The Causal Mechanism of Financial Education: Evidence from Mediation Analysis

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Abstract

This paper uses a field experiment in India with multiple financial education treatments to investigate the causal mechanisms between financial education and financial behavior. Focusing on the mediating role of financial literacy, we propose a broader definition of financial knowledge that includes three dimensions: numeracy skills, financial awareness, and attitudes towards personal finance. We then employ causal mediation analysis to investigate the proportion of the treatment effect that can be attributed to these three channels. Strikingly, we find that numeracy does not mediate any effects of financial education on household outcomes. For *simple* financial actions such as budgeting, both awareness and attitudes serve as critical pathways, while for more *complex* financial activities such as opening a savings account, attitudes play a more prominent role. These findings underscore the importance of changing perceptions about financial products and services as a vital mechanism for the success of financial education.

Keywords: Financial Education, Financial Literacy, Financial Knowledge, Causal Mediation Analysis, Mechanism of Impact, Impact Evaluation

JEL Codes: C93, D14, G21, O12

1. Introduction

Over the last decade, financial education programs have become an increasingly popular tool for fostering financial inclusion, increasing consumer welfare, and ensuring stable financial systems (e.g., Lusardi and Mitchell, 2013; World Bank, 2017). Nevertheless, the merits of such programs remain a hotly contested policy issue. On the one hand, critics maintain that financial education is a fallacy because it is neither economical nor effective, arguing instead for other forms of financial regulation such as retirement savings defaults and pro bono financial advisory services (e.g., Willis, 2011). On the other hand, many governments and organizations worldwide continue to champion financial education, as evidenced in the membership of over 110 countries and 240 public institutions in the *International Gateway for Financial Education.*[2]

At the center of this public policy discourse lies a growing – yet incomplete – body of evidence on the causal effect of financial education. Although most early studies demonstrate only modest effects (e.g., Fernandes et al. 2013; Hastings et al., 2013; Miller et al., 2015), recent research indicates a more promising role for financial education. For example, financial training delivered through popular media outlets (Berg and Zia, 2016), complemented with goal setting and counseling (Carpena et al., 2017), or targeted for specific groups (Doi, McKenzie, and Zia, 2016; Bruhn et al., 2017) all result in significant improvements in household financial outcomes. At the same time, much of this literature thus far focuses primarily on establishing causality and places little weight on the pathways of the effects. Hence, the mechanisms through which financial education operates are not well-understood.

This paper carefully unpacks the causal mechanisms of financial education. In particular, we examine gains in financial literacy as an intermediate channel by investigating the following two questions. First, fundamentally how should financial literacy be measured, especially in a developing country context? Existing studies typically use the "Big Three" questions covering interest rates, inflation, and diversification from Lusardi and Mitchell (2009), but these may not be suitable in emerging markets where consumers have poor education and lack the most basic skills. And second, how do different aspects of financial literacy (e.g., numeric calculations, familiarity with bank account opening requirements, perceptions of financial products) mediate the effects of financial education on financial outcomes? Understanding how financial knowledge acts as a mechanism is critical not only to fill a gap in the academic literature, but also to inform public policies on designing more effective financial education initiatives.

We examine the above questions using a field experiment among the urban poor in India, which we previously studied in Carpena et al. (2017). As part of the experiment, a randomly selected two-thirds of all subjects were invited to a video-based financial education program. A subset of participants assigned to financial education were likewise provided with one of three add-on treatments: (1) concrete financial goal setting; (2) individualized financial counseling; or (3) both

[2] See http://www.financial-education.org/about.html, accessed June 5, 2018.

goal setting and counseling. In Carpena et al. (2017), we focus on the Average Treatment Effect (ATE) and find that financial education alone did not bring about large changes in financial behavior. However, financial education with goal setting encouraged relatively *simple* follow-up activities (e.g., writing a budget), while financial education with counseling led individuals to undertake more *complex* financial actions (e.g., opening a savings account).

In contrast to Carpena et al. (2017), this paper moves beyond the ATE and explores the underlying channels for the effects of financial education, goal setting, and counseling. We employ causal mediation analysis (e.g., Baron and Kenny, 1986; Imai et al., 2011; VanderWeele, 2015; Acharya, Blackwell, and Sen, 2016), an approach that allows us to quantify the extent to which the treatments influence outcomes through a specific mediating variable. To this end, our empirical method consists of two components. The first component concerns measurement of financial literacy, which represents our proposed mediator. Whereas the "Big Three" questions by Lusardi and Mitchell (2009) assess financial literacy using *specific* topics such as diversification, we take a comprehensive approach that considers *general* dimensions of financial knowledge. Thus, we conceptualize financial literacy into three broad categories: financial numeracy, financial awareness, and financial attitudes.

Through a series of questions in the endline survey, we designed each of these three dimensions to capture a different aspect of financial literacy. Financial *numeracy* deals with calculating interest rates, summing expenses, and other similar computations. These skills may facilitate better fiscal management and more effective comparisons of financial products. Next, financial *awareness* emphasizes fundamental financial concepts (e.g., household budgeting) as well as basic information about financial products (e.g., deposit insurance, loan fees). This type of knowledge may enable wider adoption of financial products and promote simple financial habits. Finally, financial *attitudes* encompass individuals' perspectives on the benefits of financial services. We view financial attitudes as an essential element of financial literacy because they may have critical consequences for financial behavior: for example, if one sees no advantage of savings, then one may be less inclined to set money aside for the future.

To understand how financial numeracy, awareness, and attitudes function as mediating variables, the second component of our study implements causal mediation analysis. In particular, we follow the framework outlined in Imai et al. (2011) to decompose the ATE into an Average Causal Mediation Effect (ACME), which represents the impact of a particular mechanism, and an Average Direct Effect (ADE), which represents all other pathways. We estimate the ACME empirically using coefficients from two regressions: one for the effect of the treatment on the mediator and another for the effect of the mediator on the outcome conditional on the treatment. Intuitively, the product of these two coefficients – the ACME – captures the portion of the ATE that can be attributed to the mediating variable. We then test the sensitivity of the ACME to the key identifying assumption that the observed mediator is statistically independent of the outcome variable, given

the treatment status and baseline characteristics, and we find support for the validity of this assumption. We also show that our results are robust to using an alternative estimation strategy — specifically, sequential *g*-estimation as proposed in Acharya, Blackwell, and Sen (2016) — which requires weaker assumptions to isolate mediation effects.

Amid the ongoing research and policy debate on the value of financial education, our analysis reveals four critical insights on the mechanisms through which such a program enhances household financial outcomes. First, although conventional intuition suggests that quantitative problem-solving skills may be an important ingredient for financial capability, we strikingly find that financial numeracy does not play a significant intermediary role for any of the financial education interventions in our setting. Our results show that financial education in any way, shape, or form — whether on its own, provided with counseling or goal setting, or supplemented with both — has no economic or statistically significant impacts on financial numeracy. Consequently, we find an ACME of precisely nil for financial numeracy across all treatments, with confidence intervals that are tightly centered around zero.

Second, and in contrast to the null effects of numeracy, our results demonstrate that both financial awareness and attitudes serve as meaningful channels from financial education to household budgeting. For all combinations of financial education, goal setting, and counseling that we study, we detect an increase in awareness and attitudes scores of up to 15 percentage points. Correspondingly, our results indicate that across all treatments, up to 20 and 23 percent of the ATE for budgeting operates through awareness and attitudes, respectively. Moreover, these estimates are statistically indistinguishable, suggesting that both channels are equally important for changes in household budgeting behavior.

Third, while awareness and attitudes play analogous roles as channels for budgeting, we find key differences in how they mediate treatment impacts on household savings. Specifically, our analysis shows that for all treatments, financial attitudes but not awareness fosters adoption of formal savings accounts. Indeed, the ACME of awareness is very close to zero regardless of whether the treatment consists of financial education alone or augmented with goal setting and/or counseling. On the other hand, the ACME of financial attitudes across all types of treatments is between two and three percentage points, amounting to as much as 34 percent of the ATE for the treatment where all three of financial education, goal setting, and counseling are offered. These findings therefore underscore the importance of changing perceptions about financial products as a mechanism for financial education.

Finally, we show that although the most intensive treatments (i.e., financial education with one-on-one counseling or financial education with both counseling and goal setting) have significant positive effects on borrowing and insurance outcomes, none of the three financial literacy dimensions act as mediators for these effects. Our estimates of the ACME of awareness and

attitudes on these behaviors are all close to zero and are not statistically significant. Furthermore, the treatment effects of financial education on borrowing and insurance are much smaller in absolute terms relative to budgeting and savings outcomes. Overall, these patterns suggest that changing borrowing and insurance behavior through financial education is a difficult task, and the impacts of the treatments on these outcomes are likely mediated through channels other than improved financial knowledge.

The results of our study contribute to both the research and public policy discourse on financial education. While many studies have considered the causal effects of financial education programs on financial behavior, few have examined the *mechanisms* through which these programs are effective. Addressing this gap in the literature, this paper is, to our knowledge, the first to implement causal mediation analysis to investigate the channels of impact of financial education provision. From a more general and methodological perspective, our study likewise illustrates how field experiments can be structured to identify causal mechanisms. Indeed, if mediators can be measured as part of the endline survey and the overall study design, then one can apply causal mediation analysis as we have done here to investigate mediation effects.

From a practical and policy perspective, our findings speak to the ongoing policy debate on the merits of financial education. Our results demonstrate that broad pessimism on the value of financial literacy may be unwarranted. We show that financial education can be effective in increasing different facets of financial knowledge, and in turn, better attitudes and awareness serve as critical pathways for improved budgeting and savings. Furthermore, our results suggest that for *simple* financial actions such as writing a budget, both awareness and attitudes are equally important mechanisms, but for more *complex* actions such as opening a savings account, attitudes play a more significant role. Hence, if the objective of a financial education initiative is to encourage complex financial behaviors, it would do well to place more emphasis on changing beliefs about the benefits of financial products. We believe these insights are key, particularly for designing successful financial literacy programs that deliver meaningful impacts.

This paper proceeds as follows. Section 2 describes the experiment design and summary statistics. Section 3 explains the measurement of financial knowledge, and section 4 details the empirical method for causal mediation analysis. Section 5 presents the results, and Section 6 conducts sensitivity analysis to examine the robustness of our main findings. Lastly, Section 7 concludes.

2. Experiment Design and Summary Statistics

Our study takes place in Ahmedabad, a large and bustling metropolis located in Gujarat, India. One of the fastest growing cities nationwide, Ahmedabad has emerged in recent years as a major commercial and industrial hub, where a wide variety of financial services are available to low-income consumers, such as money lending, microfinance, formal banking, and insurance. In this vibrant financial environment, we exploit a field experiment with three types of interventions: financial education, concrete financial goal setting, and individualized financial counseling. All of

these were randomly assigned at the respondent level, and we examine different combinations of these three treatments. In what follows, we provide a summary of the treatments, and we refer the reader to Carpena et al. (2017) for a more detailed discussion of the experiment design.

2.1. Financial Education

Our main experimental intervention is a video-based financial education program which we offered to a randomly selected two-thirds of all study participants. The other one-third formed a control group and were offered health training. We chose to assign the control group to health education instead of no training at all as doing so allows us to account for Hawthorne effects. These effects may be especially important in our research setting, as the program we consider was quite intensive: whereas many existing studies examine only a short one-off financial training session,[3] the financial education program in our experiment is longer and was carried out over five weekly meetings, each lasting 2 to 3 hours. With such in-depth curriculum, providing the control participants with health education was therefore necessary to maintain the same level of everyday disruption across all respondents throughout the study.

The financial education program screened videos on five topics, namely, budgeting, savings, loans, insurance, and financial management. For consistency, the health education program also used videos and discussed five topics unrelated to financial knowledge, that is, cleanliness and hygiene; midwifery; maternal and child health; condoms, AIDS and syphilis; and night-blindness.[4] To further ensure comparability across study subjects, both the financial and health training sessions were implemented using the same logistic approach. For example, both financial and health training sessions were carried out in a classroom environment, where each class met at the same time every week and consisted of about 20 respondents assigned to the same type of program.[5] All participants likewise received a show-up fee of Rs. 50 (approximately US$ 1) for every session they attended as well as free transportation to and from the training center.

