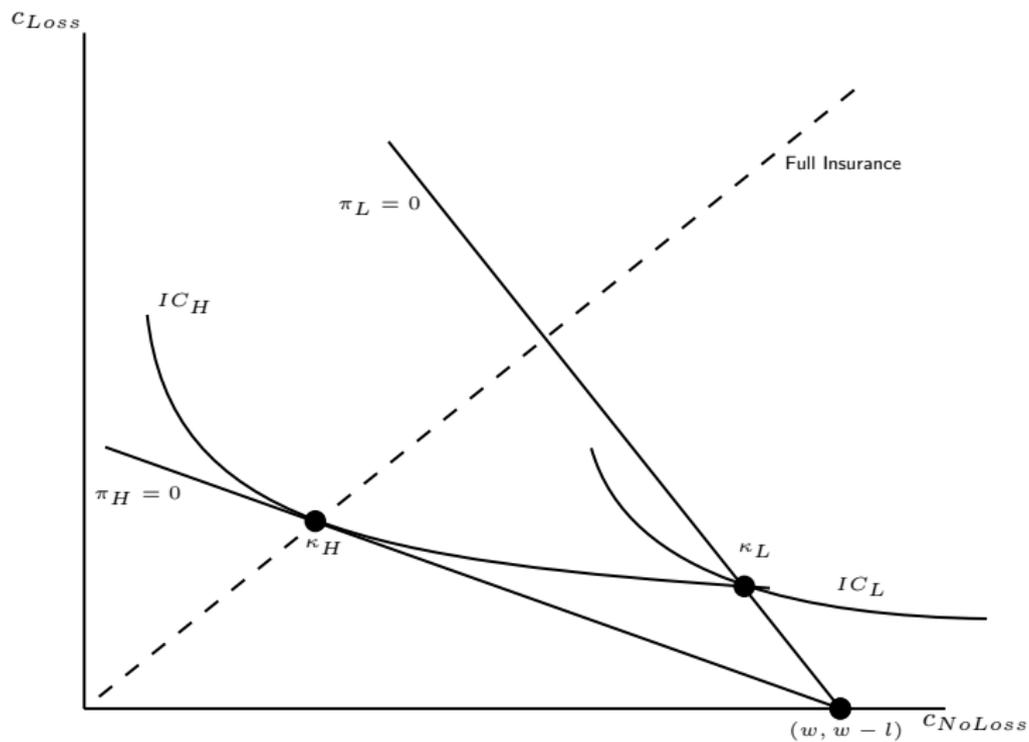
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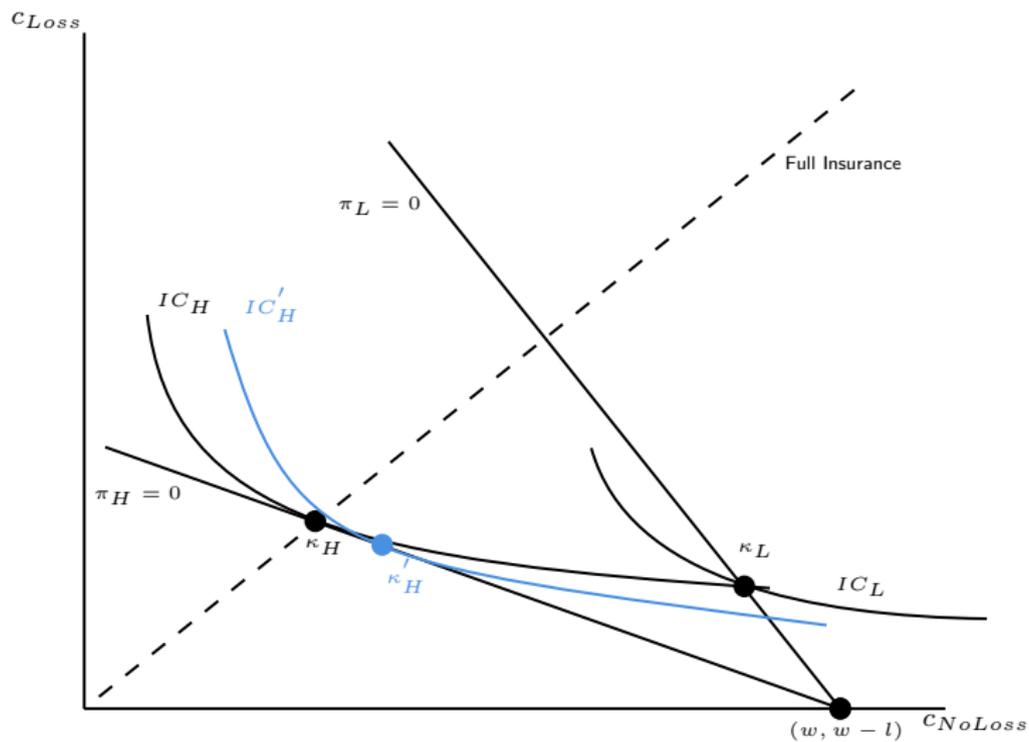


- Pessimism means shallower indifference curve, more willing to give up NL for L . Vice versa.
- Note that misperceptions by the low types have **no effect** on the equilibrium contract menu.
- Only their self-perceived utility is affected, experienced utility is not.

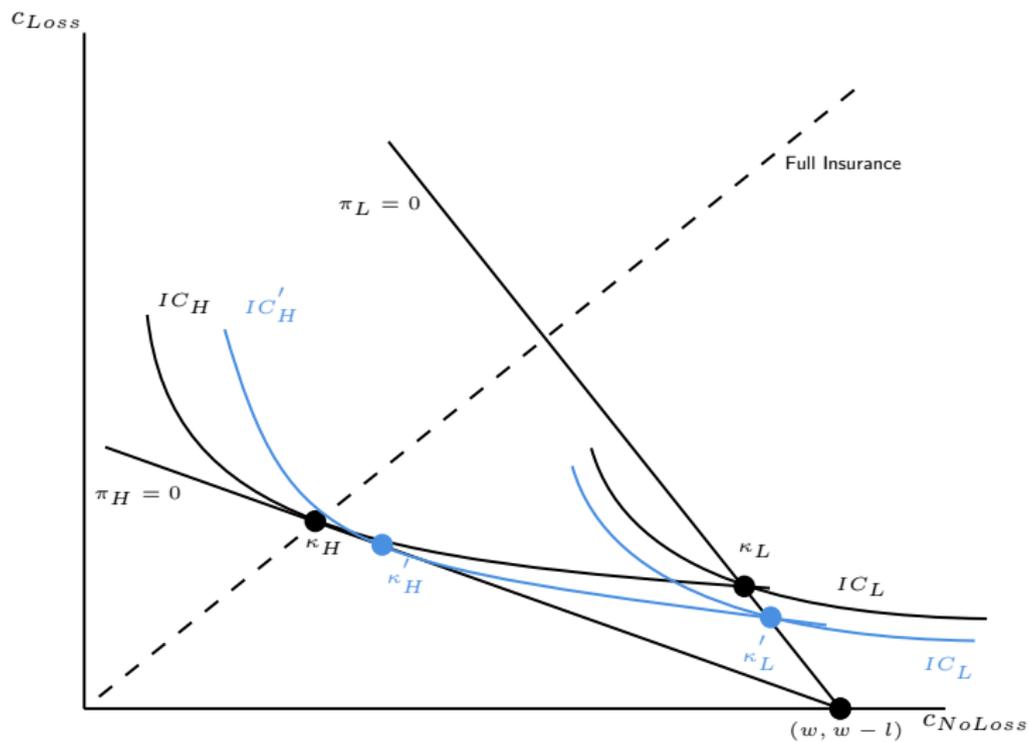
Optimistic H types



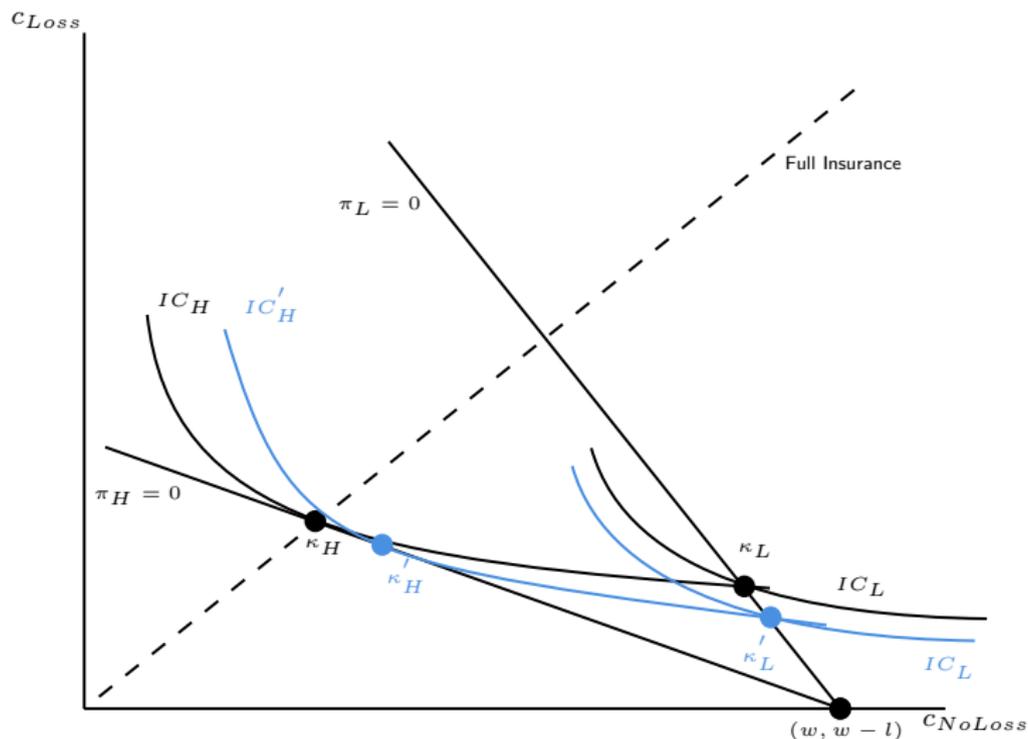
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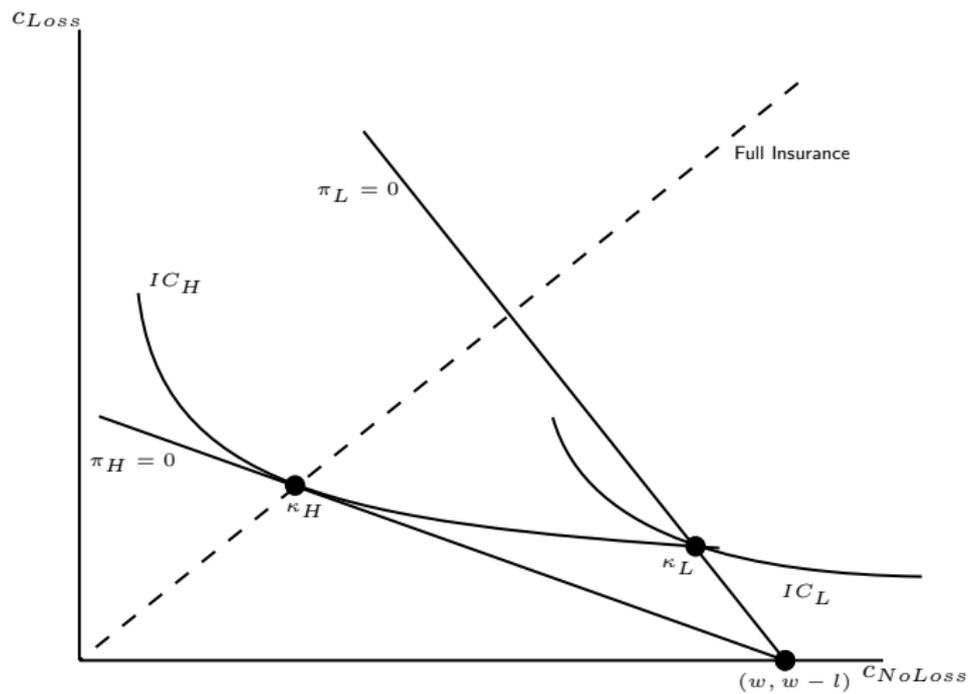


