The Causal Mechanisms of Financial Education: Evidence from Mediation Analysis

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Financial Education Programs are Very Popular

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  - 110+ countries, 240+ institutions in the *International Gateway for Financial Education*

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- Many governments and organizations worldwide promote financial education, for example:
  - 110+ countries, 240+ institutions in the *International Gateway for Financial Education*
- But fin. ed. faces many challenges to success:
  - Large literature on strong correlation between financial literacy and "good" financial behavior
  - Evidence on causal impact is more muted

There is a Growing Literature on Financial Education ...

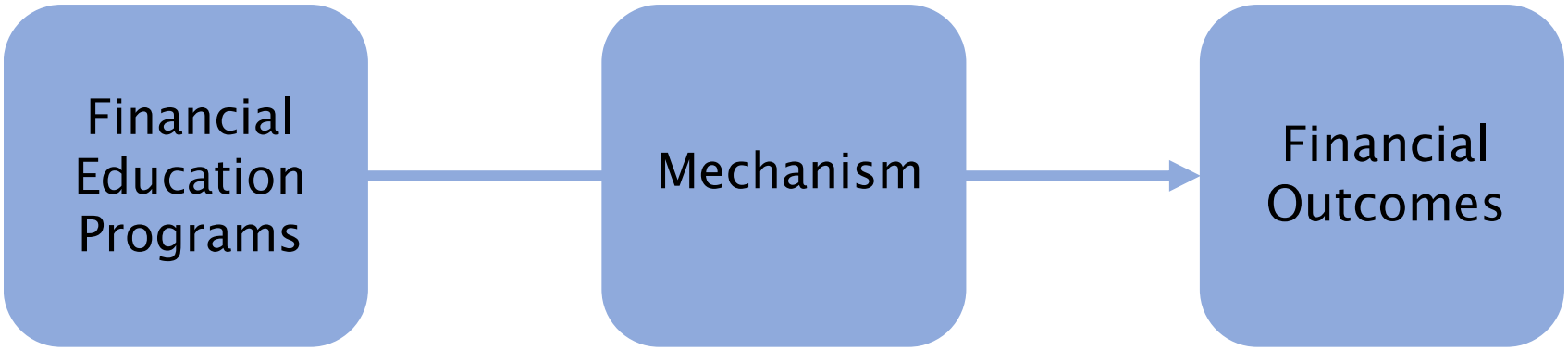
What delivery methods work?

Barron and Staten (2011), Drexler et al. (2014), Doi et al. (2016), Berg and Zia (2016), etc.

What impacts?

Fernandes et al. (2013), Hastings et al. (2013), Miller et al. (2015), etc.

... But the Evidence is Incomplete



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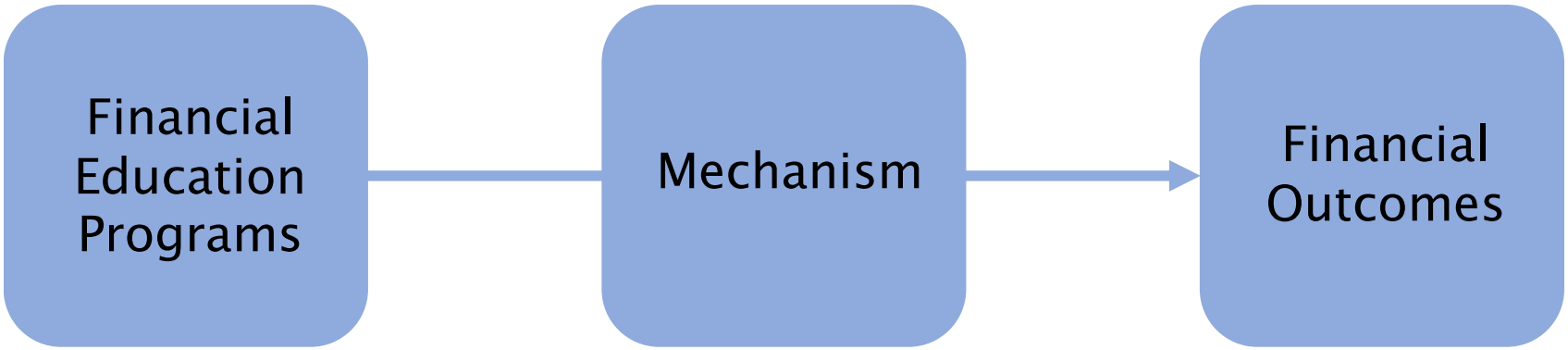

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How?

This paper: Financial Knowledge

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This Paper: Research Question #1

How should financial knowledge be measured, especially in a developing country?

- Current standard: "Big 3" (Lusardi & Mitchell, 2009) on interest rates, inflation, and diversification
- Instead, we conceptualize fin. knowledge into 3 dimensions
  1. Numeracy: calculating interest rates, etc.
  2. Awareness: bank account opening requirements, etc.
  3. Attitudes: perspectives about the benefits of financial services
- Measured through a knowledge test as part of a survey

This Paper: Research Question #2

How do numeracy, awareness, and attitudes mediate the effects of financial education on financial outcomes?

- Field experiment among urban poor in India, with different types of financial education
- Apply causal mediation analysis (e.g., Imai et al., 2010; Acharya et al., 2016)
- Estimate portion of the financial education treatment effect that is due to a particular mediator
- Consider four outcomes: budgeting, savings, borrowing, and insurance

This Paper: Preview of Findings

- Numeracy does not mediate any of the treatment effects of financial education
- For treatment effects on budgeting (writing a budget)
  - Awareness and attitudes are equality important mediators
  - Mediate 6-23% of treat. effects, depending on treatment
- For treatment effects on savings (has bank savings acct)
  - Only attitudes plays a mediating role
  - Mediates 12-35% of treat. effects, depending on treatment
- For treatment effects on borrowing and insurance
  - None of the 3 dimensions of fin. knowl. mediate treat. effects
- Implications for program design: if objective is to encourage individuals to open a bank account, changing attitudes is key

Experiment Design

Intervention 1: Financial Education

Description

- A video-based financial education program
- Covered budgeting, savings, loans, insurance, financial management

Random Assignment

- Offered to 2/3 of the sample
- Remaining 1/3 assigned to health education

Implementation

- 5 sessions over 5 weeks, each session 2-3 hours
- Classroom with 20 participants (all Fin Ed or all Health)

Intervention 2: Financial Goal Setting

Description

- Encouraging participants to set short-term achievable but non-compulsory financial goals (e.g., open a bank account)

Random Assignment

- 1/2 of all subjects assigned to financial education

Implementation

- Subjects assigned to goal setting were visited by field staff
  - Interviewed about their use of financial services
  - Asked to choose a target date for financial goals
  - Provided with a free calendar with the target dates
- Control group also visited by field staff, but were only interviewed about their use of financial services

Intervention 3: Financial Counseling

Description

- Individualized financial advice and one-on-one instruction

Random Assignment

- 1/2 of all subjects assigned to financial education
- Orthogonal to goal setting treatment

Implementation

- Financial counselor visited respondents assigned to counseling
- One visit per month for four months
- Counselors assisted respondents depending on their needs
  - Gathering documents for opening a bank account, preparing a household budget, etc.