2.2. Concrete Financial Goal Setting

Our second intervention, concrete financial goal setting, encouraged participants to set short-term achievable but non-compulsory financial goals. This treatment involved a household visit with the following three elements: (1) respondents were interviewed about their use of financial services; (2) respondents were asked to voluntarily choose a target date for completing one or more financial

[3] For instance, Miller et al. (2014) find in their meta-analysis that more than one-third of financial education programs are delivered within one week or less.

[4] The financial education videos were based on standard materials previously used in the literature, but they were adapted to our context by a local media company together with input from the research team and our local research and implementation partners. The health education videos were produced by the United Nations in India.

[5] The study was carried out over several waves, and in each wave of the study, there were about 15 classes. Of these, 10 classes were for financial education, and the remaining 5 classes were for health training. All financial and health classes were likewise facilitated by a trained instructor, who answered outstanding questions about the videos as well as promoted discussion on the course topics.

goals, namely, opening a savings account, increasing savings, reducing expenditure, and/or purchasing insurance; and (3) enumerators listed the respondents' target dates on a calendar — provided at no cost by the study — and posted the calendar in the respondent's home, as a reminder of their self-chosen but non-binding financial goal.

We administered the above goal setting treatment by design to a randomly selected half of all respondents assigned to financial education. In so doing, we are able to estimate the marginal effect of the goal setting treatment beyond financial education alone. The other half then served to separate the effects of the goal setting exercise versus a household visit. In particular, this group received the same household interview about financial services over the same field work period, but they were not asked to set financial goals and were not given calendars. As a consequence, the impacts of the goal setting intervention that we measure represent the combined effect of both the target dates and the provision of free calendars to respondents.

2.3. Financial Counseling

Our third treatment, financial counseling, consisted of one-on-one instruction and individualized advice, carried out free of charge at the participant's home. Specifically, skilled financial counselors — trained rigorously by the Center for Microfinance, our research partner in India — guided participants on money management depending on their specific needs. For example, counselors assisted respondents in preparing a budget, gathering documents for opening a bank account, or contacting an insurance provider. This counseling treatment was offered to a randomly selected half of subjects in the financial education group, orthogonally to goal setting. Shortly after goal setting treatment and control activities were completed, all subjects assigned to counseling received one household visit per month from the counselor for four months. Beyond these monthly visits, counseling services were primarily demand-driven; more frequent counseling meetings were available at the respondent's request.

2.4. Summary Statistics

The data in this study come from two household surveys: first, a baseline survey before the start of the interventions, and second, an endline survey almost ten months after the final session of the video-based education program. To accommodate the large number of respondents, the sample was split into separate waves. Respondents were drawn from various neighborhoods ("chalis") that were mutually exclusive across waves, and all treatments were stratified based on the respondent's gender, neighborhood, and whether he or she is currently a microfinance client. Attrition between baseline and endline is quite low at only 6% and is uncorrelated with treatment.

Table 1 outlines our study sample (N = 959) as well as the proportion of respondents assigned to each treatment combination.[6] As can be seen in the table, 18% were allocated to receive only

[6] In comparison to Carpena et al. (2017), the sample we use for this study contains fewer observations because we focus on the set of respondents for which we have endline measures of financial numeracy, awareness, and attitudes.

financial education; 15% to financial education and goal setting (but not counseling); 16% to financial education and counseling (but not goal setting); and 17% to all three treatments. The remaining 33% serve as control and were assigned to watch health education videos. Across both treatment and control, take-up of the education program was quite high; both financial and health training sessions received nearly 100% attendance for the duration of the five-week program.

Next, Table 2 presents baseline summary statistics for our sample. Households comprised six members on average, with a mean monthly income of Rs. 6892 (US$ 118). Sixty percent of the respondents were female, and very few (i.e., 4%) completed secondary school. About half were members of a microfinance organization, yet, almost everyone in our sample (i.e., 95%) reported having difficulty saving. Additionally, we evaluated computational skills using eight simple math and questions as well as financial knowledge using the "Big Three" Lusardi and Mitchell (2009) questions. On average, our sample scored just over 50%on both of these measures.

To better understand the preferences of our study subjects, we also measured discount rates and risk aversion. Discount rates were assessed in a standard manner, by asking respondents to provide the minimum amount they would be willing to hypothetically accept in one month in lieu of a hypothetical payment of Rs. 350 today. Respondents in our sample reported relatively high monthly discount rates: the median was 0.14, while the average was 1.40. We then measured risk aversion by allowing respondents to choose between a payment of Rs. 10 with certainty or playing a lottery that pays out Rs. 25 or Rs. 0 with equal probability. Sixteen percent of our sample chose the safe payment, and these respondents were coded as risk averse.

Finally, the p-values in Table 2, Column 4 report the statistical significance of a joint test for the difference between the means across all treatments including the control group. As the table shows, the p-values are fairly large, suggesting no significant difference across the treatments in baseline measures. Only one baseline characteristic — namely, an indicator variable for whether the respondent has inconsistent time preferences — exhibits imbalance across treatments. We include this variable as a control in all regression specifications.

3. Measuring Financial Knowledge

Because this study endeavors to investigate the role of financial knowledge as a mediator, a critical ingredient lies in measuring financial knowledge. Financial knowledge is typically assessed through survey questions designed to capture respondents' understanding of financial basics as well as their capability in applying financial concepts to financial decisions. Currently, the standard measurement approach is based on a set of three questions developed by Lusardi and Mitchell (2009), which cover interest rates, inflation, and diversification.[7] These "Big Three" questions

These questions were added only in Waves 2 to 4 of the study. Hence, the study sample in this paper consists of respondents from Waves 2 to 4, whereas the sample in Carpena et al. (2017) uses all four waves.

[7] The financial literacy questions developed by Lusardi and Mitchell (2009) are the following: (1) 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

have been implemented in a number of developed countries around the world, including Italy, Germany, Netherlands, USA, and they have been shown to be strong predictors of improved financial outcomes. They have likewise been used in many emerging markets, such as Indonesia, India, Sri Lanka, and Mexico.

Despite the ubiquity of the "Big Three" questions, they are not necessarily comprehensive nor appropriate in many settings. Indeed, Lusardi and Mitchell (2009) themselves write that it is "imperative to expand the range of measures of financial literacy, so as to better evaluate the types of problems that people find most difficult" (p. 6). Developing countries in particular possess many characteristics — among others, high poverty, low access to finance, and lack of consumer finance protections — that are necessary to consider when measuring financial knowledge (Holzmann, 2010). For instance, if most households are uneducated and hold informal savings, it may be more important to evaluate understanding of bank account opening requirements than savings returns computations. Thus, the notion of financial literacy should be extended, especially in the developing country context.

To this end, we propose a broader approach to assessing financial literacy. Our conceptualization of financial knowledge focuses not on specific topics as the "Big Three" does, but rather on three general and distinct *dimensions*. The first dimension we measure is financial *numeracy*, which concerns the ability to add income and expenses, determine interest rates, and similar calculations. In particular, as part of our endline survey, we asked respondents the following two questions.

(1) Let's assume that you deposited Rs. 10,000 in a bank account at an 8% monthly interest rate. How much money will you have in your account in one year if you do not withdraw from or add to this account any money? (a) More than 10,800; (b) Less than 10,800; (c) Exactly 10,800.

(2) Suppose you had Rs. 50 to save. You could either save this for 1 month in an account which earns 14% interest per month or save it for 1 month in an account that earns 2% interest per week. Which would you choose? (a) 14% per month; (b) 2% per week.

Such quantitative skills play an important role not only in selecting optimal financial products, but likewise in navigating one's day-to-day personal financial situation. As evidenced in the above two questions, financial *numeracy* encompasses whether the respondent can reason with numbers and whether they can use elementary arithmetic to solve financial problems.

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would have in the account if you left the money to grow: more than $102, exactly $102, or less than $102?, (2) Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?, (3) Do you think that the following statement is true or false? "Buying a single company stock usually provides a safer return than a stock mutual fund."

The second dimension of financial knowledge we introduce is what we refer to as financial *awareness.* In comparison to financial numeracy which deals mathematics-related questions, financial awareness emphasizes knowledge about fundamental financial planning tools as well as the details of basic financial products and services. We capture this type of knowledge through the following four questions in our endline survey.

(1) Shantiben is preparing a budget for her household. Which of the following needs to be included in the budget? (a) Income only; (b) Expenses only; (c) Income and expenses.

(2) Do you think you can open a savings account in a bank with amount as low as Rs 50? (a) Can open an account; (b) Cannot open an account.

(3) If I have a savings account in a bank and the bank closes down for some reason, will I get my money back? (a) Will get my money back; (b) Will not get my money back.

(4) Manojbhai recently borrowed some money from a local moneylender. He wanted to buy some clothes for his children for Diwali (festival). What do you think about Manojbhai's loan? (a) It is a productive loan; (b) It is an unproductive loan.

Notably, financial awareness does not involve any calculations. Instead, it relates to whether individuals are familiar with the different parts of a household budget, bank account opening requirements or deposit insurance in their local context, and the use of loans for productive purposes. Financial awareness may therefore be regarded as a simpler and more rudimentary form of financial knowledge than financial numeracy.

The third dimension we implement is financial *attitudes,* which involve the individual's perspectives about the benefits of financial products. We consider financial attitudes as an important element of financial literacy because it has serious implications for financial outcomes: for instance, if an individual holds a negative attitude towards savings, then s/he will be less inclined to set money aside for the future. To assess financial attitudes, our endline survey presented households with the following three questions.

(1) Rameshbhai does plastering on tall buildings. It is a dangerous job and he is worried that if he gets injured his family's income will become inadequate to meet their needs. If Rameshbhai comes to you for advice what would you suggest? (a) Take up some other (different) work; (b) Purchase health/life/accident insurance; (c) Increase savings.

(2) Vimlaben has a very bright child who is currently in secondary school but will probably do well in university. She is worried how her family will pay for the child's education. If Vimlaben comes to you for advice what would you suggest? (a) Buy child life insurance

policy; (b) Borrow money from a moneylender; (c) Open a savings account in a bank; (d) Save at home; (e) Discontinue education.

(3) Do you think making a budget is helpful? (a) Yes, (b) No.

Conceptualizing financial literacy into the above three dimensions allows us to explore which aspects of financial knowledge causally mediate impacts on endline financial behaviors. In the next section, we turn to a detailed description of our empirical method for identifying causal mediation effects.

4. Empirical Method

Our empirical approach consists of two components. In the first component, we measure average treatment effects (ATE) on household financial outcomes as in Carpena et al. (2017). Specifically, we employ the intent-to-treat estimator, and we conduct the ATE analysis using separate regressions that compare each treatment arm against the control arm. Then, in the second step, we implement causal mediation analysis.

4.1. Estimating Average Treatment Effects

Our experimental design with random assignment enables us to isolate the ATE in a straightforward manner. That is, we estimate the linear regression

$$Y_i = \alpha_1 + \beta_1 T_i + \xi_1^T \boldsymbol{X}_i + \epsilon_{1i} \quad (1)$$

where T_i is a dummy variable equal to 1 if individual i was randomly assigned to the treatment group, and 0 if she was assigned to the control group. We implement equation (1) separately for four different types of treatment variables T_i, as follows: (i) financial education only; (ii) financial education and goal setting; (iii) financial education and counseling; and (iv) all three of financial education, goal setting, and counseling. $\boldsymbol{X}_i$ represents stratification controls as well as a dummy for whether the respondent has inconsistent time preferences, which indicated imbalance at baseline. Strata are defined by gender, whether the respondent is currently a microfinance client, and neighborhood. Note that since neighborhoods were mutually exclusive across waves, we do not add wave fixed effects. Standard errors are clustered at the wave-class level.

For outcome variables Y_i, we use data from the endline which collected information on respondents' financial knowledge as well as their financial behavior. The financial behaviors we examine cover budgeting (i.e., whether the household has tried making a budget in the last six months); savings, (i.e., whether the household has a savings account); borrowing (i.e., whether, conditional on borrowing in the last six months, the loan was for productive purposes); and insurance (i.e., whether the household has purchased life insurance in the last six months). We chose these outcomes because as shown in Carpena et al. (2017), they exhibit statistically

significant ATEs which are necessary for causal mediation analysis. Indeed, it is difficult to think of causal mediation effects when the treatment itself does not impact outcomes.

