Risky Insurance: Life-Cycle Insurance Portfolio Choice with Incomplete Markets

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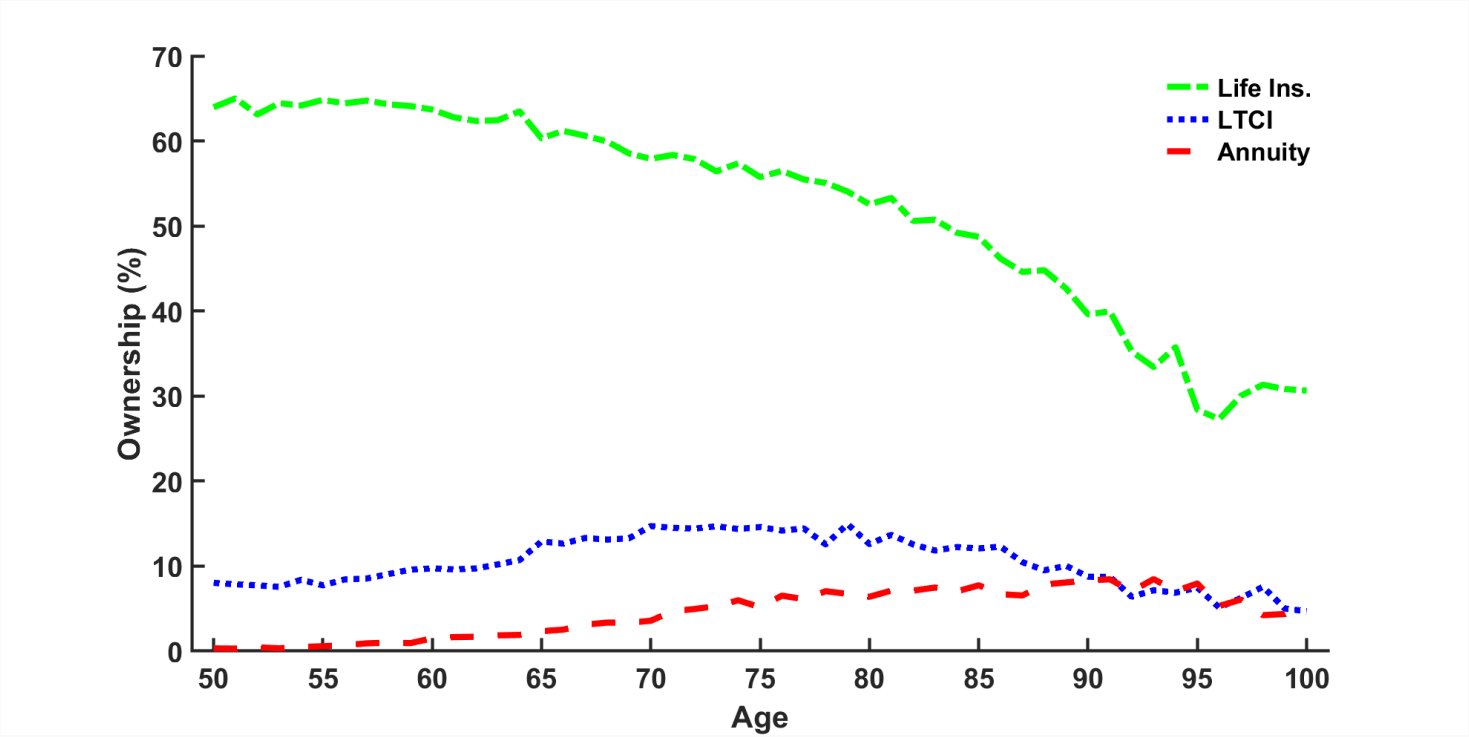
Background

- Despite significant financial risks and spending needs late in life, most people choose not to purchase insurance.
  - Annuity and long-term care insurance (LTCI) are typically owned by less than 10% of older Americans



Related Literature

Understanding consumer insurance demand has been the subject of a large body of research

- Many "puzzles": find consumer insurance holdings suboptimal and impose large welfare costs

Typically, studies that use structural models take one of two approaches:

- *Stylized Products + Very Incomplete Markets*: one-time option to purchase one state-contingent asset
- *Stylized Products + Complete Markets*: calculate life-cycle profiles of demand for portfolio of insurance products

Our approach:

- Portfolio choice of multiple insurance products under incomplete markets
- Model key features of insurance products to make them better match real-world products

Question and Research Design

Approach: Two steps

1. New survey data
    - Measured beliefs about nonpayment risk - no measure from administrative data, so we design a survey
2. New model
    - Life-cycle model with portfolio choice over annuities, life insurance, LTCI and liquid wealth (a stock-bond mutual fund)
    - Incomplete markets: model products as they are in reality and as perceived by consumers
        - non-payment risk, buy/sell wedges, quantity limits

Question: How do properties of available insurance products affect a) demand for insurance against late-in-life risk and b) welfare implications of under-insurance in this context?

