Using a Life Cycle Model to Evaluate Financial Literacy Program Effectiveness

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Goals:

• Evaluate financial literacy programs using a theoretical framework
• Model how financial knowledge shapes wealth
• Provide insights for designing policy and programs
Context: Changes in many markets and more individual responsibility

• Individuals:
  – Wide heterogeneity in behavior
  – Costs of financial illiteracy (Lusardi & Tufano, 2015)

• Financial education programs
  – Mixed evidence but many issues in evaluating effectiveness
  – Meta analyses can tell us little about this topic
Previous work on which this paper is based

- The Economic Importance of Financial Literacy: Theory and Evidence (Lusardi and Mitchell, *JEL* 2014)
- Optimal Financial Knowledge and Wealth Inequality (Lusardi, Michaud, and Mitchell, forthcoming *JPE*)
Understanding and measuring financial literacy

*Interest Rate:* Let’s say you have $100 in a saving account paying 2% interest/year. How much would you have in the account at the end of 5 years?

*Inflation:* Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, with the money in this account, would you be able to buy:

*Risk Diversification:* True or false? Buying a single company stock usually provides a safer return than a stock mutual fund.
We have found that

- Financial literacy varies over the life cycle
- Low among those with low income and education
- Strikingly similar findings across countries

It can be the result of choice
Optimal Financial Knowledge and Wealth Inequality

• Traditional saving models have hard time fitting:
  – Heterogeneity in wealth accumulation HSZ 1994; Cagetti, 2003; Gourinchas/Parker, 2002; Venti/Wise 2001
  – Low % in equity in individual retirement accounts & heterogeneity in wealth by education Cocco, Gomes and Maenhout, 2005

• Financial knowledge strongly related to wealth holdings; both quite heterogeneous Lusardi /Mitchell, 2007

• What generates that relationship?
  – The wealthy enjoy higher asset returns. Why? Yitzhaki 1987
Our Approach:

• Calibrated stochastic LC model: max EU of life cycle consumption (no preference heterogeneity).

• Budget constraint complex:
  ✓ imperfect markets,
  ✓ labor income & equity stochastic,
  ✓ mortality uncertain,
  ✓ uncertain OOP medical costs,
  ✓ realistic social insurance system.

• Endogenous Financial Knowledge (FK) accumulation, which generates higher return on investments.
Two technologies available to transfer resources over time:

- **Simple technology** pays risk-free return
  \[ \bar{R} = 1 + r \]

- **Sophisticated technology** pays an expected rate of return which depends on \( f_t \) (FK)
  \[ \tilde{R}(f_{t+1}) = \bar{R} + r(f_{t+1}) + \delta \varepsilon_{t+1} \]
  where \( \varepsilon_t \sim N(0,1) \) iid shock; middle term is excess returns due to investment; \( \delta \) is st.dev. of returns on the sophisticated technology.

- To invest, must pay fixed costs \( c_d \) and allocate time \( \pi_i(i_t) \)

- \( \kappa_t = 1 \) if invest, \( = 0 \) else.
FK evolves over time:

- Last period’s knowledge $\uparrow$ by $i$, and $\downarrow$ by $\delta$ (due to forgetting &/or obsolescence):

$$f_{t+1} = \delta f_t + i_t$$

Investment in knowledge is the additional choice variable in stochastic LC model
The Household’s Problem

\[ V_d(s_t) = \max_{c_t, i_t, \kappa_t} n_{e,t} u(c_t / n_{e,t}) \]
\[ + \beta p_{e,t} \int_{\varepsilon} \int_{\eta_y} \int_{\eta_o} V(s_{t+1}) dF_e(\eta_o) dF_e(\eta_y) dF(\varepsilon) \]

\[ a_{t+1} = \tilde{R}_\kappa(f_{t+1})(a_t + y_{e,t} + tr_t - c_t - \pi(i_t) - c_d I(\kappa_t > 0)), \quad a_{t+1} \geq 0 \]
\[ f_{t+1} = \delta f_t + i_t \]

\[ \tilde{R}_\kappa(f_{t+1}) = (1 - \kappa_t) \bar{R} + \kappa_t \tilde{R}(f_{t+1}) \]

Value function solved by backward recursion.

