“Insurance and Portfolio Decisions: A Wealth Effect Puzzle”

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Introduction (1/2)

- We study households' decisions to:

    1. Invest in risky assets
    2. Insure against monetary risks

- The two decisions reflect opposite risk retention tradeoff:
    - An agent **increases** his risk exposure by **investing** in risky assets
    - An agent **reduces** his risk exposure by purchasing **insurance**

- Factors that promote risk taking should therefore
    - Increase the demand for risky assets
    - Lower the demand for insurance

- We focus on one such factor: **Wealth**

Introduction (2/2)

- Empirical evidence that the demand for risky assets increases with wealth
  - Guiso et al. (1996), Brunnermeier and Nagel (2008), Chiappori and Paiella (2011)

- So, does the demand for insurance decrease with wealth?

- Object of the paper:
  - Test whether wealth has opposite effect on portfolio and insurance coverage decisions

- We test this hypothesis using
  - Detailed micro data from survey in U.S.
  - Industry data from France

Theory background

- An agent with wealth w and vNM utility $u(.)$ has to decide the insurance coverage α
- He pays an insurance premium $\alpha\pi$ to receive an indemnity αL in case of a random loss L.
  - $Eu(w - \alpha\pi - (1-\alpha)L)$

  $\equiv Eu(w_0 + aX)$ with $w_0 = w - \pi$, $X = \pi - L$ and $a = 1 - \alpha$
  - Insurance coverage α is similar, albeit opposite, to investment in risky assets a

- Implication: Wealth w decreases insurance demand α, or equivalently increases risky asset demand a, iff decreasing absolute risk aversion (DARA) (Pratt 1964, Mossin 1968)

Preview of Results

- We find that

    1. Insurance is a normal good
    2. Insurance and risky investments **both increase** with wealth

- We try to explain this “insurance-portfolio puzzle” theoretically
    - With conventional theory
    - By considering various behavioral factors

- None of these approaches appear sufficient to explain the puzzle fully

Empirical approach

- Strategy:

    1. Estimate a baseline, easily interpretable, model
    2. Conduct a battery of robustness tests

- Baseline model:

$$I_i = \alpha_0 W_i + \alpha_1 X_i + \alpha_2 Y_i + \varepsilon_i^I$$

$$R_i = \beta_0 W_i + \beta_1 X_i + \beta_2 Z_i + \varepsilon_i^R$$

I_i and R_i : insurance and risky investments, left censored at zero
(ε_i^I, ε_i^R) follow bivariate normal distribution with correlation ρ

- **Main exercise**: Test $H_0 = \{ \alpha_0 < 0 , \beta_0 > 0 \}$, i.e. that wealth has an opposite effect on insurance and portfolio decisions

- The baseline model is estimated with data collected in the *Survey of Consumer Expectations* and focuses on car insurance decisions

Survey of Consumer Expectations (SCE)

- Produced by Federal Reserve Bank of New York since June 2013
- Key features:
    - Monthly
    - Internet-based
    - ~1,300 (nationally representative) household heads
    - Rotating panel (12 months)
    - Focuses on expectations (point prediction and density)
    - Includes monthly core and occasional special topic surveys
- Data on risky investments are from the special surveys on household finance conducted in 08/2015 and 08/2016
- Data on insurance coverage (e.g. car, homeowner, health) are from special modules conducted in 09/2015 and 09/2016
- In total 1,811 respondents (898 in 08-09/2015; 913 in 08-09/2016)

Wealth and risky investments measures (W_i,R_i)

Liquid Wealth =

Savings and investments (e.g. checking/savings, CDs, stocks, bonds)

\+ Retirement savings (e.g. IRA, 401K, 403(b), 457, thrift savings plan)

\+ Miscellaneous (e.g. vehicles, jewelry, cash value in life insurance, collections)

\- Non-housing debt (credit cards, auto/student/personal loans, medical/legal bills)

- Alternative measure for robustness check:

Financial wealth = Liquid Wealth + Home(s) + Business(es)

\- Loans against home(s) (e.g. mortgages, home equity loans)

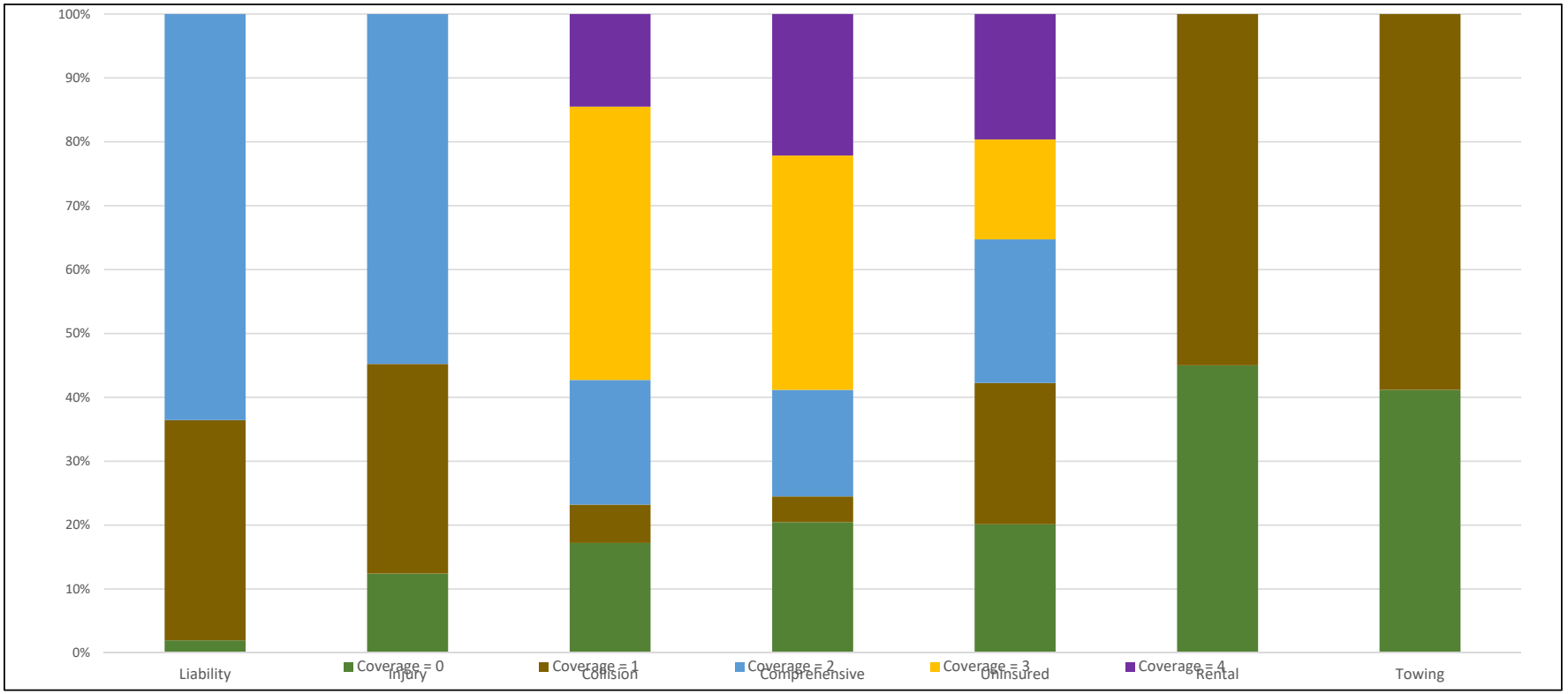
- **Risky assets** = stocks + mutual funds (+ Home(s) + Business(es))

Index of insurance coverage (I_i)

- We ask about 7 components of auto insurance contract:
  1. Liability (covers damages caused by insured to others)
  2. Personal injury (pays for insured medical bills regardless of who is at fault)
  3. Under/Uninsured (pays when other party has not enough insurance)
  4. Collision (covers insured vehicle after accident regardless of who is at fault)
  5. Comprehensive (covers insured vehicle from damage not due to collision)
  6. Rental (pays for a rental car while the insured vehicle is being repaired)
  7. Towing/road side assistance

- Each component takes values ordered from less to more coverage

Components of Car Insurance Coverage

- 

- **Liability**: 0=No coverage, 1=Legal minimum, 2=More than legal minimum. **Injury**: 0=No coverage, 1=Legal minimum, 2=More than legal minimum. **Collision**: 0=No coverage, 1=deductible>$1,000, 2=$501<deductible<$1,000, 3=$251<deductible<=$500, 4=deductible<=$250. **Comprehensive**: 0=No coverage, 1=deductible>$1,000, 2=$501<deductible<$1,000, 3=$251<deductible<=$500, 4=deductible<$250. **Uninsured**: 0=No coverage, 1= Coverage<$10k, 2=$10k<coverage<$50k, 3=$50k<coverage<$100k, 4=Coverage>$100k. **Rental**: 0=No coverage, 1=Coverage. **Towing**: 0=No coverage, 1=Coverage.

