

# The Effect of Financial Education on the Quality of Decision Making

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# Motivation

## Studying financial education is important

- Financial literacy around the world is low.
  - Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? (more than/less than/exactly \$102)

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But education may influence behavior because it involves

- Advertising, indoctrination
- Social pressure, brow-beating, shame
- Psychological anchors

# This study

## 1. Introduces the concept of *Financial Competence*

*Non-paternalistic* conception of what it means to make “good” financial choices



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## 2. Evaluation of example financial education intervention

- Conventional measures
  - Intervention has all the right effects for all the right reasons
- Our measure
  - Intervention leaves welfare unchanged, and we can tell you why

# Simple and Complex Framing

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Choose amongst goods that you intrinsically value.

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Choose amongst goods that you intrinsically value.

- E.g. standard of living before and after retirement

## Complex Framing

Choose amongst goods that merely have implications for the goods you intrinsically value (*consumption instruments*).

- E.g. choose how much of your current income to invest in retirement savings account at APR 5%, compounded yearly.

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Based on Bernheim & Rangel, 2004, 2009

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- Simple frame: subjects understand opportunity set
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Use choice made in simple frame to assess welfare loss from choices in complex frame

# Conventional Measures

## Financial Literacy (performance in knowledge tests)

Assumptions required for welfare statements:

- Education affects behavior *only* through understanding of financial concepts.
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### Observed behavior

E.g. compare average saving rate with and without education intervention

Assumption required for welfare statements:

- Behavior is *directionally* biased.

# Evaluation of Example Education Intervention

## Goal

1. Contrast our measure with conventional measures
  - Conventional measures: Intervention works great, for the right reasons
  - Our measure: Intervention does not work at all
2. Trace mechanisms for divergence

# Experiment Structure

(Web-based experiment)

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3. Incentivized test on compound interest

# Stage 1: Education Intervention

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- Section on compound interest of Malkiel and Ellis, *The Elements of Investing: Easy Lessons for Every Investor* (popular text on investing)

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  - 5 example calculations

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1. *Substance*: Explanation and application of the Rule of 72

- $(\% \text{ interest rate}) \times (\text{doubling period}) = 72$
- 5 example calculations

2. *Rhetoric*

- Quotes, e.g. “Albert Einstein is said to have described compound interest as the most powerful force in the universe”
- Examples in which relatively small initial investments grow to millions of dollars, but no calculations are done

## Treatment interventions: $2 \times 2$ *across subjects* design

Each subject is in one of 4 treatments

- Full intervention
- Substance-only (no rhetoric)
- Rhetoric-only (no rule of 72 – introductory example retained)
- Control (unrelated material from same book)

## Stage 2: Paired Choice Problems

### Paired Choice Problems (*within subjects*)

- Elicit present value (PV) for 10 future rewards
- Each subject sees each future reward twice
  - Simple framing: “We will pay you \$20 in 72 days.”
  - Complex framing: “We will invest \$10 at an interest rate of 1% per day. Interest is compounded daily. We will pay you the proceeds in 72 days.”

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### Object of Interest

Subject  $i$ 's distance between  $PV_i^{simple}$  and  $PV_i^{complex}$

# Multiple price list

(Complex framing)

you will get the specified dollar amount within two days from today

we will invest \$2 in an account with 5% interest per day. Interest is compounded daily. We will pay you the proceeds in 36 days.