This Paper: Key Results

Empirical: From collected survey data

1. Perceived nonpayment risk: large in annuity, life insurance, and LTCI markets

2. Perceived nonpayment risk: predictive of actual insurance holdings
   - Beliefs relate to actual decisions in consistent manner

Model Results: By plugging in perceived non-payment risks into model

1. Nonpayment risk: large affect on insurance ownership

2. Welfare effects of under-insurance is small
   - Welfare costs of market incompleteness: large

Survey Data: Overview

- **Survey**: Understanding America Study (UAS): USC internet panel
  - Representative of US population - tied to HRS module
  - Our module: May 2018 - 1040 responses (82% response rate)
- **Insurance product ownership**
  - Ask questions about three insurance product types: annuities, Life Insurance, LTC Insurance
  - For each insurance type, respondent has product in mind that promises to pay a certain quantity per qualifying event
    - Details on next slide
- **Non-payment risk measures** (for today)
  - Probability of full default
  - Distribution of annual payment conditional on qualifying event

$\rightarrow$ use these measures for insurance product characteristics in model

Measuring Insurance Ownership

Idea: For each insurance type, respondent has a product in mind that promises to pay a certain quantity per qualifying event

Option 1: Own the insurance product

- Ask how much it promises to pay
- If multiple policies owned, focus on largest policy owned

Option 2: Does not own the insurance product

- imagine owning best product they think they can buy
- it promises to pay $X per payout
- X randomised

Measuring Nonpayment Risk - Full Default

Suppose that you own an annuity that promises to pay $5,000 each year for the rest of your life. Suppose further that you never trade this annuity for cash and hold the contract until the end of your life.

We are now interested in the percent chance that the annuity becomes worthless due to no fault of your own at any point before the end of your life. This means that the annuity permanently stops making payments. This might occur if the insurance company goes out of business, they claim you violated a clause in the contract, or they ruled the policy void for some other reason.

What is the percent chance this occurs?

Or type in:

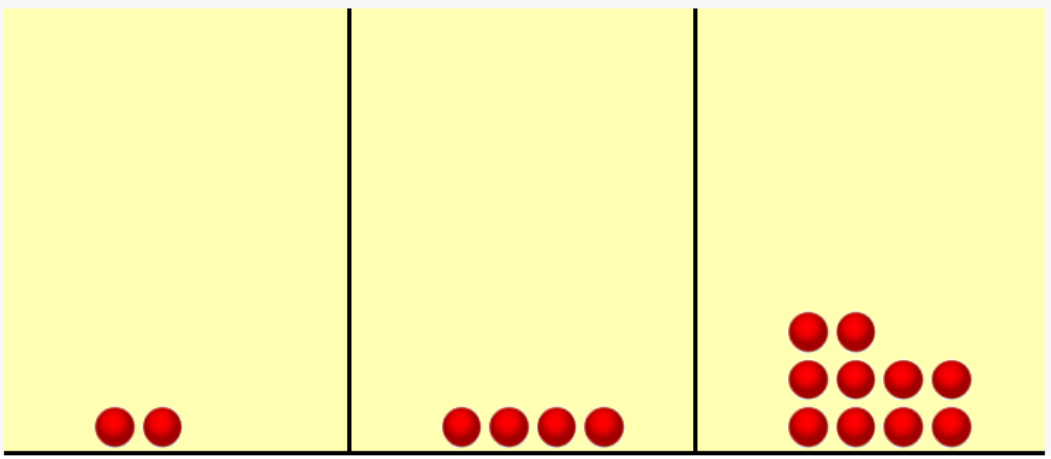
You think that there is a **0% chance** that the annuity becomes worthless at some point before the end of your life

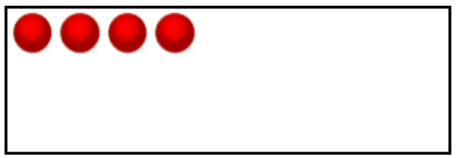
Measuring Nonpayment Risk - Annual Payout Default (1/2)

Suppose that you own an annuity that promises to pay $24,000 each year for the rest of your life. We would now like to focus on what might happen just during the next calendar year.

You have been given 20 balls to put in the following bins. Each bin describes a scenario that involves the annuity payment that you are supposed to receive next year. The more likely you think a bin is, the more balls you should put in that bin.

What do you think will happen to the annuity payment next year?