4.2. Causal Mediation Analysis

The principal aim of this paper is to go beyond the ATE and to quantify the effect of the treatment that operates through a particular channel. That is, we focus on the causal mechanism by which the treatment *T* causally affects outcomes *Y* through a mediator variable *M.* In our analysis, we consider three mediator variables corresponding to three different dimensions of financial knowledge, namely, numeracy, awareness, and attitudes. Our goal then is to decompose the ATE into an indirect effect (which represents a particular mechanism) and a direct effect (which represents all other channels).

Decomposing the ATE to study the effect of mechanisms is not trivial. As Green, Ha, and Bullock (2010) point out, conventional regression approaches to isolate causal mechanisms that have been used in different fields — such as political science, psychology, and public health — all rely on strong and often implausible identification assumptions. Moreover, in the presence of confounding variables that are influenced by treatment and affect both the mediator and the outcome, conditioning on the mediator can lead to spurious effects (Rosenbaum, 1984). As a result, such an analysis suffers from bias and loses causal inference, even in experimental studies.

Recent developments in causal mediation analysis takes these intermediate variable bias concerns seriously, and several papers have presented new estimation methods to isolate the influence of a mediating variable (e.g., Imai et al., 2011; Acharya, Blackwell, and Sen, 2016). The common thread among these methods is that they focus on issues of estimation as well as clarifying the identification assumptions that underlie mediation analysis. For our study, we apply two leading approaches to causal mediation, which we describe below.

4.2.1. Estimating Average Causal Mediation Effects

While the experimental design allows us to obtain the ATE, it does not by itself offer possibilities for capturing the mechanisms underlying the change in financial outcomes. To this end, our first approach adopts the causal mediation analysis proposed in Imai et al. (2011) and Imai, Keele, and Yamamoto (2010). We start by defining the *indirect effect* or the *causal mediation effect* as:

$$\delta_i(t) \equiv Y_i\big(t, M_i(1)\big) - Y_i\big(t, M_i(0)\big) \tag{2}$$

where $M_i(1)$ and $M_i(0)$ represent the potential value of the mediator when individual *i* is assigned to the treatment and control group, respectively. As shown in equation (2), $\delta_i(t)$ amounts to the change in Y_i due to the change in M_i from the control to the treatment group, holding the individual's treatment status constant at *t*. This quantity captures the effect of the treatment on the outcome via the mediating variable: since we fix the treatment and change only the mediator, $\delta_i(t)$

isolates the impact of the variable M from all other channels. Further, equation (2) indicates that if the treatment has no effect on the mediator so that $M_i(1) = M_i(0)$, then $\delta_i(t)$ is zero.

Next, the *direct effect* (DE) of the treatment encompasses all other mechanisms and is given by:

$$\zeta_i(t) \equiv Y_i\big(1, M_i(t)\big) - Y_i\big(0, M_i(t)\big). \tag{3}$$

Equation (3) shows that $\zeta_i(t)$ equals the impact of the treatment that is not coming from the mediator. In this sense, $\zeta_i(t)$ is the portion of the treatment effect that remains after the indirect effect $\delta_i(t)$ is accounted for, and the treatment effect is the sum of the direct effect and the indirect effect. For our analysis, we are primarily interested in the *Average Causal Mediation Effect (ACME),* $\bar{\delta}(t)$*,* and the *Average Direct Effect (ADE)*, $\bar{\zeta}(t)$. As in the ATE, these averages are obtained by taking the expected value over all individuals *i*.[8]

Following the formal definitions of the ACME and the ADE, an outstanding question is how these parameters may be identified empirically. Our randomized experiment allows us to estimate the ATE, but it is not sufficient for estimating the ACME and the ADE because the potential outcomes required for the computations in equations (2) and (3) above are never observable. In particular, although we know the values of $Y_i\big(1, M_i(1)\big)$ for the treatment group and $Y_i\big(0, M_i(0)\big)$ for the control group (i.e., the two elements necessary for calculating the ATE), we observe neither $Y_i\big(1, M_i(0)\big)$ among the treatment group nor $Y_i\big(0, M_i(1)\big)$ among the control group.

To identify the ACME and ADE, we follow Imai, Keele, and Yamamoto (2010) and impose a set of two assumptions which are collectively referred to as *sequential ignorability*.[9] The first assumption is that conditional on baseline characteristics, treatment assignment is ignorable, i.e., it is independent of potential outcomes and potential mediators. This assumption is also known as no omitted variables bias or unconfoundedness. Moreover, in our study, this assumption holds because all treatments are randomly assigned.

The second assumption is that conditional on the actual treatment status and baseline characteristics, the observed mediator is ignorable. Mathematically, this statement is expressed as

$$Y_i(t', m) \perp M_i(t) | \, T_i = t, X_i = x. \tag{4}$$

[8] Specifically, the ACME is $\bar{\delta}(t) \equiv E[Y_i\big(t, M_i(1)\big) - Y_i\big(t, M_i(0)\big)]$, the ADE is $\bar{\zeta}(t) \equiv E[Y_i\big(1, M_i(t)\big) - Y_i\big(0, M_i(t)\big)]$, and the ATE is $\bar{\tau} \equiv E[Y_i\big(1, M_i(1)\big) - Y_i\big(0, M_i(0)\big)]$.

[9] Imai, Keele, and Yamamoto (2010) call these two assumptions sequential ignorability because two ignorability assumptions are made sequentially: in the first step, it is assumed that treatment is ignorable and in the second step, it is assumed that the mediator is ignorable given the actual treatment status and baseline characteristics.

In other words, Equation (4) says that the observed mediator is statistically independent of the potential outcome, given the individual's treatment assignment and pre-treatment covariates. This assumption will be violated if there are any unobservables that affect both the mediator and the outcome variable. For example, if it is the case that: (i) respondents who have higher innate ability also have both higher financial awareness (M) and better savings outcomes (Y), and (ii) ability affects savings through channels other than financial awareness, then the assumption will not hold. Hence, the assumption embodied in Equation (4) is a very strong one, and in Section 6 we explore the robustness of our results to this assumption through sensitivity analysis.

But as Imai, Keele, and Yamamoto (2010) show, the upside for making this strong assumption is that it becomes possible to consistently estimate the ACME and ADE without any additional distributional or functional form assumptions regarding the mediatior or outcome variables. Specifically, we separately estimate the following two linear regression models:

$$M_i = \alpha_2 + \beta_2 T_i + \xi_2^T \boldsymbol{X}_i + \epsilon_{i2} \tag{5}$$

$$Y_i = \alpha_3 + \beta_3 T_i + \gamma M_i + \xi_3^T \boldsymbol{X}_i + \epsilon_{i3}. \tag{6}$$

The ACME is then given by the product of the ordinary least squares (OLS) estimates $\hat{\beta}_2 \cdot \hat{\gamma}$ from equations (5) and (6) above,[10] while the ADE is equal to $\hat{\beta}_3$ from equation (6). Importantly, Imai, Keele, and Yamamoto (2010) prove that $\hat{\beta}_2 \cdot \hat{\gamma}$ is a valid estimate of ACME under the sequential ignorability assumption.[11] Standard errors and confidence intervals for the ACME are obtained using a quasi-Bayesian Monte Carlo approximation (King, Tomz, and Wittenberg 2000) based on the implementation by Hicks and Tingley (2011).

In practice, we estimate Equations (5) and (6) using four different types of treatment variables T_i as described earlier in Section 4.2 (i.e., financial education only; financial education and goal setting; financial education and counseling; and all three treatments). We also consider three different types of mediating variables M_i (i.e., financial numeracy, financial awareness and financial attitudes. Furthermore, the regression in Equations (5) and (6) are estimated using the same sample, which as in the estimation of ATEs, consist of those respondents belonging to the control group and the particular treatment group represented by T_i.

Finally, we employ the sensitivity analysis proposed by Imai, Keele, and Yamamoto (2010) and Imai, Keele and Tingley (2010). Although the sequential ignorability assumption cannot be tested directly, the sensitivity analysis allows us to understand how the ACME would change for different degrees of violation of Equation (4). The sequential ignorability assumption implies that the

[10] An equivalent method is to take ACME = $\hat{\beta}_1 - \hat{\beta}_3$, where the $\hat{\beta}_1$ comes from the OLS regression of equation (1).
[11] In addition, linearity and the no-interaction assumption (i.e., $\bar{\delta}(1) = \bar{\delta}(0)$) must also hold.

correlation between the error terms ϵ_{i2} from Equation (5) and ϵ_{i3} from Equation (6) would be zero. Conversely, non-zero values of this correlation, which we denote as ρ, would imply that sequential ignorability has been violated.

To illustrate the sensitivty analysis, consider a setting where an individual's innate ability results in higher financial awareness (M) and likewise better savings (Y). This leads to $\rho > 0$, and as a consequence of the non-zero correlation between ϵ_{i2} and ϵ_{i3}, the estimate of the ACME will be biased. Thus, ρ serves as the sensitivity parameter, where the larger values of ρ in absolute terms result in larger bias in the ACME. The sensitivity analysis relaxes the condition that $\rho = 0$ and then estimates Equations (6) and (7) for different values of ρ. With these estimates, we then show the graphical plot of a given value of ρ against the true ACME. Doing so allows us to quantify the degree of sensitivity by looking at how large ρ must be for the mediation effect to be insignificant.

4.2.2 Sequential g-Estimation

The second method for mediation analysis that we employ is the sequential g-estimator as described in Acharya, Blackwell, and Sen (2016). This method is concerned with isolating the *controlled direct effect (CDE)*, defined as follows

$$CDE = Y_i(1, m) - Y_i(0, m). \tag{8}$$

Note that the difference between the CDE above and the DE in equation (3) is that in the former, the mediator is held constant at the same value *m* for all units, while in the latter, the mediator is held constant at an individual-specific value. In addition, the CDE is identified under weaker assumptions than the DE. As before, we estimate the average of the CDE, defined as $ACDE = E[Y_i(1, m) - Y_i(0, m)]$.

To obtain the ACDE, we follow the procedure outlined in Acharya, Blackwell, and Sen (2016), which consists of three steps. The first step is to regress the outcome on the mediator, treatment, and control variables. Specifically, we estimate the regression which corresponds to equation (6).

In the second step, we "demediate" the outcome *Y* using the estimate of γ from the previous regression. In other words, we obtain $\widetilde{Y}_i$ which is defined as

$$\widetilde{Y}_i = Y_i - \hat{\gamma} M_i. \tag{9}$$

Intuitively, by "demediating" the outcome and removing the effect of the mediator *M,* the variation that is left over in *Y* is due to the direct effect of the treatment.

In the third and final step, we regress $\widetilde{Y}_i$ on the treatment and the control variables, as follows:

$$\widetilde{Y}_i = \alpha_4 + \beta_4 T_i + \xi_4^T \boldsymbol{X}_i + \epsilon_{i4} \quad (10)$$

where the coefficient β_4 gives us an estimate of the ACDE.

To estimate the ACDE in this way, three identifying assumptions are necessary: no confounders for the effect of the treatment on the outcome, conditional on baseline characteristics; no confounders for the effect of the mediator on the outcome, conditional on the treatment, baseline characteristics, and intermediate variables (i.e., variables that are affected by the treatment and impact both the mediator and the outcome); the effect of the mediator on the outcome is independent of intermediate variables. Here, the former two assumptions are sufficient for identifying the ACDE, while the latter assumption is an additional modeling assumption that is necessary to estimate the ACDE in finite samples using sequential *g*-estimation.

Subtracting the ACDE from the ATE provides insights on the role of the mediator as a causal mechanism for the treatment effect. More specifically, as described in Acharya, Blackwell, and Sen (2016), the ATE can be decomposed into the three parts: (1) the ACDE, (2) the ACME as in Imai et al. (2011), and (3) an interaction effect between the mediator and the treatment, which represents how much of the direct effect depends on the mediator.[12] Putting this decomposition together with that of Imai et al. (2011), we can see that ADE + ACME = ACDE + ACME + interaction. Hence, although the approach in Acharya, Blackwell, and Sen (2016) is concerned with estimating the ACDE — a direct effect that is defined differently from the ADE as in Imai et al. (2011) — the ACDE and the ADE are equivalent if the interaction effect is zero. If this is the case, we can recover the ACME using sequential *g*-estimation by subtracting the ACDE from the ATE. We then calculate standard errors for both the ACDE and the ACME using bootstrapping.