Experiment Design: Summary (N=959)

Financial Education Videos	Counseling	Goal Setting	N	% of Sample
No	No	No	316	33
Yes	No	No	171	18
Yes	No	Yes	149	15
Yes	Yes	No	152	16
Yes	Yes	Yes	160	16

Baseline Summary Statistics (N=959)

	Mean	Standard Deviation	F-Test of Equality of Means Across All Treatments (p-value)
Household Characteristics			
Household Size	5.71	2.42	0.27
Monthly income (Rs.)	6892.01	5878.08	0.39
Monthly income per capita (Rs.)	1280.61	980.71	0.41
Has phone	0.84		0.89
Has water connection	0.76		0.76
Has non-farm enterprise	0.25		0.96
Respondent Characteristics			
Female	0.60		
Hindu	0.79		0.922
Completed secondary school	0.04		0.585
Microfinance client	0.49		
Has hard time saving	0.95		0.719
Interested in financial matters	0.87		0.949
Has inconsistent time preferences	0.45		0.082*
Monthly discount rate	1.40	4.45	0.669
Risk-averse	0.16		0.824
Math score (out of 8)	4.73	2.05	0.558

Measuring Financial Knowledge

Standard Approach: "Big 3" (Lusardi & Mitchell, 2009)

Question 1: Interest Rates

You have $100 in a savings acct and interest rate is 2% per year. After 5 years, how much will you have if you left the money to grow: more than, exactly, or less than $102?

Question 2: Inflation

The interest rate on your savings acct is 1% per year and inflation is 2% per year. After 1 year, will you be able to buy more than, exactly the same, or less than today with the money in this acct?

Question 3: Diversification

True or False: Buying a single company stuck usually provides a safer return than a stock mutual fund.

"Big 3" Not Necessarily Comprehensive

- Big 3 questions are parsimonious and easy to implement, but is a limited measure in developing countries:
  - The poor have low education, limited access to financial services, lack trust in financial institutions, etc.
  - Lusardi & Mitchell (2009) themselves write it is "imperative to expand the range of measures of financial literacy to better evaluate the types of problems people find the most difficult"
- We break down financial knowledge into different dimensions of learning, which allow us to delve into causal mechanisms

A Broader Approach to Measuring Financial Knowldge

1. *Financial Numeracy*
   - Ability to use basic arithmetic to solve financial problems
   - Example: Respondents were asked to add income and expenses of a hypothetical household
2. *Financial Awareness*
   - Basic knowledge about financial products/tools
   - Example: Can you open a bank account with Rs. 50? Y/N
3. *Financial Attitudes*
   - Individuals' perspectives on benefits of financial products/tools
   - Example: Do you think writing a budget is helpful? Y/N

Empirical Method

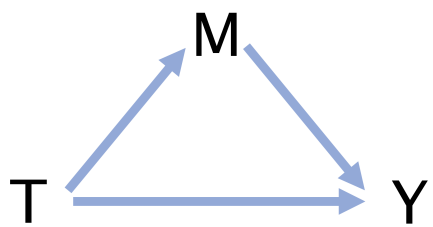
Overview

Part 1: Estimate Average Treatment Effect (ATE)

- Focus of our previous paper, published in 2017
- We found that Fin Ed + Goal Setting leads to simple follow-up actions (e.g., budgeting)
- Fin Ed + Counseling stimulates more complex behaviors (e.g., opening a bank account)

Part 2: Estimate Average Causal Mediation Effect (ACME)

- Decompose ATE into indirect effects (ACME) + direct effects



- Key identifying assumption: observed mediator is independent of potential outcomes, given treatment.

Part 1: Estimate Average Treatment Effect

Estimation

$$Y_i = \alpha_1 + \beta_1 T_i + \mathbf{X}_i \xi_1 + \epsilon_{i1} \quad (1)$$

- $Y_i(t)$: potential outcome of person i under treatment t
- $T \in \{\text{Fin Ed only, Fin Ed+Goal, Fin Ed+Couns, All Three}\}$
- ATE $= \widehat{\beta}_1$

Identification Assumption

- $\{Y_i(0), Y_i(1)\} \perp T$, satisfied because of randomization

Part 2: Estimate Average Causal Mediation Effect

Objective

- Decompose the ATE into two parts:
  - Indirect effects (due to a particular mediator)
  - Direct effects (all other channels)
- Adopt the method proposed in Imai et al. (2010)
- Results consistent with sequential g-estimation method proposed in Acharya et al. (2016)

Definitions

- $M_i(t)$: value of the mediator under treatment t
- $M \in \{\text{Numeracy, Awareness, Attitudes}\}$
- $Y_i(t, m)$: potential outcome under treatment t, mediator m

Part 2: Estimate ACME

Estimation

$$M_i = \alpha_2 + \beta_2 T_i + \mathbf{X}_i \xi_2 + \epsilon_{i2} \quad (2)$$

$$Y_i = \alpha_3 + \beta_3 T_i + \gamma M_i + \mathbf{X}_i \xi_3 + \epsilon_{i3} \quad (3)$$

- ACME $= \widehat{\beta}_2 \cdot \widehat{\gamma}$
- ADE $= \widehat{\beta}_3$
- ATE $=$ ACME $+$ ADE

Identification Assumptions (Imai et al., 2010)

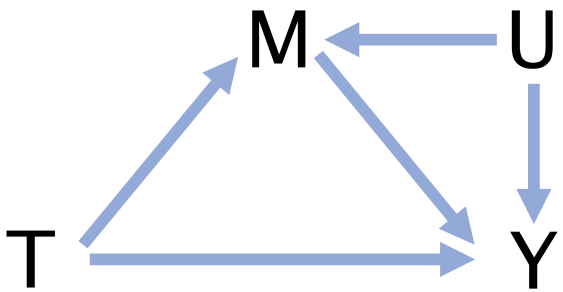
1. $\{Y_i(t', m), M_i(t)\} \perp T_i \mid X_i = x$
2. $Y_i(t', m) \perp M_i(t) \mid T_i = t, X_i = x$

- Assumption # 1: satisfied because of randomization
- Assumption # 2: strong assumption, cannot be tested directly

Understanding Assumption # 2

$$Y_i(t', m) \perp M_i(t) \mid T_i = t, X_i = x$$

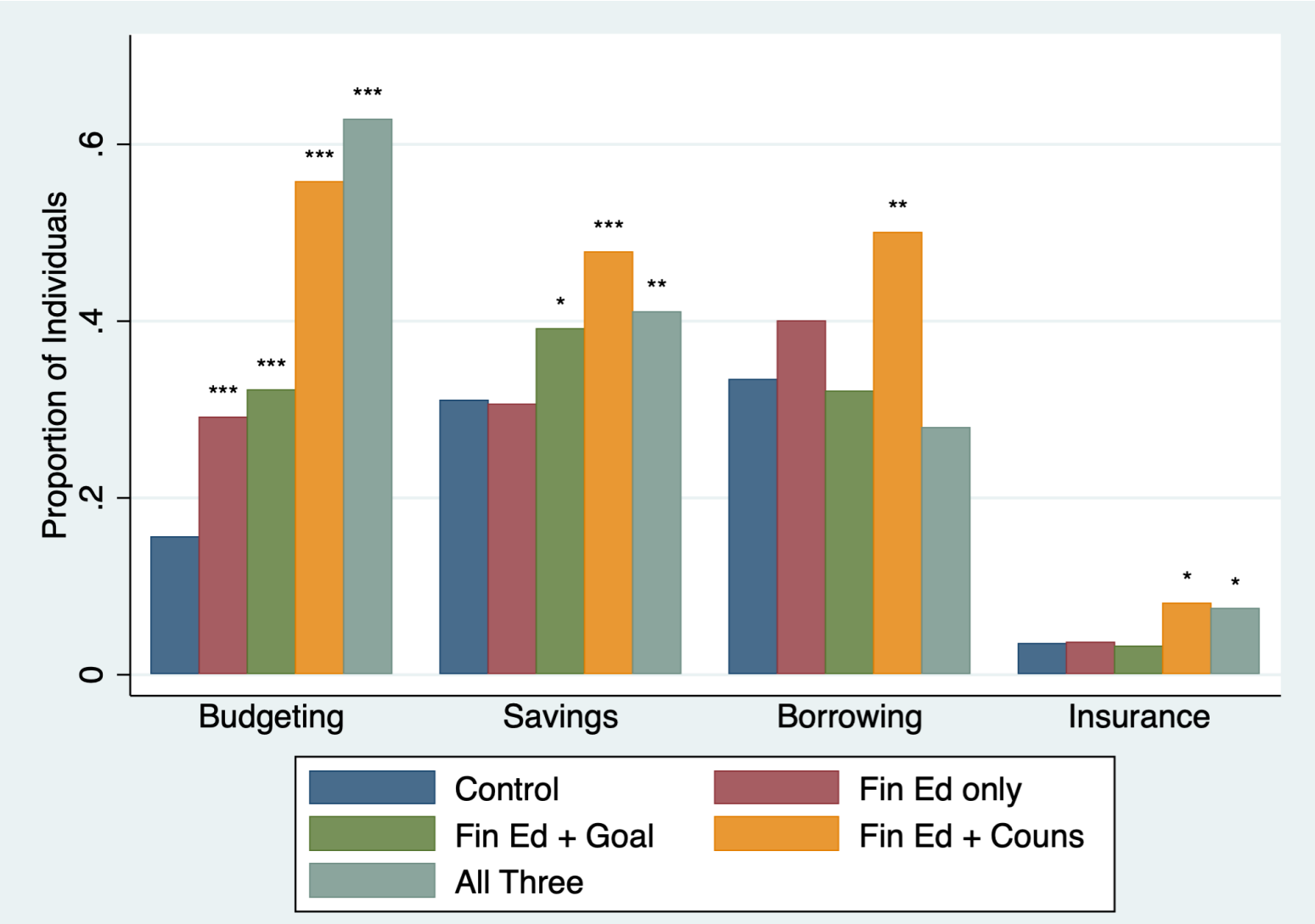
- Conditional on baseline covariates and observed treatment status, the mediator must be as-if randomized, for example:
  - Financial awareness is "as-if" randomized among those who have same treat. assignment and same baseline characteristics
- Fails if there are unobservables U that affect both M and Y



