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Cultivating Self-Control in FinTech: Evidence from a Field Experiment on Online Consumer Borrowing

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Abstract

We report the results of a longitudinal intervention with students across 5 universities in China designed to reduce online consumer debt. We allocate participants to either a financial literacy treatment group, a self-control treatment group, or a zero-touch control group. Our self-control training intervention features detailed tracking of spending and borrowing, budgeting, and introspection about consumption choices. This intervention reduces online borrowing and delinquency charges, mainly driven by a reduction in entertainment-related spending and borrowing. In contrast, financial literacy interventions improve test scores but only marginally affect borrowing. Our results suggest that cultivating self-regulation and budgeting skills can improve borrowing behavior on e-commerce platforms.

I. Introduction

Advances in technology have transformed the way individuals access credit and make purchases. China presents an illustrative example, where only a decade ago, deferred payments, installment loans, and personal credit cards were rare or used sparingly. Today, consumer credit is commonplace and increasing across the country. Outstanding bank-issued consumer loans more than doubled from 2016

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through the first quarter of 2020 to more than 40 trillion RMB ($6.1 trillion), and recent reports state that online consumer financing has grown by 400 times since 2014 to nearly 8 trillion RMB (Shen, Woo, and Leng (2020)).[1]

Consumer credit on e-commerce platforms in China has grown rapidly not only because of its ease and convenience but also because the segment of the population that it often targets has a limited credit history, making it difficult for them to obtain credit (Xie (2019)).[2] As opposed to traditional sources of credit, which require a credit score, proof of employment, and regular income, e-commerce platforms such as Alibaba and JD.net (the largest online portals in China) determine loan eligibility and create credit-rating profiles using an individual's purchasing history and account data (e.g., Alibaba's online retail site and Alipay, Alibaba's mobile payment app). Instant, online credit is often marketed to university students, who represent a large, at-risk group of online borrowers.[3] In China, more than 25% of individuals under the age of 30 have an Ant Check Later (Alibaba) microloan account, and nearly half are under the age of 30 (Xie (2019)).[4] Bu and Liao ((2021), p. 360) report that 53% of college students have used loan services for purchases such as Apple laptops and iPhones and spend a large fraction of their income on debt repayment. Indeed, in our setting, almost 50% of survey participants had recently used online lending, and more than 20% stated that these loans were a source of constant stress.

A large literature has examined the skills associated with financial literacy (i.e., numeracy, understanding inflation, and risk diversification) and how they translate into savings and borrowing decisions (i.e., stock market participation, retirement planning, and credit-card usage).[5] Recent studies examine how *non-cognitive skills*, such as self-efficacy and self-control, are linked to financial behavior, either in the cross section or by offering the opportunity for the sophisticated to benefit from a commitment device.[6] However, whether these skills can be trained or manipulated and whether they might affect downstream behavior is

[1]The speed with which the country has transformed payment and credit norms is unparalleled. As an example, consider mobile payments, which in 2018 totaled over $41 trillion, 92% of which occurred over two platforms, Alipay and WeChat, which each boast over a *billion* users (Klein (2019)).

[2]Online credit is often targeted toward young adults and students who are crowded out of the traditional credit-card market. Many suggest that these forms of credit and a completely digital (or mobile) purchasing process is more convenient than traditional credit cards or cash (Hancock and Wang (2018), Nakamura (2018)).

[3]These young adults are technology-savvy and well accustomed to online purchasing. They represent a large market and have been shown to be vulnerable to peer pressure and conspicuous consumption decisions (O'Cass and McEwen (2004), Podoshen, Li, and Zhang (2011), and Hao, Liu, Jiesisibieke, and Xu (2019)). Adverse decisions that can affect credit scores and indebtedness can manifest well into adulthood and have far-reaching consequences.

[4]Estimates suggest that Huabei (meaning "just spend") has nearly 500 million clients (Xie (2019)).

[5]For recent reviews of the literature on financial literacy and education, see Lusardi and Mitchell (2014), Fernandes, Lynch, and Netemeyer (2014), Kaiser, Lusardi, Menkhoff, and Urban (2020), and Gomes, Haliassos, and Ramadorai (2021).

[6]For examples of cross-sectional studies, see Meier and Sprenger (2010), Lown (2011), Gathergood (2012), Cadena and Keys (2013), Farrell, Tim, and Risse (2016), Kuhnen and Melzer (2018), Parise and Peijnenburg (2019), and Kuchler and Pagel (2018). For intervention examples, see Ashraf, Karlan, and Yin (2006) and Beshears, Choi, Harris, Laibson, Madrian, and Sakong (2015), or Beshears, Choi, Laibson, and Madrian (2018) for a comprehensive review.