• 3 consumer decision variables: 2 continuous \((c_t, i_t)\), 1 discrete \((\kappa)\)
• 5 state space variables : e, f_t, a_t, \(\eta_y \eta_o\)
## Results: Simulated & Observed at Retirement

<table>
<thead>
<tr>
<th></th>
<th>&lt;HS</th>
<th>College</th>
<th>Coll/&lt;HS</th>
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<tbody>
<tr>
<td><strong>Baseline Simulation</strong></td>
<td></td>
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<tr>
<td>Med. Wealth ($W)</td>
<td>95K</td>
<td>347K</td>
<td>3.66</td>
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<tr>
<td>Ave. Income ($Y)</td>
<td>32K</td>
<td>48K</td>
<td>1.49</td>
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<tr>
<td>W/Y Ratio</td>
<td>2.98</td>
<td>7.3</td>
<td>2.45</td>
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<tr>
<td>% Poor ($w_t &lt; 2y_t$)</td>
<td>0.39</td>
<td>0.17</td>
<td>0.45</td>
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<tr>
<td>% Part. ($\kappa_t &gt; 0$)</td>
<td>0.45</td>
<td>0.78</td>
<td>1.74</td>
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<tr>
<td><strong>Data (PSID)</strong></td>
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<tr>
<td>Med. Wealth ($W)</td>
<td>102K</td>
<td>365K</td>
<td>3.59</td>
</tr>
<tr>
<td>% Poor ($w_t &lt; 2y_t$)</td>
<td>0.35</td>
<td>0.16</td>
<td>0.46</td>
</tr>
<tr>
<td>% Part. ($\kappa_t &gt; 0$)</td>
<td>0.28</td>
<td>0.75</td>
<td>2.68</td>
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Some important findings

• It is not convenient for everyone to invest in financial knowledge:
  – optimal levels of financial literacy can be low or zero for some people

• Financial knowledge can decrease over time and the life cycle (optimally)

• Financial knowledge matters a lot
  - From 30 to 40% of wealth inequality is due to financial knowledge
Then Use Model to Evaluate Employer-Provided FK Programs

- Fin program cuts EE cost of investing in knowledge;
- Firm offers program & eligibility assigned randomly to all EEs of a given age;
- We compare each (simulated) EEs outcome with and without access to program;
- Great advantage: we see actual counterfactuals! So can estimate selection bias.
Program Effects: Offer FK @ ages 30, 40, 50

- 1-shot treatment offered to age 40 does best.
- Slowing depreciation key to higher retirement wealth.
- Lower cost programs more favorable.
Participant vs Nonparticipant Diff’s
*(conditional on being eligible):*

• When people can chose to take FK:
  – At baseline: *participants* have higher earnings, more initial knowledge, and more wealth;
  – Nonparticipants are poorer, earn less, and have little financial knowledge.

• This implies: Average program effect that assumes program *nonparticipants* benefit as much as *participants* quite upwardly biased.
Illustration:

• If (wrongly) assumed participation independent of retirement wealth & use nonparticipants as counterfactual:
  – Est. program effect suggests retirement wealth ↑ by 75%.
  – But actually, true estimated effect 1%, ns.

• So using wealth of nonparticipants as counterfactual overestimates program effect.
Other important insights

• *About financial education programs*
  – Should not expect 100% participation
  – Should expect some groups to be more likely to participate
  – Increase in knowledge may not translate into increase in savings

• *Which programs are more likely to have an impact?*
  – *Longer term programs rather than one shot ones*
  – *Target middle-age or older population*
Conclusions

- Financial knowledge *economically important* for understanding differences in LC wealth accumulation.
- Makes sense for some to remain unsophisticated, and for effects to fade in later life, even with fin educ
- Theoretical models can help us understand the effects of financial education programs
Policy Relevance

• We can learn relatively little about program effectiveness when we have limited information about programs and cannot account of endogenous financial knowledge

• We have new insights on how to make programs effective
Where to get additional information

Papers and other information

• Global Financial Literacy Excellence Center (GFLEC)
  http://www.gflec.org

Wharton’s Pension Research Council:
• http://www.pensionresearchcouncil.org/