- Explore violations using sensitivity analysis
  - If $\rho \equiv corr(\epsilon_{i2}, \epsilon_{i3})$ is not zero, assumption does not hold
  - How does mediating effect change for different values of ρ?

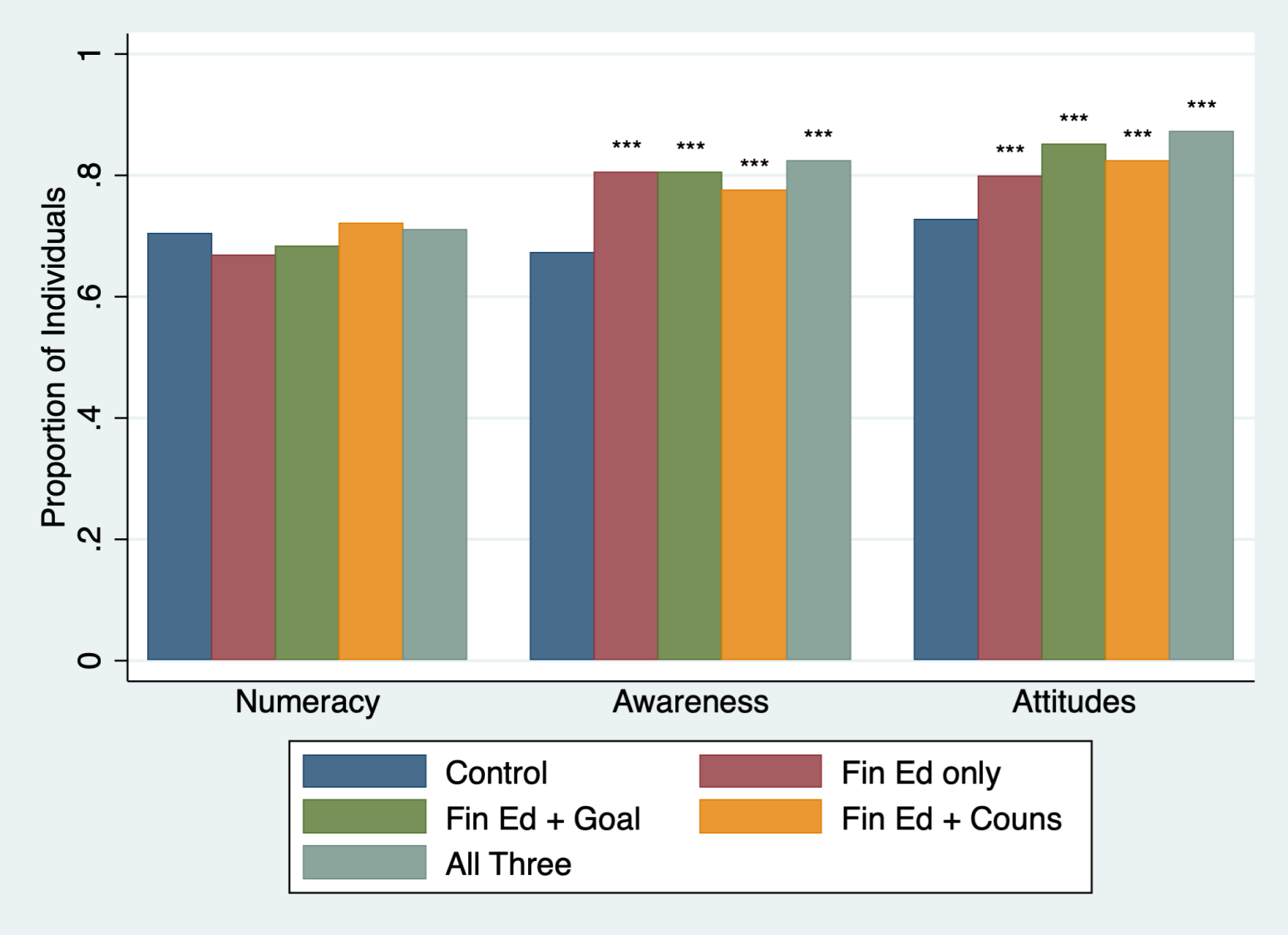
Results

ATE on Financial Outcomes

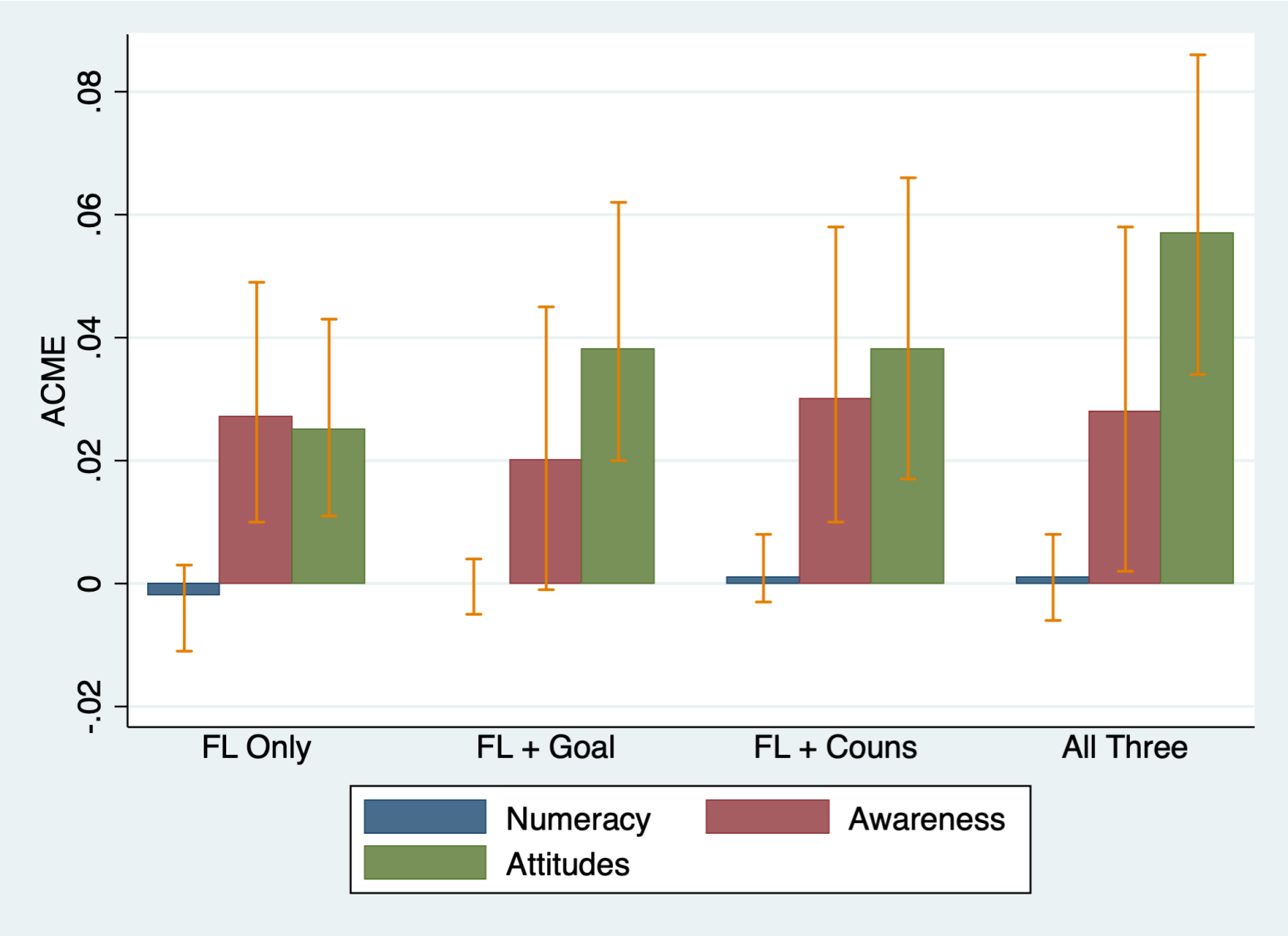