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still debated. Furthermore, we know little about how these skills intersect with financial technology and new forms of credit. Examining these channels in a controlled setting is particularly relevant as new technology increases the speed, saliency, and ease with which (potentially) at-risk borrowers may access capital.

In this article, we report the results of a longitudinal intervention study on self-control with university students in Wuhan, China, spanning from Nov. 2016 to Feb. 2019. We examine the uptake of online consumer debt before and after subjects receive substantial financial literacy or financial self-control training. Our study is one of the first large-scale information-based interventions to examine individuals' borrowing choices. We hypothesize that in an era of financial technology (FinTech), self-control and budgeting skills are important determinants of online consumption and borrowing behavior. If individuals are misinformed about borrowing, improving financial knowledge with education may affect subsequent field behavior. On the other hand, if online borrowing is driven by factors other than information or basic literacy, budgeting and self-control training may be more suited to improving borrowing outcomes.

Our research design randomizes participants into either a self-control treatment group, a placebo treatment group on financial literacy, or a control group. The self-control interventions in our study are motivated by psychology studies where (financial) self-regulation has three key components: i) goal setting, ii) engaging in actions that lead to achieving one's standard or goal, and iii) monitoring progress toward the goal (Baumeister and Newman (1994), Carver and Scheier (1998)). We are motivated by Oaten and Cheng (2006a), (2006b), (2007), where individuals follow the previously described protocol to improve health behaviors. Students in the treatment group use a personal financial management (PFM) tool to track expenses, and in subsequent sessions, they discuss, in detail, budgeting plans, specific transactions, and motivations and feelings about purchases with the instructor, with the aim of improving their personal financial goals. Whereas our education treatments attempt to represent a baseline improvement in key areas of financial literacy,[7] the self-control sessions aim to increase individuals' self-reflection, budgeting, and spending skills. The counseling intervention is inherently financial education of a different form compared with traditional literacy approaches. Because the intervention provides actual training on the core concepts of borrowing and saving, its goal was to eliminate barriers that agents may have in mapping abstract knowledge onto concrete financial choices (e.g., D'Acunto, Hoang, Paloviita, and Weber (2019), Ilut and Valchev (2020)).

Online borrowing is prevalent among the students in our sample. Prior to our intervention, 47% of students report having borrowed online at least once in the last 12 months. The majority of our sample is female (66%), more than half of the students are involved in a business-degree program, and many of them report relatively high levels of financial confidence and awareness. Although some of the borrowing is reported to be used for university-related expenses, most students state that they use consumer credit for entertainment-related consumption.

[7]The courses on finally literacy are small-group sessions where students learn about financial topics, such as the time value of money and compounding interest, risk diversification, and importantly, information about consumer lending, such as associated fees and interest rates.

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We find that participants in the control group experience a large increase in their rate of online borrowing from pre- to postintervention. This reflects the general increasing trend in online payments, borrowing, and financial technology in China during the period of our study. In contrast, subjects in the self-control treatment group reduce borrowing by 14 percentage points compared with those in the control group, more than twice the size of the effect of the literacy treatment. This is an economically significant effect, given a pretreatment rate of borrowing of 47%, and corresponds to an average treatment effect of 29.7%. At the same time, subjects in the self-control treatment group show no improvement in objective measures of financial literacy. This finding is partially consistent with our main hypothesis and suggests that online borrowing may be not driven purely by a lack of financial literacy, and skills such as budgeting and planning, along with self-control training, may be particularly relevant in reducing online-based consumer debt. Participants in the financial literacy intervention group improve their financial literacy test scores, relative to the control and self-control groups, by approximately 0.8 points out of 6, relative to a mean preperiod score of 3.35. However, we do not find that financial literacy treatments significantly reduce online consumer loan take-up. This result in part rules out the potential explanation that borrowing behavior is due to a lack of financial literacy (Agarwal, Driscoll, Gabaix, and Laibson (2008), Ru and Schoar (2016)).

One important question that arises is whether the self-control interventions affect all participants or if the treatment effects are heterogeneous across the sample. Indeed, we find substantial gender effects: The unconditional rate of borrowing pre- to posttreatment decreases by approximately 6 percentage points (pp) for women and 7 pp for men in the literacy treatment, and it decreases by approximately 10 pp for women and 20 pp for men in the self-control treatment. The men in our sample are as responsive to the education intervention as women, but they are twice as likely to respond to the self-control sessions. At the intensive margin, we note the opposite finding: Women seem to be more responsive to the self-control treatment. Thus, men are less likely to borrow following the self-control intervention, but women borrow less, conditional on borrowing. This is likely because men borrow at a preintervention rate that is higher than that of women (76% vs. 37%). Women may reduce the amount borrowed following the treatment rather than cutting necessary purchases completely, whereas men may be more likely to reduce unnecessary entertainment-based borrowing. This seems plausible, given that the preintervention share of entertainment-based consumption and gaming is approximately 12% for men and 6% for women.