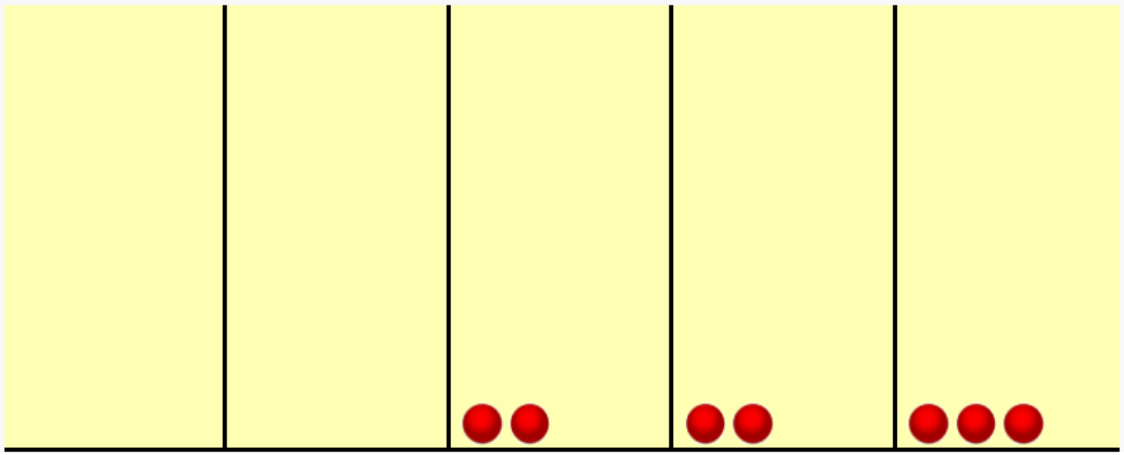




Measuring Nonpayment Risk - Annual Payout Default (2/2)

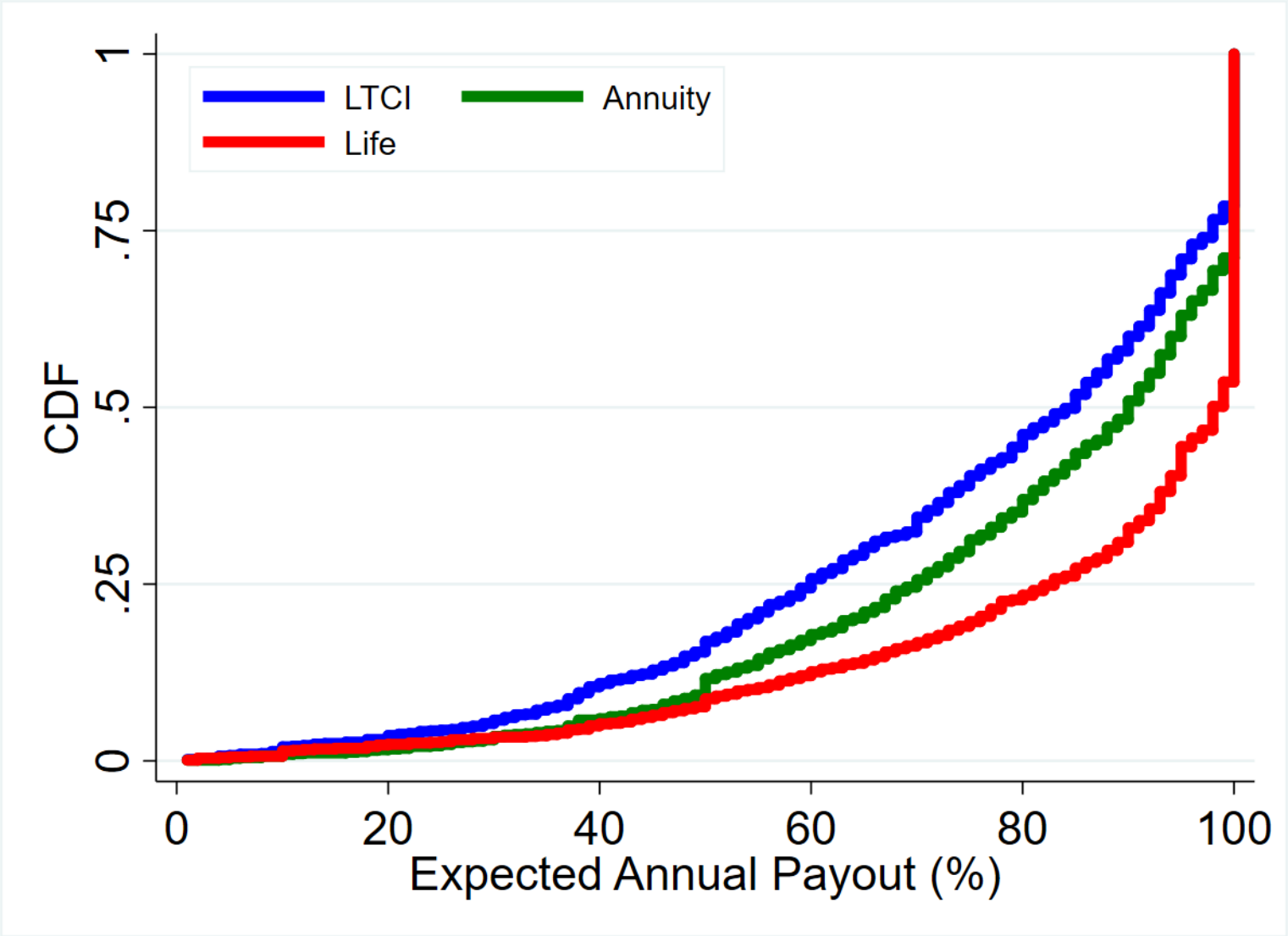
You put 8 ball(s) in the bin marked "I will receive a payment less than I am supposed to receive." Please distribute those balls in the following bins. The more likely you think a bin is, the more balls you should put in that bin.