Outcomes: *Budgeting:* Made a budget in the last 6 months; *Savings:* Has a savings account; *Borrowing:* Borrowed for productive purpose (e.g., for business); *Insurance:* Bought life insurance in last 6 months

ATE on Financial Knowledge



ACME for Budgeting



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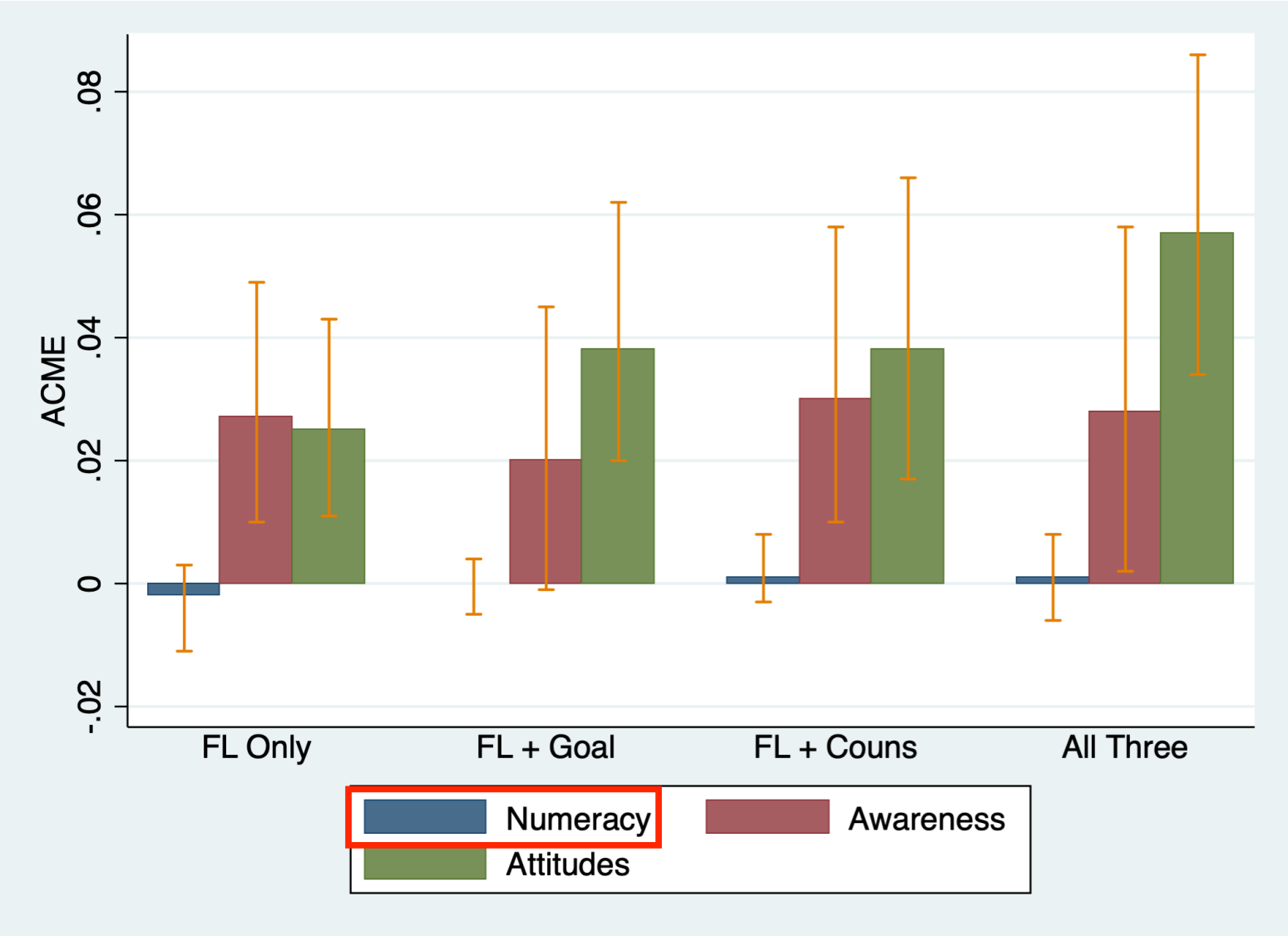