\$20



\$18



\$16



\$14



## Details

- Elicited using (iterated) multiple price list
- Time horizon 36 or 72 days (easy application of rule of 72)



## Stage 3: Financial Literacy

### Incentivized test about compound interest

- 5 questions, e.g.
  - If an investment grows at 8 percent per year (interest is compounded yearly), by how much has it grown after 4 years?
  - If somebody tells you an investment should double in four years, what rate of return (per year) is he promising?
- 5 additional questions on contents of control intervention

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### Self reports about decision process

[later]

# Data

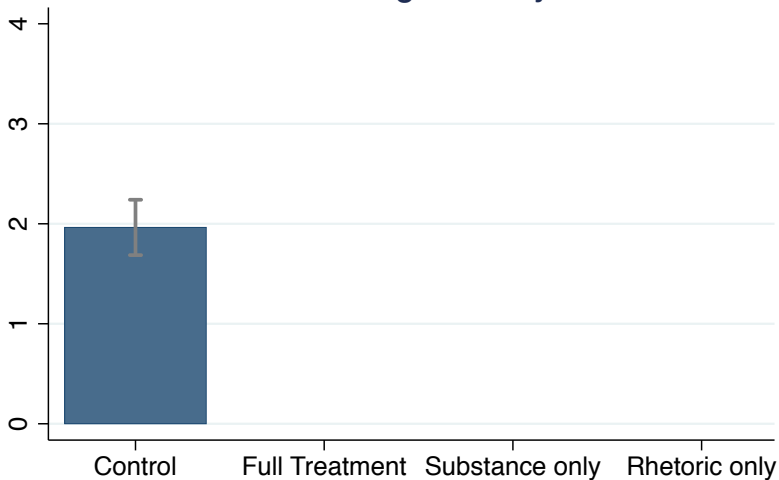
- Subjects recruited and paid through Amazon Mechanical Turk (online labor platform)
  - usually earn about \$5 per hour
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  - Negligible attrition
- Demographics relative to US population
  - Lower income
  - More highly educated, higher financial literacy
  - Younger, whites and males overrepresented

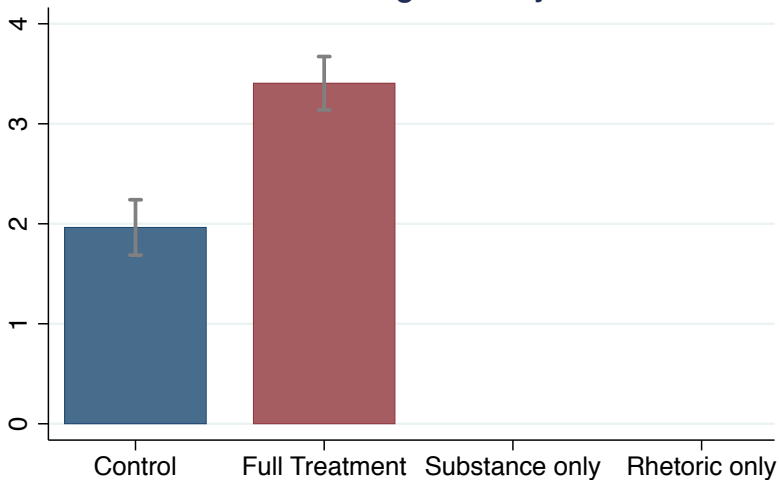
## Conventional Measure 1: Financial Literacy