5. Empirical Results

5.1 Average Treatment Effects

As a point of departure, we present ATE estimates using the specification described in Equation 1. The results are shown in Table 3, which includes the four main financial behaviors targeted by the financial education curriculum: budgeting, savings, loans, and insurance. Specifically, the outcome variables in Table 3 are dummy variables for whether the respondent tried to write a budget in the past 6 months (Column 1); whether the household has a savings account (Column 2); whether, conditional on borrowing in the past 6 months, the loan was obtained for productive purposes such as business, education, or durable goods (Column 3); and whether the household purchased life insurance in the last 6 months (Column 4). Demonstrating the ATEs for these behaviors is a necessary first step in our study, given that in the causal mediation analysis below, we focus only on those financial outcomes for which the interventions had a statistically significant effect.

[12] As explained in Acharya, Blackwell, and Sen (2016), if the mediator is a binary variable, then the interaction effect can be expressed as $E[M_i(0)] * \big[\big(Y_i(1,1) - Y_i(0,1)\big) - \big(Y_i(1,0) - Y_i(0,0)\big)\big]$.

The results in Table 3 indicate that providing financial education alone is not a panacea for changing households' financial behavior. We find that the effects of the financial education only intervention on savings, borrowing, and insurance outcomes are all statistically insignificant, with magnitudes that are all very close to zero (Table 3, Panel A, Columns 2 to 4). Nevertheless, the financial education only treatment does foster better budgeting outcomes: individuals assigned to financial education classes are 13.6% more likely than the control group to have written a budget in the past 6 months (Table 3, Panel A, Column 1). Since the control group average for this variable is only 15.5%, the treatment coefficient represents a sizable improvement in the respondents' propensity to start writing a household budget.

Despite the limited scope of financial education alone in influencing financial outcomes, we find that complementing it with individualized add-ons results in substantial positive effects. We see that adding goal setting to financial education leads to a 16.6% and 8.1% increase compared to the control group in the likelihood of making a budget and opening a savings account, respectively (Table 3, Panel B, Columns 1 and 2). Augmenting financial education with counseling shows even stronger treatment effects, with a 40.2% rise in the propensity of making a budget, 16.7% of having a savings account, 16.7% of borrowing for productive purposes, and 4.5% of buying life insurance (Table 3, Panel C, Columns 1 to 4). Furthermore, the combination of all three treatments together exhibit positive effects of 47.2% for budgeting, 10% for savings, and 3.9% for insurance (Table 3, Panel D, Columns 1,2, and 4).

Since this paper aims to investigate financial knowledge as a mechanism for financial education, we likewise examine the ATEs of the interventions on financial knowledge scores as measured through a series of questions at endline. This analysis is presented in Table 4, where the outcome variables are the scores for financial numeracy (Column 1), awareness (Column 2), and attitudes (Column 3). These scores are based on the proportion of correct answers in each of the financial knowledge dimensions. Our estimates show that none of the treatments have any significant effect on numeracy skills. However, all four treatment combinations have statistically significant positive impacts on both awareness and attitudes. The magnitude of these effects is non-trivial: compared to the control group average of 67% and 73%, financial awareness improves by as much as 15.1% and financial attitudes by up to 14.5%, respectively.

5.2 Mediating Effects of Financial Numeracy, Awareness, and Attitudes

Having described the ATEs of our experimental interventions, we now consider the principal question of interest in this paper: how do the different dimensions of financial knowledge mediate the impact of financial education programs? We examine this question in Tables 5 to 8, where we present causal mediation analysis results using the approach outlined above in Section 4.2.1. In each of the tables, we focus on one specific experimental intervention as well as the household financial outcomes for which that intervention had statistically significant ATEs. Panel A then reports the coefficients from estimating Equation 6, while Panel B presents the estimates for the

ACME and the ADE. In Appendix Tables 1 to 4, we repeat the same analysis using sequential g-estimation (explained earlier in Section 4.2.2) and obtain nearly identical quantitative results. Hence, for the rest of this paper, we focus on discussing the estimates in Tables 5 to 8.

Our results reveal four notable patterns that shed light on the role of numeracy, awareness, and attitudes as mechanisms between financial education and financial outcomes. First, consistent with the nil ATEs on numeracy knowledge scores, we find that numeracy does not serve as a mediator for financial education in any way. For instance, the ACME of numeracy in Table 5, Column 1 is very close to zero, indicating that none of the positive impacts of the financial education only treatment on budgeting is channeled through numeracy. This pattern of zero ACME for numeracy persists in all financial education interventions and all household financial outcomes that we study — that is, whether we consider financial education augmented with goal setting vis-à-vis budgeting or savings outcomes (Table 6, Columns 1 and 4); financial education with counseling vis-à-vis budgeting, savings, loans, or insurance (Table 7, Columns 1, 4, 7, and 10); and all three treatments vis-à-vis budgeting, savings, or insurance (Table 8, Columns 1, 4, and 7). Importantly, the null ACME of numeracy are estimated relatively precisely, as that the confidence intervals are all tightly centered around zero.

Second, notwithstanding the zero ACMEs of numeracy, we observe that across all treatment combinations, the mediating effects of both attitudes and awareness on budgeting are large, positive, and highly statistically significant. Specifically, Table 5, Column 2 show an ACME of 2.7 percentage points for awareness and 2.5 percentage points for attitudes, both statistically significant at the 1% level. These ACMEs amount to 20% and 18% of the ATE of the financial education only intervention on budgeting, respectively. Moreover, we find similar results when we examine the ACMEs for the rest of the treatments. For example, in the intervention involving financial education counseling, 7% of the ATE on budgeting operates through awareness, while 9% through attitudes (Table 7, Columns 2 and 3). Notably, for all variants of financial education treatments in our study, we cannot statistically distinguish the ACME of awareness on budgeting from that attitudes.[13] Thus, our estimates suggest that both financial awareness and attitudes are equally important for improvements in budgeting behavior.

Third, whereas awareness and attitudes function similarly in fostering household *budgeting*, there are important differences in how they mediate household *savings*. In particular, we find that only attitudes (and not awareness) mediates the impact of financial education on savings outcomes. This is true for all variants of the treatments. Depending on the intervention, our estimates show an ACME of attitudes on savings ranging from 2 to 3.4 percentage points, corresponding to mediating 12 to 34% of the ATE (Table 5, Column 3; Table 6 to 8, Column 6). In contrast, the ACME of awareness on budgeting is almost zero and is statistically insignificant in all treatments (Table 5,

[13] In particular, across the estimates in Tables 5 to 8, the differences in the ACME of awareness and attitudes all have 95% confidence intervals that contain zero.

Column 2; Tables 6 to 8, Column 5). These results suggest that simply increasing individuals' awareness about savings account opening requirements or deposit insurance does not enable them to undertake the complex financial action of opening a savings account. Our findings therefore point to the importance of changing attitudes and perceptions about financial products as a mechanism of impact, particularly for financial education provision to more effectively induce poor households to start a savings account.

Finally, we find is that none of our three dimensions of financial knowledge causally mediate effects on borrowing and insurance behavior. One the one hand, the two most intensive interventions — financial education with counseling (which provides one-on-one financial advice) and the combination of all three treatments (which includes financial education, counseling, and goal setting) — had significant positive ATEs on whether the respondent took out a loan for productive purchases or purchased life insurance. On the other hand, the ACME for numeracy, awareness, and attitudes are all close to zero and statistically insignificant (Table 7, Columns 7 to 12; Table 8, Columns 7 to 9). Consequently, the impacts of the treatments on borrowing and insurance are likely mediated through pathways other financial knowledge. Indeed, our results suggest that borrowing and insurance behavior are quite difficult to influence using financial education, as the magnitude of their ATEs for such outcomes are much smaller in absolute terms relative to budgeting and savings.

5.3 Discussion

Amid the ongoing research and policy debate on the merits of financial education programs, our analysis shows that for financial education to effectively impact financial outcomes through knowledge gains, two links in the causal chain must be operative. The first link is that financial education must increase financial knowledge, and our results point to a broader measure for how the former impacts the latter. We highlight financial literacy not as a singular concept, but rather one that involves multiple dimensions: numeracy, awareness, and attitudes. In a setting with low-income participants in a developing country, we find that financial education affects financial knowledge through avenues other than numeracy, by improving understanding of basic financial concepts and beliefs in the value of financial planning. Notably, these seemingly small advances are important mediators that encourage poor consumers to improve their finances. Hence, our results call for measuring financial knowledge using a combination of awareness and attitudinal assessments, and our study provides a starting list for such questions to complement existing measures.

The second step in the causal chain is that financial literacy in turn must translate into improved financial behavior. In particular, our study identifies the particular facets of financial knowledge that serve as mechanisms in this causal link. We find that for *simple* financial actions such as attempting to write a household budget, both awareness and attitudes are equally critical, but for more *complex* financial actions, such as opening a savings account, attitudes play a more meaningful mediating role. Results from the open-ended questions in our survey likewise support

the view that the main hindrance subjects faced in opening a bank account is not awareness, but rather attitudes. For instance, respondents at endline stated one of the reasons they are trying to save more money now is because they realized the value and importance of savings. Therefore, the financial education treatments operate by increasing positive perceptions about personal finance, consistent with our finding that the ACME for attitudes is much larger than that of awareness for savings outcomes.

The substantial role of attitudes for simple financials actions and awareness for complex ones suggests that higher and cumulative levels of learning may be necessary to encourage sophisticated financial behaviors. This may be the case because building financial awareness centers on merely supplying respondents with information (e.g., required deposits for opening a bank account), while building financial attitudes concentrates on providing guidance that facilitates the internalization of that knowledge into one's everyday life. Our ACME estimates support this view: we find a cumulative mediation channel for financial attitudes in that a stronger treatment results in higher mediation effects. In other words, when financial education is combined with either counseling or goal setting, the ACME of attitudes on savings outcomes is similar at 2 percentage points each. In contrast, when providing financial education with both counseling and goal setting, the ACME of attitudes increases to 3.4 percentage points, a change of 70%. Interestingly, this pattern likewise indicates potential complementarities between counseling and goal setting, such that a more comprehensive treatment increases both the ATEs and the mediating efficacy of financial attitudes.

6. Robustness

The empirical results in the previous section demonstrate that both financial awareness and attitudes are important mediators for the impact of financial education, goal setting, and counseling on households' financial behavior. Nevertheless, the validity of these findings depends on the assumption that the mediators are ignorable, conditional on baseline characteristics and the treatment assignment. This assumption is quite strong because it is unlikely that respondents' levels of awareness of and attitudes towards personal finance are random: for instance, it may be that those who have better financial awareness and attitudes also have higher unobserved ability. If unobserved ability influences financial outcomes through channels other than awareness and attitudes, then the assumption on the ignorability of the mediator will be violated, and the estimated ACME will be confounded with the impacts of unobservable characteristics.

To understand the robustness of our results to such biases, we conduct sensitivity analysis as follows. Under the sequential ignorability assumption, the correlation between the error terms in Equations 5 and 6 (denoted ρ) is equal to zero. We relax the condition that $\rho = 0$ by specifying hypothetical values of ρ, and then we estimate the ACME from Equations 5 and 6 under these non-zero correlations. The results from this exercise are shown in Figures 1 to 4, where we provide plots of the ACME vs. ρ for the different combinations of treatment, awareness and attitudes mediators, and outcome variables from the main causal mediation analysis results. Here, the

connected line represents the ACME, while the shaded area shows the bootstrapped 95% confidence interval. Additionally, the ACME at the point where $\rho = 0$ corresponds to the ACME estimates shown in Tables 5 to 8.