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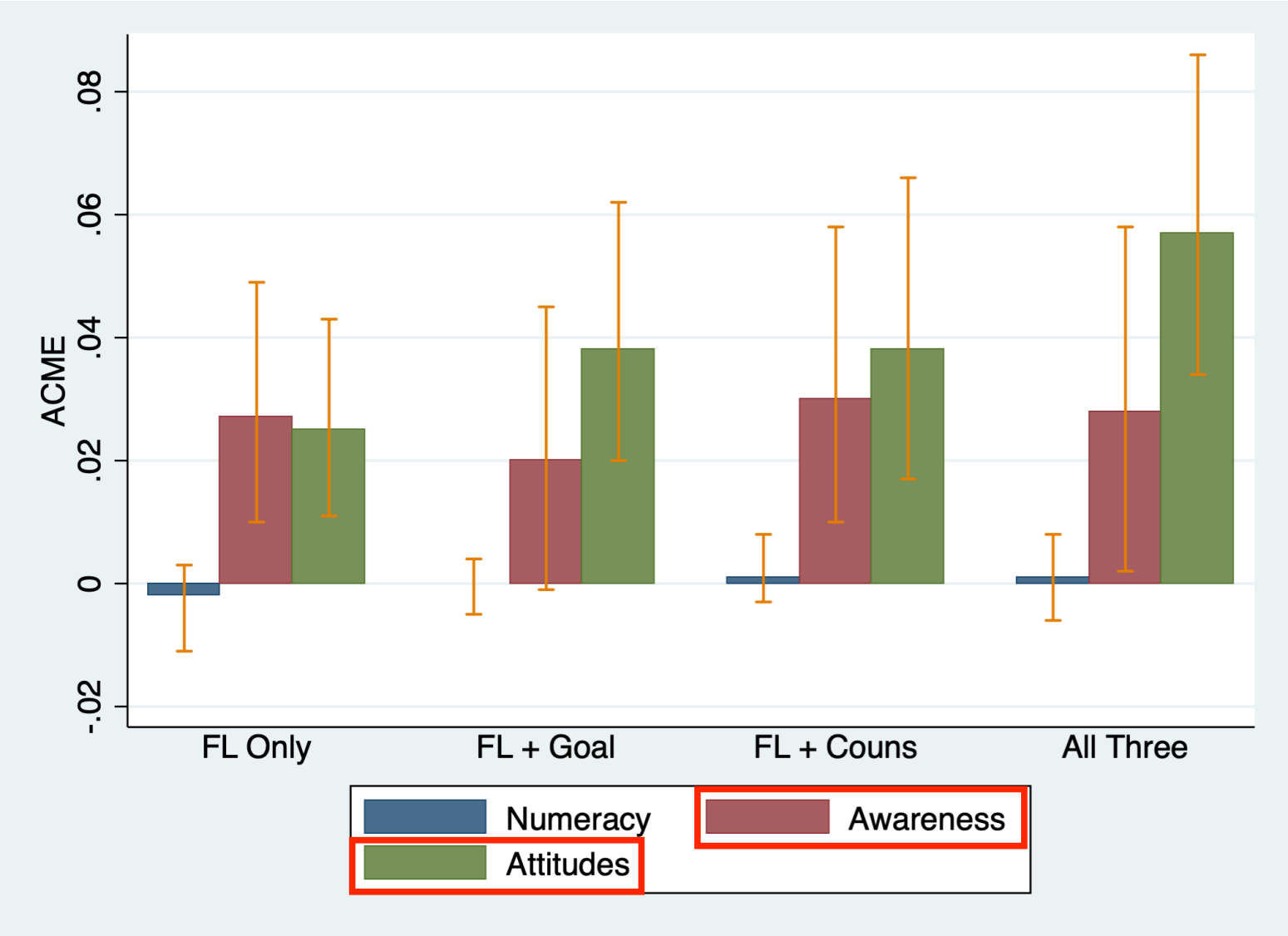
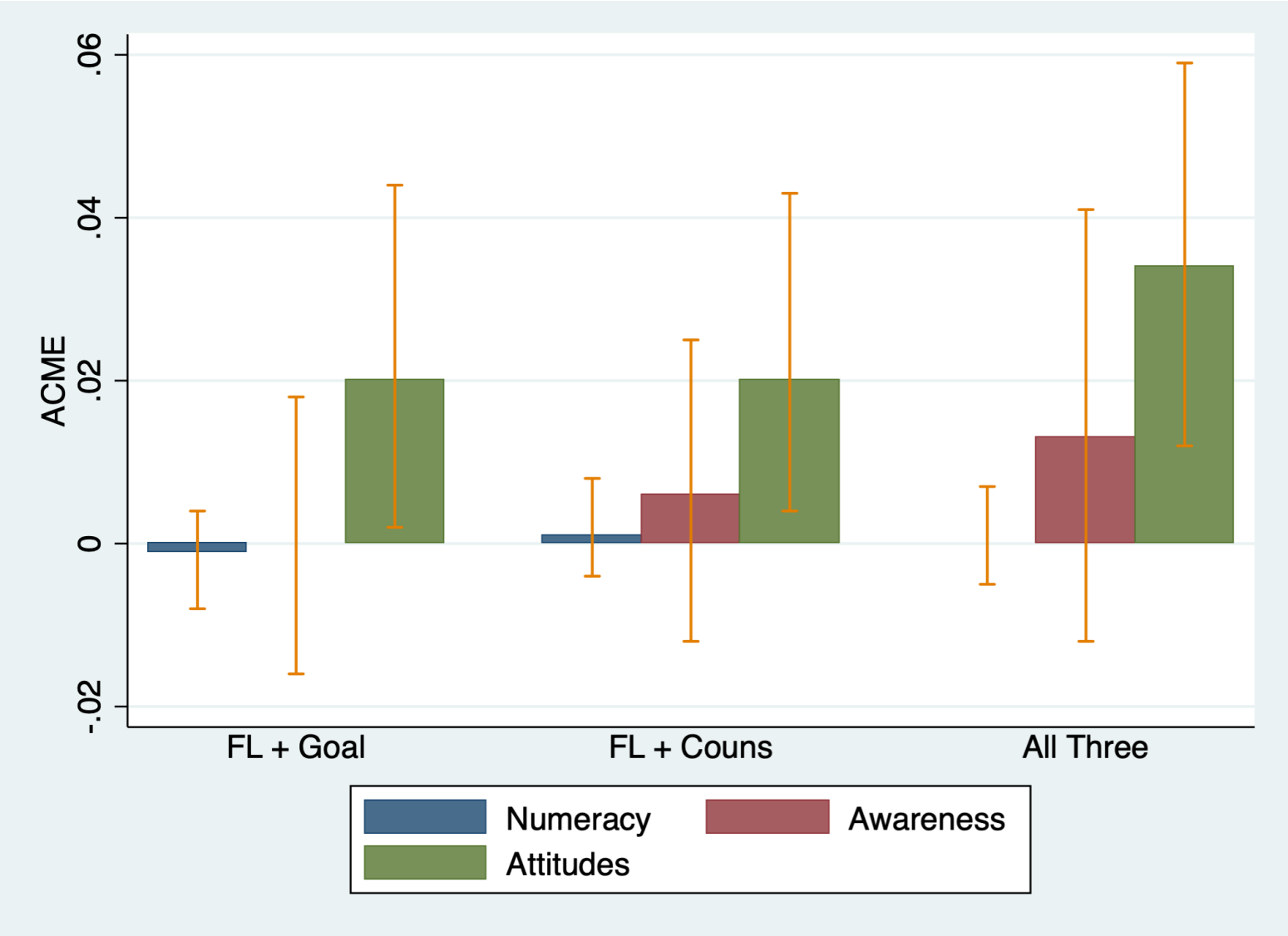
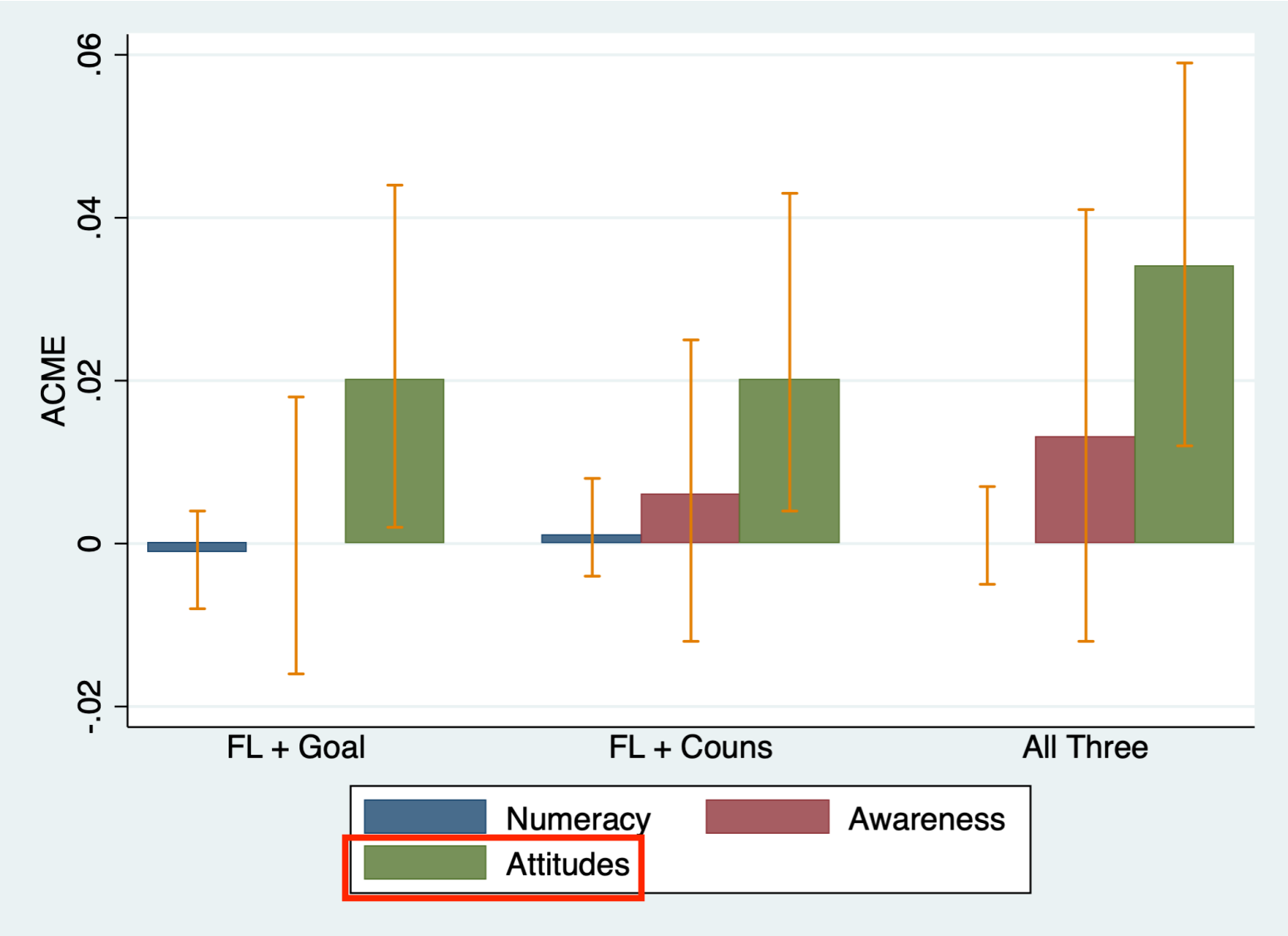