Score on knowledge test by treatment



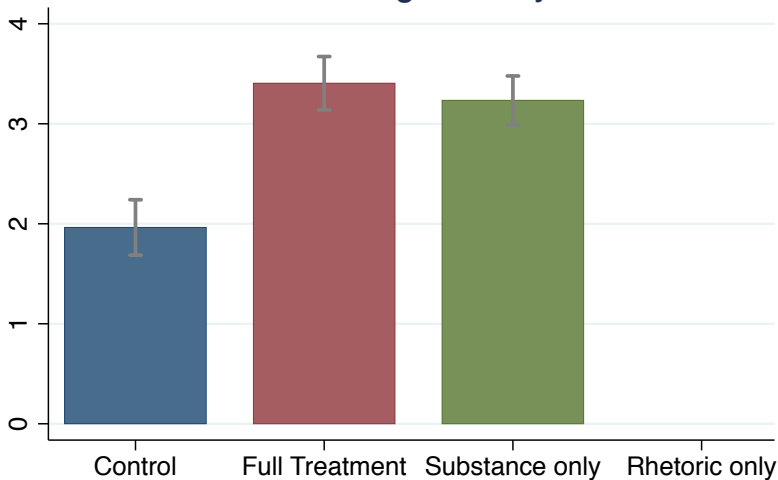
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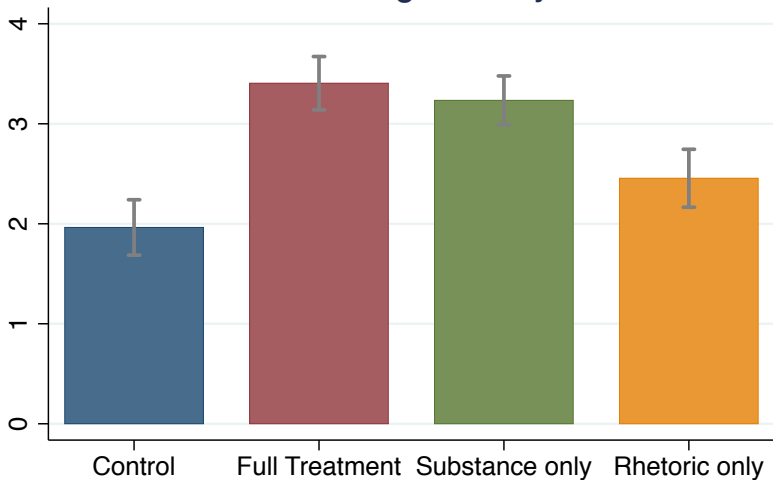
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## Conventional Measure 2: Observed Behavior

How does the intervention affect choices?

- Subjects tend to underestimate compound interest (Exponential Growth Bias): e.g. Eisenstein and Hoch, 2007, Stango and Zinman, 2009, Levy and Tasoff, 2014, 2015
- Absent education, valuations in the complex framing will be too low.
- If valuations in the complex framing increase with education, this suggests the intervention improved welfare.

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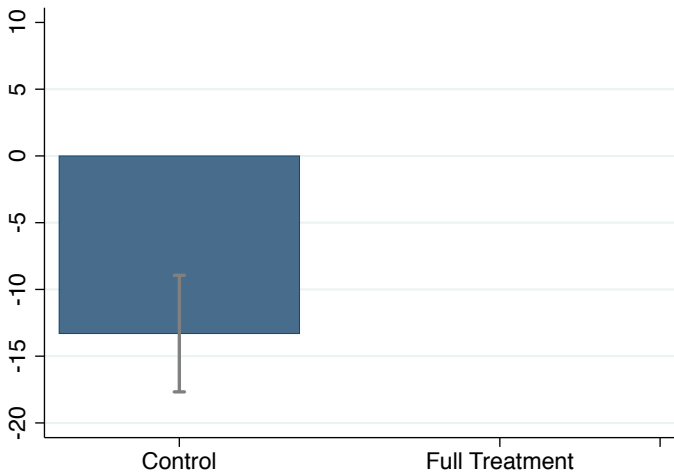
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### Normalizations

- We look at  $V_i^{complex} - V_i^{simple}$
- All future values normed to \$100.

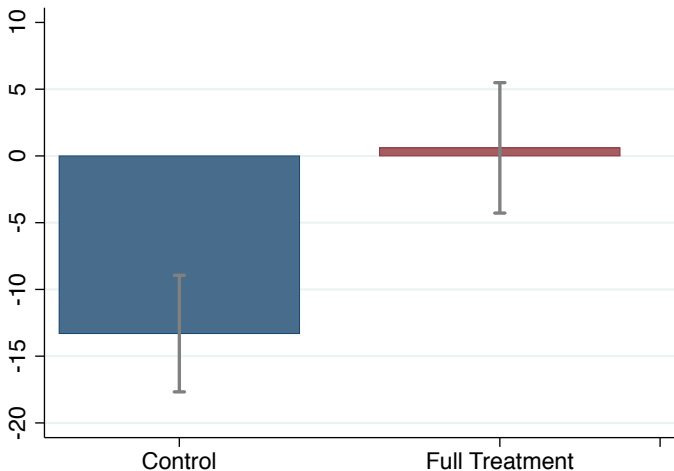
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(pooled over time horizons)

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## Financial Competence (Welfare)

Use choices in simple frame to assess welfare loss due to complex framing.