Index of insurance coverage (I_i)

- Previous studies focus on a single dimension of auto insurance (e.g. Puelz and Snow 1994, Cohen and Einav 2007, Barseghyan et al. 2011)
- We summarize multiple dimensions into a single index: normalized sum of each component

$$I_{i,1} = \sum_{j=1,\ldots,7} c_{i,j} / k_j$$

where k_j is # of possible values (-1) of component j

- $I_{i,1}$ varies from 0 (no coverage) to 7 (full coverage)
- E.g. Coverage = only uninsured up to \$10k, then $I_{i,1}$ = ¼
- Three other indexes for robustness check

Insurance and risky investments variables (Y_i,Z_i)

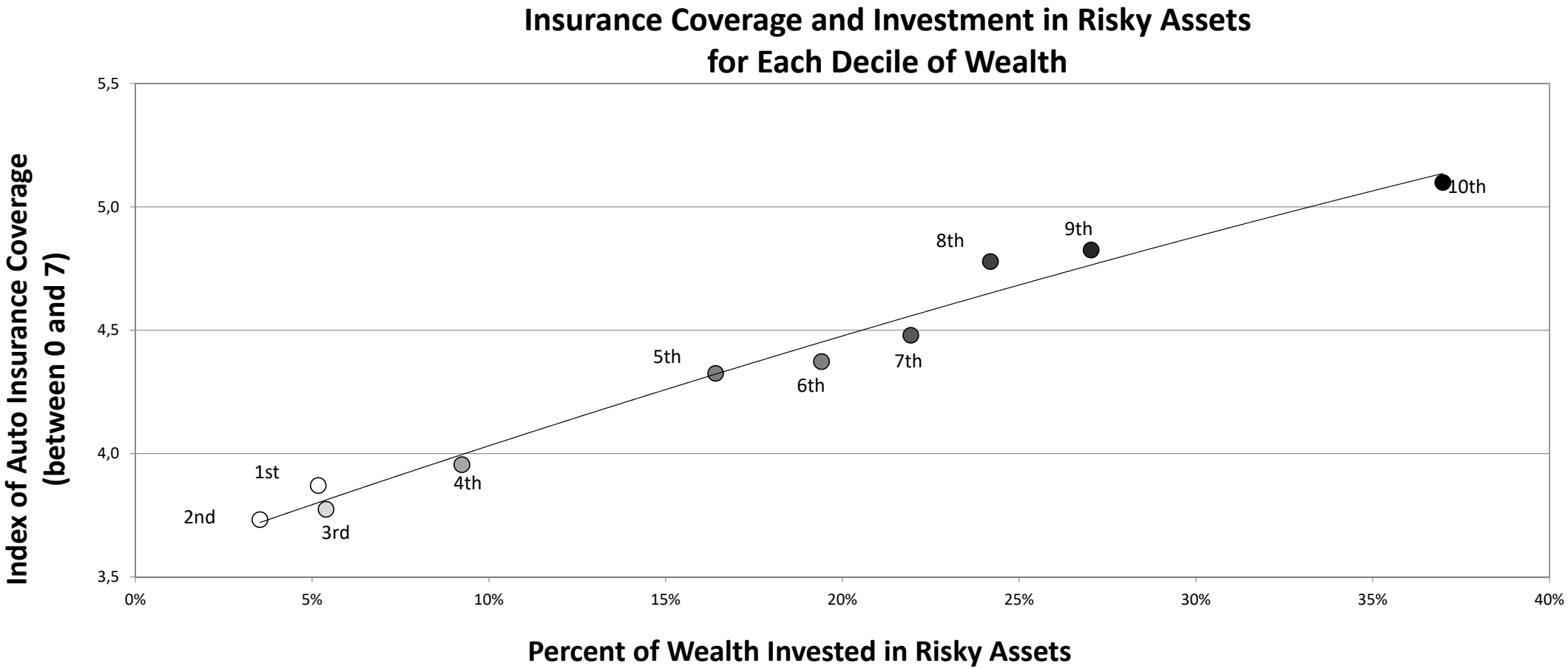
- Insurance Variables (Y_i):
    - Value of (most valuable) vehicle
    - Premium paid
    - Population density within zip code
    - Measure of objective risk (damages incurred past 2 years)
    - Measure of subjective risk (expected damages next 2 years)
    - Knowledge of car insurance

- Risky investments variables (Z_i):
    - Expectations (change in U.S. stock market next 12 months)
    - Knowledge of debts and savings

Individual Characteristics (X_i)

- Age of household head
- Education attainment
- Wealth
- Measure of financial literacy
- Measure of credit worthiness (credit score)
- Measure of liquidity constraint or financial fragility
- Subjective measure of risk attitude
- Other: race, marital status, employment status, number of kids…

Prima-Facie Evidence



Insurance Coverage					
Wealth					
Car Value					
Objective Risk					
Premium					
Age					
Zip Density					
Education					
Subjective Risk					
Low Numeracy					
Know Car Insurance					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
AtanhRho					

Risky Investments					
Wealth					
Age					
Zip Density					
Education					
Expected Stock Change					
Low Numeracy					
Know Savings And Debts					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
N					
AIC					

Insurance Coverage					
Wealth	6.5e-04*** (7.0e-05)				
Car Value					
Objective Risk					
Premium					
Age					
Zip Density					
Education					
Subjective Risk					
Low Numeracy					
Know Car Insurance					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)				

Risky Investments					
Wealth	2.6e-04*** (2.2e-05)				
Age					
Zip Density					
Education					
Expected Stock Change					
Low Numeracy					
Know Savings And Debts					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
N	1811				
AIC	8.8e+03				

Result 1

***R1**: Insurance coverage and investments in risky assets are positively correlated with wealth*

- Implications:
  - Insurance is a normal good
  - ***R1*** is not consistent with the hypothesis that wealth has opposite effect on portfolio and insurance decisions

Insurance Coverage					
Wealth	6.5e-04*** (7.0e-05)				
Car Value					
Objective Risk					
Premium					
Age					
Zip Density					
Education					
Subjective Risk					
Low Numeracy					
Know Car Insurance					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)				

Risky Investments					
Wealth	2.6e-04*** (2.2e-05)				
Age					
Zip Density					
Education					
Expected Stock Change					
Low Numeracy					
Know Savings And Debts					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
N	1811				
AIC	8.8e+03				

Insurance Coverage

Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)			
Car Value		2.4e-02*** (4.5e-03)			
Objective Risk		1.2e-01** (5.6e-02)			
Premium		5.7e-05 (1.1e-04)			
Age					
Zip Density					
Education					
Subjective Risk					
Low Numeracy					
Know Car Insurance					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)			

Risky Investments

Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)			
Age					
Zip Density					
Education					
Expected Stock Change					
Low Numeracy					
Know Savings And Debts					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
N	1811	1811			
AIC	8.8e+03	8.7e+03			

