Financial Literacy, Ignorance, Stock Market Participation: Evidence from the RAND American Life Panel

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Motivation

- Evidence shows that financial literacy matters for retirement planning and savings in general
- Stock market participation is particularly important for long-term wealth accumulation
- How does financial literacy affect this decision?
  - Mistaken beliefs about stocks: individuals over or underinvest based on their subjective understanding of the stock market
  - Fundamental lack of knowledge: individuals prefer not to invest in what they do not understand

Standard theoretical framework

- An risk-averse investor has wealth *W* and CARA utility
- He chooses the share of wealth *a* to invest
  - *f* > 0 is a fixed cost that must be incurred in order to buy stocks, which have normally-distributed excess return with mean *r* > 0 and variance σ^2
  - The alternative is a safe asset with zero return
- The investor buys stock if $E[U(V(a^*))] > U(W)$, which implies $f < r^2 / 2\theta\sigma^2$

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Adding ambiguity aversion

- Suppose our investor is unfamiliar with stocks: he thinks of the expected return as uncertain and distributed N(r, $\sigma_\delta{}^2$) and faces a conditional expected utility E[$U(a)$| δ]
- *Ambiguity-averse investors* dislike mean-preserving spreads of E[$U(a)$| δ]
  - The investor chooses to maxmize the certainty-equivalent of a function ϕ(E[$U(a)$| δ]) where ϕ has the form of a CRAA utility function with ambiguity aversion parameter γ
- We can then write $f < r^2 / 2\,\theta\,(\sigma^2 + (1+\gamma)\,\sigma_\delta{}^2)$
- Illiteracy reduces demand (distinct from wrong beliefs, which can go either way)

The RAND American Life Panel

- Drawn from the American Life Panel on 7/10/07
  - ALP is an ongoing panel of 2500+ US respondents
  - For this study, 533 individuals are matched across multiple Monthly Surveys

- Demographic: older, affluent & well-educated
  - Median Age(years): 54
  - Median 2002 Income: $61,000
  - 53% college graduate or higher
  - 68% stock market participation (including mutual funds)

Measuring Risk Aversion I: Barsky et al.

MS2 implements an experiment based on Barsky et al(1997)

- Respondent is presented with a series of hypothetical choices
  - Guaranteed current lifetime income Y, or
  - 50/50 gamble: $2Y$ or λY where $\lambda \in \{\frac{1}{10}, \frac{1}{5}, \frac{1}{3}, \frac{1}{2}, \frac{3}{4}\}$
- Protocol: Respondent is first presented with $\lambda = \frac{1}{3}$
  - If gamble is rejected in favor of Y,
    - A less-risky gamble is presented, $\lambda = \frac{1}{2}$
    - If also rejected, an even less-risky gamble is presented, $\lambda = \frac{3}{4}$
  - If gamble is accepted,
    - A riskier gamble is presented, with $\lambda = \frac{1}{5}$
    - If also accepted, an even riskier gamble is presented, $\lambda = \frac{1}{10}$
- Risk aversion increases with the minimum acceptable λ

Measuring Risk Aversion II: Holt/Laury

MS9 implements an experiment based on Holt and Laury(2002)

- Respondents play a series of 10 lotteries with real payoffs
- In each lottery, the player chooses from option A or option B

	A				B				
Decision	P(High)	High	P(Low)	Low	P(High)	High	P(Low)	Low	Exp(A-B)
1	1/10	$2.00	9/10	$1.60	1/10	$3.85	9/10	$0.10	$1.17
2	2/10	$2.00	8/10	$1.60	2/10	$3.85	8/10	$0.10	$0.83
3	3/10	$2.00	7/10	$1.60	3/10	$3.85	7/10	$0.10	$0.50
4	4/10	$2.00	6/10	$1.60	4/10	$3.85	6/10	$0.10	$0.16
5	5/10	$2.00	5/10	$1.60	5/10	$3.85	5/10	$0.10	($0.18)
6	6/10	$2.00	4/10	$1.60	6/10	$3.85	4/10	$0.10	($0.51)
.		....				....			
10	10/10	$2.00	0/10	$1.60	10/10	$3.85	0/10	$0.10	($1.85)

- Payments are calibrated such that
  - Risk-neutral individuals choose A 4 times, then switch to B
  - All rational individuals choose B at the end
- Risk aversion increases with the number of times A is chosen

Measuring Financial Literacy: Lusardi/VS

Basic Financial Knowledge	Correct	Wrong	Don't Know
1) Compound Interest 1	92.3	5.3	2.3
2) Compound Interest 2	77.7	19.7	2.6
3) Inflation 1	94.2	3.9	1.9
4) Inflation 2	78.8	19.9	1.3
5) Time Value	77.6	14.9	7.5
Investment Knowledge	Correct	Wrong	Don't Know
1) Main function of the stock market	75.9	19.8	5.3
2) Characteristics of mutual funds	72.9	12.2	14.9
3) Rank historical asset-class returns	70.9	29.3	9.8
4) Rank historical asset-class volatility	90.0	2.2	6.8
5) Stock risk vs bonds	82.5	4.1	13.1
6) Bond pricing	37.89	41.7	21.20
7) Individual stocks risk vs mutual funds	78.8	4.5	16.5
8) Risk and portfolio diversification	81.9	11.3	6.2