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### Example

- For the *same* future reward, state:  $V^{simple} = \$10$ ,  
 $V^{complex} = \$15$ .
- Offered future reward in complex framing at present price \$12.
- Hence, buy at \$12 although only valued at \$10. Lose \$2.

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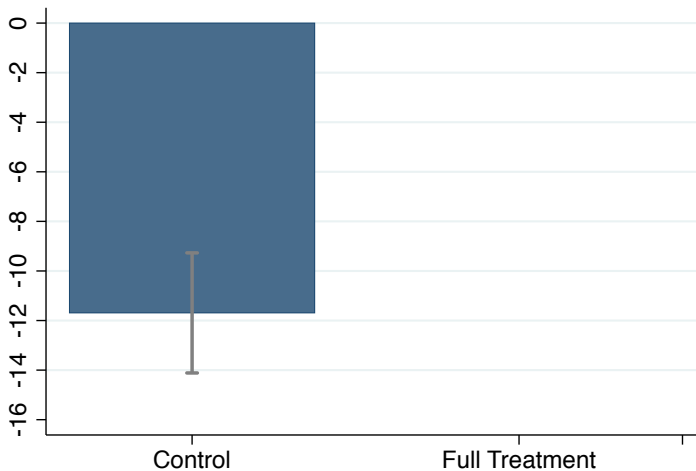
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Given uniform distribution of price in our experiment, expected welfare loss proportional to

$$(V^{complex} - V^{simple})^2$$

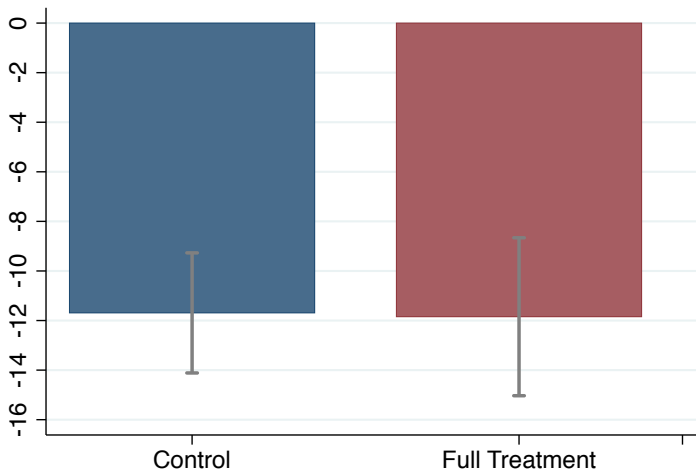
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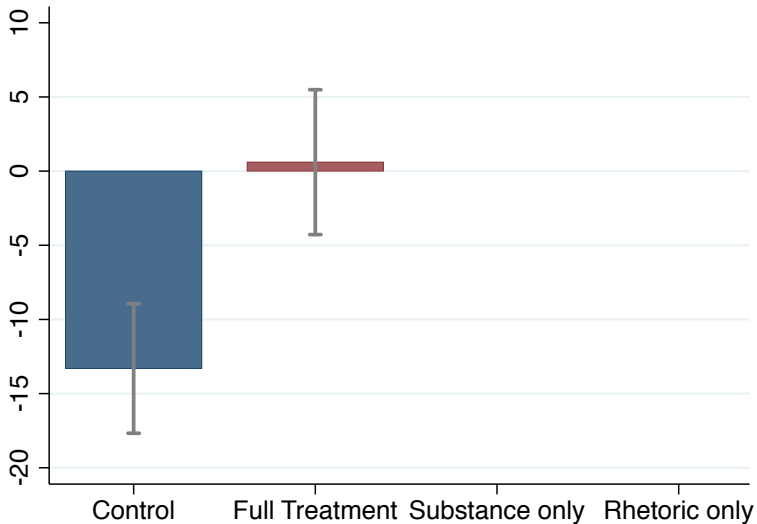
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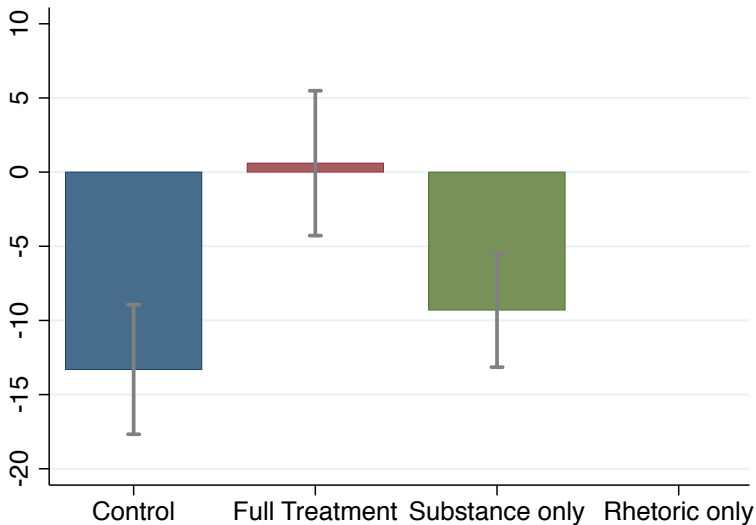
*WHAT ???*