If you do receive a payment that is less than you are supposed to receive, how much do you think you would get?



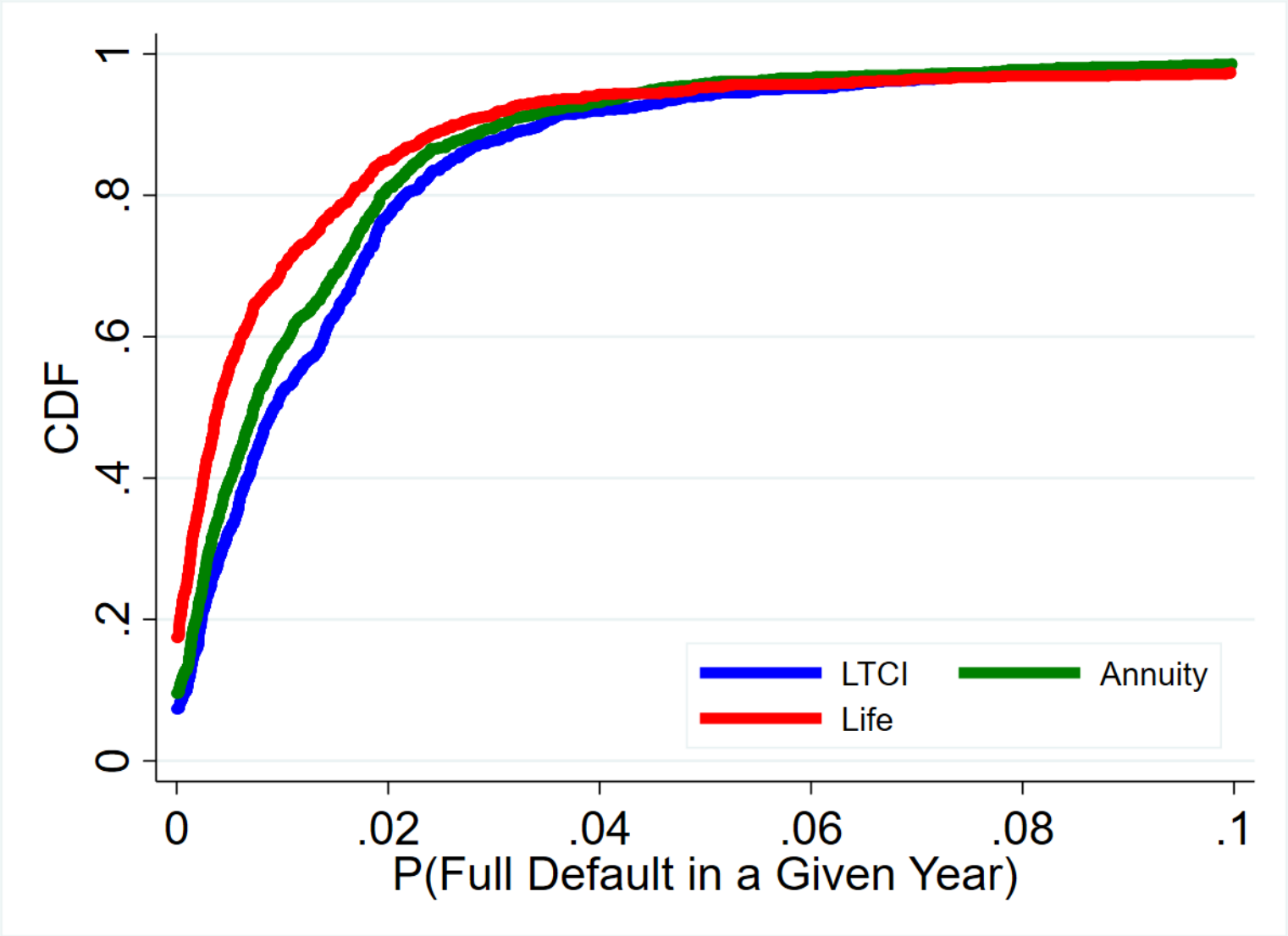
+ -	+ -	+ -	+ -	+ -
I will receive between 1%-19% of the payment I am supposed to receive	I will receive between 20%-39% of the payment I am supposed to receive	I will receive between 40%-59% of the payment I am supposed to receive	I will receive between 60%-79% of the payment I am supposed to receive	I will receive between 80%-99% of the payment I am supposed to receive

Distribution of Expected Value of Annual Payments



Certainty Equivalent
Beliefs: Aggregate State

Distribution of Full Default Probability



Model

Structural Model Overview 1/2

- Life-cycle, heterogeneous agent choice problem
- Each year age 55+ individuals choose how much to consume, save, and a portfolio allocation of savings to a risk free bond and 3 insurance products
- Individuals exogenously heterogeneous in age, income (including SS and DB pensions), sex, and stochastic health status
- Nonhomothetic health-state dependent utility (as in ABCST JPE 2020)
- Individuals endogenously heterogeneous in wealth, insurance holdings, insurance premia, government care status (means-tested Medicaid)