Conditional on preintervention borrowing, participants in the control group slightly reduced borrowing in the postintervention. This suggests that the increase in the overall borrowing rate is mainly driven by participants who are first-time borrowers. The effect for the financial literacy treatment is small and marginally significant, whereas participants in the self-control treatment, conditional on previous borrowing, decrease borrowing in the postintervention by more than 20 percentage points. Our interventions therefore affect the intensive margin borrowing of participants rather than preventing them from borrowing for the first time. Relative to the control sample, the unconditional effect for participants in the self-control treatment is a reduction in borrowing of approximately 150 RMB per month

(approximately $260 per year). This is a significant effect, given that the average monthly online borrowing amount in our sample is 570 RMB.

One concern about our design and institutional setting is that our treatments may induce student participants to exaggerate or lie about their borrowing behavior. Additionally, because there is a relatively long time lag between the intervention and the follow-up, participants may have simply forgotten the details of their spending. To address these sources of potential imprecision in our outcome variable, we match participants to transaction-level data on online borrowing from the third-party PFM app we use alongside our self-control intervention. This allows us to investigate the effect of the sessions on borrowing, aside from measurement error or bias in self-reported borrowing behavior. The data show a decline in borrowing at both the extensive and intensive margins following the second and third classes for those in the self-control treatment group, precisely after the sessions where participants analyze their spending behavior. The decline in borrowing decays over time, but in our last time period, it remains statistically lower than initial borrowing rates. Furthermore, this approach allows us to rule out Hawthorne effects, or that our results are simply driven by subjects responding to being monitored, because we observe a decrease in borrowing after the study period. Finally, the data allow us to investigate the channels through which the self-control treatment may affect borrowing behavior. If subjects react to the in-person counseling aspects of the intervention, we would expect those with relatively low self-tracking (as measured by app logins) to show equivalent or higher rates of improvements compared to those with relatively high app usage. We find that those who do not regularly use the app alongside counseling sessions do not decrease borrowing, suggesting that self-tracking of expenses is likely to be an important component, in addition to in-person counseling.

It may be fully rational to take high-interest loans for short periods for smoothing fluctuations in income in order to meet payment deadlines and avoid additional costs, or for emergencies or investments that may lead to higher future income (Morse (2011), Ru and Schoar (2016)). In our setting, participants report, however, that the majority of their borrowing is for entertainment-related expenses, such as clothing, dining out, or electronics. Importantly, we find that this is the expense channel where our interventions have the largest effect. Similarly, when we examine the heterogeneity of consumption patterns for participants in the self-control treatment, we find that those with an above-median share of entertainment consumption in the preintervention period seem to be most responsive by decreasing borrowing at the extensive margin.

If individuals are able to perfectly smooth consumption, online borrowing presents a source of liquidity for consumption. However, our analysis of PFM data shows a large and statistically significant reduction in late-fee payments on delinquent online loans after self-control sessions for participants who are liquidity constrained and those who indicate high levels of "stress" associated with online debt. This suggests that participants indeed incur nonnegligible financial and nonpecuniary costs associated with online borrowing. On the other hand, survey responses suggest that those who are the *least* stressed by their borrowing behavior are those who are most able to reduce borrowing at the extensive margin.

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The credit product we study is unique from credit cards and other sources of consumer debt because it is linked to online purchases at the point of sale and is targeted directly to consumers based on their purchase history. However, many of these technology-based differences echo existing credit products, and we believe that our results extrapolate broadly to consumer debt behavior. Our findings generally suggest that self-control is an important underlying mechanism relevant to the study of consumer financial decision making. Furthermore, not only are our results externally valid for other parts of the world, but our self-control treatment is simple to administer and is as cost-effective as our standard literacy interventions.