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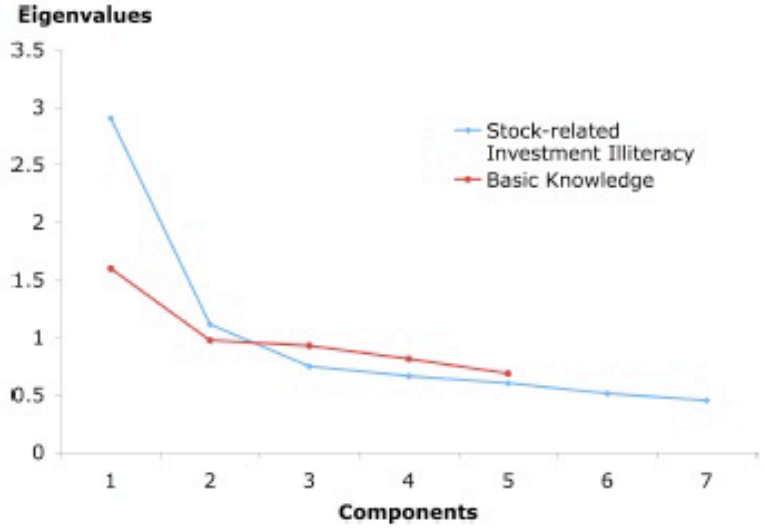
Measuring Financial Literacy : PCA

PCA is applied to generate indexes from 2 sets of variables

- Lack of stock-market investment knowledge
  - 7 out of 8 investment questions related to stock participation
  - Indicators for "Don't Know" answers
- Basic financial knowledge/ability
  - All 5 questions from the basic knowledge questions
  - Indicators for correct answers on basic knowledge

Scores are computed from the first principal component of each set



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Basic empirical specification

Estimate a linear probability model with the specification

$$X_i = \beta I_i + \delta Z_i + \epsilon_i$$

X_i: binary indicator for owning any stocks
I_i: (normalized) index of stock-related investment illiteracy
Z_i: individual-level controls (including basic knowledge, age, gender, education and risk-aversion)
ϵ_i: individual-level error term.

Ordinary Least Squares Estimation

1 SD in illiteracy is correlated with 10% less participation

	(1)	(2)	(3)	(4)
Stock-Related Investment Illiteracy Index	-0.127***	-0.116***	-0.104***	-0.100***
	(0.020)	(0.021)	(0.024)	(0.023)
Basic Financial Knowledge Index		0.052**	0.062**	0.064**
		(0.020)	(0.023)	(0.023)
Overestimate risk relative to returns		-0.134**	-0.104	
		(0.051)	(0.055)	
Underestimate risk relative to returns		-0.035	0.063	
		(0.125)	(0.137)	
DK Bond Pricing		-0.020	0.001	
		(0.049)	(0.055)	
Risk Aversion	-0.023	-0.012	-0.018	-0.022
	(0.015)	(0.015)	(0.016)	(0.016)
Log of 2002 Income			0.054**	0.057**
			(0.017)	(0.017)
N	533	533	462	462
R-squared	0.17	0.20	0.19	0.18

Constant and controls for age, gender, education, marital and retirement status not shown

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Potential Endogenity Bias

Lack of knowledge about stock-market is potentially endogenous and poorly-measured, but direction of bias is not *a-priori* clear.

- Omitted variables bias, reverse causality
- Measurement error due to guessing is not classical

Instrumental variables strategy

- Perform 2SLS estimation and test for valid instruments
  - Bernheim et al(2001): Available HS Financial Education
  - Bayer et al(1996): Available Workplace Financial Education
  - Van Rooij et al (2007): Self-reported economics education
  - This paper: Unrelated literacy variables that do not *directly* affect demand for stocks, e.g. knowledge of bond pricing
- Check for endogenity using Hausman specification test

Instrumental Variables Estimation

With unrelated literacy as IV, Hausman test suggests little bias

	(1)	(2)	(3)
IV 1	*HS Fin. Educ.*	*HS Fin. Educ.*	*HS Fin. Educ.*
IV 2	*Workplace Fin. Educ.*	*Econ. Educ.*	*Know Bond Pricing*
Stock-Related Investment Illiteracy Index	-0.798*	-0.747	-0.113
	(0.385)	(0.600)	(0.066)
Basic Financial Knowledge Index	-0.066	-0.056	0.062*
	(0.081)	(0.117)	(0.025)
Log of 2002 Income	0.013	0.016	0.056**
	(0.039)	(0.048)	(0.018)
Risk Aversion	-0.014	-0.015	-0.022
	(0.028)	(0.027)	(0.016)
Testing Valid IV Specification			
Anderson LR stat (H_0:IV not relevant)	4.874	1.812	56.888
P-value	0.087	0.404	0.000
Sargan Test Statistic (H_0:Exclusion valid)	0.000	0.000	0.221
P-value	0.998	0.985	0.638
Cragg-Douglas F-Statistic (Weak Instruments)	2.370	0.878	29.286
Pagan Hall Test Statistic(H_0: Homoskedasticity)	2.527	1.644	18.067
P-value	1.000	1.000	0.204
Testing For Endogenity Bias			
Wu-Hausman F test			0.044
F(1,447) P-value			0.84
Durbin-Wu-Hausman chi-sq test			0.045
Chi-sq(1) p-value			0.82

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Conclusions

- Lack of information depresses participation in the stock market, consistent with ambiguity aversion (dislike of the unknown)
- This effect is distinct from *mistaken beliefs* and *independent of risk aversion*, *income* and *formal education*
- Implication is that basic familiarity is needed in order for investors to overcome fundamental psychological barriers to investment
- Suggest need for financial education remains even in highly-structured choice-environments