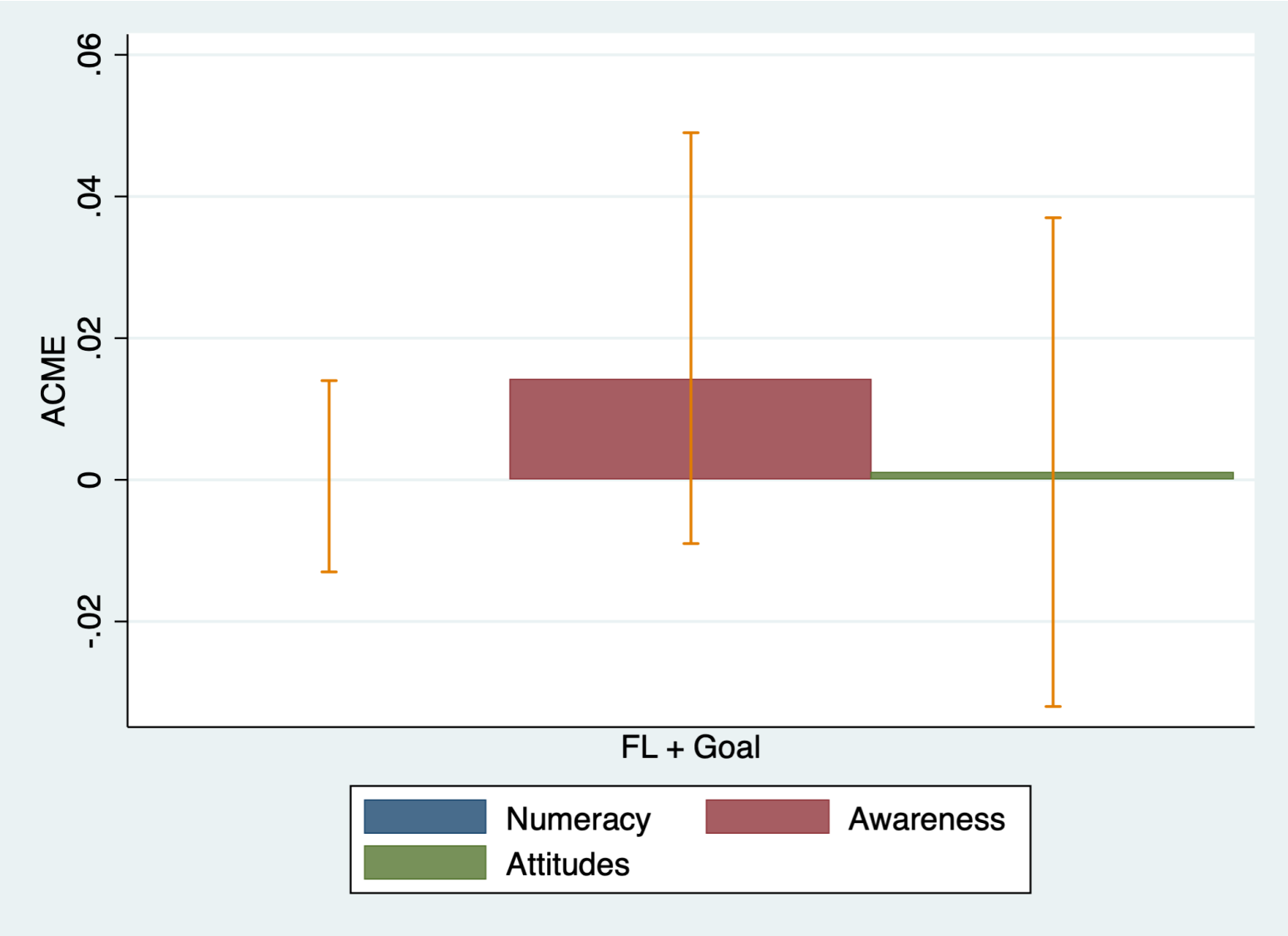
ACME for Savings



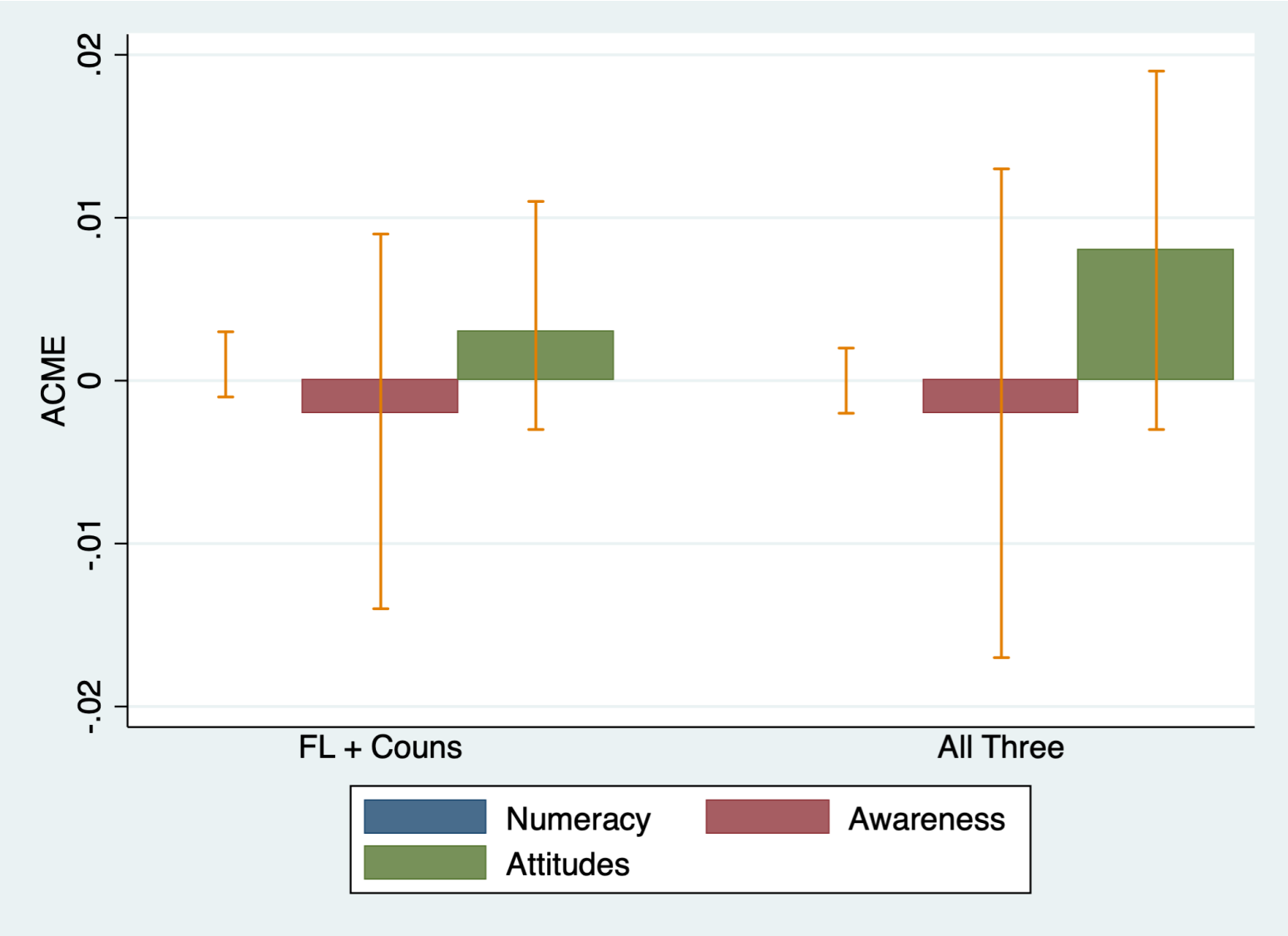
ACME for Savings



ACME for Borrowing



ACME for Insurance



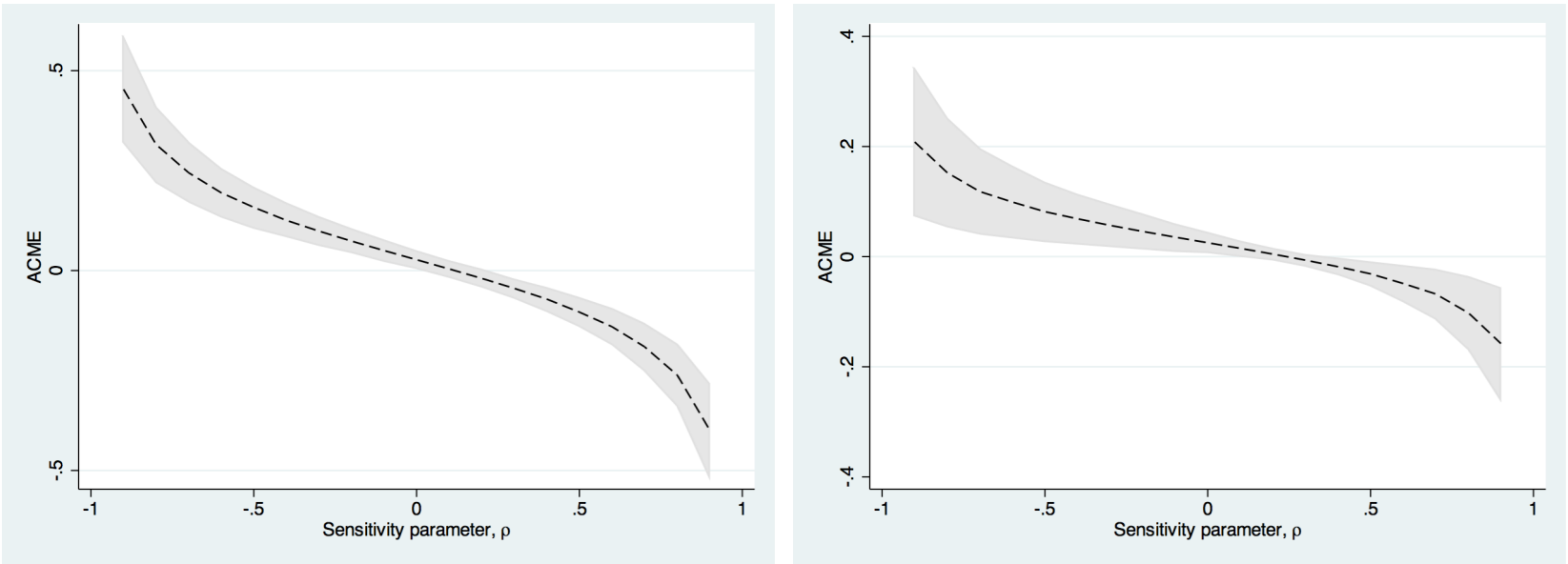
Sensitivity Analysis: Overview

- If the assumption that M is as-if randomized conditional on observed T is violated, then $\rho \equiv corr(\epsilon_{i2}, \epsilon_{i3})$ is not zero
  - ϵ_{i2} is the error term in the regression of M on T and X
  - ϵ_{i3} is the error term in the regression of Y on T, M, and X
- ρ is a sensitivity parameter: large $|\rho| \implies$ large bias in ACME
- We specify hypothetical values of ρ and re-estimate ACME for different values of ρ
- Two important questions:
  - How large must ρ be for ACME to be zero?
  - What is the direction of the bias?

Sensitivity Analysis: Takeaways

1. ACME of Attitudes is less sensitive than ACME for Awareness
2. If true $\rho > 0$, we are overestimating ACME

Figure: Outcome: Budgeting, Treatment: Fin Ed only



(a) Awareness (b) Attitudes

Value of ρ for which ACME of Awareness is zero: 0.112; for Attitudes: 0.231

Conclusion

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- We employ a field experiment in India to investigate financial knowledge as a causal mechanisms from financial education to financial outcomes
- We conceptualize financial knowledge into: numeracy, awareness, and attitudes