Our study contributes to three important strands of literature. First, we add to articles that analyze the link between financial literacy and household financial decision making. Some of these articles initially focused on financial aptitude or cognitive skills in financial decision making (e.g., Grinblatt, Keloharju, and Linnainmaa (2011); or see Lusardi and Mitchell (2014) for a review of the literature), whereas others examined the link between noncognitive skills and financial distress, debt behavior, and poor financial decision making (Thaler and Shefrin (1981), Heidhues and Kőszegi (2010), Kuhnen and Melzer (2018), and Parise and Peijnenburg (2019)). Articles examining self-control in financial decisions have almost exclusively focused on present bias and time-inconsistent behavior. Much of this work has focused on providing (partially) sophisticated time-inconsistent agents with i) the ability to select into a commitment device (Ashraf et al. (2006), Ambec and Treich (2007), and Beshears et al. (2015)), ii) objective information disclosure (Duflo and Saez (2003), Bertrand and Morse (2011)), or iii) payment reminders (Karlan, McConnell, Mullainathan, and Zinman (2016)), with the goal of improving downstream behavior. Laudenbach, Pirchsel, and Siegel (2018) examine how personal communication from a loan officer and a standard information disclosure affect default rates. Our article examines a different channel: Rather than lenders communicating with borrowers, we study the effect of borrowers' self-introspection on their own borrowing behavior.

Our intervention differs from the existing literature in a number of ways. Importantly, we do not offer a commitment device to subjects, with the hypothesis that the take-up of such an instrument would affect borrowing. Rather, we study how students' engagement with a curriculum that fosters introspection of personal spending affects their downstream behavior. This "self-control" track is simply an alternative or modification to a pure financial literacy classroom setting. The instructor could be the same (which they are in our experiment), and in fact, the costs are identical. The PFM app used in our application has the sole function of data collection to mitigate the risk of measurement error. In our article, we need not assume that subjects have time-inconsistent preferences, nor do we measure individuals' sophistication about potential lack of self-control. Although research and policy often highlight the need to integrate financial literacy into training and curriculum across the general population (Lusardi (2019), Organisation for Economic Co-operation and Development (OECD) (2019)), our results suggest that self-control and budgeting skills may be an important aspect of such education (Shefrin (2019)).

Studies on financial education are generally divided into two streams. The first documents the effect of heterogeneity in financial literacy on downstream financial

behavior, that is, "measured financial literacy" (Fernandes et al. (2014)). For example, Lusardi and Tufano (2015) document low levels of debt literacy and find that only about one-third of American adults understand the basics of compounding interest. These low levels of debt literacy are linked to costly borrowing habits.[8] The second stream analyzes the effect of financial education interventions on future behavior, that is, "manipulated financial literacy" (Fernandes et al. (2014)). These articles span countries and regions (Cole, Sampson, and Zia (2011), Xu and Zia (2012), Cole, Paulson, and Shastry (2014), and Sayinzoga, Bulte, and Lensink (2016)), age groups (e.g., Becchetti, Caiazza, and Coviello (2013), and Lührmann, Serra-Garcia, and Winter (2015)), the type of educational intervention and what is taught (Clark, Morrill, and Allen (2012)), and the type of downstream behavior that is affected. Agarwal, Amromin, Ben-David, Chomsisengphet, and Evanoff (2020) find that low-credit-score mortgage borrowers are not significantly affected by mandatory counseling sessions, whereas higher-credit-score borrowers avoid counseling by taking less risky mortgages. In our controlled setting, subjects' access to treatments is exogenously determined aside from product choice or credit score, and our findings indicate that counseling has a significantly higher deterrent effect compared with general financial education. Our findings show that interventions aimed at improving students' noncognitive skills (e.g., self-regulation and budgeting skills) by increasing awareness of consumption and borrowing decisions can lead to significant changes in field behavior.

Second, we add to the literature on consumer credit, most specifically on studies on payday lending and credit-card debt.[9] Bertrand and Morse (2011) increase the information available to payday borrowers and find large reductions in borrowing. Burke, Leary, and Wang (2016) provide information on the costs and likelihood of renewing payday loans and suggest that these disclosures can significantly reduce the payday loan demand. Other studies investigate the impact of income timing (Leary and Wang (2016)) and insurance coverage (Allen, Swanson, Wang, and Gross (2017)) on the use of payday loans. Our contribution to this literature is twofold: We first describe a relatively new and prevalent source of consumer credit that, at least in China, is gaining mainstream appeal. The similarities between online consumer credit and payday lending and installment credit are numerous, and therefore understanding the underlying determinants and consequences is of great importance. Secondly, we provide evidence on how self-regulation and education on budgeting techniques can affect individuals' credit demand.