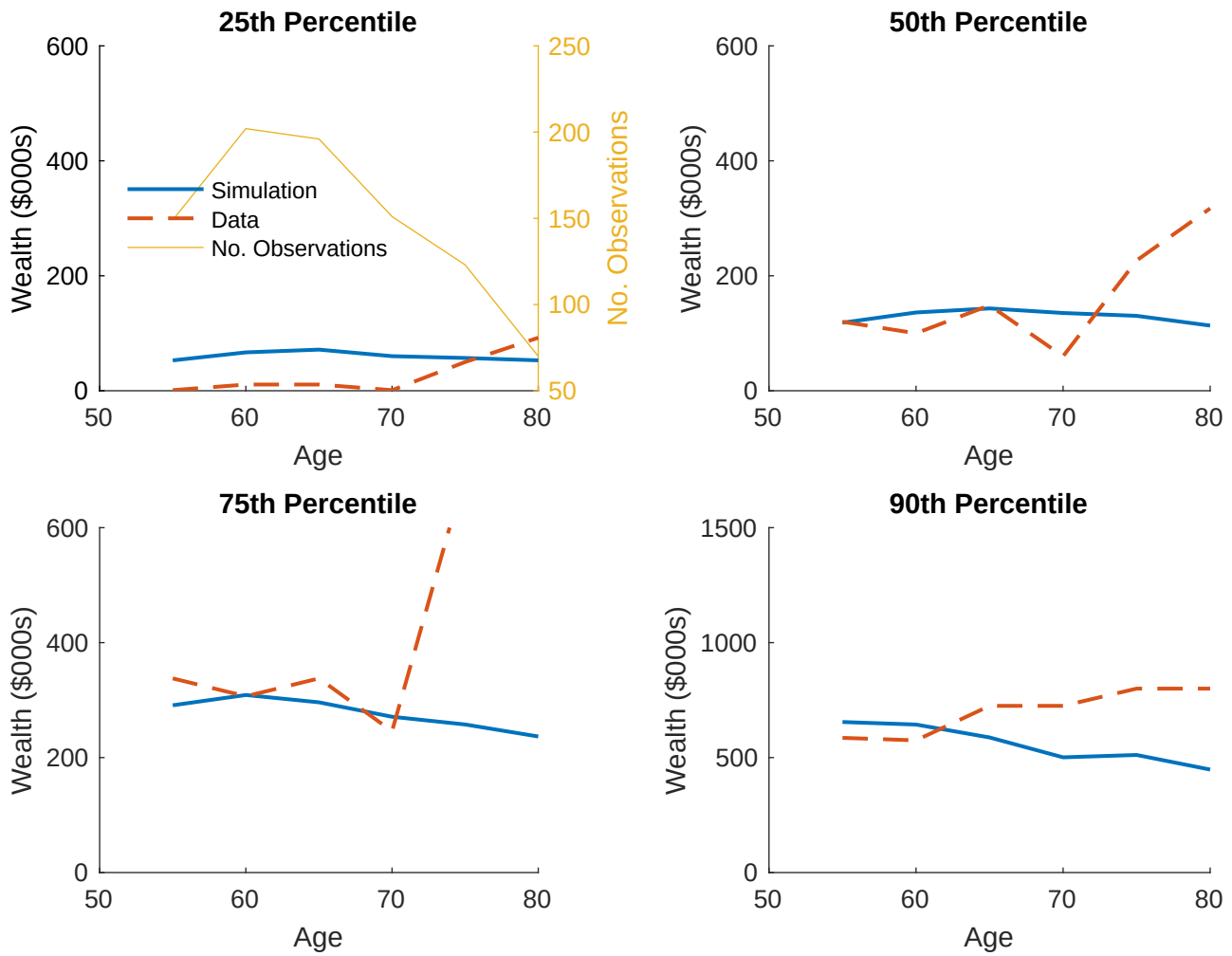
Structural Model Overview 2/2

Insurance Products: GOAL to characteristise insurance products as in real world

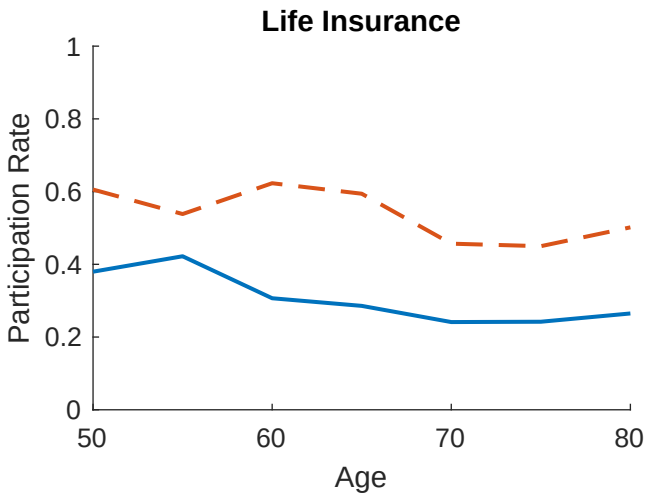
1. Exogenous insurance prices reflect real-world markups above actuarially fair value
2. Annuities paid lump-sum, LI and LTCI paid as annual premia
3. Some probabilities a) insurance product terminates and/or b) insurance product does not pay out in qualifying event. Taken from survey
4. Age limit on purchasing of insurance products