Result 2

***R2**: Insurance coverage increases with*

- *The value of good insured*
- *Objective risk*

Insurance Coverage					
Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)			
Car Value		2.4e-02*** (4.5e-03)			
Objective Risk		1.2e-01** (5.6e-02)			
Premium		5.7e-05 (1.1e-04)			
Age					
Zip Density					
Education					
Subjective Risk					
Low Numeracy					
Know Car Insurance					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)			

Risky Investments					
Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)			
Age					
Zip Density					
Education					
Expected Stock Change					
Low Numeracy					
Know Savings And Debts					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
N	1811	1811			
AIC	8.8e+03	8.7e+03			

Insurance Coverage

Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)		
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)		
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)		
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)		
Age			1.8e-02*** (2.7e-03)		
Zip Density			4.9e-03 (9.0e-03)		
Education			2.0e-01*** (6.2e-02)		
Subjective Risk					
Low Numeracy					
Know Car Insurance					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	6.9e-02** (2.8e-02)

Risky Investments

Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)		
Age			-1.3e-03** (6.6e-04)		
Zip Density			-9.7e-04 (1.2e-03)		
Education			9.4e-02*** (1.6e-02)		
Expected Stock Change					
Low Numeracy					
Know Savings And Debts					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
N	1811	1811	1811	1806	1806
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	8.3e+03

Result 3

R3:

- *Older people have more insurance and less risky assets*
- *Higher educated have more insurance and more risky assets*

Insurance Coverage

Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)		
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)		
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)		
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)		
Age			1.8e-02*** (2.7e-03)		
Zip Density			4.9e-03 (9.0e-03)		
Education			2.0e-01*** (6.2e-02)		
Subjective Risk					
Low Numeracy					
Know Car Insurance					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)		

Risky Investments

Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)		
Age			-1.3e-03** (6.6e-04)		
Zip Density			-9.7e-04 (1.2e-03)		
Education			9.4e-02*** (1.6e-02)		
Expected Stock Change					
Low Numeracy					
Know Savings And Debts					
Credit Worthiness					
Financial Liquidity					
Risk Attitude					
N	1811	1811	1811	1806	1806
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	8.3e+03

Insurance Coverage

Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)	3.0e-04*** (6.2e-05)	
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)	1.6e-02*** (3.9e-03)	
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)	5.6e-02 (5.8e-02)	
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)	1.8e-04 (1.2e-04)	
Age			1.8e-02*** (2.7e-03)	1.2e-02*** (2.6e-03)	
Zip Density			4.9e-03 (9.0e-03)	2.8e-03 (8.7e-03)	
Education			2.0e-01*** (6.2e-02)	6.6e-02 (6.2e-02)	
Subjective Risk				1.2e-01** (4.8e-02)	
Low Numeracy				-2.3e-01** (9.6e-02)	
Know Car Insurance				2.4e-01*** (2.7e-02)	
Credit Worthiness				3.0e-02 (3.3e-02)	
Financial Liquidity				6.7e-01*** (1.4e-01)	
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	

Risky Investments

Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)	1.9e-04*** (2.0e-05)	
Age			-1.3e-03** (6.6e-04)	-2.3e-03*** (6.4e-04)	
Zip Density			-9.7e-04 (1.2e-03)	-1.2e-04 (1.1e-03)	
Education			9.4e-02*** (1.6e-02)	4.4e-02*** (1.6e-02)	
Expected Stock Change				3.7e-01*** (1.2e-01)	
Low Numeracy				-7.4e-02*** (2.4e-02)	
Know Savings And Debts				3.0e-02** (1.2e-02)	
Credit Worthiness				2.1e-02** (8.1e-03)	
Financial Liquidity				3.2e-01*** (3.6e-02)	
Risk Attitude					
N	1811	1811	1811	1806	
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	

Insurance Coverage

Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)	3.0e-04*** (6.2e-05)	
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)	1.6e-02*** (3.9e-03)	
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)	5.6e-02 (5.8e-02)	
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)	1.8e-04 (1.2e-04)	
Age			1.8e-02*** (2.7e-03)	1.2e-02*** (2.6e-03)	
Zip Density			4.9e-03 (9.0e-03)	2.8e-03 (8.7e-03)	
Education			2.0e-01*** (6.2e-02)	6.6e-02 (6.2e-02)	
Subjective Risk				1.2e-01** (4.8e-02)	
Low Numeracy				-2.3e-01** (9.6e-02)	
Know Car Insurance				2.4e-01*** (2.7e-02)	
Credit Worthiness				3.0e-02 (3.3e-02)	
Financial Liquidity				6.7e-01*** (1.4e-01)	
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	

Risky Investments

Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)	1.9e-04*** (2.0e-05)	
Age			-1.3e-03** (6.6e-04)	-2.3e-03*** (6.4e-04)	
Zip Density			-9.7e-04 (1.2e-03)	-1.2e-04 (1.1e-03)	
Education			9.4e-02*** (1.6e-02)	4.4e-02*** (1.6e-02)	
Expected Stock Change				3.7e-01*** (1.2e-01)	
Low Numeracy				-7.4e-02*** (2.4e-02)	
Know Savings And Debts				3.0e-02** (1.2e-02)	
Credit Worthiness				2.1e-02** (8.1e-03)	
Financial Liquidity				3.2e-01*** (3.6e-02)	
Risk Attitude					
N	1811	1811	1811	1806	
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	

Insurance Coverage

Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)	3.0e-04*** (6.2e-05)	
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)	1.6e-02*** (3.9e-03)	
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)	5.6e-02 (5.8e-02)	
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)	1.8e-04 (1.2e-04)	
Age			1.8e-02*** (2.7e-03)	1.2e-02*** (2.6e-03)	
Zip Density			4.9e-03 (9.0e-03)	2.8e-03 (8.7e-03)	
Education			2.0e-01*** (6.2e-02)	6.6e-02 (6.2e-02)	
Subjective Risk				1.2e-01** (4.8e-02)	
Low Numeracy				-2.3e-01** (9.6e-02)	
Know Car Insurance				2.4e-01*** (2.7e-02)	
Credit Worthiness				3.0e-02 (3.3e-02)	
Financial Liquidity				6.7e-01*** (1.4e-01)	
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	

Risky Investments

Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)	1.9e-04*** (2.0e-05)	
Age			-1.3e-03** (6.6e-04)	-2.3e-03*** (6.4e-04)	
Zip Density			-9.7e-04 (1.2e-03)	-1.2e-04 (1.1e-03)	
Education			9.4e-02*** (1.6e-02)	4.4e-02*** (1.6e-02)	
Expected Stock Change				3.7e-01*** (1.2e-01)	
Low Numeracy				-7.4e-02*** (2.4e-02)	
Know Savings and Debts				3.0e-02** (1.2e-02)	
Credit Worthiness				2.1e-02** (8.1e-03)	
Financial Liquidity				3.2e-01*** (3.6e-02)	
Risk Attitude					
N	1811	1811	1811	1806	
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	

Result 4

R4:

- Expectations and awareness matter
- People with
  - low numeracy
  - liquidity constraints

have less insurance coverage and invest less in risky assets

Insurance Coverage					
Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)	3.0e-04*** (6.2e-05)	
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)	1.6e-02*** (3.9e-03)	
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)	5.6e-02 (5.8e-02)	
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)	1.8e-04 (1.2e-04)	
Age			1.8e-02*** (2.7e-03)	1.2e-02*** (2.6e-03)	
Zip Density			4.9e-03 (9.0e-03)	2.8e-03 (8.7e-03)	
Education			2.0e-01*** (6.2e-02)	6.6e-02 (6.2e-02)	
Subjective Risk				1.2e-01** (4.8e-02)	
Low Numeracy				-2.3e-01** (9.6e-02)	
Know Car Insurance				2.4e-01*** (2.7e-02)	
Credit Worthiness				3.0e-02 (3.3e-02)	
Financial Liquidity				6.7e-01*** (1.4e-01)	
Risk Attitude					
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	