Finally, we contribute to a growing literature on the interaction between individuals and households and financial technology. Recent studies focus on algorithmic lending and changes in the access to credit or its pricing as a result of technology (Bartlett, Morse, Stanton, and Wallace (2019), Parlour, Rajan, and Zhu (2019)). Berg, Burg, Gombović, and Puri (2018) show that the digital footprint left

[8]Similarly, Jaroszek (2019) finds that low financial literacy and cognitive-reflection skills are linked to high overdraft consumer credit in Germany, and many articles have found a link between financial literacy and better financial outcomes, such financial risk taking, portfolio diversification, and stock market participation (Guiso and Jappelli (2008), Bucher-Koenen and Lusardi (2011), Van Rooij, Lusardi, and Alessie (2011), Lührmann et al. (2015), Von Gaudecker (2015), and Brugiavini, Cavapozzi, Padula, and Pettinicchi et al. (2018)).

[9]See Stegman (2007) for a detailed review on payday lending.

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by online consumers provides simple and statistically powerful information for predicting default rates. Similarly, Agarwal, Alok, Ghosh, and Gupta (2020) extend this finding to mobile data, which are particularly relevant among younger consumers. Other articles examine the link between mobile apps and savings and spending behavior (Carlin, Olafsson, and Pagel (2018), D'Acunto, Rossi, and Weber (2019), and D'Acunto, Rauter, Scheuch, and Weber (2020)). An important related article is that by Gargano and Rossi (2020), who similarly investigate an intervention based on goal setting. Our study differs by including a counseling feature, which we find is highly successful, and we study borrowing rather than saving behavior. In general, we contribute to this literature by using a controlled setting to investigate how financial literacy and self-control may be important contributors to participation in new, technology-based forms of credit and consumption.

Our study proceeds as follows: In Section II, we briefly describe the institutional setting in China. In Section III, we describe our experimental setting, discuss the baseline and follow-up surveys, and provide information on our financial literacy and self-control treatments. Section IV provides descriptive statistics of our sample, and in Section V, we present our main findings. In Sections VI and VII, we discuss the ramifications of our findings, along with robustness checks and various other results, and we conclude in Section VIII.

II. Institutional Background

Shopping habits in China have changed rapidly. The balance of online consumer loans grew fivefold between 2015 and 2017, reaching 350 billion RMB ($54.6 billion) (Nakamura (2018)), and recent reports suggest a staggering increase of up to 8 trillion RMB in 2020 ($1.2 trillion) (Shen et al. (2020)). This increase in online lending comes as Chinese internet companies, including e-commerce giant Alibaba Group Holdings and JD.com, have begun offering new forms of lending. Part of the growth in consumer credit can be attributed to a wave of regulatory changes, which eased restrictions on smaller-scale lending to consumers and are fueling a technology-driven marketplace (Nakamura (2018)).

As noted, these online consumer credit products are underwritten by the retailers themselves, and loans are made to borrowers based on the company's internal data and credit-scoring models. Because these companies already have shopping data on their customers, these shoppers do not need to provide more information to complete their purchases. Alibaba has its own smartphone payment service, Ant Financial (formally Alipay). JD.com works with WeChat Pay, a smartphone payment service owned and operated by Tencent Holdings. The vast amount of individual data that these retailers retain on their customers allows them to quickly extend credit at varying principal amounts and interest rates at the point of sale based on individuals' purchase history. Customers choose their method of payment as soon as they select a product, and they remit payment in a lump sum or in installments.

Online consumer loans vary across major platforms and lenders, and there does not appear to be any definitive standard. For example, Huabei is the credit-granting arm of Ant Financial and grants financing on major e-commerce

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platforms in China (e.g., Tmall (formerly Taobao), Meituan, Sulin, and others). Financing is available from 500 RMB ($70) to 50,000 RMB ($7,000). Huabei offers 0% interest from a minimum of 10 days to a maximum of 41 days, with a 0.05% daily late fee over the unpaid loan balance; the terms are the same for all borrowers. Fixed repayment plans range from a 0.83% interest rate for 3-month terms to 0.73% for 12-month periods. Alibaba's main competitor, Jingdong (JD.com), operates its credit arm under the name of JD Finance (or Baitio). JD Finance offers credit exclusively on JD.com for up to 15,000 RMB ($2,000) and offers 30-day 0% interest. After this period, borrowers face a 0.03% daily late fee over the unpaid loan balance, which is the same for all borrowers. As opposed to Ant Financial, fixed repayment plans with similar schedules offer monthly interest rates of 0.5% to 1.2%, which vary between products and borrowers. A major online cash loan product (known as "Jiebei") owned by Ant Financial is also offered in the market at varying daily interest rates (0.04% to 0.05%) based on the borrower's credit rating and standing. WeiLiDai, owned by Tencent, offers a flat interest rate of 0.05% to all borrowers. Credit-card–based installment credit offered by major banks (Bank of China, China Construction Bank, Bank of Communications, and others) provides fixed terms at similar or slightly higher interest rates with similar late fees. However, students and young adults need to provide their guardians' consent and need to be preapproved to access this type of credit.