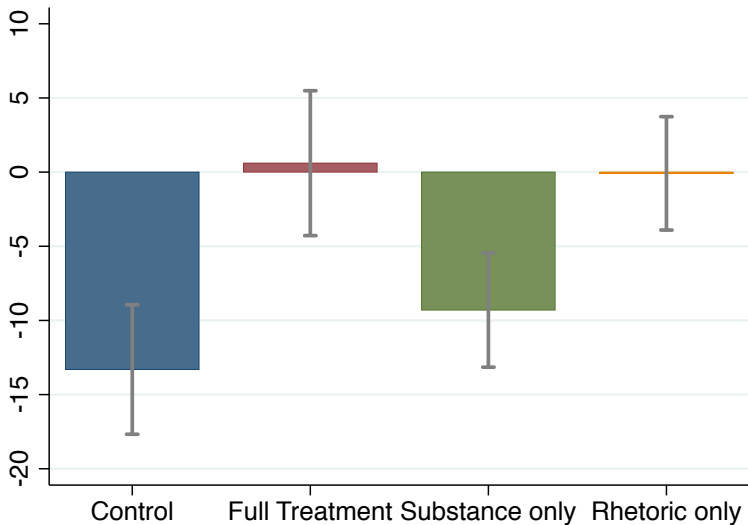
Another look at  $V_i^{complex} - V_i^{simple}$