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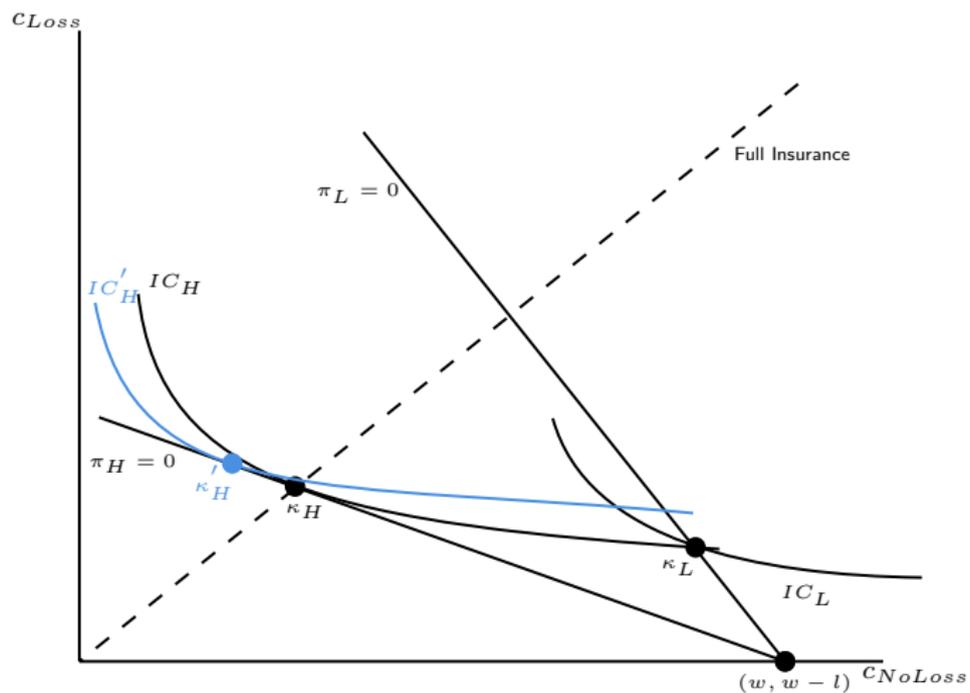


- Misperceptions by the high types have an externality on the low types.
- Optimistic misperceptions push down on the IC constraints.

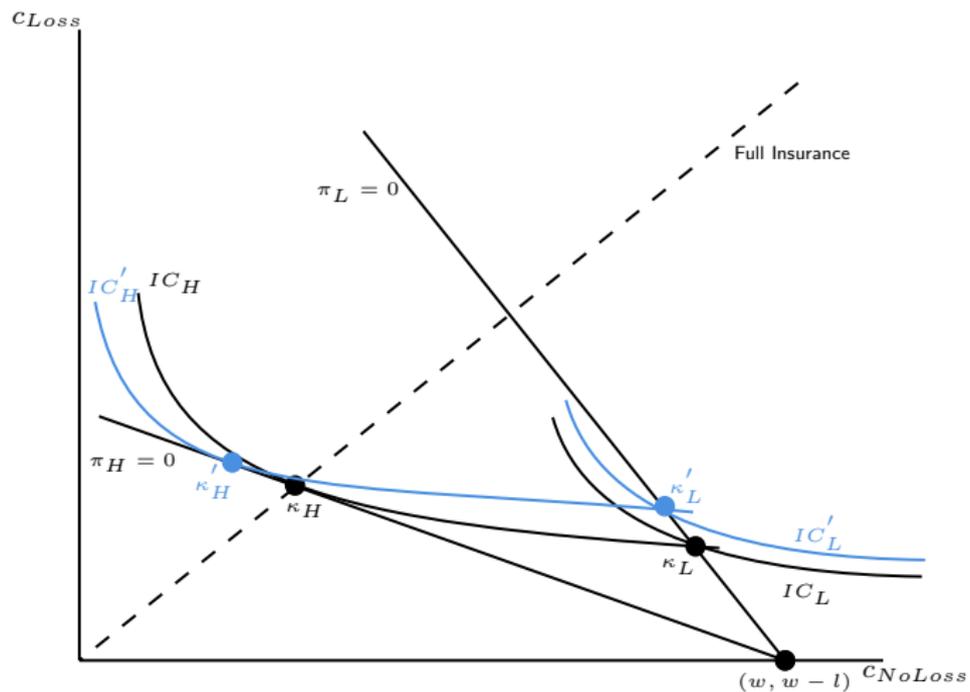
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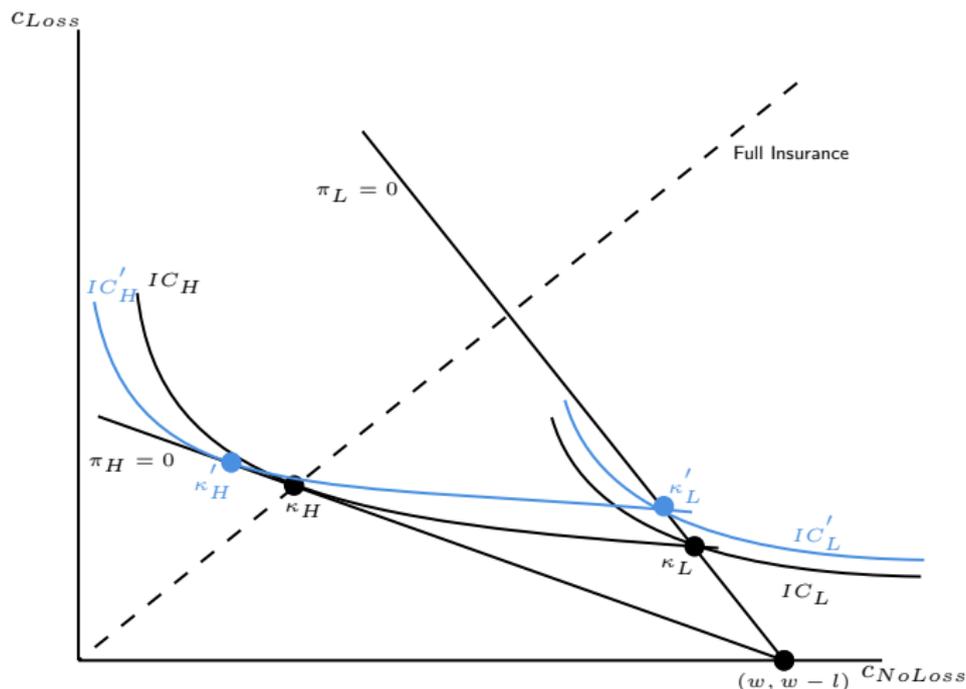
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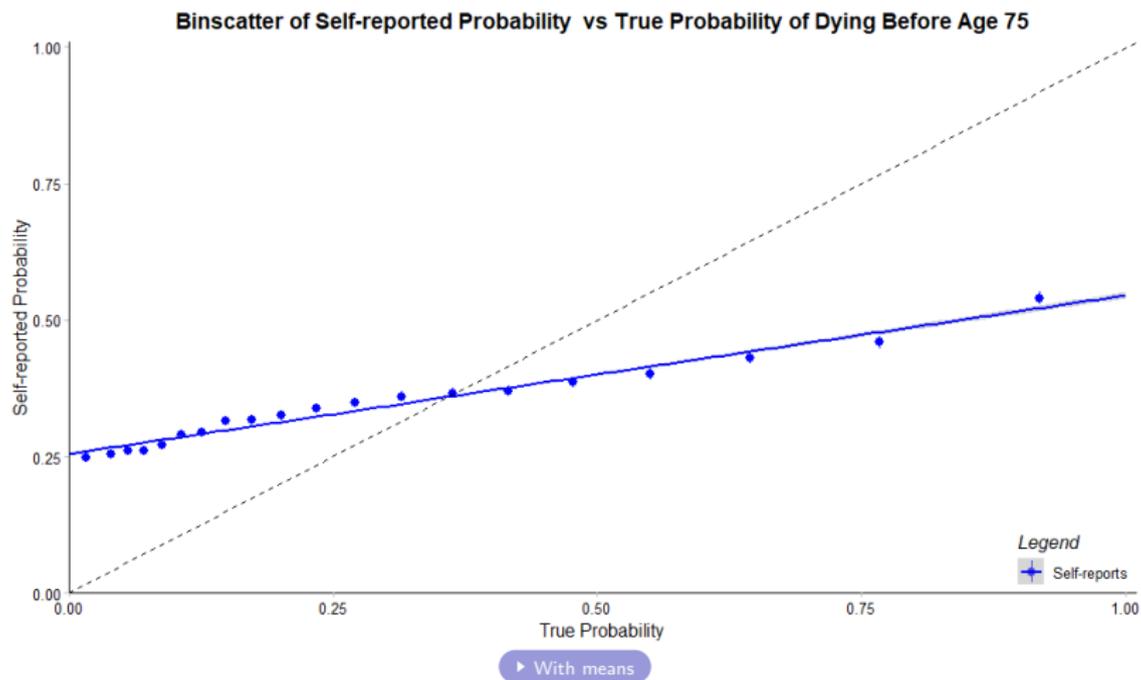


- Pessimistic misperceptions by the high type have a **positive** externality.

Who misperceives (riskiness), and in which **direction** the misperceptions are matters greatly.

Who makes which misperceptions?

Consider the risk: Death before the age of 75



Mean of self-reported = 0.36, Mean of true = 0.33.

The rest of the talk

- Brief word on the literature
- More detail about the theory
- Much more detail about the data, their issues, and my proposed solutions.