The cost of default associated with online consumer loans is relatively lower than that of traditional bank credit. Institutional lenders, subject to credit-reporting regulations in China, can be classified into reporting lenders (e.g., financial institutions, including banks and financial firms) and nonreporting lenders (e.g., FinTech companies). Only reporting lenders are mandated to report borrower repayments and defaults to the public credit registry under the central bank, the People's Bank of China. Beginning in 2005, financial institutions are required to report repayment/default information on both business and individual loans to the Credit Reference Center at the People's Bank of China (i.e., the public credit registry). Formal credit reports, composed of loan performance information, are shared among financial institutions on a complimentary basis.

The benefits and detriments of credit-card debt and access to higher-cost credit have been well researched in developed countries, particularly the United States. But aside from reports in the news media, there are few studies on credit card debt in China. This is surprising, in part, because the Chinese consumer credit market is very large and quickly evolving. At the same time, attitudes about debt accumulation, savings, and consumption have changed (Hancock and Wang (2018)). Moreover, in contrast to the United States, the indebtedness of youth and university students is not caused by credit-card debt or payday lending but, rather, is driven by the emergence of FinTech companies that provide online financial credit services.

These new forms of credit may be convenient; however, they may also pose a dangerous threat to financial health. Young adults are in the formative years of their financial life cycle. Students, for example, are transitioning from financial dependence to financial independence. They may have learned basic skills in cash management before coming to university, but it is during their university years that they employ various forms of credit (Xiao et al. (2008)). University students can

borrow online with ease, but they may know little about how to use credit services effectively. Thus, financial guidance and support seem to be crucial and motivate our study of how financial education, budgeting, and self-control skills affect the usage of such products.

III. Experimental Design

A. Baseline Survey (Wave 1)

We conducted a baseline survey before the interventions from Sept. to Nov. 2016. The survey contained questions on demographic characteristics, spending and consumption information, debt behavior, and financial literacy. We surveyed 1,972 randomly selected second-year university students living in 650 on-campus student dormitories across 5 universities in Wuhan, China.[10] The students span the main educational majors offered in universities in China. We conducted our survey in students' dormitories because of the novel feature that on-campus dorms are mandatory for all students in universities in China. This allows us to mitigate concerns over confounding spillover effects between treatments and from family and friends. In the universities in Wuhan, one dorm room can accommodate four to six students. Once students' rooms are assigned at the time they enroll in the university, it is difficult, and unlikely, for students to change their rooms for the remainder of their time at the university. Students therefore normally stay with the same roommates for 4 years. To achieve high response rates, we conducted both the baseline survey and the follow-up survey in students' dorms between 7:00 p.m. and 10:30 p.m. during the time students are most likely (and sometimes required) to remain in their dorms.[11]

We first randomly selected 650 student dormitory rooms across five universities in Wuhan, China. The five universities were selected based on the feasibility of study implementation, and we chose universities with various standard academic rankings to obtain a cross-section of students.[12] We then interviewed all the residents who were available in the selected dorms. There were 4 to 6 residents in each of the selected dorms.

We hired 20 volunteer student interviewers from the 5 universities to help us collect responses. The surveys were conducted in person by the student volunteers in collaboration with dormitory managers. Dormitory managers are building attendants employed as third-party consultants overseeing the safety and security of the dorms. These managers walked volunteers through living quarters and approached student residences but were not involved during the interviews. Our volunteers made clear that they were not university staff but independent researchers and

[10]Wuhan is the capital of Hubei province and is one of the most populous cities in central China. The city has the third-largest education and scientific base in China and the largest number of undergraduate students. In Wuhan, there are 84 higher educational institutions, including 2 of the top 10 universities in China.

[11]In some universities, dorm managers check to see if students have come back to the dorms at night.

[12]Of the subjects, 241 (13.4%) are from a university in the highest relative ranking; 393 (21.9%) in the second; 508 (28.4%) in the third; 423 (23.6%) in the fourth; and 227 (12.6%) in the fifth, or lowest ranking.