The results of the sensitivity analysis tell us how large ρ must be for the mediation effect to be zero. If this value of ρ is small and our ACME estimate is statistically significant, then even small violations in the sequential ignorability will change our conclusions. Conversely, the larger the value of ρ, the more robust the results are to unobserved confounders. Throughout Figures 1 to 4, we see that generally speaking, the results involving attitudes are much less sensitive than the results for awareness. For example, when we consider the budgeting outcome and the financial education only treatment, the value of ρ for which the ACME of awareness is zero is equal to 0.112, while that for attitudes is 0.231 (Figure 1). Similarly, for the same outcome variable but for the treatment with both financial education and counseling, the ACME of awareness and attitudes are zero when ρ equals 0.080 and 0.191, respectively (Figure 2, Panel A).

The analysis in Figure 1 to 4 allow us not only to quantify the degree of sensitivity, but likewise to understand the direction of the potential bias in our estimate of the ACME. Indeed, across all figures, we see that if the true ρ is less than 0, we would be underestimating the ACME, but if the true ρ is greater than 0, then we would overestimate the ACME. Note that the regression error ϵ_{i2} in Equation 5 captures factors that impact financial literacy other than the financial education treatments, while ϵ_{i3} in Equation 6 represents all other variables that impact financial outcomes that are not contained in financial literacy nor the financial education treatments. For instance, unobserved "ability" may be contained in both ϵ_{i2} and ϵ_{i3}, and intuition suggests that these two regression errors are potentially positively correlated.

To further investigate both the sign and the magnitude of the correlation between the error terms, we consider the sample analog of the errors, given that the population error terms are unobservable. In Figures 5 to 8, we show scatterplots of $\hat{\epsilon}_{i2}$ (i.e., the sample residual from the regression of the mediator on the treatment) in the x-axis and $\hat{\epsilon}_{i3}$ (i.e., the sample residual from the regression of the financial outcomes on the treatment and the mediator) in the y-axis. In these figures, the red line represents the fitted line from the bivariate linear regression of $\hat{\epsilon}_{i2}$ on $\hat{\epsilon}_{i3}$, thus indicating the correlation between the two. Importantly, all scatterplots demonstrate that the correlation between the sample regression residuals are all close to zero. These patterns support the validity of the sequential ignorability assumption, providing additional evidence for the robustness of our results.

7. Conclusion

In this paper, we employ a field experiment in India to investigate the causal mechanisms from financial education to financial outcomes. Whereas the most common method of measuring financial knowledge uses survey questions covering interest rates, inflation, and diversion, we conceptualize financial literacy into three broad components, namely, numeracy skills (e.g.,

calculating expenses), basic financial awareness (e.g., bank account opening requirements) and financial attitudes (e.g., beliefs in the benefits of financial products). We find that providing households with financial literacy training has no impact numeracy but has significant positive effects on awareness and attitudes. Our paper therefore highlights the need for a more comprehensive measure of financial knowledge, particularly in development settings where financial education beneficiaries may have low levels of schooling. Furthermore, we provide a field-tested set of such questions to supplement existing measures.

Using causal mediation analysis, we likewise show that numeracy does not mediate the treatment effects on any financial behaviors that we study, but awareness and attitudes serve as important channels for financial education. We find that both awareness and attitudes make up a substantial portion of the treatment effects on budgeting, a relatively simple financial action. However, for more complex financial activities, particularly opening a savings accounts, only attitudes play a mediating role and awareness accounts for none of the treatment effects. One reason why this may be the case is because building financial awareness is much less a cumulative exercise than building financial attitudes; that is, gaining information about the parts of a budget and bank account opening requirements is a one-off event. Understanding how these patterns of causal mediation change over time remains an important avenue for future research, especially if individuals' financial attitudes evolve further as they gain more experience with financial products.

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Table 1: Experimental Design

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

Notes: This table describes the randomization across the various treatments. The total sample consists of 959 respondents to whom knowledge questions on financial literacy (i.e., financial numeracy, financial awareness, and financial attitudes) were administered both at endline.

Table 2: Baseline Summary Statistics

	Median	Mean	Standard Deviation	Test of Joint Equality of Means Across All Treatments (F-test p-value)
Household size	5.00	5.71	2.42	0.27
Household monthly income (Rs.)	5500.00	6892.01	5878.08	0.39
Household monthly income per capita (Rs.)	1026.79	1280.61	980.71	0.41
Household has phone		0.84		0.89
Household has water connection		0.76		0.76
Household has non-farm enterprise		0.25		0.96
Respondent is Female		0.60		
Respondent is Hindu		0.79		0.922
Respondent has completed secondary school		0.04		0.585
Respondent is microfinance client		0.49		
Respondent has hard time saving		0.95		0.719
Respondent is interested in financial matters		0.87		0.949
Respondent has inconsistent time preferences		0.45		0.082*
Respondent monthly discount rate	0.14	1.40	4.45	0.669
Respondent is risk averse		0.16		0.824
Respondent math score (out of 8)	5.00	4.73	2.05	0.558
Respondent financial knowledge score (out of 3)	2.00	1.58	0.62	0.181

Notes: This table provides baseline summary statistics for our sample. The last column the p-value of the F-test of joint significance across all treatment coefficients in regressions of the baseline characteristics on treatment dummies. The four treatments consist of: (1) financial education video only; (2) financial education video and goal setting; (3) financial education video and counseling; and (4) financial education video, goal setting, and counseling. The regression specification in the last column also control for strata dummies, where strata are defined by gender, location, and whether the household was an MFI client. Standard errors are clustered at the wave-class level. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level.

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

Notes: This table presents regressions estimating the Average Treatment Effects (ATE) on household budgeting and savings outcomes. Each panel refers to a different treatment. *Financial Education Only* is a dummy equal to 1 for an individual who was invited to the financial education classes but did not receive either financial counseling or goal setting. *Financial Education and Goal Setting* is a dummy equal to 1 for an individual who received the financial education and goal setting treatments, but not the financial counseling treatment. *Financial Education and Financial Counseling* is a dummy equal to 1 for an individual who received the financial education and counseling treatments, but not the goal setting treatment. *All Three Treatments* is a dummy equal to 1 for an individual who received all three (i.e., financial education, financial counseling, and goal setting treatments). In each panel, the regression sample consists of the control group and those individuals who received the particular treatment. For example, in Panel A, the regression sample consists of those who received the *Financial Education Only* treatment and those who were assigned to control. All regressions include baseline control variables (i.e., completed secondary education and has inconsistent time preferences dummies) as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors are clustered at the wave-class level. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level

Table 4: Effects on Financial Knowledge

	Financial Numeracy (1)	Financial Awareness (2)	Financial Attitudes (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

Notes: This table presents regressions estimating the effect of the various treatments on the mediator variables, which capture three different facets of financial knowledge. Each panel refers to a different treatment. *Financial Education Only* is a dummy equal to 1 for an individual who was invited to the financial education classes but did not receive either financial counseling or goal setting. *Financial Education and Goal Setting* is a dummy equal to 1 for an individual who received the financial education and goal setting treatments, but not the financial counseling treatment. *Financial Education and Financial Counseling* is a dummy equal to 1 for an individual who received the financial education and counseling treatments, but not the goal setting treatment. *All Three Treatments* is a dummy equal to 1 for an individual who received all three (i.e., financial education, financial counseling, and goal setting treatments). In each panel, the regression sample consists of the control group and those individuals who received the particular treatment. For example, in Panel A, the regression sample consists of those who received the *Financial Education Only* treatment and those who were assigned to control. All regressions include baseline control variables (i.e., completed secondary education and has inconsistent time preferences dummies) as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors are clustered at the wave-class level. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level.

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%

Notes: This table presents estimates the Average Causal Mediation Effect (ACME) and the Average Direct Effect (ADE) of the *Financial Education Only* treatment. The mediator variables considered are financial numeracy (column 1), financial awareness (column 2), and financial attitudes (column 3). *Financial Education Only* is a dummy equal to 1 for an individual who was invited to the financial education classes but did not receive either financial counseling or goal setting. In Panel B, the ADE is replicated from the coefficient estimate of the treatment variable in Panel A, and the ATE is replicated from the coefficient estimate of the treatment variable from Table 3. In all regressions, the sample consists of the control group and those individuals who received the *Financial Education Only* treatment. All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors are clustered at the wave-class level. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level.

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%

Notes: This table presents estimates the Average Causal Mediation Effect (ACME) and the Average Direct Effect (ADE) of the *Financial Education and Goal Setting* treatment. The mediator variables considered are financial numeracy (colums 1 ,4), financial awareness (columns 2, 5), and financial attitudes (columns 3, 6). *Financial Education and Goal Setting* is a dummy equal to 1 for an individual who received the financial education and goal setting treatments, but not the financial counseling treatment. In Panel B, the ADE is replicated from the coefficient estimate of the treatment variable in Panel A, and the ATE is replicated from the coefficient estimate of the treatment variable from Table 3. In all regressions, the sample consists of the control group and those individuals who received the *Financial Education and Goal Setting* treatment. All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors are clustered at the wave-class level. *** indicate statistical significance at the

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%

Notes: This table presents estimates the Average Causal Mediation Effect (ACME) and the Average Direct Effect (ADE) of the *Financial Education and Counseling* treatment. The mediator variables considered are financial numeracy (colums 1, 4, 7, and 10), financial awareness (columns 2, 5, 8, and 11), and financial attitudes (columns 3, 6, 9, and 12). *Financial Education and Counseling* is a dummy equal to 1 for an individual who received the financial education and counseling treatments, but not the goal setting treatment. In Panel B, the ADE is replicated from the coefficient estimate of the treatment variable in Panel A, and the ATE is replicated from the coefficient estimate of the treatment variable from Table 3. In all regressions, the sample consists of the control group and those individuals who received the *Financial Education and Counseling* treatment. All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors are clustered at the wave-class level. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level.

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%

Notes: This table presents estimates the Average Causal Mediation Effect (ACME) and the Average Direct Effect (ADE) of *All Three Treatments.* The mediator variables considered are financial numeracy (colums 1 ,4 and 7), financial awareness (columns 2, 5, and 8), and financial attitudes (columns 3, 6, and 9). *All Three Treatments* is a dummy equal to 1 for an individual who received all three treatments (i.e., financial education, financial counseling, and goal setting). In Panel B, the ADE is replicated from the coefficient estimate of the treatment variable in Panel A, and the ATE is replicated from the coefficient estimate of the treatment variable from Table 3. In all regressions, the sample consists of the control group and those individuals who received *All Three Treatments.* All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors are clustered at the wave-class level. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level.

Appendix Table 1: Sequential *g*-Estimation: Financial Education Treatment

	Budgeting		
	Has tried making a budget in the last 6 months		
	Financial Numeracy (1)	Financial Awareness (2)	Financial Attitudes (3)
ACME	-0.002	0.027**	0.025**
	(0.004)	(0.012)	(0.011)
ACDE	0.138***	0.109**	0.111***
	(0.043)	(0.044)	(0.042)
ATE		0.136***	
		(0.038)	
% of ATE Mediated	-1%	20%	18%

Notes: This table presents estimates the Average Controlled Direct Effect (ACDE), obtained using sequential g-estimation as outlined in Acharya, Blackwell, and Sen (2016), for the *Financial Education Only* treatment. The ACDE is comparable to the ADE (Average Direct Effect) from Table 5 under the assumption of no treatment-mediator interaction. With this assumption, the ACME (Average Causal Mediation Effect) is then obtained by substracting the ACDE from the from the Average Treatment Effect (ATE). The ATE given above is replicated from the coefficient estimate of the treatment variable from Table 3. The mediator variables considered are financial numeracy (column 1), financial awareness (column 2), and financial attitudes (column 3). In all regressions, the sample consists of the control group and those individuals who received the *Financial Education Only* treatment. All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors for the ACME and ACDE are bootstrapped with 1000 iterations. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

Appendix Table 2: Sequential *g*-Estimation: Financial Education and Goal Setting Treatment

	Budgeting			Savings		
	Has tried making a budget in the last 6 months			Has a savings account		
	Financial Numeracy (1)	Financial Awareness (2)	Financial Attitudes (3)	Financial Numeracy (4)	Financial Awareness (5)	Financial Attitudes (6)
ACME	0.000	0.020*	0.038***	-0.001	0.000	0.020*
	(0.003)	(0.012)	(0.012)	(0.004)	(0.015)	(0.012)
ACDE	0.166***	0.146***	0.128***	0.081	0.080	0.060
	(0.046)	(0.048)	(0.047)	(0.051)	(0.052)	(0.052)
ATE		0.166***			0.081*	
		(0.044)			(0.044)	
% of ATE Mediated	0%	12%	23%	-1%	0%	25%

Notes: This table presents estimates the Average Controlled Direct Effect (ACDE), obtained using sequential g-estimation as outlined in Acharya, Blackwell, and Sen (2016), for the *Financial Education and Goal Setting* treatment. The ACDE is comparable to the ADE (Average Direct Effect) from Table 6 under the assumption of no treatment-mediator interaction. With this assumption, the ACME (Average Causal Mediation Effect) is then obtained by substracting the ACDE from the from the Average Treatment Effect (ATE). The ATE given above is replicated from the coefficient estimate of the treatment variable from Table 3. The mediator variables considered are financial numeracy (columns 1 and 4), financial awareness (columns 2 and 5), and financial attitudes (columns 3 and 6). In all regressions, the sample consists of the control group and those individuals who received the *Financial Education and Goal Setting treatment* . All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors for the ACME and ACDE are bootstrapped with 1000 iterations. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level.