The project and its place in the literature

The literature has documented risk misperceptions that occur on average in the population:

- Pessimism about mortality (O'Dea & Sturrock (2020), ReStat)
- Optimism about re-employment prospects (Mueller et al (2020) , AER)
- Pessimism about health (Handel et al (2020), WP)

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Question 1: How does risk misperception distort a competitive insurance market?

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Question 3: How does misperception covary with risk?

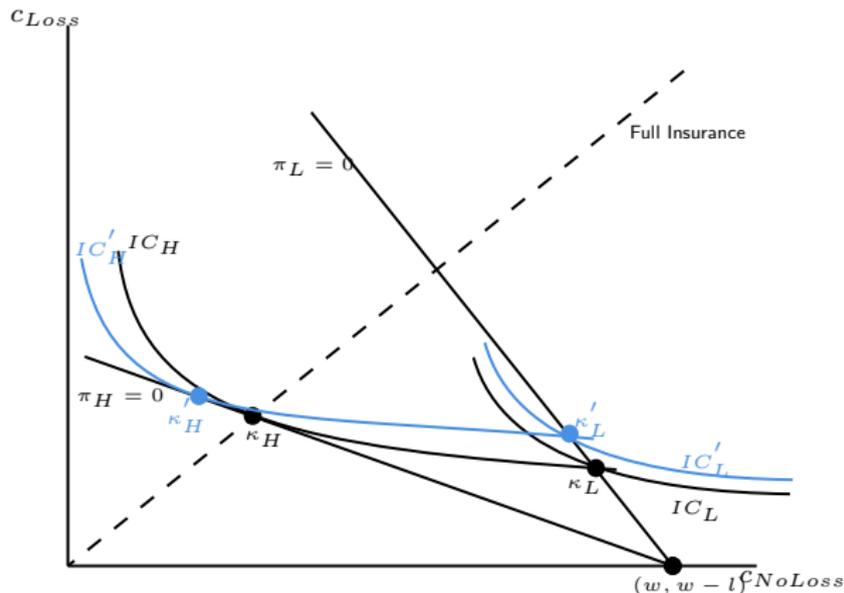
A: Low mortality risk individuals are pessimistic, high mortality risk individuals are optimistic.

Back to Theory - Welfare

Consider a planner who evaluates welfare according to the sum of **experienced** utilities. (i.e. according to p_i)

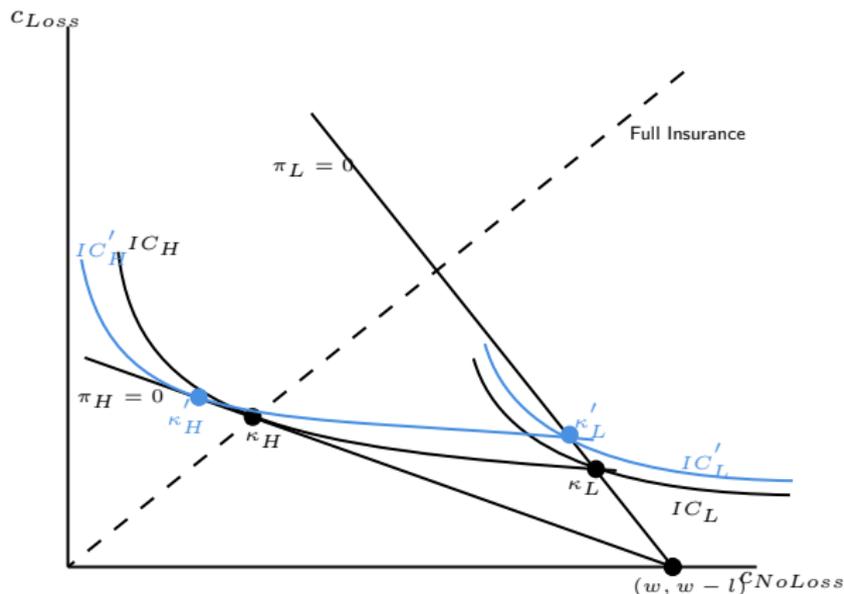
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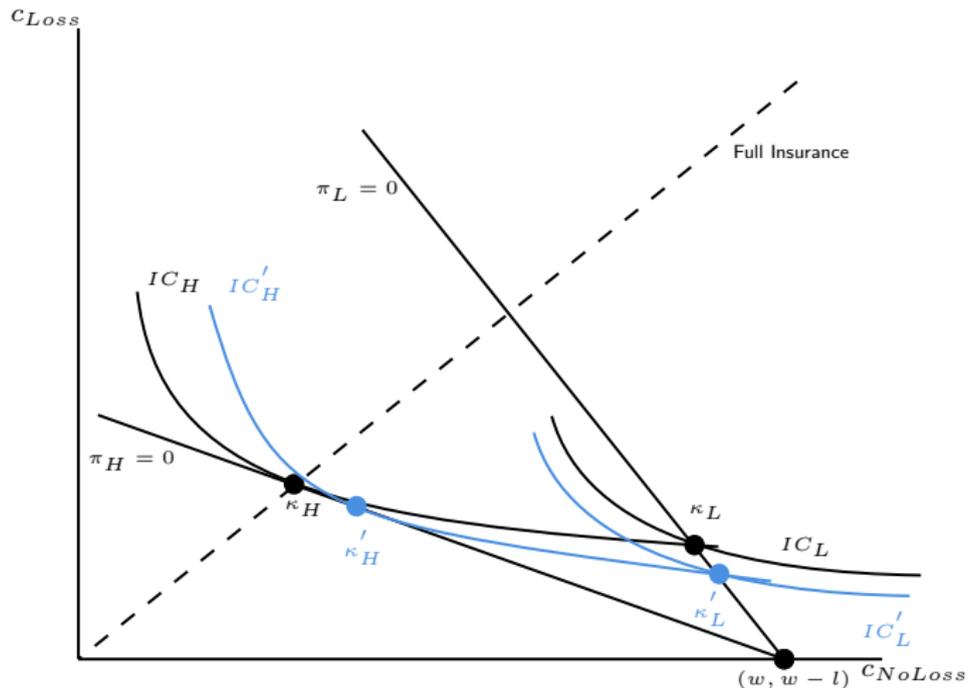


Small pessimistic misperceptions by the high type may **increase welfare**.

- High types have a second order loss of experienced utility (envelope theorem)
- Low types have a first order gain in experienced utility.

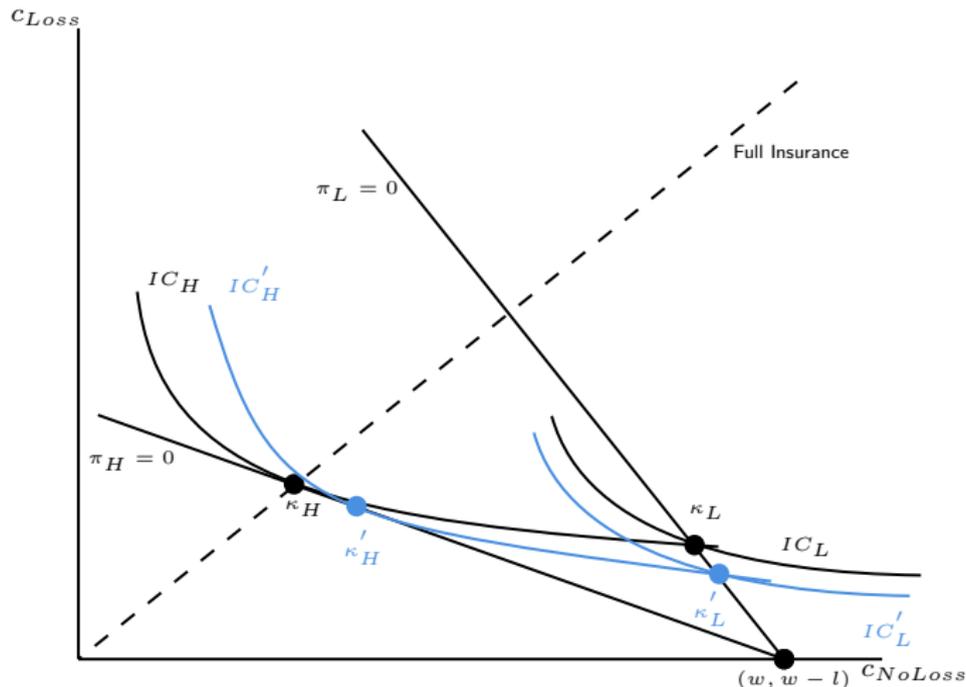
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Optimistic misperceptions by the high type always **decrease welfare**.

- Both types lose experienced utility

Three conclusions to take from the model:

- 1 Fixing the contract menu in welfare analysis misses an important dimension.
- 2 Knowing the aggregate level of misperception in a market is not welfare-sufficient.
- 3 Knowing the misperception of the *marginal* consumer is also not welfare sufficient.

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Key comparative statics are robust to:

- A monopolist instead of a competitive market
- A planner who can implement any IC, IR and budget balanced menu.

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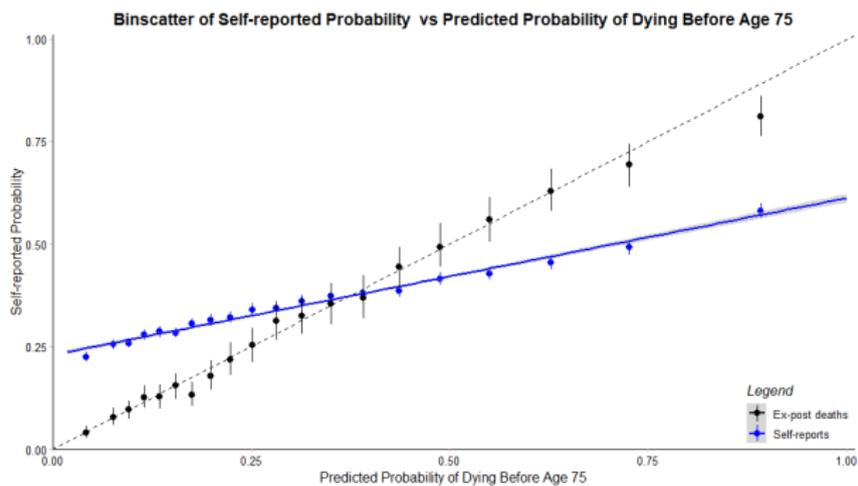
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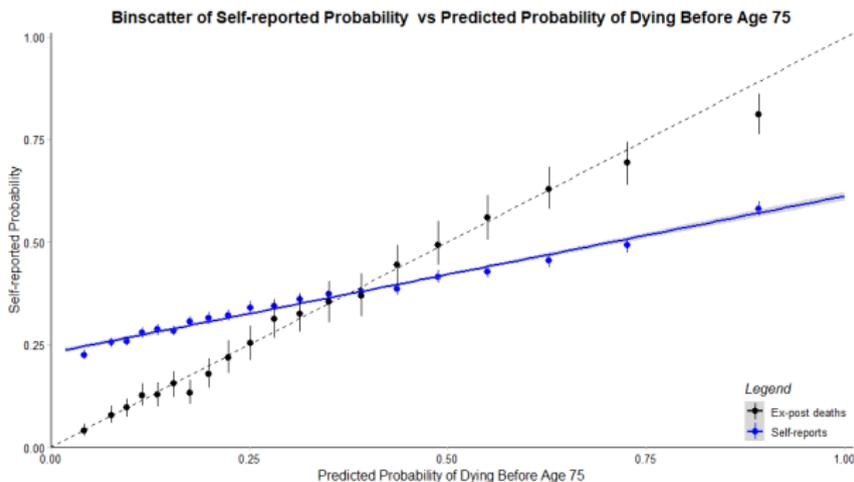
Prediction:

- Prediction is done in long form (i.e. a separate prediction is done for 60 year old Adam and for 65 year old Adam)
- Half of the respondents (and all their responses over time) are in a training set.
- All inference in what follows is done on the test set.
- Robust to many different prediction algorithms, today: Lasso Probit.