Risky Investments					
Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)	1.9e-04*** (2.0e-05)	
Age			-1.3e-03** (6.6e-04)	-2.3e-03*** (6.4e-04)	
Zip Density			-9.7e-04 (1.2e-03)	-1.2e-04 (1.1e-03)	
Education			9.4e-02*** (1.6e-02)	4.4e-02*** (1.6e-02)	
Expected Stock Change				3.7e-01*** (1.2e-01)	
Low Numeracy				-7.4e-02*** (2.4e-02)	
Know Savings and Debts				3.0e-02** (1.2e-02)	
Credit Worthiness				2.1e-02** (8.1e-03)	
Financial Liquidity				3.2e-01*** (3.6e-02)	
Risk Attitude					
N	1811	1811	1811	1806	
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	

Expected effect of risk attitude

- In standard theory, wealth affects investment and insurance decisions only through coefficient of absolute risk aversion $A(.)=-u''(.)/u'(.)$

- Thus, if we control properly for $A(.)$ in regressions, then the wealth parameter should become insignificant

Insurance Coverage					
Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)	3.0e-04*** (6.2e-05)	3.3e-04*** (6.4e-05)
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)	1.6e-02*** (3.9e-03)	1.7e-02*** (3.9e-03)
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)	5.6e-02 (5.8e-02)	5.8e-02 (5.8e-02)
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)	1.8e-04 (1.2e-04)	1.8e-04 (1.2e-04)
Age			1.8e-02*** (2.7e-03)	1.2e-02*** (2.6e-03)	1.1e-02*** (2.6e-03)
Zip Density			4.9e-03 (9.0e-03)	2.8e-03 (8.7e-03)	3.5e-03 (8.7e-03)
Education			2.0e-01*** (6.2e-02)	6.6e-02 (6.2e-02)	8.1e-02 (6.2e-02)
Subjective Risk				1.2e-01** (4.8e-02)	1.7e-01*** (4.6e-02)
Low Numeracy				-2.3e-01** (9.6e-02)	-2.5e-01*** (9.6e-02)
Know Car Insurance				2.4e-01*** (2.7e-02)	2.4e-01*** (2.7e-02)
Credit Worthiness				3.0e-02 (3.3e-02)	2.7e-02 (3.3e-02)
Financial Liquidity				6.7e-01*** (1.4e-01)	7.0e-01*** (1.4e-01)
Risk Attitude					-5.7e-02** (2.5e -02)
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	6.9e-02** (2.8e-02)

Risky Investments					
Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)	1.9e-04*** (2.0e-05)	1.8e-04*** (1.9e-05)
Age			-1.3e-03** (6.6e-04)	-2.3e-03*** (6.4e-04)	-1.6e-03** (6.6e-04)
Zip Density			-9.7e-04 (1.2e-03)	-1.2e-04 (1.1e-03)	-4.8e-04 (1.2e-03)
Education			9.4e-02*** (1.6e-02)	4.4e-02*** (1.6e-02)	3.5e-02** (1.6e-02)
Expected Stock Change				3.7e-01*** (1.2e-01)	3.0e-01** (1.2e-01)
Low Numeracy				-7.4e-02*** (2.4e-02)	-6.2e-02** (2.4e-02)
Know Savings and Debts				3.0e-02** (1.2e-02)	1.7e-02 (1.2e-02)
Credit Worthiness				2.1e-02** (8.1e-03)	2.0e-02** (8.1e-03)
Financial Liquidity				3.2e-01*** (3.6e-02)	3.0e-01*** (3.6e-02)
Risk Attitude					4.4e-02*** (6.1e-03)
N	1811	1811	1811	1806	1806
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	8.3e+03

Insurance Coverage					
Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)	3.0e-04*** (6.2e-05)	3.3e-04*** (6.4e-05)
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)	1.6e-02*** (3.9e-03)	1.7e-02*** (3.9e-03)
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)	5.6e-02 (5.8e-02)	5.8e-02 (5.8e-02)
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)	1.8e-04 (1.2e-04)	1.8e-04 (1.2e-04)
Age			1.8e-02*** (2.7e-03)	1.2e-02*** (2.6e-03)	1.1e-02*** (2.6e-03)
Zip Density			4.9e-03 (9.0e-03)	2.8e-03 (8.7e-03)	3.5e-03 (8.7e-03)
Education			2.0e-01*** (6.2e-02)	6.6e-02 (6.2e-02)	8.1e-02 (6.2e-02)
Subjective Risk				1.2e-01** (4.8e-02)	1.7e-01*** (4.6e-02)
Low Numeracy				-2.3e-01** (9.6e-02)	-2.5e-01*** (9.6e-02)
Know Car Insurance				2.4e-01*** (2.7e-02)	2.4e-01*** (2.7e-02)
Credit Worthiness				3.0e-02 (3.3e-02)	2.7e-02 (3.3e-02)
Financial Liquidity				6.7e-01*** (1.4e-01)	7.0e-01*** (1.4e-01)
Risk Attitude					-5.7e-02** (2.5e -02)
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	6.9e-02** (2.8e-02)

Risky Investments					
Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)	1.9e-04*** (2.0e-05)	1.8e-04*** (1.9e-05)
Age			-1.3e-03** (6.6e-04)	-2.3e-03*** (6.4e-04)	-1.6e-03** (6.6e-04)
Zip Density			-9.7e-04 (1.2e-03)	-1.2e-04 (1.1e-03)	-4.8e-04 (1.2e-03)
Education			9.4e-02*** (1.6e-02)	4.4e-02*** (1.6e-02)	3.5e-02** (1.6e-02)
Expected Stock Change				3.7e-01*** (1.2e-01)	3.0e-01** (1.2e-01)
Low Numeracy				-7.4e-02*** (2.4e-02)	-6.2e-02** (2.4e-02)
Know Savings and Debts				3.0e-02** (1.2e-02)	1.7e-02 (1.2e-02)
Credit Worthiness				2.1e-02** (8.1e-03)	2.0e-02** (8.1e-03)
Financial Liquidity				3.2e-01*** (3.6e-02)	3.0e-01*** (3.6e-02)
Risk Attitude					4.4e-02*** (6.1e-03)
N	1811	1811	1811	1806	1806
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	8.3e+03

Result 5

R5:

- The effect of our measure of risk attitude is consistent with standard theory
- The wealth parameters remain positive and highly significant

- Implications:
  - Wealth affects behavior outside utility function channel

and/or

  - Our measure of risk attitude does not capture properly *A(.)*

Insurance Coverage					
Wealth	6.5e-04*** (7.0e-05)	5.5e-04*** (6.6e-05)	3.7e-04*** (6.7e-05)	3.0e-04*** (6.2e-05)	3.3e-04*** (6.4e-05)
Car Value		2.4e-02*** (4.5e-03)	2.3e-02*** (4.4e-03)	1.6e-02*** (3.9e-03)	1.7e-02*** (3.9e-03)
Objective Risk		1.2e-01** (5.6e-02)	1.1e-01** (5.5e-02)	5.6e-02 (5.8e-02)	5.8e-02 (5.8e-02)
Premium		5.7e-05 (1.1e-04)	1.1e-04 (1.2e-04)	1.8e-04 (1.2e-04)	1.8e-04 (1.2e-04)
Age			1.8e-02*** (2.7e-03)	1.2e-02*** (2.6e-03)	1.1e-02*** (2.6e-03)
Zip Density			4.9e-03 (9.0e-03)	2.8e-03 (8.7e-03)	3.5e-03 (8.7e-03)
Education			2.0e-01*** (6.2e-02)	6.6e-02 (6.2e-02)	8.1e-02 (6.2e-02)
Subjective Risk				1.2e-01** (4.8e-02)	1.7e-01*** (4.6e-02)
Low Numeracy				-2.3e-01** (9.6e-02)	-2.5e-01*** (9.6e-02)
Know Car Insurance				2.4e-01*** (2.7e-02)	2.4e-01*** (2.7e-02)
Credit Worthiness				3.0e-02 (3.3e-02)	2.7e-02 (3.3e-02)
Financial Liquidity				6.7e-01*** (1.4e-01)	7.0e-01*** (1.4e-01)
Risk Attitude					-5.7e-02** (2.5e -02)
AtanhRho	1.0e-01*** (2.8e-02)	8.7e-02*** (2.8e-02)	8.6e-02*** (2.8e-02)	6.8e-02** (2.8e-02)	6.9e-02** (2.8e-02)