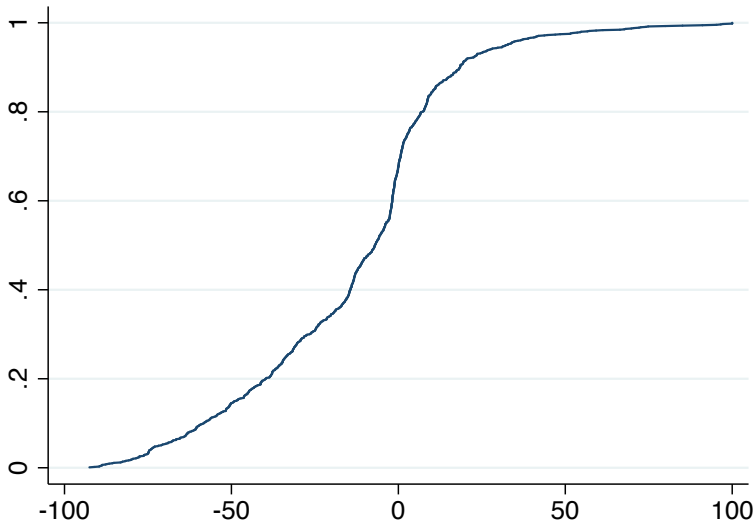
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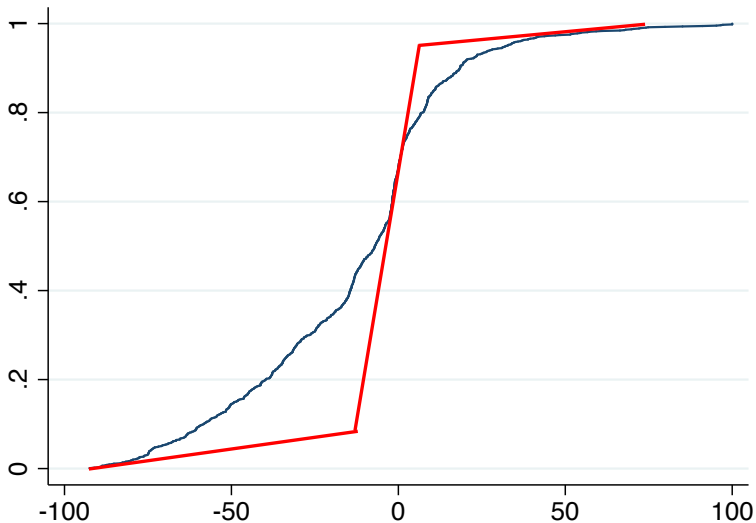


# C.D.F. of $V^{complex} - V^{simple}$



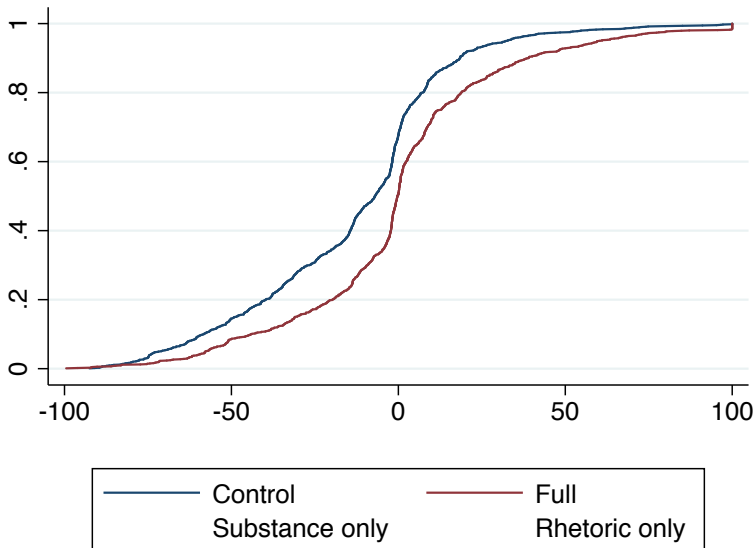
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What good education *should* do:



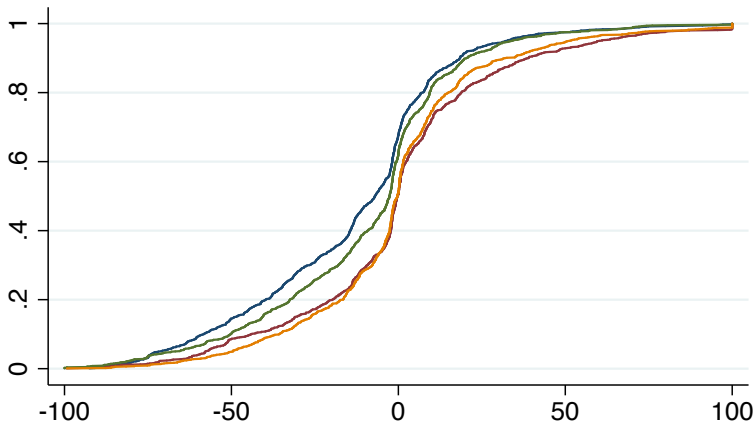
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What the education intervention actually does:



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- This particular education intervention does not help people better achieve their own goals
- It merely shifts behavior indiscriminately of initial bias
- Due to heterogeneity in bias, this is good for some, bad for others

... in spite of improvement in financial literacy, and elimination of exponential growth bias!