Data and empirical challenge



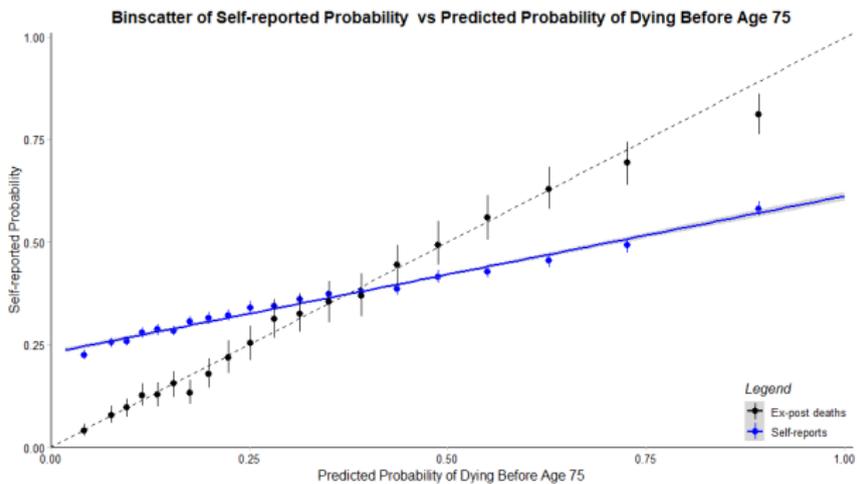
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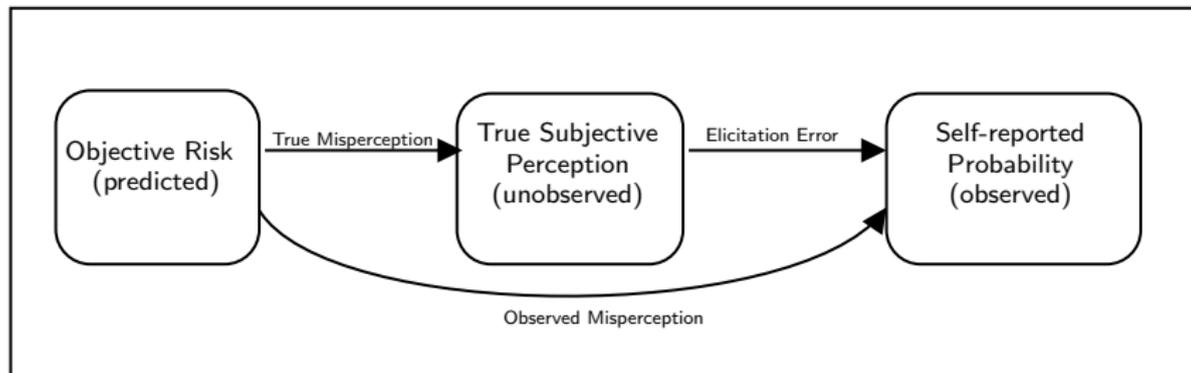
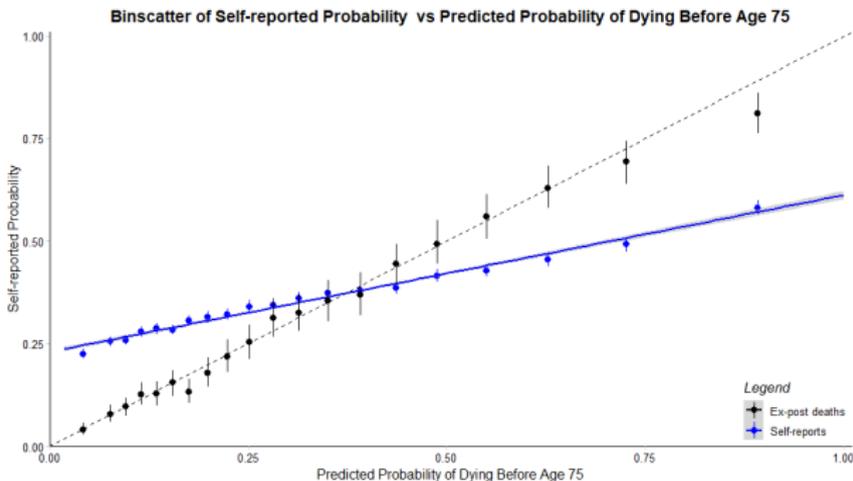
Key concern

Maybe the respondents have accurate beliefs (when purchasing insurance) but faced with this survey cannot respond more finely than to the nearest tenth/quarter/half.

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Maybe all the observed misperception is elicitation error?

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- 2 Put structure on elicitation errors (conservatively): assume a small amount of observed misperception is due to true misperception / large amount due to elicitation error.

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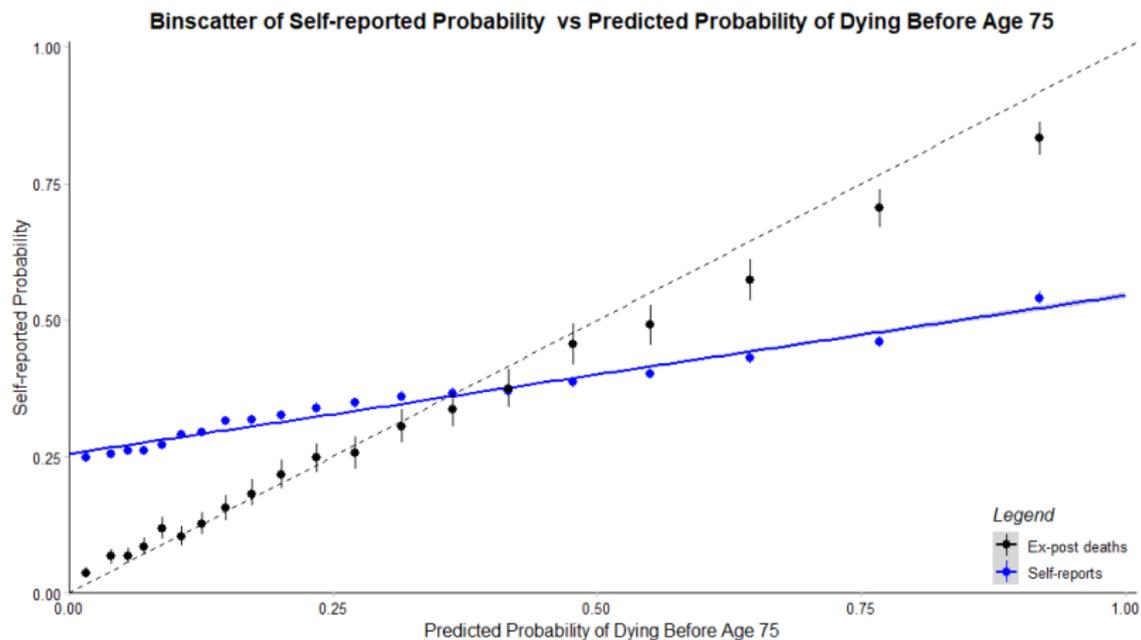
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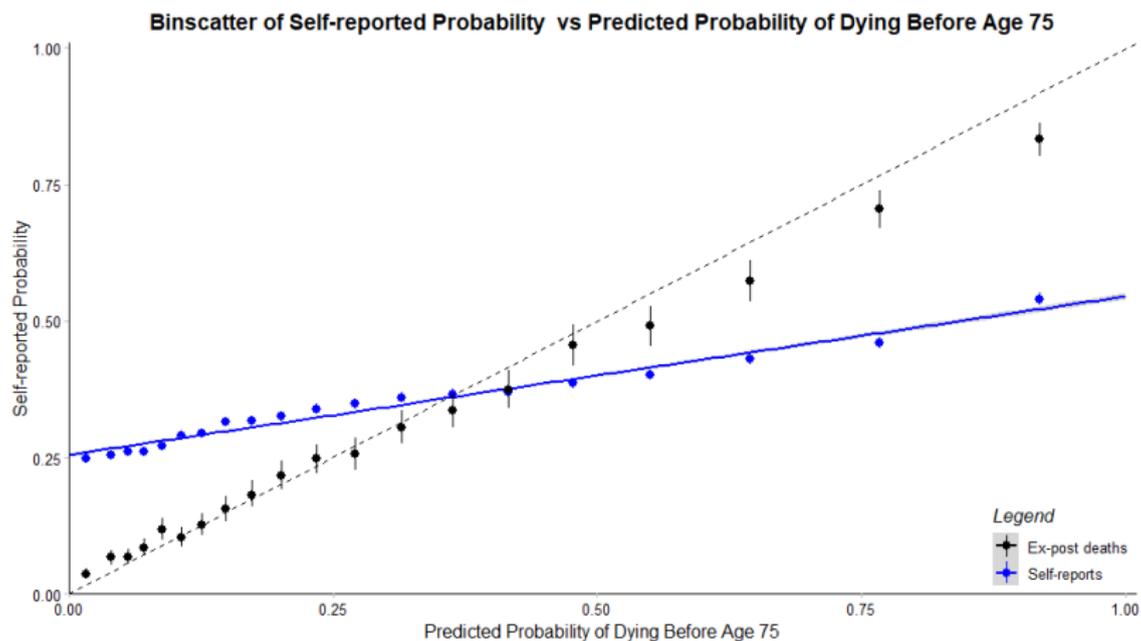
2. Use the panel structure to reinforce the presence of misperceptions.

- 1 Show that, accounting for inertia and rounding, the population under-reacts to mortality risk shocks.
- 2 Provides some evidence about how individuals (mis)react to mortality shocks over time.