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explained that the data that may or may not be provided would not be shared with any university officials and the responses were purely for research purposes. Each interview took approximately 10–15 minutes. The volunteers did not get a response upon knocking on the doors of 31 dorm rooms. There were also 19 rooms in which none of the students agreed to participate in our study. We continued to randomly select dorms and interview students until we reached our target of 650 dorm rooms. In total, 1,972 students were interviewed in our baseline survey. The average number of students interviewed in each dorm was 2.76.[13]

B. Selection and Treatment Interventions

After our initial collection of the baseline sample, we randomly allocated the 1,972 students into 3 groups: a zero-touch control group, a self-control training group, and a financial education group. We randomly selected one student from each of the 650 student dorms to be part of the intervention. When we selected these students, we required that they guarantee their time to participate in the intervention. If the initially selected student could not commit to attending all sessions, we asked another student in the same dorm at random. We do not believe that this requirement had a meaningful effect on our selection because only a handful of students could not commit in the initial selection process. This process guaranteed that there would be one student in the treatment group from each dorm. The treatment group is therefore composed of these 650 students, and 1,322 nonselected students comprise the control group. We randomly divided the 650 students in the treatment group into 2 groups: 325 students were assigned to the financial education treatment, and the other 325 students were assigned to the self-control treatments.[14]

For all of our intervention sessions, we hired 10 second-year master's students from the Department of Finance at Wuhan University of Science and Technology (WUST) as instructors. Each instructor was paid a standard amount for each session they taught, regardless of the subject matter. In total, we organized 20 treatment-group cohorts (10 financial literacy groups and 10 self-control groups). We then randomly assigned each instructor to one financial literacy group and one self-control group (i.e., each instructor was required to supervise a group from the 2 interventions). Once groups were assigned to an instructor, that instructor was required to teach the 3 sessions for each group.

Because instructors may put different effort into teaching and may have different teaching skills and styles, we were careful to try to reduce any potential confounds to our study. First, before the intervention took place, all 10 instructors were trained together by our research team. In order to become an instructor, each applicant had to strictly follow our procedures and had to hold and pass a trial class. In addition, instructors were told that our research team would randomly visit their classes throughout the interventions. In total, we visited 10 sessions and found no

[13]Students were incentivized to participate in the survey with a small gift, such as a package containing toothpaste, a hand towel, and soap, costing approximately 4 RMB (~$0.55).

[14]Students in the treatment groups were incentivized to attend the sessions with a 30-RMB (~$4.25) supermarket gift card upon completion of each session. These incentives were designed to affect attendance rather than initial participation.

areas of concern. Finally, instructors were told at length that students' loan take-up is voluntary and individual, and therefore they should not push students to specifically cut their loan take-up or try to sway their decisions. To belabor this point, our setup explicitly features no incentive for instructors tied to students' outcomes or responses. Therefore, it is not surprising that our results are largely unaffected when we control for both universities and instructors.

1. Treatment 1: Self-Control Training

For our study on self-control, we rely heavily on the extant literature in psychology. Muraven, Baumeister, and Tice (1999) provide initial evidence on the benefits of increasing self-regulatory strength. Baumeister, Gailliot, DeWall, and Oaten (2006) argue that self-control is analogous to a muscle, in that it becomes tired after exertion and can be improved by regular exercise and practice.[15] Further evidence is provided in a series of investigations by Oaten and Cheng (2006a), (2006b), (2007). In one project, Oaten and Cheng (2006a) enrolled participants in a physical exercise program for 2 months. They find that people who performed the exercise routines became more successful at reducing their cigarette smoking, alcohol use, and impulsive spending. Oaten and Cheng (2007) focus on financial behavior and suggest that self-control failures are the most troublesome and costly.

We employ a financial monitoring program to improve participants' financial self-control using the 3 components of self-regulation: i) setting standards (or goals), ii) engaging in actions that lead to obtaining one's standard or goal, and iii) monitoring progress toward the goal (Baumeister and Newman (1994), Carver and Scheier (1998), and Oaten and Cheng (2007)). In the financial monitoring program of Oaten and Cheng (2007), participants were instructed to bring personal spending and/or banking records (i.e., check stubs, bank statements, credit-card statements, receipts, etc.) from the previous month to provide a baseline measure of personal spending. An experimenter discussed with the participants their financial goals, and a personalized financial monitoring program was then prepared. In a sense, such self-control sessions provide financial literacy education of a different form by framing the topics in a less abstract manner than conventional educational interventions.

We closely followed the financial monitoring program proposed by Oaten and Cheng (2007) and designed a similar self-control training intervention. One of our innovations to the design was to migrate the data-collection process for spending data to the use of a mobile app, which automatically links students' bank accounts, purchases, income, and credit and borrowing behavior. We document this process in detail later in the article. We randomized the 325 students into 10 groups with approximately 33 students each. These 10 groups of students participated in 3 parallel training sessions from Mar. 2017 to Oct. 2017. Each of the sessions lasted 90 minutes, and the average attendance in the self-control training sessions was 92%.