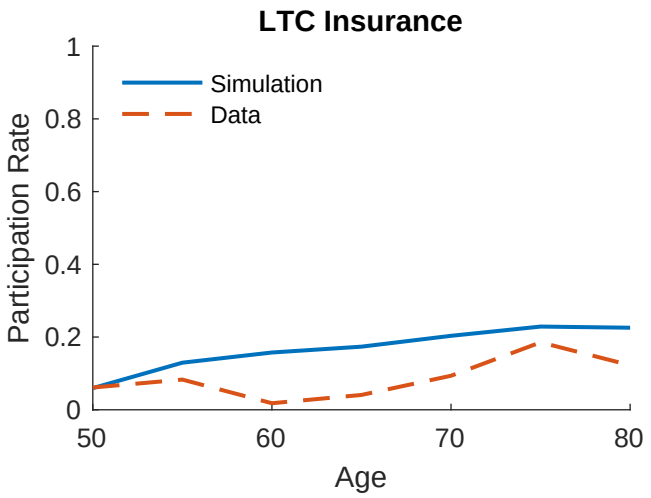
Model Estimation: Choose small number of parameters to match rich moments of wealth distribution and average insurance ownership rates

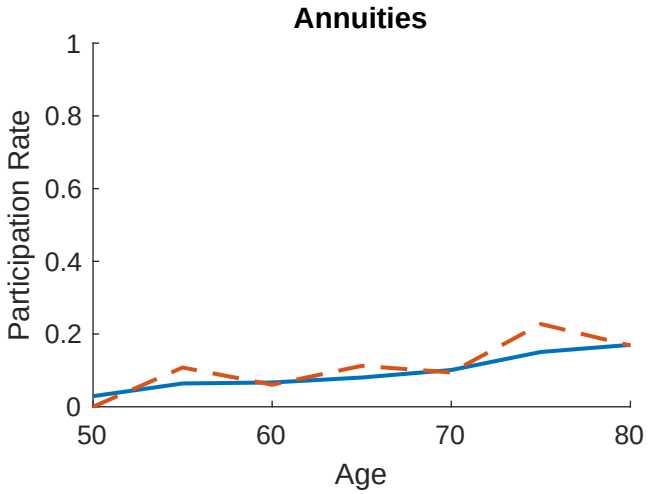
Wealth Distribution: Model and Data: Baseline



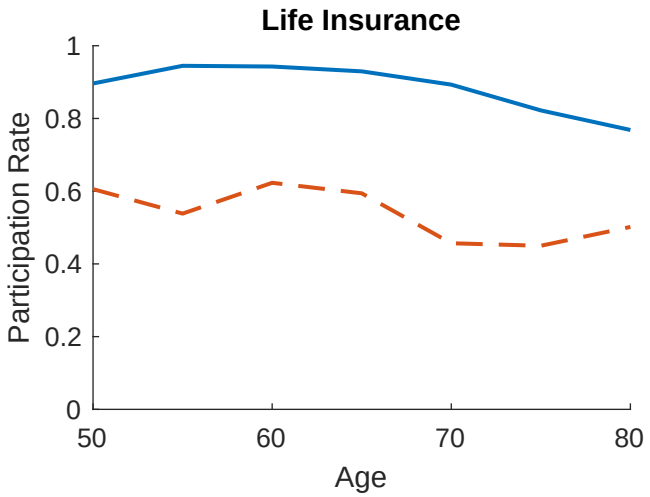
Insurance Ownership: Model and Data: Baseline