Overall pattern and qualitative hypotheses



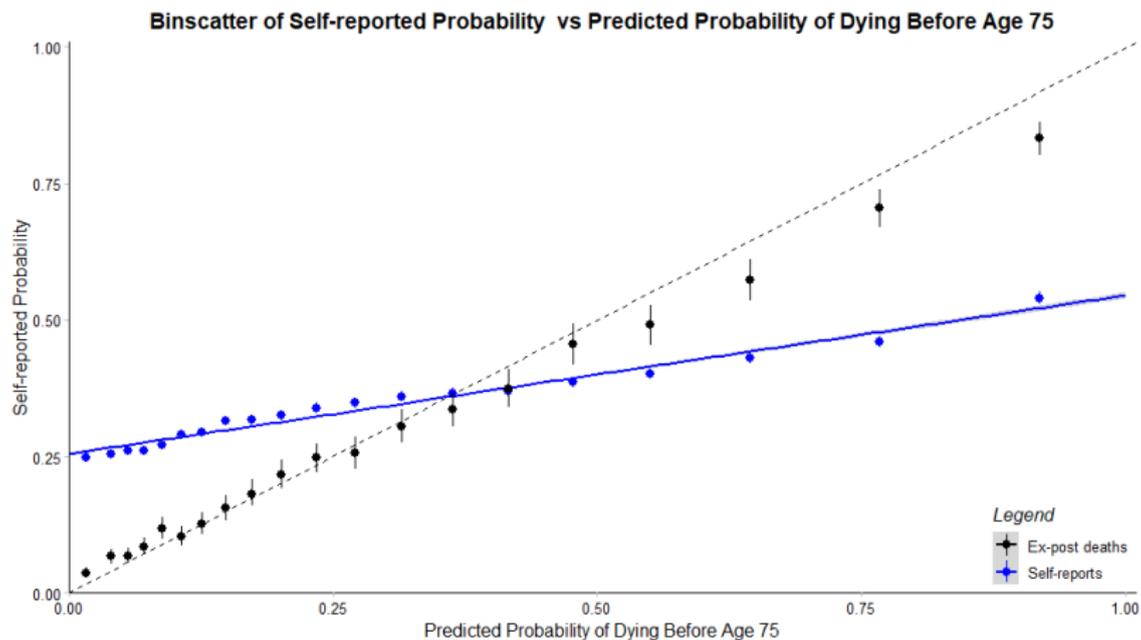
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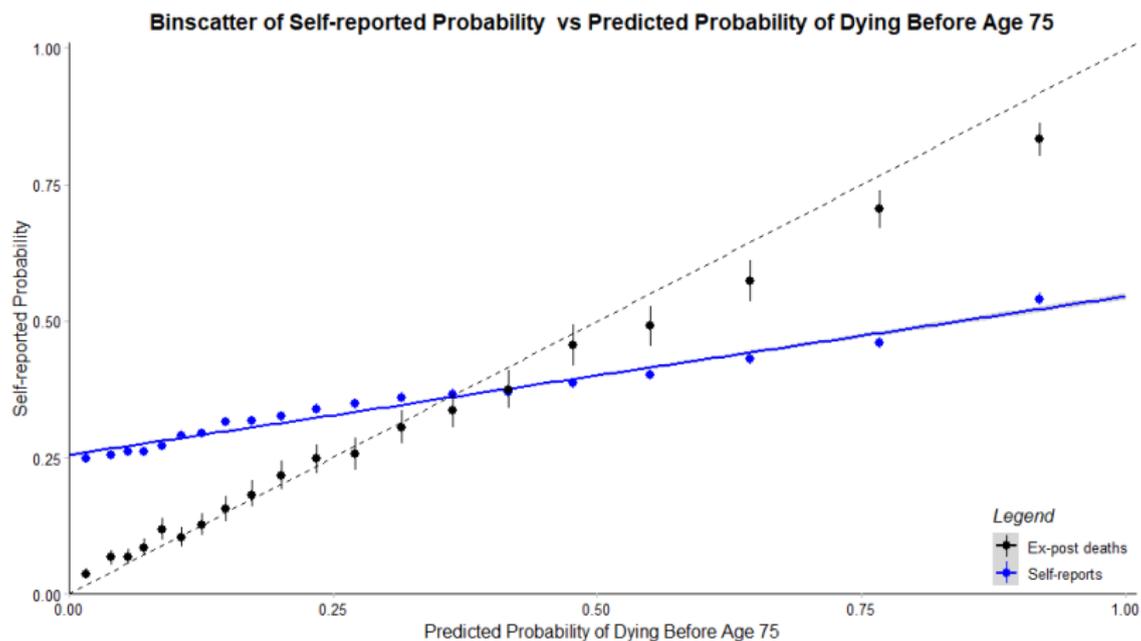
Note first that the prediction (45 degree line) fits averaged observed deaths quite well.

($AUC \approx 0.8$)

Overall pattern and qualitative hypotheses



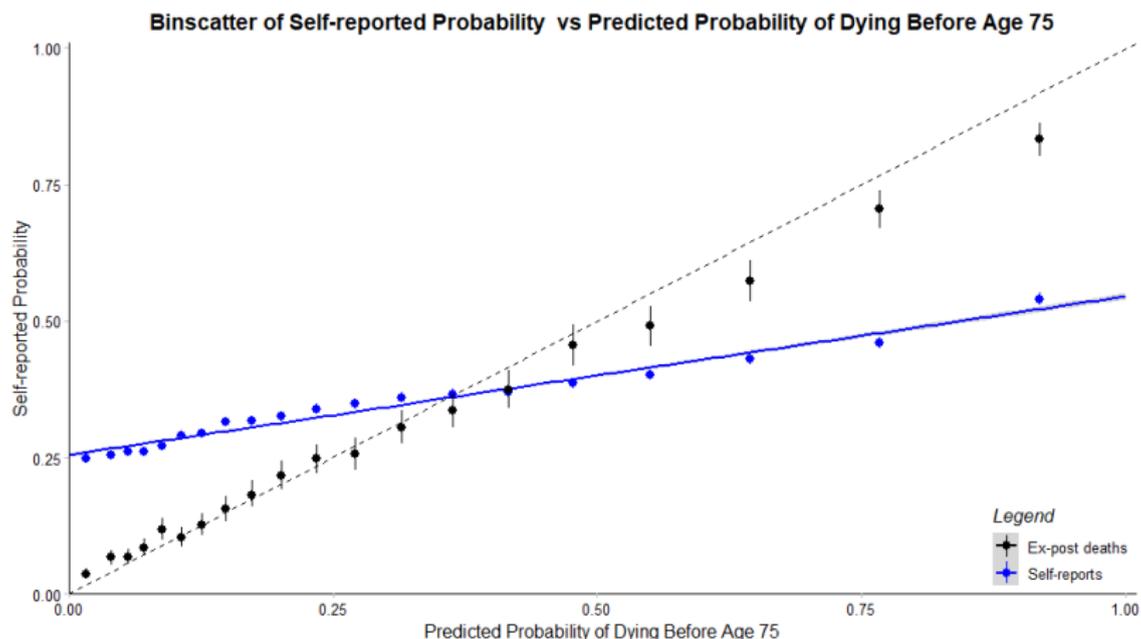
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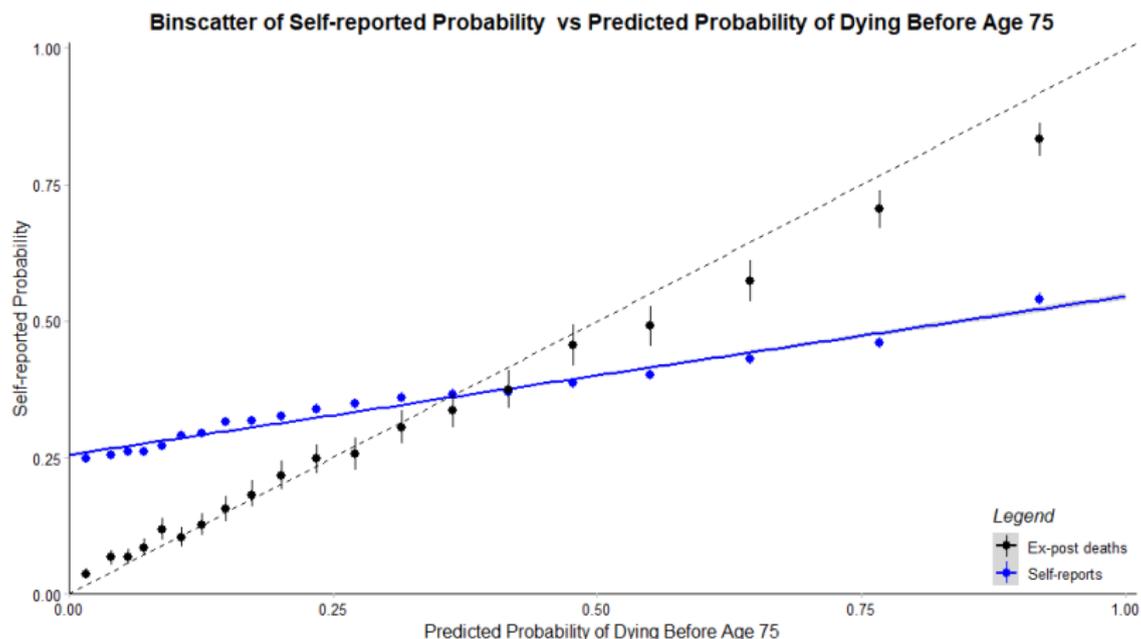
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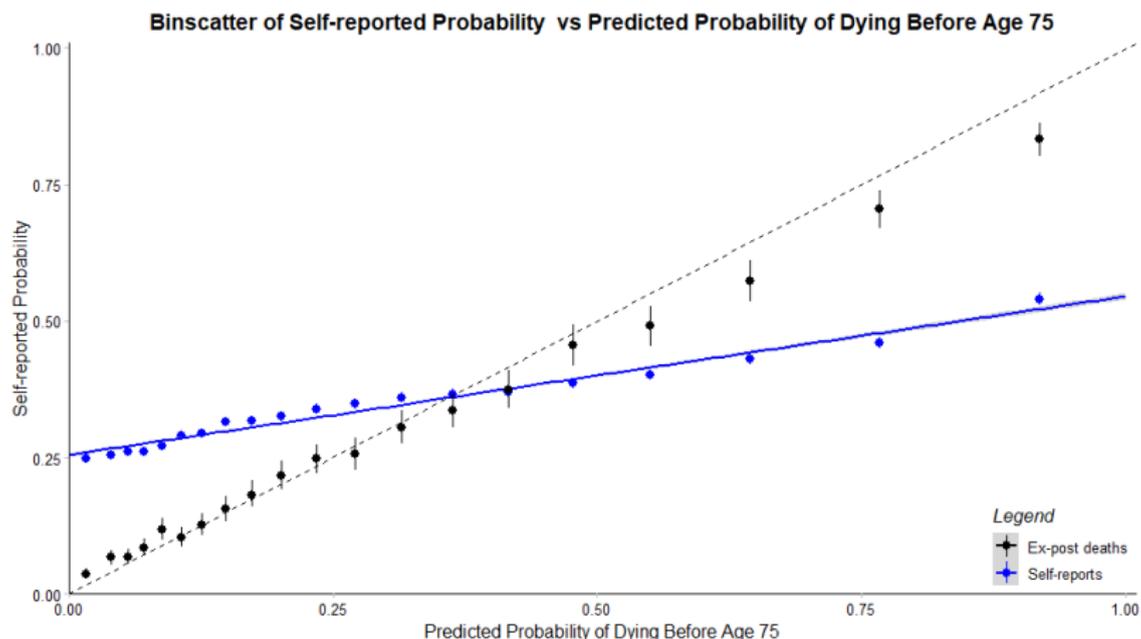
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Remains to show that these are robust to accounting for elicitation error.