Risky Investments					
Wealth	2.6e-04*** (2.2e-05)	2.6e-04*** (2.2e-05)	2.5e-04*** (2.3e-05)	1.9e-04*** (2.0e-05)	1.8e-04*** (1.9e-05)
Age			-1.3e-03** (6.6e-04)	-2.3e-03*** (6.4e-04)	-1.6e-03** (6.6e-04)
Zip Density			-9.7e-04 (1.2e-03)	-1.2e-04 (1.1e-03)	-4.8e-04 (1.2e-03)
Education			9.4e-02*** (1.6e-02)	4.4e-02*** (1.6e-02)	3.5e-02** (1.6e-02)
Expected Stock Change				3.7e-01*** (1.2e-01)	3.0e-01** (1.2e-01)
Low Numeracy				-7.4e-02*** (2.4e-02)	-6.2e-02** (2.4e-02)
Know Savings and Debts				3.0e-02** (1.2e-02)	1.7e-02 (1.2e-02)
Credit Worthiness				2.1e-02** (8.1e-03)	2.0e-02** (8.1e-03)
Financial Liquidity				3.2e-01*** (3.6e-02)	3.0e-01*** (3.6e-02)
Risk Attitude					4.4e-02*** (6.1e-03)
N	1811	1811	1811	1806	1806
AIC	8.8e+03	8.7e+03	8.6e+03	8.4e+03	8.3e+03

Robustness checks

- Other measures of wealth (including home(s) and shares in business)
- Amount (vs. share) of wealth invested in risky assets
- Other indexes of insurance demand
    - Relative coverage (CDF)
    - First component in principal component analysis
    - Subjective coverage
- Estimation without the limited liability insurance component
- Estimation with only US states with similar limited liability legal requirements
- Estimation with 2015 and/or 2016 data
- Estimation with interaction effects (CarValue*Wealth, Objective risk*Wealth, Subjective Risk*Wealth)
- Nonlinear wealth effects
- Possible wealth endogeneity
    - Housing price growth in zip code over past 3 years
    - Unexpected change in wealth over past year (Hurst and Lusardi 2004, Guiso and Paiella 2008)

US homeowner insurance data

- To measure coverage, respondents are asked about nine different components of coverage for their primary home:
  - the amount of coverage on 1) the dwelling (the home itself), 2) personal property and 3) liability; 4) the deductible; and whether the respondent contracted additional 5) flood, 6) earth movement (earthquake, mudslides or landslides), 7) windstorm, 8) floater or rider (to cover special items such as expensive jewelry or antiques), or 9) umbrella (to cover lawsuits and claims) insurance
- Results:
  - Car and homeowner insurance decisions share most of the same determinants (e.g. age, education, beliefs)
  - Wealth has a positive and significant effect on insurance and risky investment decisions

Industry data

- French bancassurance company (Crédit Agricole – North of France) supplies both insurance and banking services in 1999
- Detailed information on N=24,642 individuals:
  - Sociodemographic characteristics of
    - Age, gender, professional status, living area, etc.
  - Banking characteristics
    - Financial wealth, amount invested in risky assets
    - Loan, means of payment, duration
  - Car insurance
    - Insurance contract types (“au tiers” and “tous risques”) and deductible – low and high coverage
    - Characteristics of contract, characteristics of the driver (bonus-malus), attributes of the insured vehicle (car value)
- Result: Wealth has a also a positive and significant effect on insurance and risky investment decisions

A new puzzle

- We find that find that risky investments and insurance coverage both increase with wealth, making insurance a normal good
  - US (car and homeowner) insurance and financial data
  - French industry bancassurance data

- Can we explain this insurance-portfolio puzzle?
  - Standard theory
  - Behavioral theory

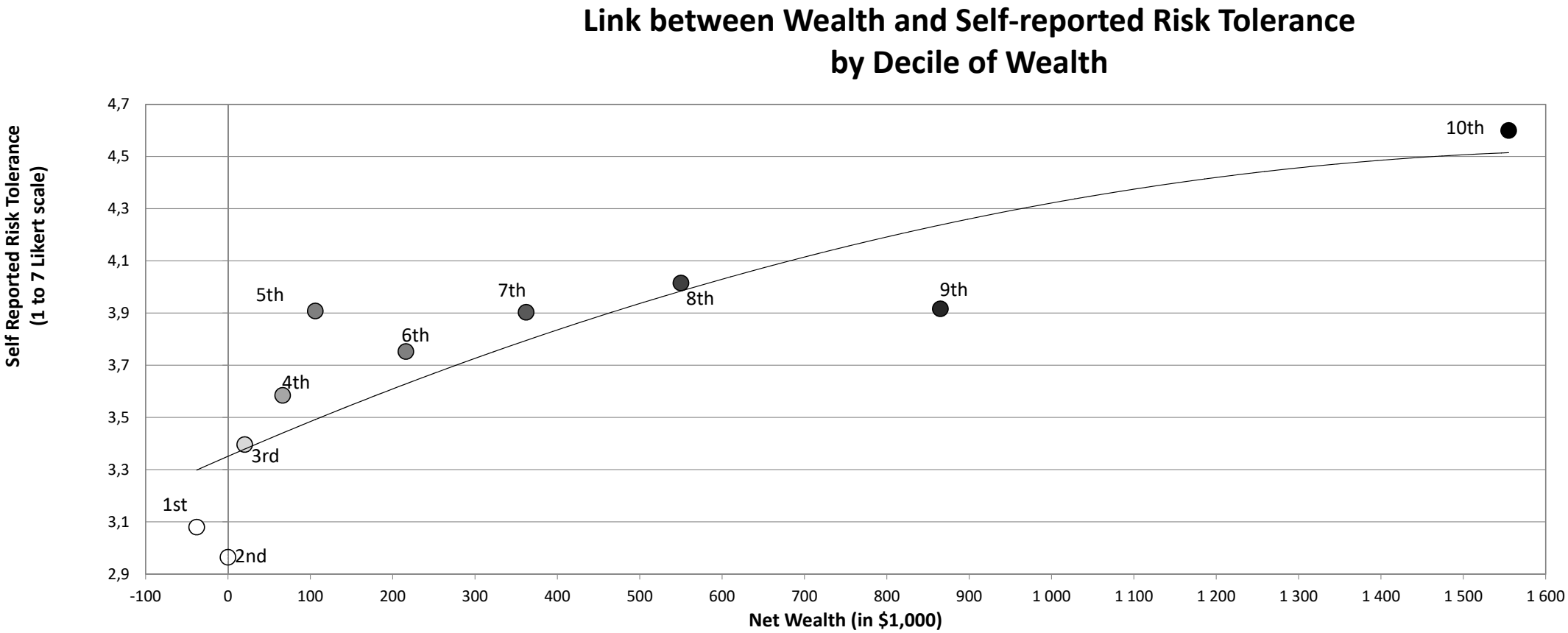
DARA vs. IARA

- Explanation: Investments in risky assets increase with wealth under DARA (Pratt 1964) and insurance demand increases with wealth iff IARA (Mossin 1968)

- Experimental (e.g. Holt and Laury 2002), survey (e.g. Guiso and Paiella 2008), and field data (e.g. Brunnermeier and Nagel 2008), not IARA
  - Moreover, our self-reported risk tolerance index give support to DARA (see Figure)

- The standard EU model admits a single utility function, and so cannot explain both DARA and IARA

Our data provide direct support for DARA



Simultaneous insurance-portfolio decisions

- A few papers show, using a model involving multiple decisions, that insurance may be a normal good for a subset of DARA agents
  - Dionne and Eeckhoudt (1984), Eeckhoudt et al. (1997), Meyer and Meyer (2005), Loubergé and Watt (2007)

- Explanation: a wealthier agent would invest more in risky assets, thus facing a background risk, perhaps leading to more insurance purchase

- We show theoretically that this cannot be generically true
  - An increase in wealth always decreases insurance demand iff DARA for « small risks »
  - That result is preserved when a savings decision is made simultaneously with other portfolio-insurance decisions, as in Aura et al. (2002).