- Numeracy does not mediate any of the treatment effects
- For budgeting: Awareness and attitudes mediate a substantial portion of the ATE
- For bank savings: Only attitudes play a mediating role
  - Supported by qualitative responses in the survey

Appendix

Average Treatment Effects

Table 3: Average Treatment Effects

	Budgeting	Savings	Borrowing	Insurance
	Has tried making a budget in the last 6 months	Has a savings account	Loan purpose: Business, education, or purchase of durable goods	Bought life insurance in the last 6 months
	(1)	(2)	(3)	(4)
Panel A. Financial Education Only				
Financial Education Only	0.136***	-0.004	0.067	0.001
	(0.038)	(0.037)	(0.085)	(0.017)
R-squared	0.304	0.298	0.436	0.214
Number of Observations	487	487	235	487
Panel B. Financial Education and Goal Setting				
Financial Education and Goal Setting	0.166***	0.081*	-0.013	-0.003
	(0.044)	(0.044)	(0.088)	(0.015)
R-squared	0.300	0.315	0.393	0.205
Number of Observations	465	465	223	465
Panel C. Financial Education and Counseling				
Financial Education and Counseling	0.402***	0.167***	0.167**	0.045*
	(0.048)	(0.043)	(0.071)	(0.024)
R-squared	0.396	0.334	0.424	0.234
Number of Observations	468	468	227	468
Panel D. All Three Treatments				
All Three Treatments	0.472***	0.100**	-0.055	0.039*
	(0.040)	(0.045)	(0.064)	(0.021)
R-squared	0.413	0.308	0.393	0.229
Number of Observations	476	476	228	476
Control Group Mean	0.155	0.310	0.333	0.035