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In words: categorize individuals into rounding categories.
Then 'de-round' elicitation by attributing as much error to rounding as is consistent with rounding categories.

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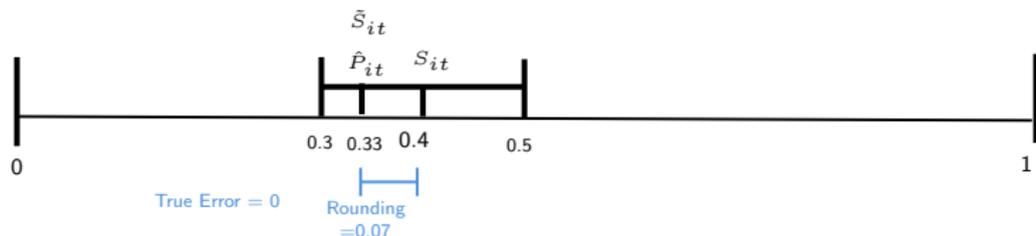
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\tilde{S}_{it} = Self-reported probability corrected for elicitation error = 0.33

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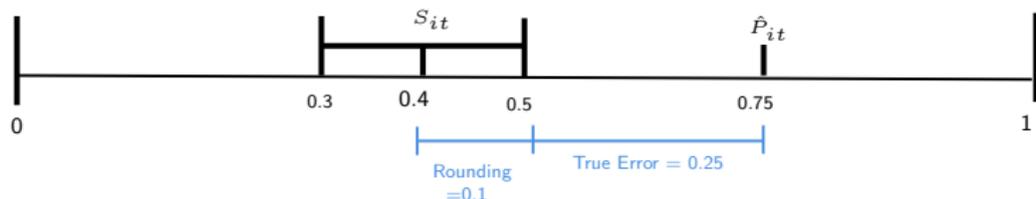
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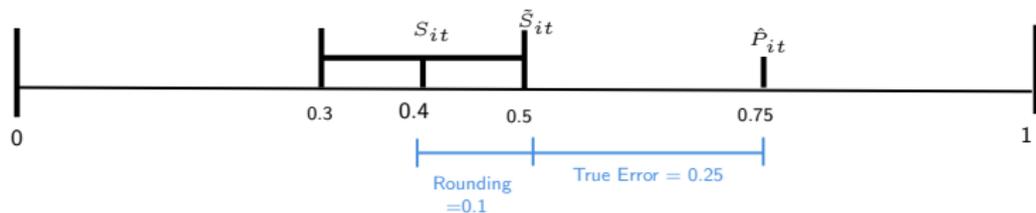
\hat{P}_{it} = Predicted probability = 0.75

\tilde{S}_{it} = Self-reported probability corrected for elicitation error

Generic de-rounding procedure

In words: categorize individuals into rounding categories.
Then 'de-round' elicitation by attributing as much error to rounding as is consistent with rounding categories.

Assume the individual with $S_{it} = 0.4$ is a '20%' rounder



Probability of dying before 75

S_{it} = Self-reported probability = 0.4

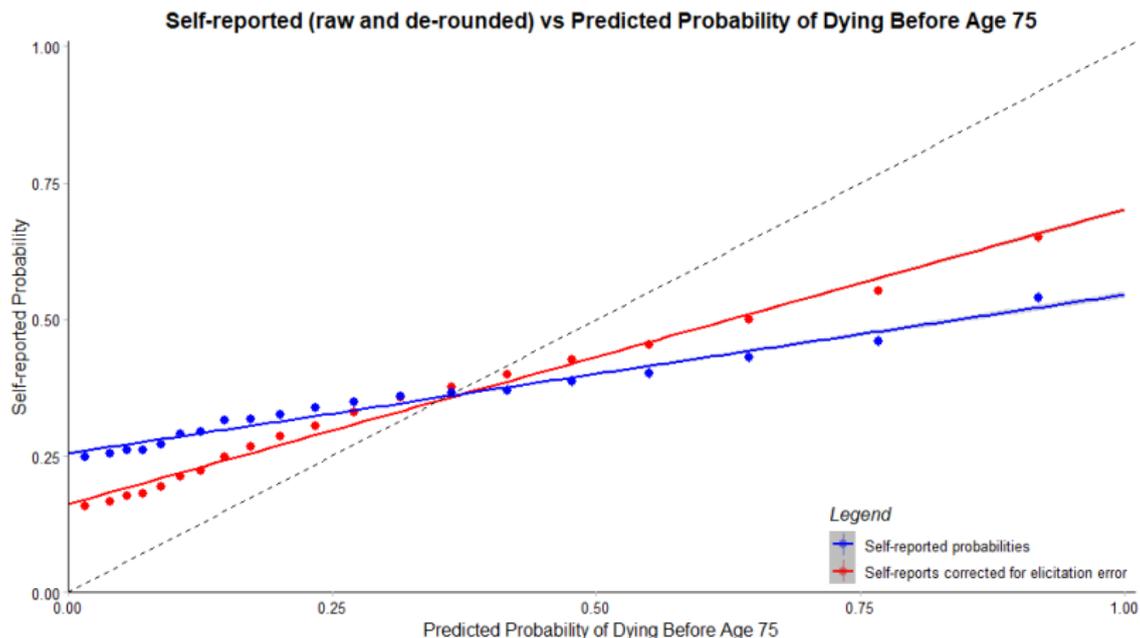
\hat{P}_{it} = Predicted probability = 0.75

\tilde{S}_{it} = Self-reported probability corrected for elicitation error = 0.5

Rounding categories (trying to be conservative):

- If elicitation $\in \{0, 0.5, 1\}$, then assume 0.5 rounder.
- If elicitation $\in \{0.25, 0.75\}$, then assume 0.25 rounder.
- If elicitation $\in \{0.1, 0.2, 0.3, 0.4, 0.6, 0.7, 0.8, 0.9\}$, then assume 0.2 rounder.
- If elicitation $\in \{0.05, 0.15, \dots, 0.95\}$, then assume 0.1 rounder.
- Everyone else, assume no rounding.

Conservatively de-rounded results



Hypotheses:

- 1 Unbiased perceptions fails ✓
- 2 Low risk are pessimistic ✓
- 3 High risk are optimistic ✓

▶ With ex-post deaths

▶ Wave1

In light of this framework, we can interpret the qualitative empirical findings:

- The mortality pessimism is concentrated at the *lowest* mortality risk part of the distribution.
- The high mortality risk part of the distribution is optimistic.

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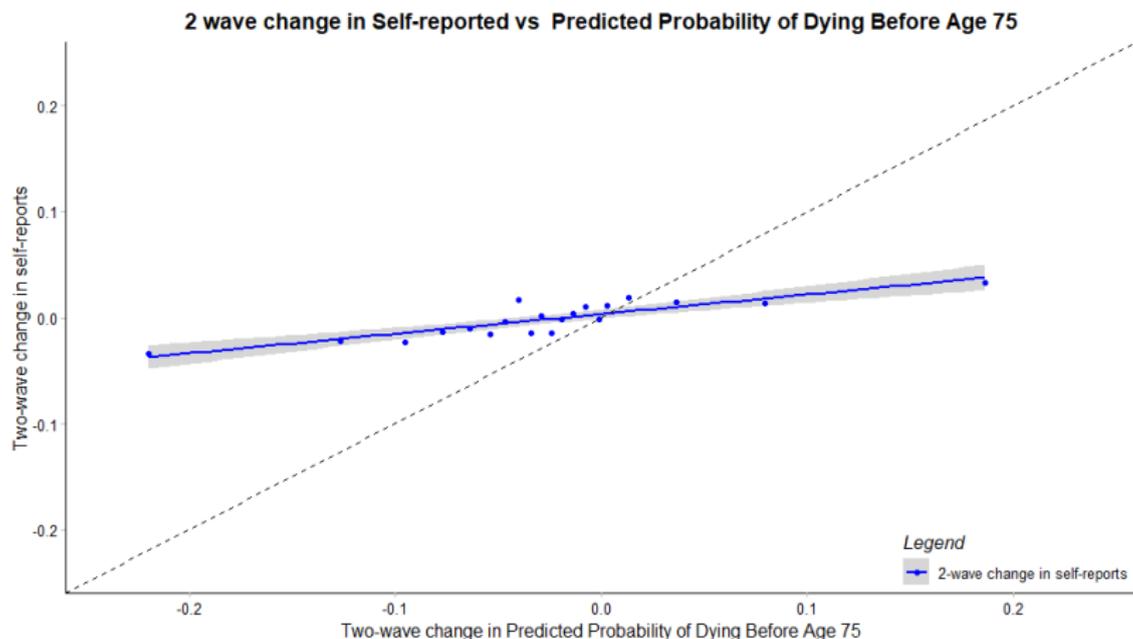
- Per logic above, this would greatly distort downwards the amount of insurance all types receive.
- Consistent with the annuity market actually providing very little insurance (most annuities have long guarantee period, so are mostly bond).
 - Annuity puzzle/problem is not just in the rate of annuitization, but in the insurance value of the annuities purchased. This offers an explanation.

Evidence using the panel structure

To provide further evidence of true errors, as well as to understand the pattern of these errors, we will exploit the panel structure of these data.

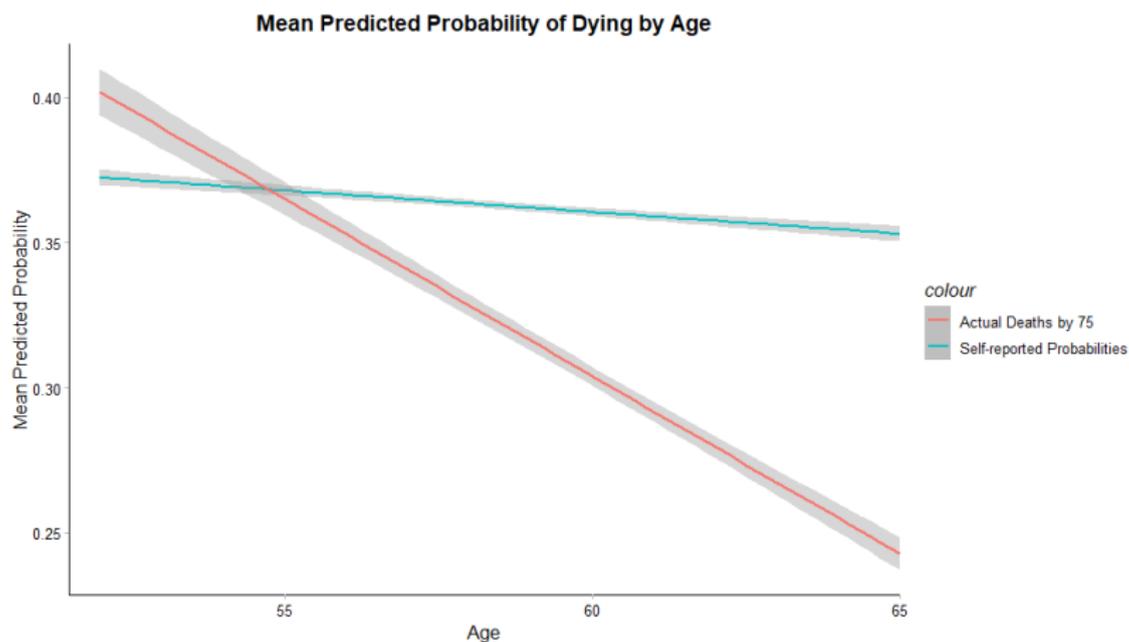
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The departure from unbiasedness (slope ≈ 0.2) is striking in two-wave differenced self-reports vs predicted probabilities.