Wealth-dependent loss

- Explanation: The value of the insured good is higher for wealthier agents, thus leading to more insurance
  - We show theoretically that insurance can indeed be a normal good if the elasticity if the insured good with respect to wealth is high enough
  - Consistent with previous empirical results (Guiso and Jappelli 1998)

- We systematically control for the value of the insured good (both on US and French data)

Liability insurance

- The insurance contract includes several components including liability insurance (which is wealth-dependent)
- Explanation: related to the previous point (i.e., wealth-dependent loss)
- Robustness check where the insurance index is calculated without the liability insurance component
- Moreover, the French data provide additional evidence since liability insurance in France is compulsory and unlimited regardless of wealth

Liquidity constraints

- Explanation: the poor purchase less insurance because they are liquidity constrained and cannot pay the insurance premium
  - See e.g. Liu and Myers (2006)

- Yet, insurance companies permit clients to smooth insurance premium over the year (both in the US and France)
  - So liquidity constraints are not expected to play a big role

- Moreover, we control for this effect as a specific variable captures the effect of a liquidity contraint

Adverse selection

- Classical result: Separating equilibrium in which high-risk agents purchase full coverage while low-risk agents purchase partial coverage
- Explanation: insurance is a normal good if high-risk agents are wealthier
- However, the estimations include controls for both objective and subjective risks and their possible interactions with wealth

Prospect theory

- Prospect theory: two decisions pertaining to different domains need not be conceived as similar even if same monetary consequences
  - E.g. insurance = loss domain, finance = gain domain

- However, it is unclear why insurance and portfolio decisions would belong to different domains: both decisions entail gains and losses

- Moreover, even if the two decisions belong to different domains, prospect theory would have to be extended to account for the opposite effect of wealth in each domain

Risks (mis)perceptions

- Explanation: The rich may be systematically more optimistic than the poor about financial risks, but less optimistic about insurance risks

- We are not aware of any empirical evidence about such optimism/pessimism wealth effect reversal

- We find limited evidence in our sample for this hypothesis. Moreover, we control for subjective risk perceptions

Complexity

- Financial and insurance products are notoriously complex (e.g. Carlin 2009, Handel and Kolstad 2015)

- Explanation: If the wealthy are more educated or have more financial literacy, they may be more willing to purchase complex financial and insurance products

- However, we control for education, financial literacy, and knowledge of car insurance and of savings/debts

Context dependent risk preferences

- Explanation: agents would be DARA in the financial context, and IARA in the insurance context

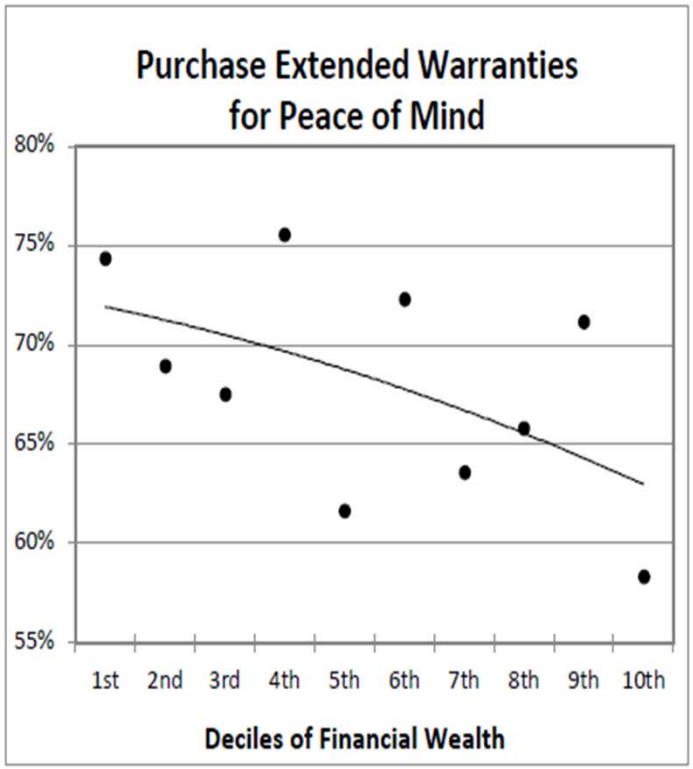
- This would imply that risk preferences belong to a different « family » of utility functions across different domains
  - Unusual assumption in the literature, need to be further explored

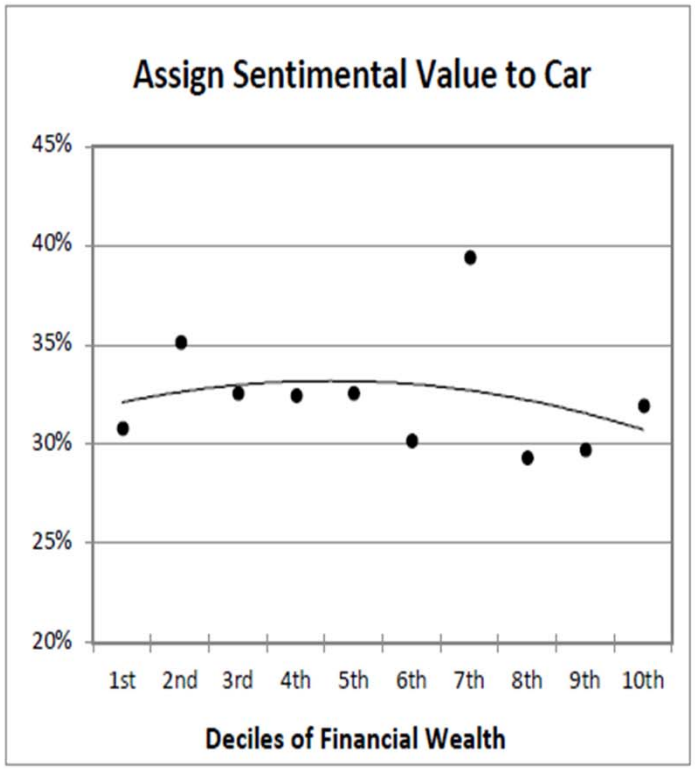
Non monetary benefits

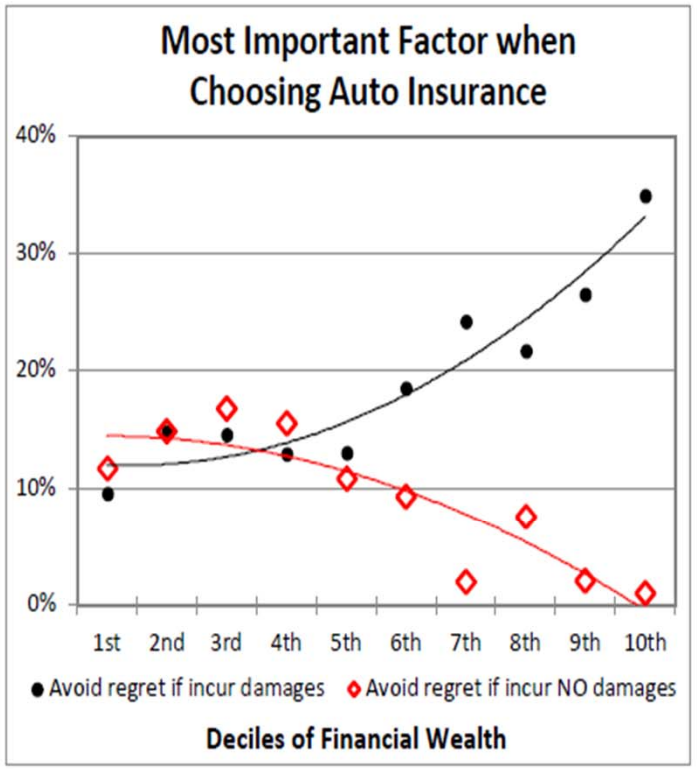
- Explanation: The rich may purchase more insurance because they (e.g.)
  - Enjoy a feeling of “peace of mind” (Kunreuther and Pauly 2005)
  - Want to compensate for the loss in sentimental value when damages occur (Huang and Tzeng 2006)
  - Feel regret avoidance (Braun and Muermann 2004)

- We find no evidence for the “peace of mind” or sentimental value hypotheses, but cannot exclude the regret avoidance hypothesis

Figure A1: Behavioral Factors







Purchase Extended Warranties for Peace of Mind: Respondents who purchased extended warranties at least occasionally are asked "*Why do you purchase insurance or extended warranty on appliances? (1) For peace of mind (2) It is worth the money (3) Other (please specify).*" The figure shows the proportion who selected (1).