Appendix Table 3: Sequential *g*-Estimation: 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		
	Financial Numeracy	Financial Awareness	Financial Attitudes	Financial Numeracy	Financial Awareness	Financial Attitudes	Financial Numeracy	Financial Awareness	Financial Attitudes	Financial Numeracy	Financial Awareness	Financial Attitudes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ACME	0.001	0.030***	0.038***	0.001	0.006	0.020*	-0.001	0.016	0.002	0.000	-0.002	0.003
	(0.004)	(0.011)	(0.014)	(0.004)	(0.012)	(0.011)	(0.014)	(0.020)	(0.024)	(0.002)	(0.006)	(0.004)
ACDE	0.401***	0.372***	0.364***	0.166***	0.162***	0.148***	0.168*	0.151*	0.165*	0.045*	0.048*	0.042
	(0.048)	(0.049)	(0.048)	(0.052)	(0.052)	(0.052)	(0.087)	(0.089)	(0.090)	(0.025)	(0.026)	(0.026)
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%	-1%	10%	1%	0%	-4%	7%

Notes: This table presents estimates the Average Controlled Direct Effect (ACDE), obtained using sequential g-estimation as outlined in Acharya, Blackwell, and Sen (2016), for the *Financial Education and Counseling* treatment. The ACDE is comparable to the ADE (Average Direct Effect) from Table 7 under the assumption of no treatment-mediator interaction. With this assumption, the ACME (Average Causal Mediation Effect) is then obtained by substracting the ACDE from the from the Average Treatment Effect (ATE). The ATE given above is replicated from the coefficient estimate of the treatment variable from Table 3. The mediator variables considered are financial numeracy (columns 1, 4, 7, and 10), financial awareness (columns 2, 5, 8, and 11), and financial attitudes (columns 3, 6, 9, and 12). In all regressions, the sample consists of the control group and those individuals who received the *Financial Education and Counseling treatment* . All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors for the ACME and ACDE are bootstrapped with 1000 iterations. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level

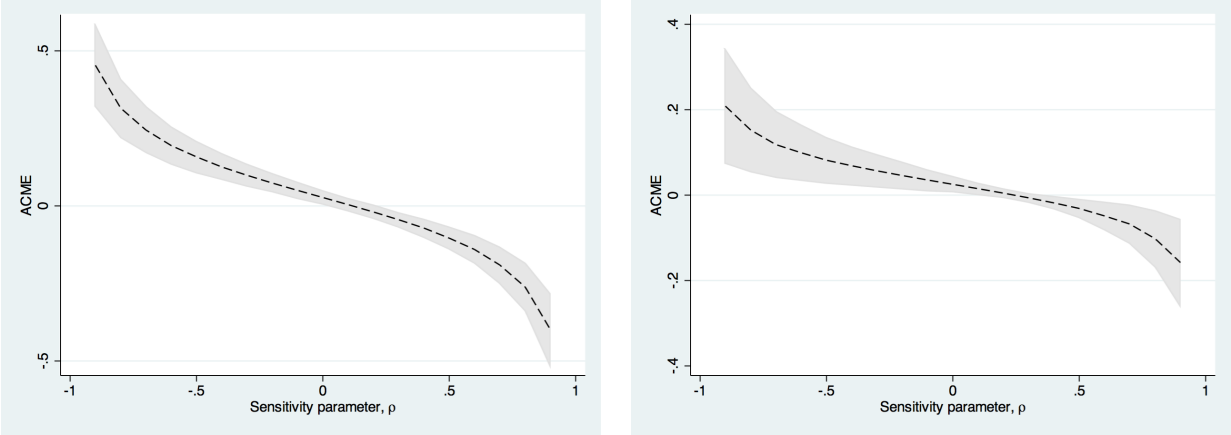
Appendix Table 4: Sequential *g*-Estimation: All Three Treatments

	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		
	Financial Numeracy	Financial Awareness	Financial Attitudes	Financial Numeracy	Financial Awareness	Financial Attitudes	Financial Numeracy	Financial Awareness	Financial Attitudes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ACME	0.001	0.028*	0.057***	0.000	0.013	0.033**	0.000	-0.002	0.008
	(0.004)	(0.015)	(0.014)	(0.003)	(0.017)	(0.015)	(0.027)	(0.029)	(0.028)
ACDE	0.472***	0.445***	0.416***	0.100**	0.088*	0.067	0.039	0.041	0.031
	(0.045)	(0.048)	(0.047)	(0.050)	(0.050)	(0.052)	(0.027)	(0.029)	(0.028)
ATE		0.472***			0.100**			0.039*	
		(0.040)			(0.045)			(0.021)	
% of ATE Mediated	0%	6%	12%	0%	13%	33%	0%	-5%	21%

Notes: This table presents estimates the Average Controlled Direct Effect (ACDE), obtained using sequential g-estimation as outlined in Acharya, Blackwell, and Sen (2016), for *All Three Treatments* of financial education, goal setting, and counseling. The ACDE is comparable to the ADE (Average Direct Effect) from Table 8 under the assumption of no treatment-mediator interaction. With this assumption, the ACME (Average Causal Mediation Effect) is then obtained by substracting the ACDE from the from the Average Treatment Effect (ATE). The ATE given above is replicated from the coefficient estimate of the treatment variable from Table 3. The mediator variables considered are financial numeracy (columns 1, 4, and 7), financial awareness (columns 2, 5, and 8), and financial attitudes (columns 3, 6, and 9). In all regressions, the sample consists of the control group and those individuals who received *All Three Treatments* . All regressions include controls for baseline discount rate as well as strata dummies (where strata are defined by gender, location, and whether the household was an MFI client). Standard errors for the ACME and ACDE are bootstrapped with 1000 iterations. *** indicate statistical significance at the 1% level, ** at the 5% level, and * and the 10% level.

Figure 1: Sensitivity Analysis (Treatment: Financial Education Only)

Has tried making a budget in the last 6 months

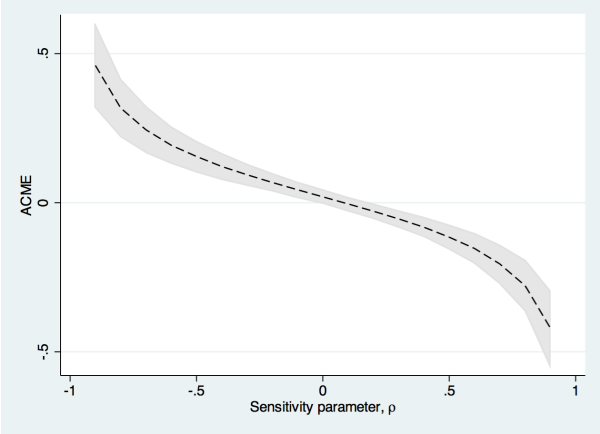


Awareness Attitudes

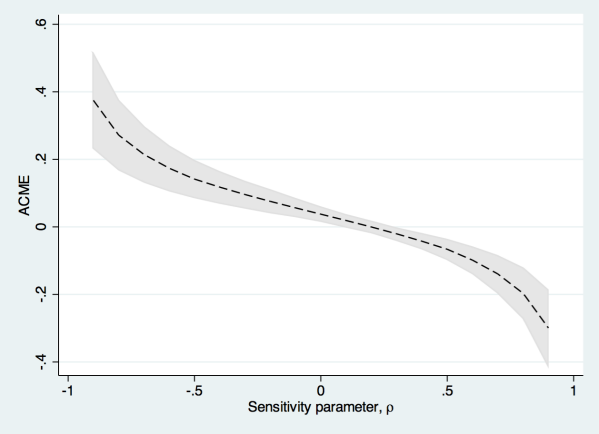
Notes: This figure shows how the estimates of the Average Causal Mediation Effect (ACME) change with different values of ρ, defined as the correlation between the error terms in the regression of the mediator on the treatment (ϵ_{i2}) and the regression of the financial outcomes on the treatment and the mediator (ϵ_{i3}). The dashed line represents the estimated ACME for the given mediator and for different values of ρ, while the shaded area represents the 95% confidence interval. The figures on the left side consider financial awareness as the mediator, and the those on the right use financial knowledge as the mediator. The treatment variable is *Financial Education Only*, defined as a dummy equal to 1 for an individual who was assigned to the financial education but not goal setting nor counseling treatments. Sequential ignorability implies that ρ is equal to zero, so the ACME for $\rho = 0$ in the above figures corresponds to the ACME estimate in Table 5.

Figure 2: Sensitivity Analysis (Treatment: Financial Education and Goal Setting)

Panel A: Has tried making a budget in the last 6 months

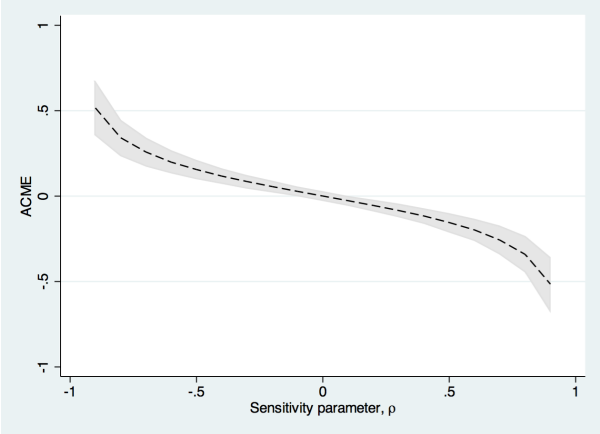


(A1) Awareness

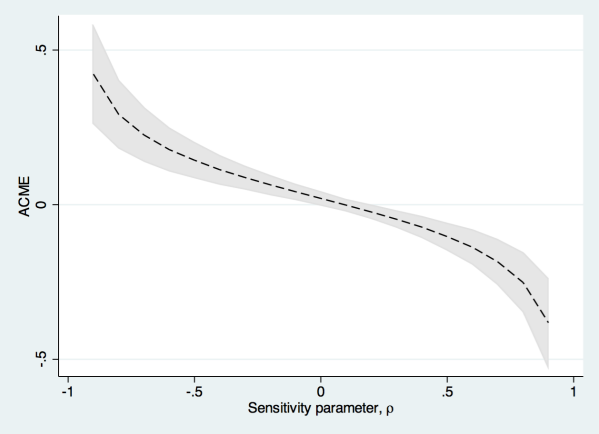


(A2) Attitudes

Panel B: Has a savings account



(B1) Awareness

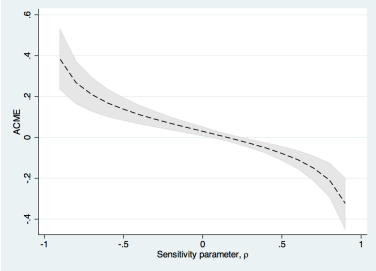


(B2) Attitudes

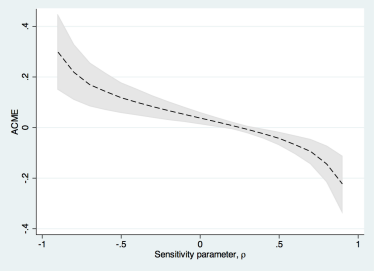
Notes: This figure shows how the estimates of the Average Causal Mediation Effect (ACME) change with different values of ρ, defined as the correlation between the error terms in the regression of the mediator on the treatment (ϵ_{i2}) and the regression of the financial outcomes on the treatment and the mediator (ϵ_{i3}). The dashed line represents the estimated ACME for the given mediator and for different values of ρ, while the shaded area represents the 95% confidence interval. The figures on the left side consider financial awareness as the mediator, and the those on the right use financial attitudes as the mediator. The treatment variable is *Financial Education and Goal Setting*, defined as a dummy equal to 1 for an individual who was assigned to financial education and goal setting, but not counseling. Sequential ignorability implies that ρ is equal to zero, so the ACME for $\rho = 0$ in the above figures corresponds to the ACME estimate in Table 6.