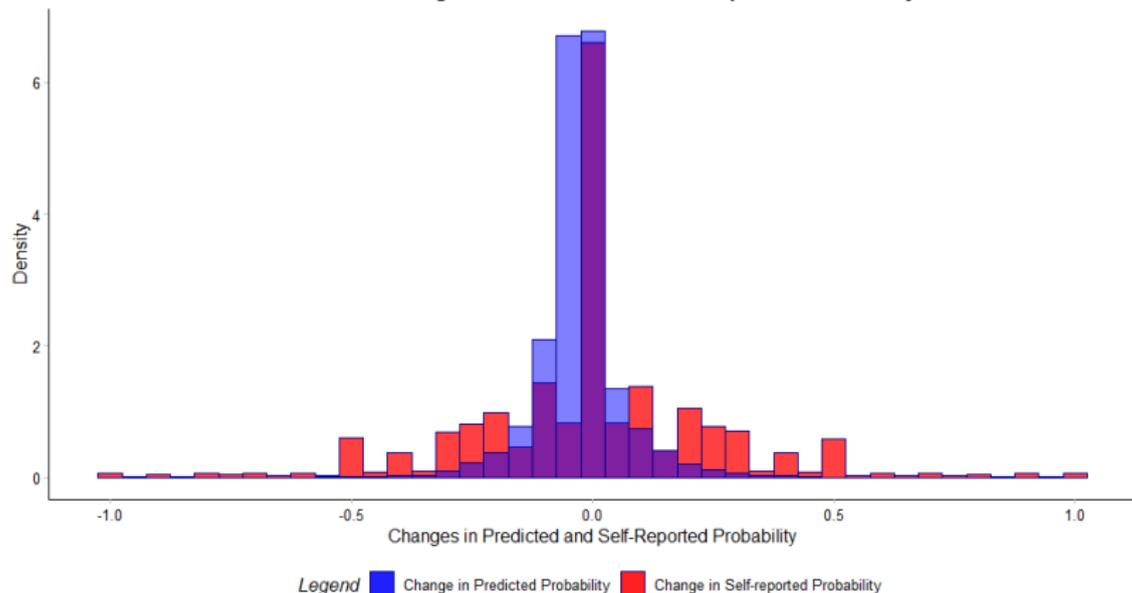
How does risk typically evolve over time?



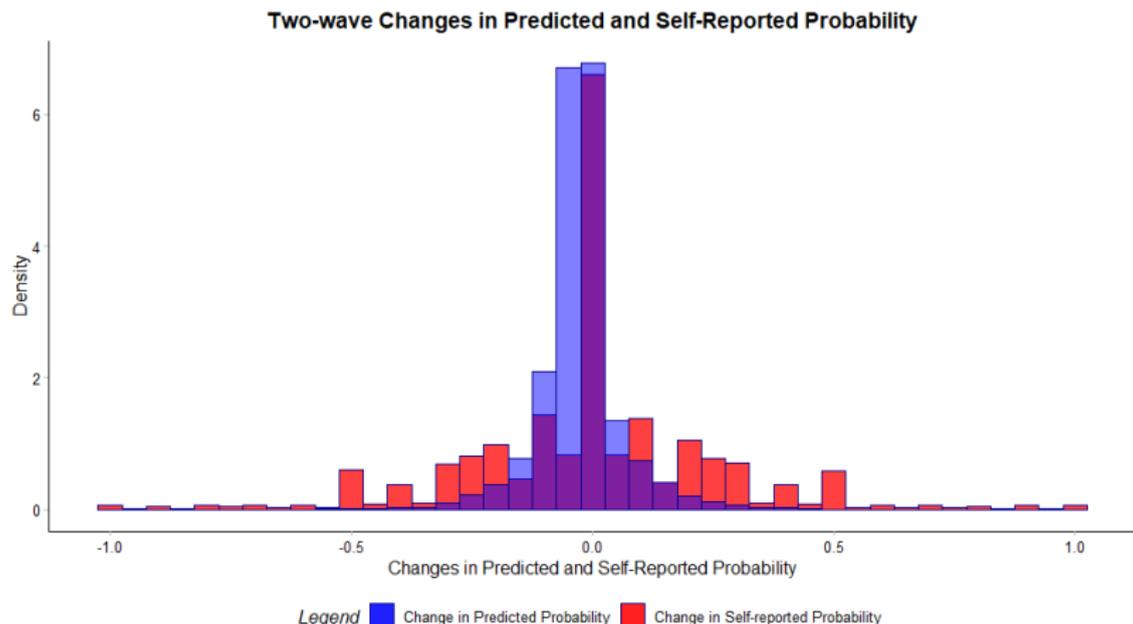
- As one approaches 75, the probability of dying by 75, ceteris paribus, declines.
- On average these declines are not sufficiently internalized.
- So is the above pattern simply due to inertia?

Is it due to inertia?

Two-wave Changes in Predicted and Self-Reported Probability



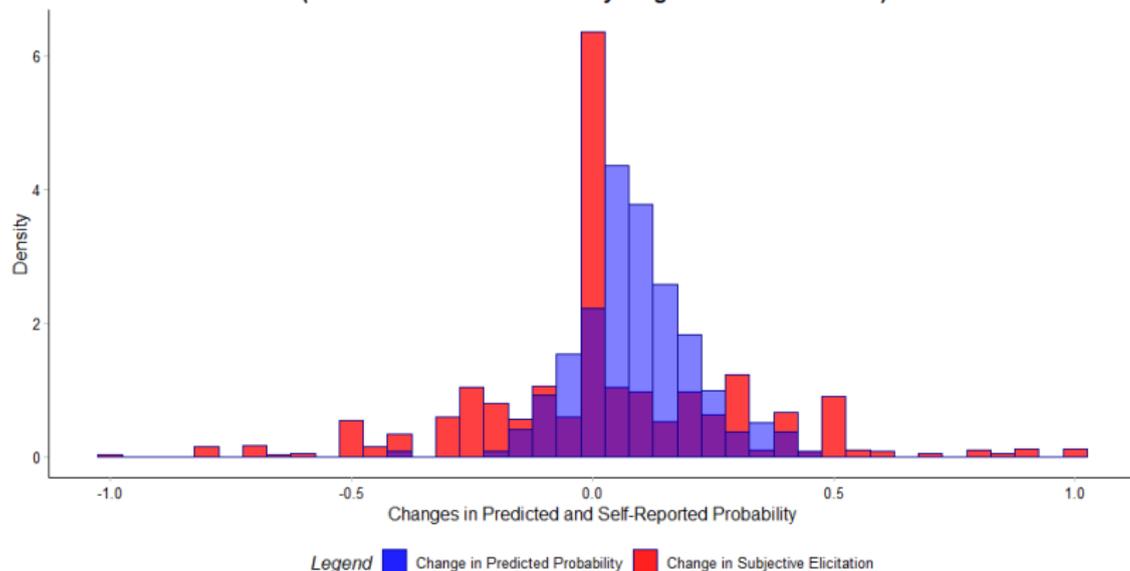
Is it due to inertia?



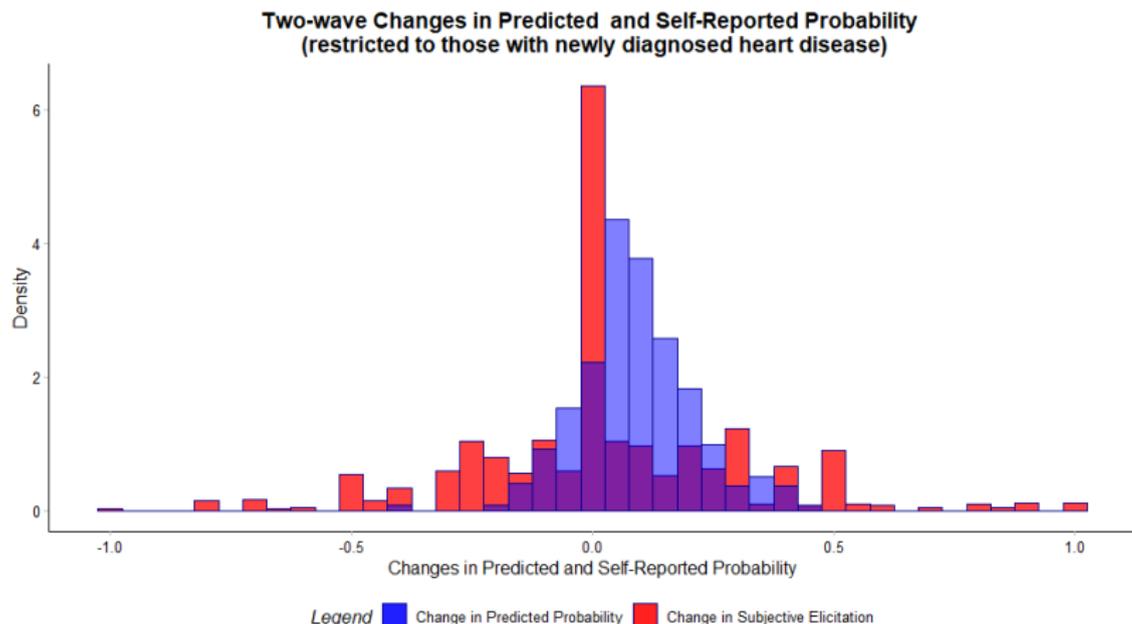
- Over two waves, self-reports move more in magnitude than predicted probabilities.
- The severe attenuation on the prior slide must be due to the wrong people moving or moving in the wrong direction.

How are upward shocks reacted to?

Two-wave Changes in Predicted and Self-Reported Probability
(restricted to those with newly diagnosed heart disease)



How are upward shocks reacted to?