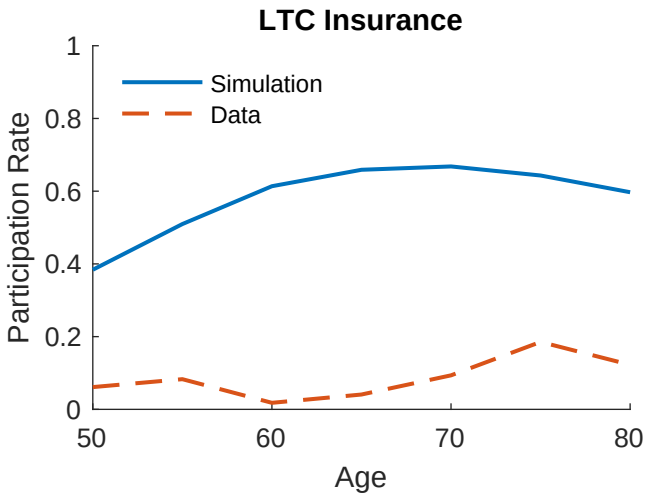


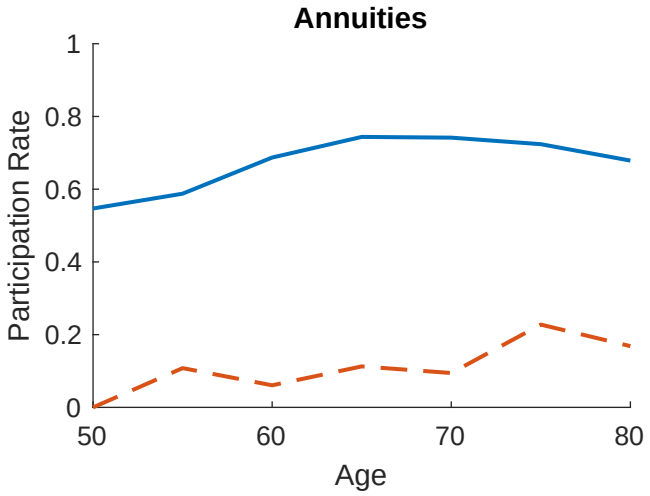




Insurance Ownership: Model and Data: Frictionless







Preliminary Model Predictions: Rational Expectations

	No Insurance	Baseline	No Nonpayment Risk	No Price Wedges	No Price Wedges or Nonpayment Risk
A. *Insurance Ownership*					
LI	0	31%	80%	41%	89%
LTCI	0	16%	34%	20%	57%
Annuity	0	9%	55%	17%	67%
B. *Welfare Gains*					
Consumption Equivalent	0	0.4%	5.2%	1.3%	7.9%

- Real-world asset features have strong effect on ownership
  - especially for annuities and LTCI
- Welfare costs of "under-insurance" much smaller than complete market analysis suggests

Alt Baseline: Nonpayment Beliefs, Full Payments Made

	No Insurance	Baseline	No Nonpayment Risk	No Price Wedges	No Price Wedges or Nonpayment Risk
B. *Welfare Gains*					
Consumption Equivalent	0	1.4%	5.2%	2.7%	7.9%

- Insurer always pays what's promised, but change household beliefs
- Welfare Gains: Rational Expectations vs. Payments Always Made
  - Baseline: 1.4% vs. 0.4% — obviously payouts are better than defaults
  - No Price Wedges: 2.7% vs. 1.3%
- Incorrect beliefs would have large welfare costs: 5.2% vs. 1.4%
  - Even when all payments are made, only 1.4% welfare gain in baseline compared to 5.2% if beliefs correctly reflected zero non-payment risk

Conclusion

- Incomplete markets and perceived risks are important determinants of insurance holdings, and measuring and modeling actual product features is important when studying consumer choices and welfare
- Perceived nonpayment risk is large in annuity, life insurance, and LTCI markets
- Perceived nonpayment risk is strongly predictive of actual insurance holdings
- After accounting for nonpayment risk and other incomplete markets features, welfare costs associated with deviations from optimal insurance portfolios are much smaller
- Valuable to study supply and demand of insurance products together, but deeper understanding of one side of the market valuable in and of itself

Appendix

Average Expected Payouts, Certainty Equivalents, and Implied Risk Premia

	Population Mean Expected Value (1)	Population Mean Certainty Equivalent (2)	Risk Premia (3)
Life	87.16	81.43	5.72
Annuity	81.51	73.79	7.72
LTCI	76.17	72.90	3.27

Main

Nonpayment Risk Measures Predict Insurance Ownership

	Own Annuity (1)	Own Life (2)	Own LTCI (3)	Own Annuity (4)	Own LIfe (5)	Own LTCI (6)
Annuity Payment Exp. Value	-0.0018			-0.0005		
	(0.212)			(0.373)		
Annuity Full Def. Prob	-0.0021***			-0.0020***		
	(0.000)			(0.000)		
Annuity Payment SD	-0.0043**			-0.0029***		
	(0.002)			(0.000)		
Life Payment Exp. Value		0.0046***			0.0045**	
		(0.001)			(0.003)	
Life Full Default Prob		-0.0015			-0.0013	
		(0.129)			(0.142)	
Life Payment SD		-0.0006			-0.0002	
		(0.686)			(0.896)	
LTCI Payment Exp. Value			0.0007			0.0006
			(0.111)			(0.181)
LTCI Full Default Prob			-0.0023***			-0.0022***
			(0.000)			(0.000)
LTCI Payment SD			-0.0009			-0.0010
			(0.195)			(0.136)
Trust				0.0188	-0.0063	0.0162
				(0.091)	(0.758)	(0.241)
Cognitive Score				-0.0007	-0.0033	0.0004
				(0.747)	(0.271)	(0.852)
Financial Literacy Score				-0.0112	-0.0662*	-0.0083
				(0.459)	(0.019)	(0.609)
Numeracy Score				-0.0079	0.0207	-0.0240
				(0.560)	(0.319)	(0.101)
Experienced Fraud				0.0298	0.0545	-0.0031
				(0.549)	(0.375)	(0.941)
Risk Aversion				-0.0072	-0.0160	-0.0015
				(0.252)	(0.072)	(0.776)
Propensity to Plan				0.0137	-0.0013	0.0016
				(0.243)	(0.947)	(0.888)
Early Stock Returns				0.1474	-0.5123	-0.7936
				(0.757)	(0.441)	(0.122)
N	1055	1046	1040	1055	1046	1040
R^2	0.170	0.132	0.129	0.268	0.218	0.179
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Main