Figure 3: Sensitivity Analysis (Treatment: Financial Education and Counseling)

Panel A: Has tried making a budget in the last 6 months

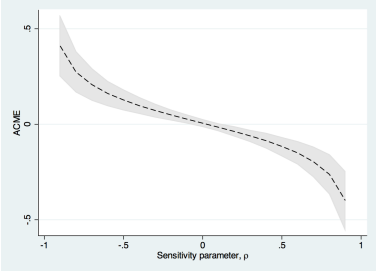


(A1) Awareness

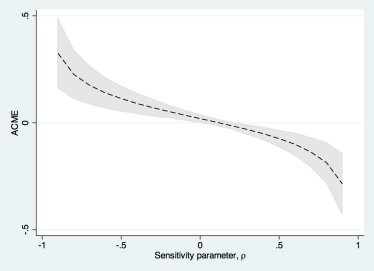


(A2) Attitudes

Panel B: Has a savings account

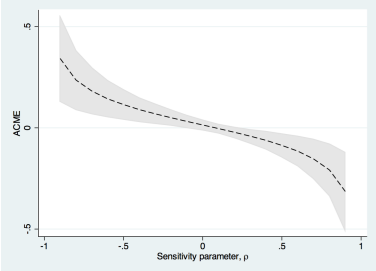


(B1) Awareness

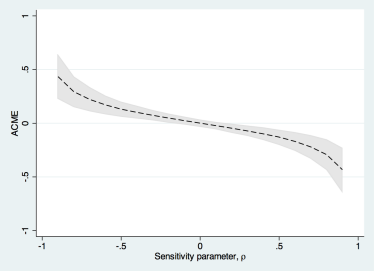


(B2) Attitudes

Panel C: Loan purpose: Business, education, or purchase of durable goods

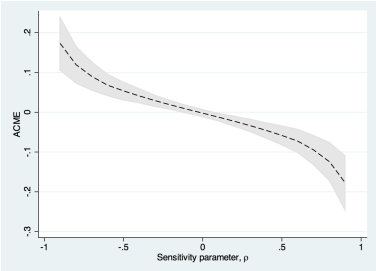


(C1) Awareness

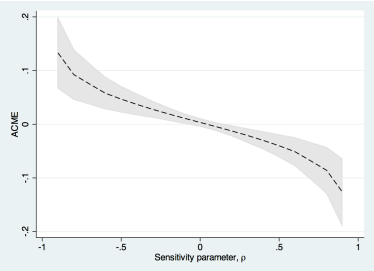


(C2) Attitudes

Panel D: Bought life insurance in the past six months



(D1) Awareness

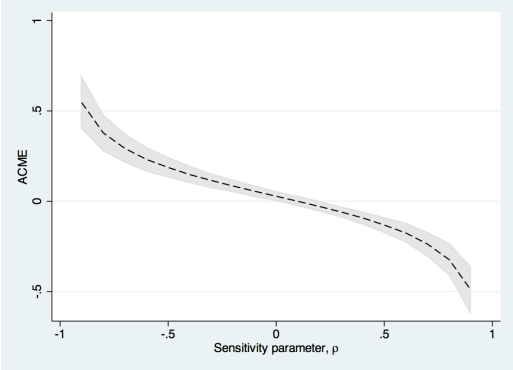


(D2) Attitudes

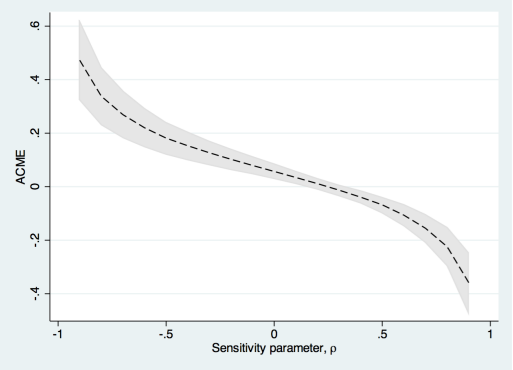
Notes: This figure shows how the estimates of the Average Causal Mediation Effect (ACME) change with different values of ρ, defined as the correlation between the error terms in the regression of the mediator on the treatment (ϵ_{i2}) and the regression of the financial outcomes on the treatment and the mediator (ϵ_{i3}). The dashed line represents the estimated ACME for the given mediator and for different values of ρ, while the shaded area represents the 95% confidence interval. The figures on the left side consider financial awareness as the mediator, and the those on the right use financial attitudes as the mediator. The treatment variable is *Financial Education and Counseling*, defined as a dummy equal to 1 for an individual who was assigned to financial education and counseling, but not goal setting. Sequential ignorability implies that ρ is equal to zero, so the ACME for $\rho = 0$ in the above figures corresponds to the ACME estimate in Table 7.

Figure 4: Sensitivity Analysis (Treatment: All Three Treatments)

Panel A: Has tried making a budget in the last 6 months

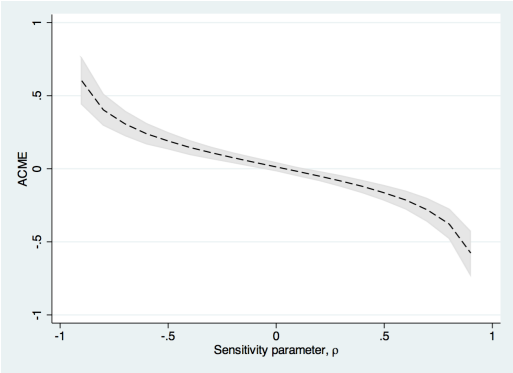


(A1) Awareness

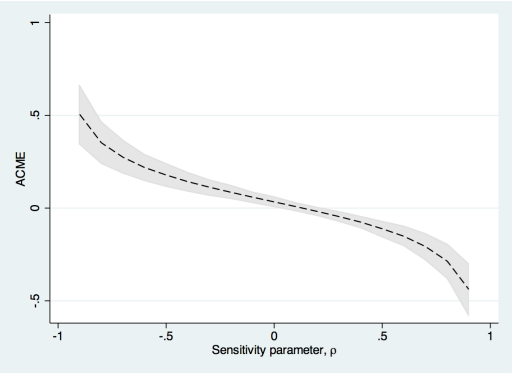


(A2) Attitudes

Panel B: Has a savings account

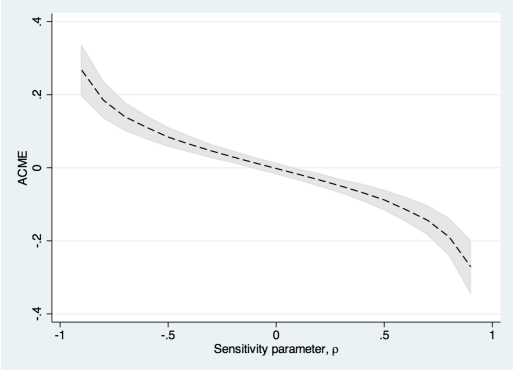


(B1) Awareness

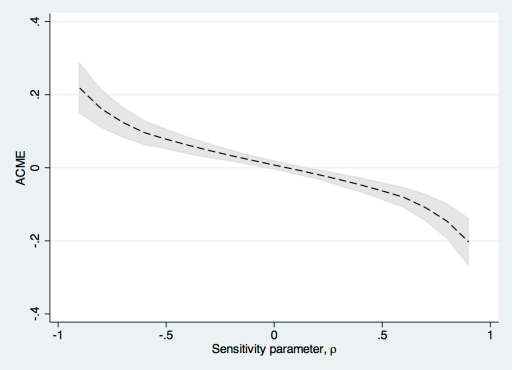


(B2) Attitudes

Panel C: Bought life insurance in the past six months



(C1) Awareness

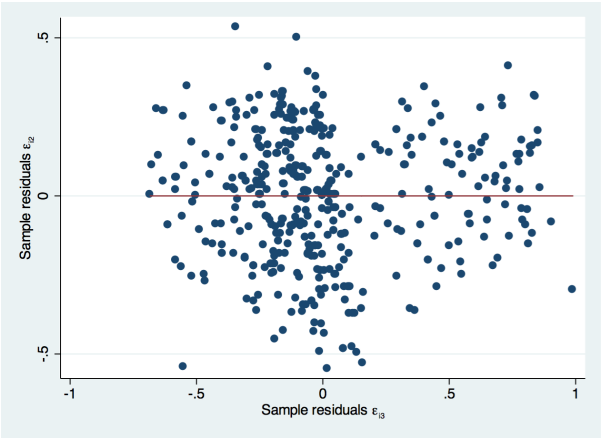


(C2) Attitudes

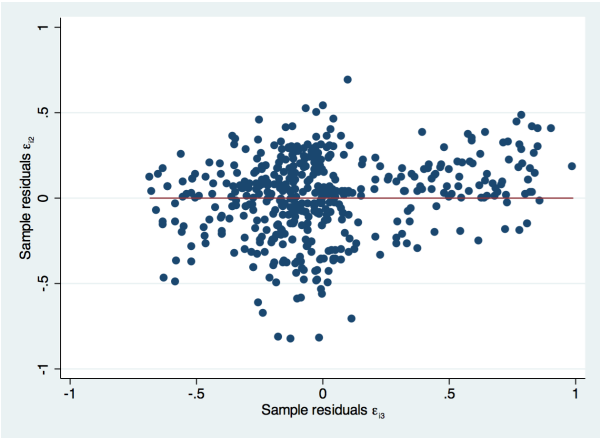
Notes: This figure shows how the estimates of the Average Causal Mediation Effect (ACME) change with different values of ρ, defined as the correlation between the error terms in the regression of the mediator on the treatment (ϵ_{i2}) and the regression of the financial outcomes on the treatment and the mediator (ϵ_{i3}). The dashed line represents the estimated ACME for the given mediator and for different values of ρ, while the shaded area represents the 95% confidence interval. The figures on the left side consider financial awareness as the mediator, and the those on the right use financial attitudes as the mediator. The treatment variable is *All Three Treatments*, defined as a dummy equal to 1 for an individual who was assigned to all three treatments of financial education, goal setting, and counseling. Sequential ignorability implies that ρ is equal to zero, so the ACME for $\rho = 0$ in the above figures corresponds to the ACME estimate in Table 8.

Figure 5: Scatterplot of $\widehat{\epsilon}_{i2}, \widehat{\epsilon}_{i3}$ (Treatment: Financial Education)

Has tried making a budget in the last 6 months



Awareness

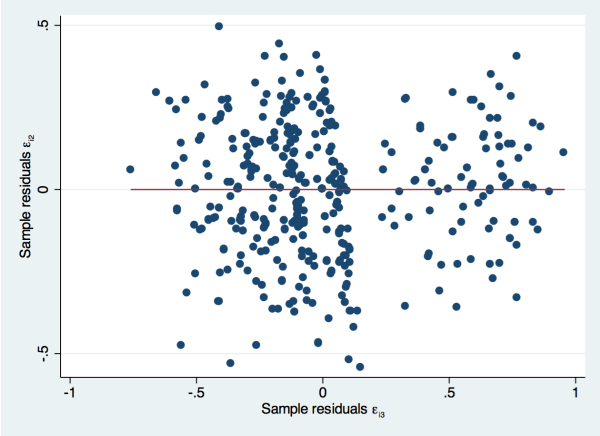


Attitudes

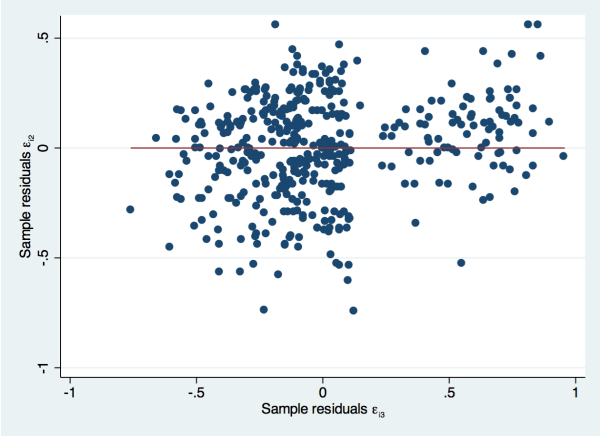
Notes: This figure shows a scatter plot where the y-axis represents the sample residuals from the regression of the mediator on the treatment ($\widehat{\epsilon}_{i2}$), and the x-axis represents the sample residuals from the regression of the financial outcomes on the treatment and the mediator ($\widehat{\epsilon}_{i3}$). The red line represents the corresponding fitted line from the bivariate linear regression.