Assign Sentimental Value to Car: Respondents are asked: "*Other than any financial considerations, to what extent are you "sentimentally" attached to the vehicle you insured?*" Responses are measured on a Likert scale from 1 (No sentimental attachment) to 7 (Very strong sentimental attachment). The Figure shows the percentage of responses above 4.

Most Important Factor when Choosing Auto Insurance: Respondents are asked: *"When you chose your auto insurance coverage, what was the most important factor? (1) Making sure I would have enough coverage if I were to incur damages (2) Making sure I would not pay too much for insurance if I end up not incurring any damages (3) Both were equally important.*" The figure shows the proportion of respondents who chose (1) (black dots) and (2) (red diamonds).

Is the puzzle big?

- Back of the envelope calculations:
  - If an individual were to move from the first to the third quartile of liquid wealth, then all else equal (i.e. taking all the other explanatory variables at their median), the share the individual invests in risky assets would increase from 8.1% to 23.2% (an increase of 14.4 percentile points), while his index of car insurance coverage would increase from 3.8 to 4.8 (an increase of 0.58 22.2 percentile points)

- This effect is roughly 1.5 times larger than the effect of a similar 50 percentile points shift in the risk tolerance distribution

Is the puzzle costly?

- Back of the envelope calculations:
  - Assuming DARA, the rich over-insures and/or the poor under-insures. We estimate that the rich selects an index of insurance coverage of 5.4 when he should have selected an index no greater than 4.3 (because insurance coverage decreases with wealth under DARA). Similarly, we estimate that the poor should have selected an index of insurance coverage no lower than 4.7 instead of 3.7

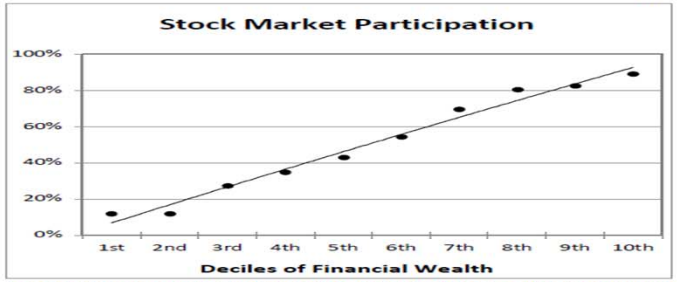
- Estimating an auxiliary insurance premium, we find that this cost of over- or under-insuring is of the order of 10% of the insurance premium

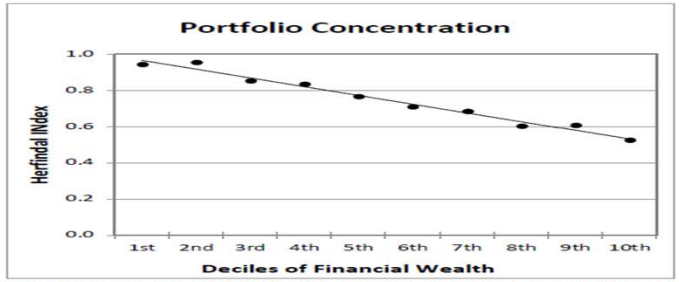
Who is making a mistake, the poor or the rich?

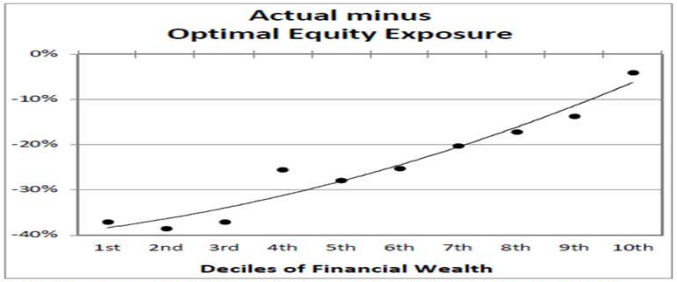
- We find that:
  - The wealthy are less prone to investment mistakes and that the poor tend to under-invest in risky assets (consistent with Calvet et al. 2009)
  - Over-insurance is not rare and is more prevalent among the wealthy

- A behavioral pattern thus emerges: the poor tend to under-invest in risky assets, while the rich tend to over-insure

Figure 7: Measures of Investment Mistakes

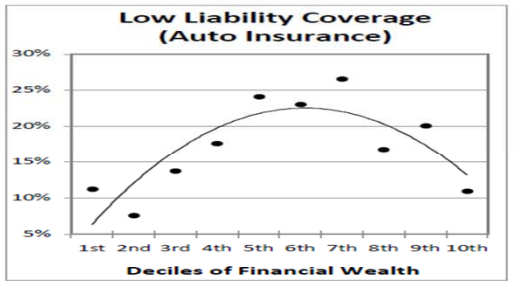


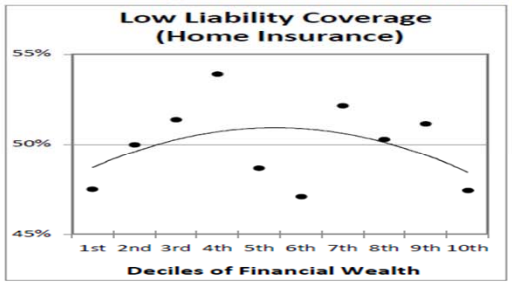


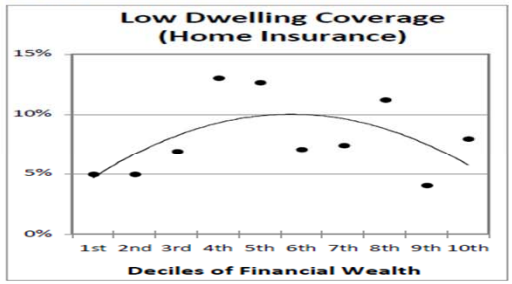


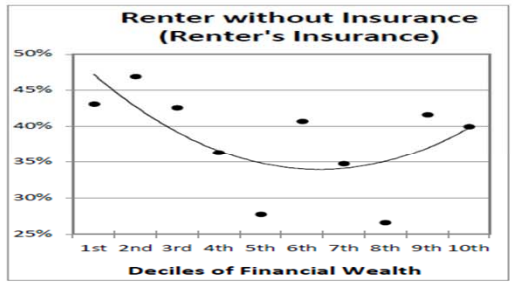
Stock Market Participation: Percentage of respondents in each decile of financial wealth who report owning stock directly or indirectly in pooled investment funds.
Portfolio Concentration: Herfindal index of the respondent's portfolio when decomposed in 6 categories: cash, stocks, bonds, Treasury bills, Treasury inflation protected securities (TIPS), and real estate investment trusts (REIT). Average for each decile of financial wealth.
Actual minus Optimal Equity Exposure: Percentage of liquid assets the respondent actually owns in stocks minus the percentage of stocks the respondents should own given his age according to the optimal life-cycle asset allocation of Gomes and Michealides (2005). Average for each decile of financial wealth.