Extrapolation of Regression Results

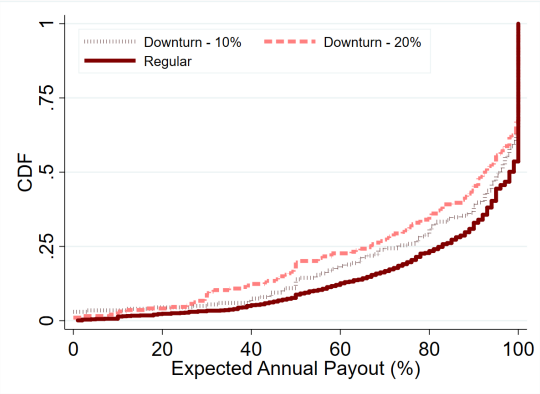
Counterfactual Predictions of Probit Regressions Under Various Specifications of Risk Perception

			Maginal Effects, 1 Std. Dev. Increase		
	P(Own)	P(Own—No Risk)	Exp. Value	Full Default	Std. Dev.
	(1)	(2)	(3)	(4)	(5)
Annuity	.12	.24	-.010	-.017	-.030
Life	.57	.66	.111	-.042	-.010
LTCI	.10	.23	.039	-.046	-.003

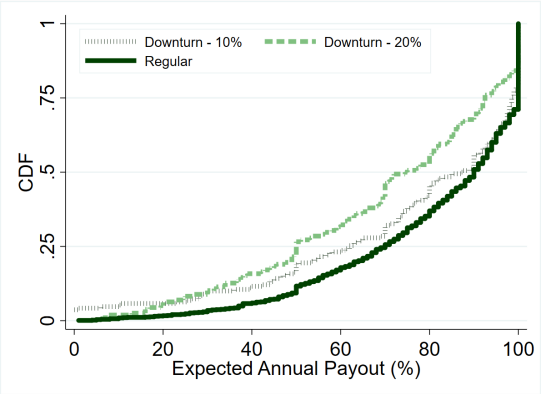
Main

Annuity and Life Expected Payouts Vary with Aggregate Risk, but LTCI Payouts Do Not

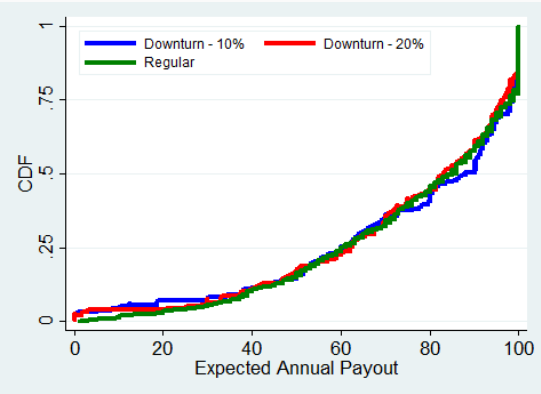
Life



Annuity



LTCI



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Household Problem

Household solves the following life-cycle problem Calibration

$$V_t = \max_{C_t, B_{t+1}, W_t^k} \frac{\theta_s}{1-\sigma} C_t^{1-\sigma} + \beta E_t \left[\mathbf{1}_{s_{t+1} \neq 3} V_{t+1} + \mathbf{1}_{s_{t+1}=3} \nu_{s_{t+1}} (\tilde{B}_{t+1}^{BEQ}) \right]$$

where

$$B_{t+1} = (1+r) \left(B_t - C_t - \sum_{k \in ANN} \left[W_t^k p_{t,s,f,G}^k \left(1 - \lambda_-^k \mathbb{I}_{W_t^k < 0} + \lambda_+^k \mathbb{I}_{W_t^k > 0} \right) \right] \right)$$
$$+ Y_{t+1}(1 - D_{t+1}^{LTCI} \Upsilon_{t_0,s_0,f,G_0}^{LTCI} - D_{t+1}^{LI} \Upsilon_{t_0,s_0,f,G_0}^{LI}) - HC_{t+1}^{s,f} + \Gamma(s_t, :) \sum_k D_{t+1}^k \hat{D}_{t+1}^k$$

such that

- $B_{t+1} \geq 0$ (no borrowing)
- $D_{t+1} \geq 0$ (no negative insurance holdings)
- $\tilde{B}_{t+1}^{BEQ} = B_{t+1} + D_{t+1}^{LI} \hat{D}_{t+1}^{LI}$