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## Effects of the example intervention

- Intervention increases financial literacy, but subjects do not implement it when making choices
- Rhetoric can be very effective in changing behavior

## Discussion

- How to engage and motivate subjects without triggering simplistic heuristic reactions that overpower knowledge-based responses?
- More generally, how to use these findings to improve financial decision making and financial education?
- Other interpretations?





## Generalizability

- Experiment does *not* show that financial education generally fails to improve welfare
- Shows that raising financial literacy and counteracting known biases does not *necessarily* increase welfare

# Financial competence

## Principle

- Different opportunity sets of financial instruments sometimes lead to same opportunity sets of intrinsically valued consumption
- Call these opportunity sets *equivalent*
- **Person is financially competent if she makes equivalent choices from equivalent opportunity sets**

## Advantage

- Non-paternalistic, no need to make assumptions about “true preferences”, due to focus on internal consistency
- Based on behavior rather than questionnaires or tests
- Accounts for individual differences
- But: Researcher must take stand on what is intrinsically valuable to consumer

## Implementation

- Study whether choices lead to the same time and state dependent *income* streams
  - Implies that the same intrinsically valued goods will be chosen if there are no *persistent framing effects*
  - Lack of financial competence equivalent to *contemporaneous* framing effects
- Instrument  $i_c$  is *complexly framed* if a financial principle needs to be applied to infer the income stream it implies. Define that income stream as  $i_s$ , the simple framing of the same instrument.
- Elicit WTPs  $V_c$  and  $V_s$  to be given instruments  $i_c$  and  $i_s$ , respectively.
- Define financial competence as

$$C = |V_c - V_s|$$

## Welfare interpretation

If individual misconstrues opportunity set in complex, but not simple framing:

- $|V_C - V_S|$  is the maximal possible welfare loss due to having to make a choice in the complex framing from decisions of the form: Choose either  $i_C$  or certain immediate amount of money  $d$ .

If individual reduces complexly framed choices to simply framed choices before making a decision

- $|V_C - V_S|$  is a measure of how much the misunderstanding of a financial concept contributes to the overall welfare loss

With other behavioral anomalies

- Obtain upper and lower bounds for welfare loss by applying Bernheim / Rangel (2009) framework

## Choice Pairs

Final amount	Invested amount	Daily interest rate	#Doublings
Duration: 72 days			
\$20	\$10	1 %	1
\$18	\$4.5	2 %	2
\$16	\$2	3 %	3
\$14	\$0.9	4 %	4
\$12	\$2	2.5 %	2.5
Duration: 36 days			
\$20	\$10	2 %	1
\$18	\$4.5	4 %	2
\$16	\$2	6 %	3
\$14	\$0.9	8 %	4
\$12	\$2	5 %	2.5

Rationale: (i) # doublings (ii) variety of decision problems

## Financial Literacy

FL1. Suppose you had \$100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

*More than \$102 (92.86%), Exactly \$102 (3.37%), Less than \$102 (1.98%), Do not know (1.79%)*

FL2. Suppose you had \$100 in a savings account and the interest rate is 20 percent per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?

*More than \$200 (72.62%), Exactly \$200 (22.62%), Less than \$200 (2.98%), Do not know (1.79%)*

FL3. Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, how much would you be able to buy with the money in this account?

*More than today (8.33%), exactly the same (6.94%), less than today (1.15%), do not know (3.57%)*