Figure 8: Measures of Under-Insurance



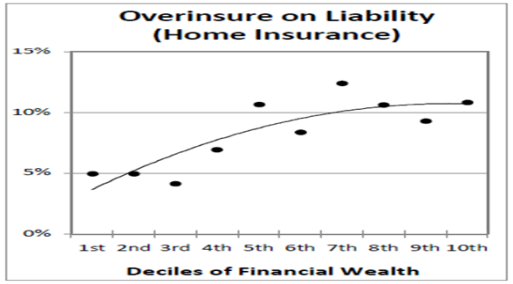


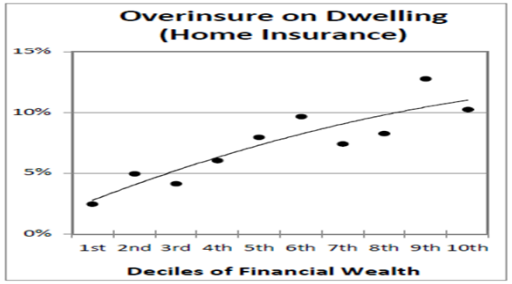


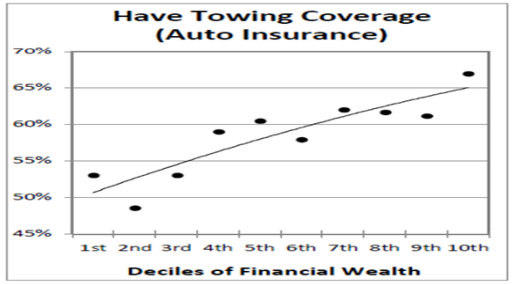


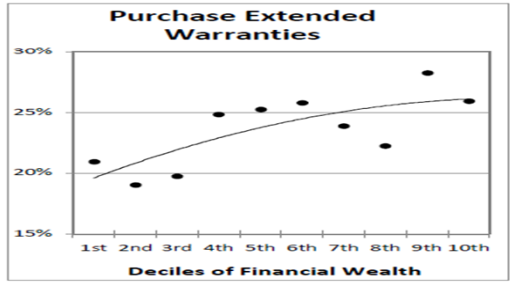
Low Liability Coverage (Auto Insurance): The respondent purchased the minimum auto liability coverage required by law, this minimum is less than half of the respondent's exposed assets (i.e. all assets absent retirement savings), and the respondent does not have an umbrella insurance. Average for each decile of financial wealth.
Low Liability Coverage (Home Insurance): The home insurance liability coverage is less than half of the respondent's exposed assets and the respondent does not have an umbrella insurance. Average for each decile of financial wealth.
Low Dwelling Coverage (Home Insurance): The dwelling coverage is less than half of the replacement cost. Average for each decile of financial wealth.
Renter without Insurance (Renter's insurance): The respondent is a renter and has not purchased renter's insurance. Average for each decile of financial wealth.

Figure 9: Measure of Over-insurance









Over-insurance on Liability (Home Insurance): The home insurance liability coverage is more than 25% over the respondent's exposed assets (i.e. all assets absent retirement savings). Average for each decile of financial wealth. **Over-insurance on Dwelling (Home Insurance)**: The dwelling coverage is more than 25% over the replacement cost. Average for each decile of financial wealth. **Have Towing Coverage (Auto Insurance)**: The respondent purchased towing coverage. Average for each decile of financial wealth. **Purchase Extended Warranties:** The respondent purchased insurance or extended warranties when purchasing new appliances (such as electronics or home appliances) at least occasionally. Average for each decile of financial wealth.

Conclusion (1/2)

- Empirical evidence that the insurance-portfolio puzzle is:
  - Robust and economically relevant
  - Driven in part by “mistakes”: the poor tend to invest too conservatively, while the rich tend to over-insure

- Theory implications
  - Insurance as a normal good: inconsistent with DARA hypothesis used to derive many results in risk and insurance theory (Gollier 2001, Dionne 2013)
  - Inconsistent with the canonical EU model that predicts similar, but opposite, effect of wealth on insurance and risky asset demands

Conclusion (2/2)

- Macro implications
  - The relationship between insurance and economic growth is still not well understood (Loubergé 2013, Outreville 2013)
  - This paper helps understand better the demand-side drivers of insurance growth

- Policy implications
  - If the poor under-invest and the rich over-insure, this may call for paternalistic policy intervention
  - But controversial intervention: e.g., the wealthy may “feel good” about over-insuring and that feeling should matter for welfare analysis
  - Moreover, inducing the public to be more exposed to risks may be controversial

Annex

- Descriptive statistics
- New variables

Descriptive Statistics

- Income
  - 2015 SCE reports average/median income of $82k/$57k. Similar values of $89k/$53k with 2014 Census, and $87k/$47k with 2014 SCF
- Housing
  - Homeownership rate is 69% in the 2015 SCE, comparable to 2014 Census and SCF of 64% and 65% respectively
  - Average and median home value are $268k/$180k in 2015 SCE, and $263k/$170k in the 2014 SCF
- Risky assets
  - The proportion of SCE households who report owning stocks is 51% is similar to 2013 SCF (49%), but lower than the 58% reported by Brunnermeir and Parker (2008)
- Wealth
  - Average wealth is $414k in 2015 SCE, $535 in SCF, $339 in 2011 Census, and $479k in Brunnermeir and Parker (2008)
- Vehicle insurance
  - The proportion of households who report owning a vehicle (i.e., a car, light truck or SUV) is 95% in the 2015 SCE. It is higher than 2013 SCF (86%) and 2011 Census (85%)
  - SCE respondents evaluate their car's value at $15k vs. $18k for average used cars by *Edmunds*
  - SCE respondents report paying $961 of insurance premiums, similar to $954 reported by the *National Association of Insurance Comissioners*

New variables in the SCE (1/4)

- Financial numeracy
- Credit score

New variables in the SCE (2/4)

- Risk attitude

“On a scale from 1 to 7, how would you rate your willingness to take risks regarding financial matters?“

- Liquidity constraint

“What do you think is the percent chance that you could come up with $2,000 if an unexpected need arose within the next month?”

- Knowledge of savings [and debts]

“How would you rate your knowledge about your "own" [retirement and saving and investment account(s)]?” [idem for “debts”]

- *Very poor (1)*
- *Fair/Below Average (2)*
- *Good/Average (3)*
- *Very good/Above Average (4)*
- *Excellent (5)*

New variables in the SCE (3/4)

- Car value

“What do you think is the value of that vehicle if you were to sell it today? If you are not sure, please provide your best guess.”

- Knowledge of car insurance

“How would you rate your knowledge of your auto insurance policy?”

	Not at all knowledgeable (h1)	1 (1)		2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	Very knowledgeable (h2)	7 (7)	
(1)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

New variables in the SCE (4/4)

- Subjective Risk

"For the questions on this screen and next, we want you to consider all the damages you may incur on that vehicle which you (or your insurance) would be financially responsible for (that is, bodily and property damages to you and to others due to collision(s) you caused, theft(s), hail, vandalism, and such).

What do you think is the percent chance that the sum of all these damages over the next two years will be in the following ranges?

$0 (1)	_____	*% (1)*
$1 to $500 (2)	_____	*% (2)*
$501 to $1,000 (3)	_____	*% (3)*
$1,001 to $10,000 (4)	_____	*% (4)*
More than $10,001 (5)	_____	*% (5)"*

- Objective Risk

"Now, what about the past two years, how many times did you incur damages for which you (or your insurance) were financially responsible (that is, bodily and property damages to you and to others due to a collision you caused, a theft, hail, vandalism, and such)?

What was the approximate total amount of these damages over the past two years? Please, provide the sum of all damages, regardless of whether you or your insurance paid for the damages, and regardless of whether the damages were repaired or not. If you are not sure, please provide your best guess."