Figure 6: Scatterplot of $\widehat{\epsilon}_{i2}, \widehat{\epsilon}_{i3}$ (Treatment: Financial Education and Goal Setting)

Panel A: Has tried making a budget in the last 6 months

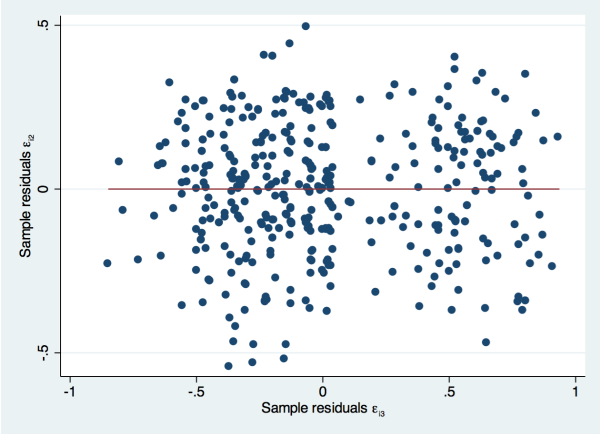


(A1) Awareness

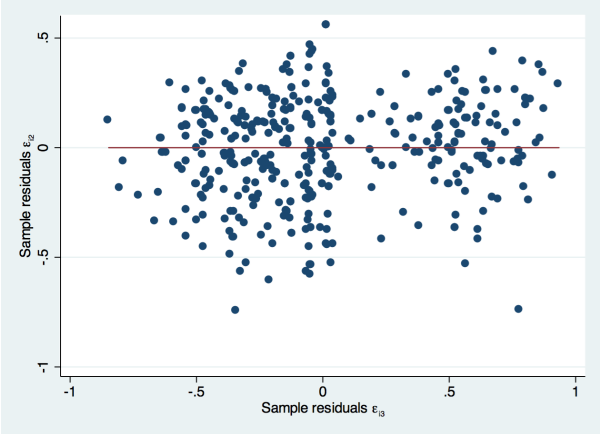


(A2) Attitudes

Panel B: Has savings account



(B1) Awareness

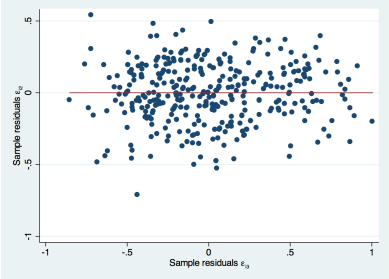


(B2) Attitudes

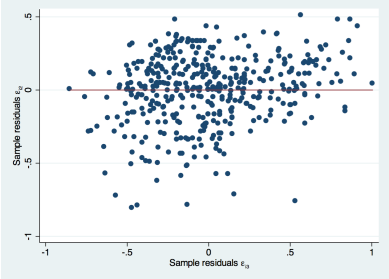
Notes: This figure shows a scatter plot where the y-axis represents the sample residuals from the regression of the mediator on the treatment ($\widehat{\epsilon}_{i2}$), and the x-axis represents the sample residuals from the regression of the financial outcomes on the treatment and the mediator ($\widehat{\epsilon}_{i3}$). The red line represents the corresponding fitted line from the bivariate linear regression.

Figure 7: Scatterplot of $\widehat{\epsilon}_{i2}, \widehat{\epsilon}_{i3}$ (Treatment: Financial Education and Counseling)

Panel A: Has tried making a budget in the last 6 months

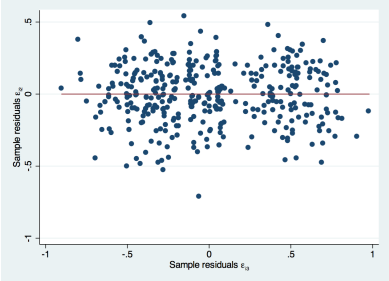


(A1) Awareness

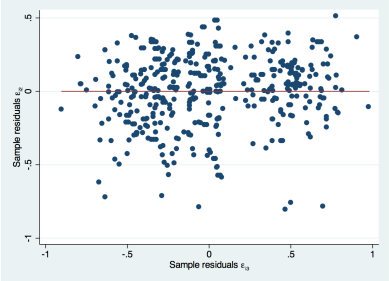


(A2) Attitudes

Panel B: Has savings account

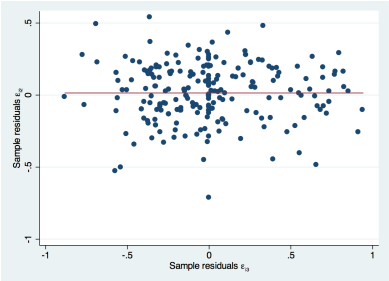


(B1) Awareness

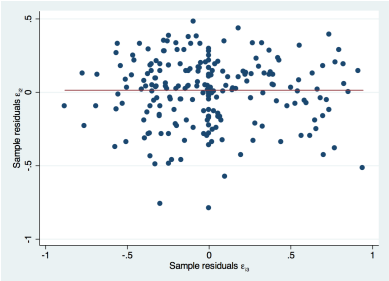


(B2) Attitudes

Panel C: Loan purpose: Business, education, or purchase of durable goods

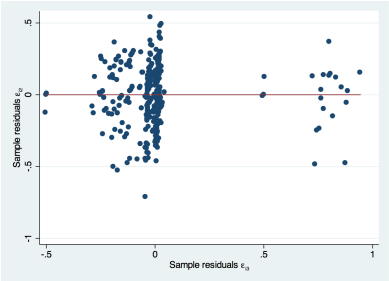


(C1) Awareness

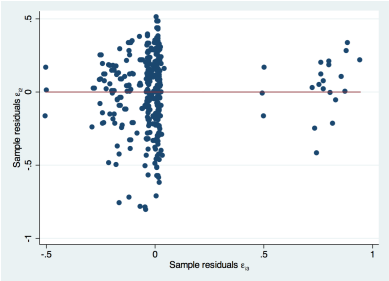


(C2) Attitudes

Panel D: Bought life insurance in the last 6 months



(D1) Awareness

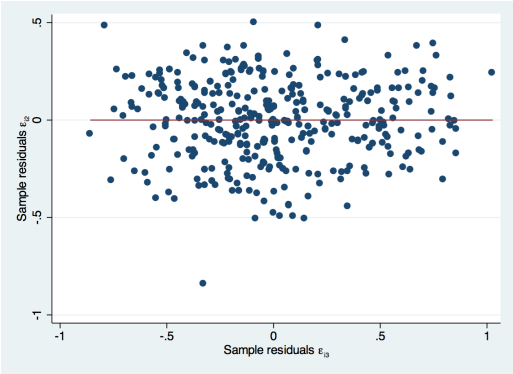


(D2) Attitudes

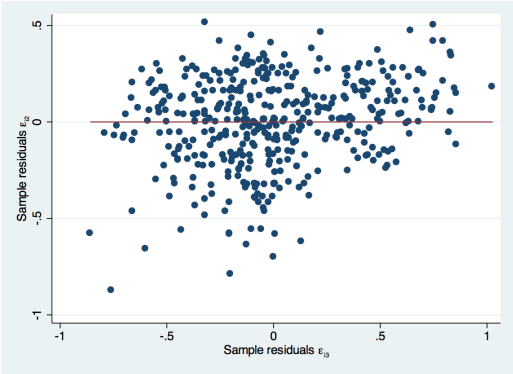
Notes: This figure shows a scatter plot where the y-axis represents the sample residuals from the regression of the mediator on the treatment ($\widehat{\epsilon}_{i2}$), and the x-axis represents the sample residuals from the regression of the financial outcomes on the treatment and the mediator ($\widehat{\epsilon}_{i3}$). The red line represents the corresponding fitted line from the bivariate linear regression.

Figure 8: Scatterplot of $\widehat{\epsilon}_{i2}, \widehat{\epsilon}_{i3}$ (Treatment: All Three Treatments)

Panel A: Has tried making a budget in the last 6 months

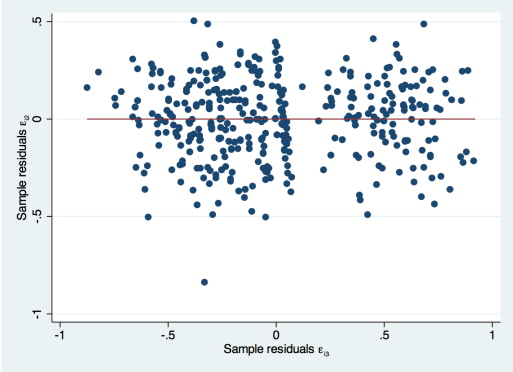


(A1) Awareness

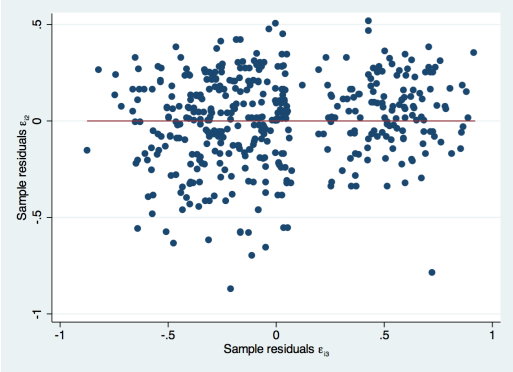


(A2) Attitudes

Panel B: Has savings account

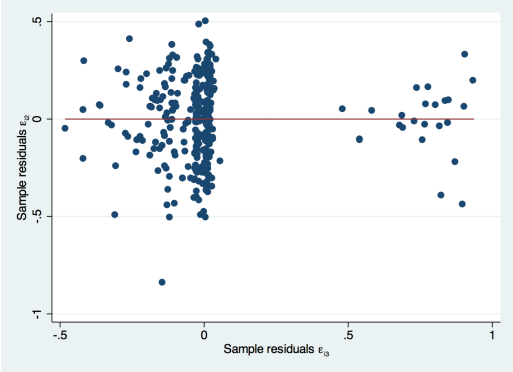


(B1) Awareness

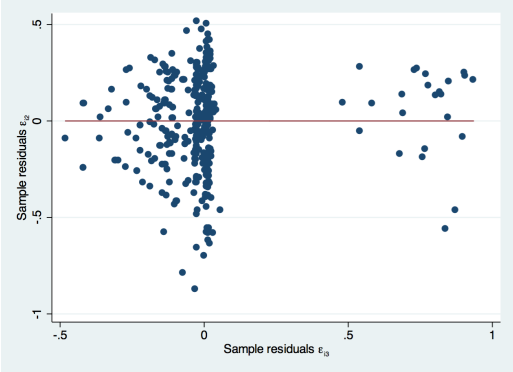


(B2) Attitudes

Panel C: Bought life insurance in the last 6 months



(D1) Awareness



(D2) Attitudes

Notes: This figure shows a scatter plot where the y-axis represents the sample residuals from the regression of the mediator on the treatment ($\widehat{\epsilon}_{i2}$), and the x-axis represents the sample residuals from the regression of the financial outcomes on the treatment and the mediator ($\widehat{\epsilon}_{i3}$). The red line represents the corresponding fitted line from the bivariate linear regression.