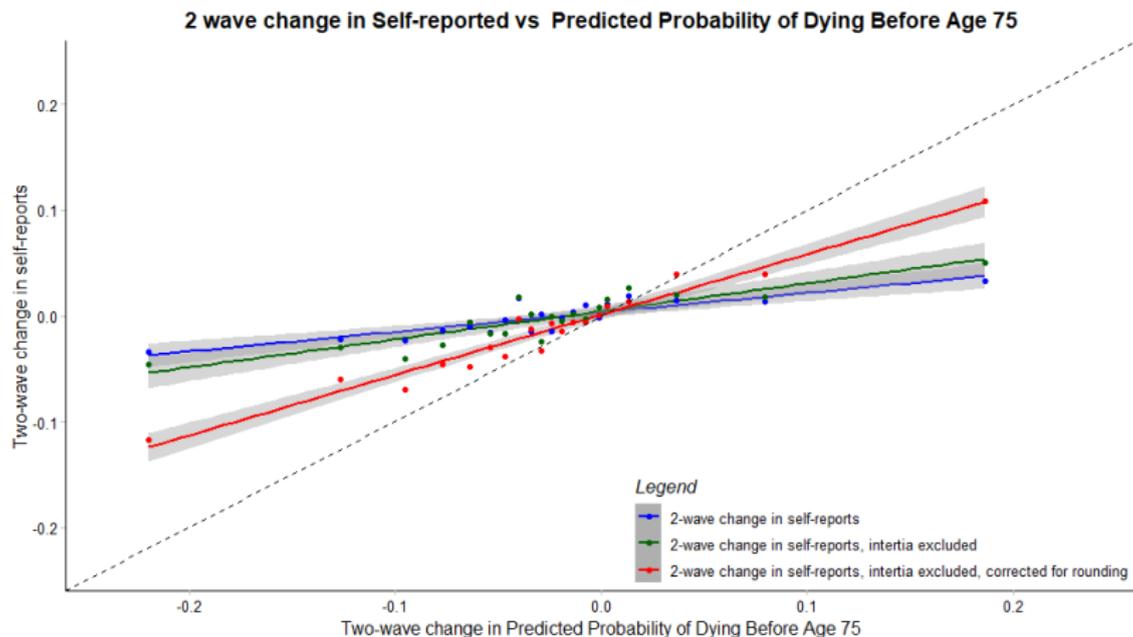
- Even those with a recent, memorable adverse diagnosis, seem to exhibit similar patterns in changes in self-reports.
- Mean change to predicted probability is $\approx 10\%$, mean change to self-reported probability is $\approx 3\%$.

Remove inert and account for rounding

Suppose we exclude everyone whose self-report doesn't change between waves (green). Suppose we also use the predictions accounting for rounding as before (red).

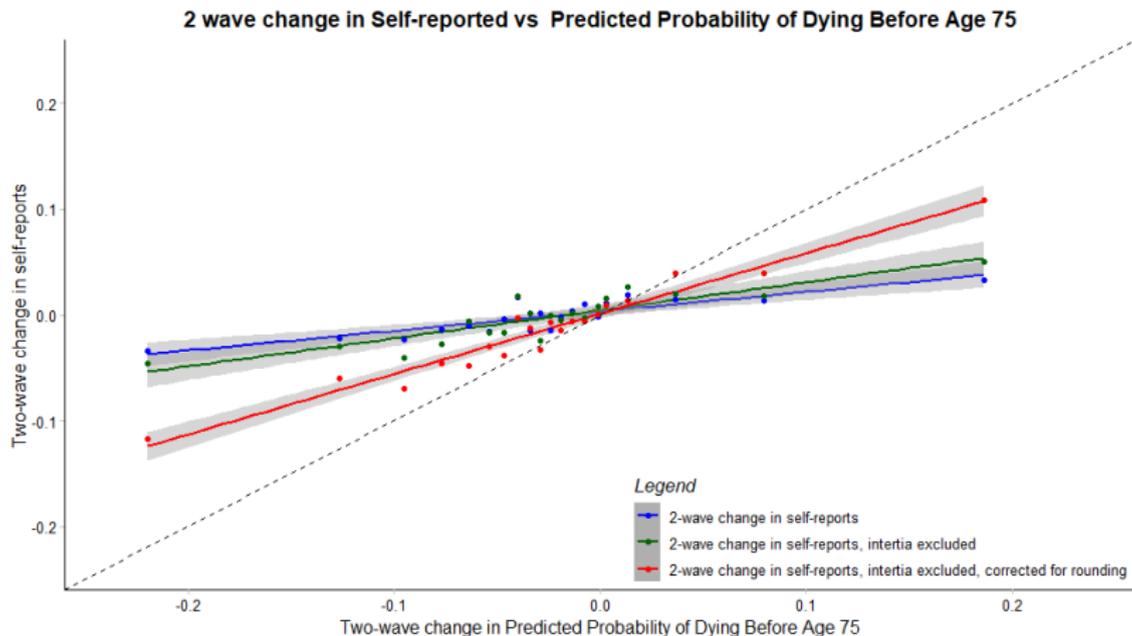
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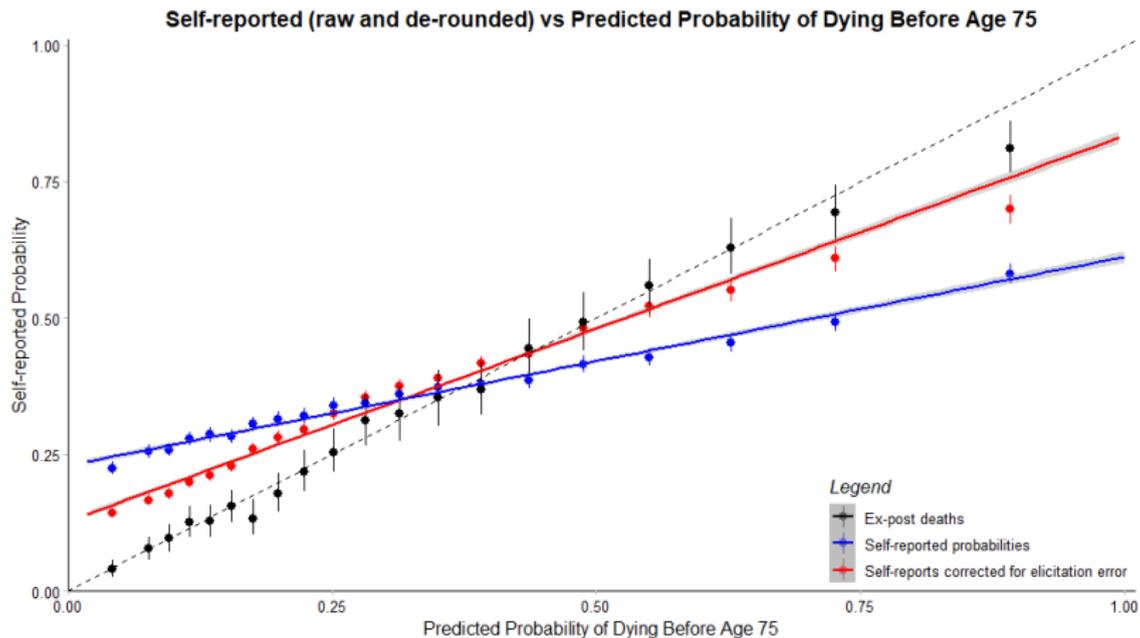
Evidence that even amongst the active changers, and accounting for rounding, there are updating errors over time.

Conclusion

- Showed that in a model of competitive insurance provision with endogenous contracts, misperceptions matter.
- **Who** makes the misperceptions, and **in what direction** matters. In themselves, aggregate error, or marginal error, don't say much.
- Used HRS data to study misperceptions about mortality risk.
- Showed that in the cross section, accounting for rounding, there is pessimism amongst low risk and optimism amongst high risk.
- Showed that, over time, positive and negative shocks are not sufficiently reacted to, accounting for inertia and rounding.

Thank you for listening!

Conservatively de-rounded results

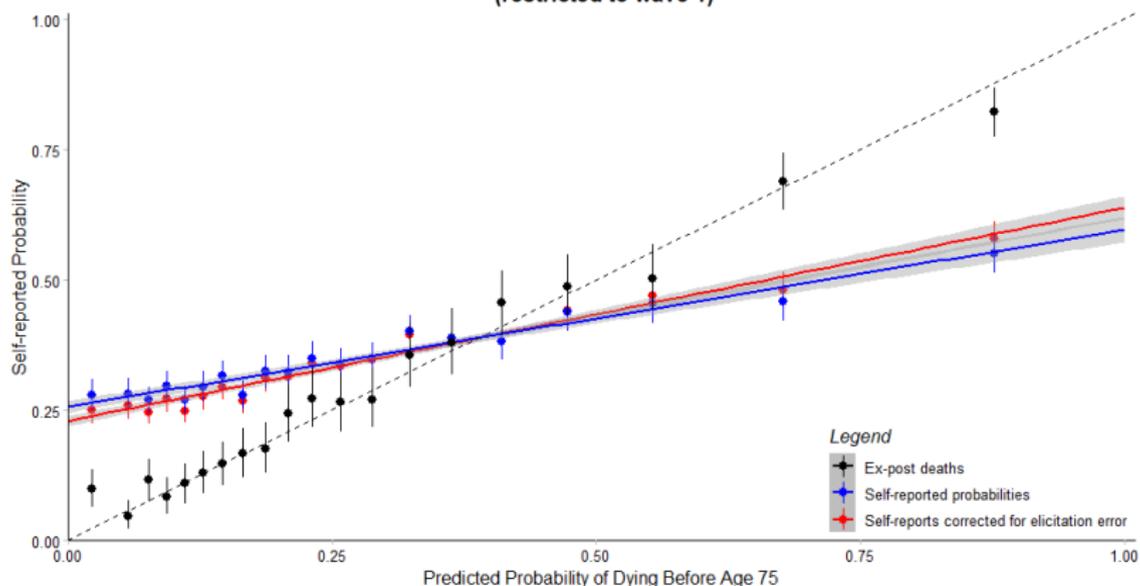


▶ Back

Wave 1 only

- In wave 1, answers had to be an integer chance in 10 (e.g. 0 in 10, 1 in 10... 10 in 10)
- So here it is safer to assume that everyone is rounding to the nearest 10%.
- Prediction is noisier due to sample size, and fewer medical data are collected in wave 1.

Self-reported (raw and de-rounded) vs Predicted Probability of Dying Before Age 75
(restricted to wave 1)



Interpreting the empirical facts - Life Insurance

In the life insurance market, we have a small portion of optimists at the top, then a large pool of pessimists.

- The life insurance market would be hurt (but less) by this pattern of error.
- The high mortality individuals are optimistic, so don't demand that much insurance, so distort down all other life insurance.
- But high mortality is quite predictable from observables, so life insurance markets have many rejections, negating this problem.
- Thus maybe only pessimists remain, which might increase welfare.
- So rejections plus this pattern may be helpful relative to no welfare.

▶ Back

But who makes which misperceptions?

Consider the risk: Death before the age of 75