Effects on Financial Knowledge

Table 4: Effects on Financial Knowledge

	Financial Numeracy	Financial Awareness	Financial Attitudes
	(1)	(2)	(3)
Panel A. Financial Education Only			
Financial Education Only	-0.036	0.133***	0.071***
	(0.033)	(0.023)	(0.023)
R-squared	0.276	0.297	0.307
Number of Observations	487	487	487
Panel B. Financial Education and Goal Setting			
Financial Education and Goal Setting	-0.021	0.132***	0.123***
	(0.033)	(0.026)	(0.022)
R-squared	0.301	0.328	0.330
Number of Observations	465	465	465
Panel C. Financial Education and Counseling			
Financial Education and Counseling	0.017	0.103***	0.097***
	(0.030)	(0.024)	(0.029)
R-squared	0.266	0.348	0.310
Number of Observations	468	468	468
Panel D. All Three Treatments			
All Three Treatments	0.007	0.151***	0.145***
	(0.037)	(0.021)	(0.021)
R-squared	0.242	0.346	0.319
Number of Observations	476	476	476
Control Group Mean	0.703	0.672	0.727

Causal Mediation: Fin Ed Only Treatment

Table 5: Causal Mediation: Financial Education Treatment

	Budgeting		
	Has tried making a budget in the last 6 months		
	(1)	(2)	(3)
Panel A. Coefficient Estimates			
Financial Education Only	0.138***	0.109***	0.111***
	(0.033)	(0.035)	(0.032)
Endline Numeracy Score	0.065		
	(0.064)		
Endline Awareness Score		0.203***	
		(0.065)	
Endline Attitudes Score			0.353***
			(0.059)
R-Squared	0.035	0.046	0.089
Number of Observations	487	487	487
Control Group Mean		0.155	
Panel B. Estimates of ACME, ADE, and ATE			
ACME	-0.002	0.027***	0.025***
	(0.003)	(0.010)	(0.008)
ADE	0.138***	0.109***	0.111***
	(0.033)	(0.035)	(0.032)
ATE		0.136***	
		(0.038)	
% of ATE Mediated	-1%	20%	18%

Causal Mediation: Fin Ed + Goal Treatment

Table 6: Causal Mediation: Financial Education and Goal Setting Treatment

	Budgeting			Savings		
	Has tried making a budget in the last 6 months			Has a savings account		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Coefficient Estimates						
Financial Education and Goal Setting	0.166***	0.146***	0.128***	0.081**	0.080**	0.060
	(0.039)	(0.043)	(0.041)	(0.039)	(0.039)	(0.042)
Endline Numeracy Score	-0.000			0.038		
	(0.064)			(0.072)		
Endline Awareness Score		0.150*			0.003	
		(0.079)			(0.064)	
Endline Attitudes Score			0.305***			0.164**
			(0.070)			(0.077)
Adj. R-Squared	0.038	0.044	0.075	0.003	0.002	0.011
Number of Observations	465	465	465	465	465	465
Control Group Mean		0.155			0.310	
Panel B. Estimates of ACME, ADE, and ATE						
ACME	-0.000	0.020*	0.038***	-0.001	0.000	0.020**
	(0.002)	(0.011)	(0.011)	(0.003)	(0.009)	(0.010)
ADE	0.166***	0.146***	0.128***	0.081**	0.080**	0.060
	(0.039)	(0.043)	(0.041)	(0.039)	(0.039)	(0.042)
ATE		0.166***			0.081*	
		(0.044)			(0.044)	
% of ATE Mediated	0%	12%	23%	-1%	0%	25%

Causal Mediation: Fin Ed + Counseling Treatment

Table 7: Causal Mediation: Financial Education and Counseling Treatment

	Budgeting			Savings			Borrowing			Insurance		
	Has tried making a budget in the last 6 months			Has a savings account			Loan purpose: Business, education, or purchase of durable goods			Bought life insurance in the last 6 months		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A. Coefficient Estimates												
Financial Education and Counseling	0.401***	0.372***	0.364***	0.166***	0.162***	0.148***	0.134***	0.120***	0.133***	0.045**	0.048**	0.042*
	(0.042)	(0.046)	(0.045)	(0.038)	(0.040)	(0.037)	(0.046)	(0.044)	(0.048)	(0.021)	(0.023)	(0.021)
Endline Numeracy Score	0.058			0.051			-0.003			0.023		
	(0.071)			(0.075)			(0.092)			(0.021)		
Endline Awareness Score		0.289***			0.054			0.152			-0.022	
		(0.101)			(0.084)			(0.132)			(0.053)	
Endline Attitudes Score			0.391***			0.203**			0.007			0.035
			(0.078)			(0.082)			(0.116)			(0.031)
Adj. R-Squared	0.196	0.214	0.246	0.029	0.029	0.042	0.019	0.025	0.019	0.006	0.006	0.007
Number of Observations	468	468	468	468	468	468	227	227	227	468	468	468
Control Group Mean		0.155			0.310			0.333			0.035	
Panel B. Estimates of ACME, ADE, and ATE												
ACME	0.001	0.030***	0.038***	0.001	0.006	0.020**	-0.000	0.014	0.001	0.000	-0.002	0.003
	(0.003)	(0.012)	(0.013)	(0.003)	(0.009)	(0.010)	(0.006)	(0.015)	(0.017)	(0.001)	(0.006)	(0.003)
ADE	0.401***	0.372***	0.364***	0.166***	0.162***	0.148***	0.134***	0.120***	0.133***	0.045**	0.048**	0.042*
	(0.042)	(0.046)	(0.045)	(0.038)	(0.040)	(0.037)	(0.046)	(0.044)	(0.048)	(0.021)	(0.023)	(0.021)
ATE		0.402***			0.167***			0.167**			0.045*	
		(0.048)			(0.043)			(0.071)			(0.024)	
% of ATE Mediated	0%	7%	9%	1%	4%	12%	0%	8%	1%	0%	-4%	7%

Causal Mediation: All Three Treatments

Table 8: Causal Mediation: All Three Treatments

	Budgeting			Savings			Insurance		
	Has tried making a budget in the last 6 months			Has a savings account			Bought life insurance in the last 6 months		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. Coefficient Estimates									
All Three Treatments	0.472***	0.445***	0.416***	0.100**	0.088**	0.067	0.039**	0.041*	0.031
	(0.035)	(0.037)	(0.035)	(0.040)	(0.037)	(0.041)	(0.018)	(0.022)	(0.019)
Endline Numeracy Score	0.081			0.047			0.002		
	(0.065)			(0.062)			(0.025)		
Endline Awareness Score		0.185**			0.085			-0.013	
		(0.089)			(0.085)			(0.047)	
Endline Attitudes Score			0.394***			0.232***			0.052
			(0.074)			(0.075)			(0.036)
Adj. R-Squared	0.259	0.263	0.301	0.008	0.008	0.024	0.005	0.005	0.009
Number of Observations	476	476	476	476	476	476	476	476	476
Control Group Mean		0.155			0.310			0.035	
Panel B. Estimates of ACME, ADE, and ATE									
ACME	0.001	0.028**	0.057***	0.000	0.013	0.034***	-0.002	-0.017	-0.003
	(0.003)	(0.014)	(0.013)	(0.003)	(0.013)	(0.012)	0.002	0.013	0.019
ADE	0.472***	0.445***	0.416***	0.100**	0.088**	0.067	0.039**	0.041*	0.031
	(0.035)	(0.037)	(0.035)	(0.040)	(0.037)	(0.041)	(0.018)	(0.022)	(0.019)
ATE		0.472***			0.100**			0.039*	
		(0.040)			(0.045)			(0.021)	
% of ATE Mediated	0%	6%	12%	0%	13%	34%	-5%	-44%	-8%