[15]Also see Eisenberg, Bissett, Enkavi, Li, MacKinnon, Marsch, and Poldrack (2019) for a recent review and meta-analysis of self-regulation studies in psychology.

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The first class was held on Saturday, Mar. 18, 2017. During this class, participants were instructed to install and sign up with a free PFM mobile app.[16] The app can synchronize students' financial accounts, including bank accounts, WeChat Pay account, Alipay account, and students' campus cards.[17] Participants were required to give the app permission to access all their payment accounts, including bank accounts, credit-card accounts, WeChat Pay account, Alipay account, and their campus cards, so that the app can combine all spending data and keep the data in one place. The PFM accurately tracks income and expenses by category, much like those discussed in recent studies (e.g., Olafsson and Pagel (2018), Braeuer, Hackethal, and Hanspal (2019)). Categories in the app include utilities, groceries, dining out, cash withdrawals, movies, tuition, books and magazines, electronics and software, gym and fitness, pharmacy, alcohol, travel, shopping, and so forth.[18] In this first session, our trainers instructed the participants on how to use the app. Subjects were then asked to record their spending with the app for the following 2 months, from Mar. 19, 2017, to May 19, 2017.

The second class took place on Saturday, June 10, 2017. In this session, participants were required to provide their spending tracked by the app from Mar. 19, 2017, to May 19, 2017, along with their total monthly income, expenses, and savings or debt for the period. The financial accounting for these 2 months provided a baseline measure of the participants' personal spending in the third session. Based on the spending records, our trainer asked each participant to detail any nonplanned purchases, purchases that cost more than half the subject's monthly income, and spending categories that cost more than the amount budgeted in the last 2 months. With each of these, subjects were asked to describe how they felt about the purchases ex post in a one-on-one, private conversation with the session counselors. In addition, counselors helped the participants to set goals and establish budgets in each spending category each month for the following four months and required that they keep tracking their spending for the next period (June 11, 2017–Oct. 10, 2017). At the end of each month, the participants were required to submit their spending records to their counselor through WeChat and email.

In the final class on Saturday, Oct. 10, 2017, participants were required to provide their spending tracked by the app since the last session, along with income and financial accounting as previously. Participants were asked to compare their true spending to the goals and budgets set in session 2 and were again asked about unplanned or unbudgeted purchases and how they felt about them ex post. In addition, participants were asked if they experienced difficulty in complying with the program and if they felt they were progressing.

[16]The app used in the treatment was developed by Youdao, Inc., which is listed on the NYSE.

[17]WeChat Pay and Alipay are the most popular third-party mobile payment apps in China. Both have become very common in China, so paying with cash is rare, even with street performers and taxi drivers. A campus card can be used as an electronic wallet in the canteen and supermarket, on the school shuttle bus, and for other personal payments on campus. Students can top up their campus card with their bank account or cash.

[18]In our empirical analysis, we aggregate these categories to broader levels: food, clothing, education, entertainment, gaming, and other.

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2. Treatment 2: Financial Literacy

Similar to the self-control treatment, we held 3 financial literacy course sessions for each group. We randomized the 325 students into 10 parallel sessions with approximately equal numbers of participants. The participants in each session were expected to attend all 3 of the financial literacy classes over 9 months in 2017. The first class was held on Saturday, Mar. 11, 2017, and focused on the time value of money and compounding interest. The second class was held on Saturday, June 3, 2017, and focused on risk diversification and the trade-offs between risk and returns. Finally, the third class was held on Saturday, Oct. 28, 2017, and focused on an introduction to online consumer loans, fees, and interest rates provided by the main lenders in the market. The goal of these sessions was to expose the participants to important general concepts in financial literacy (Lusardi and Mitchell (2014), Lusardi and Tufano (2015)) and to improve their knowledge of such topics.

Each training session lasted approximately 90 minutes. In each session, the trainer taught the basic financial topics for about 70 minutes, followed by a 20-minute peer discussion. Attendance was taken by the instructor in every training session. The average attendance across the training sessions was 94%. We excluded students from the treatment group if they missed 2 or more training sessions. Figure A.1 in the Supplemental Material shows 2 classrooms from the 2 different treatments in 2017. Both the financial literacy and self-control treatments used traditional classroom seating arrangements, as well as more of a group seating arrangement in smaller classrooms, depending on which type of classroom was available at the time.

C. Follow-Up Survey (Wave 2)

Fifteen months after the interventions, we revisited students in both the treatment and control groups who participated in the baseline survey and conducted a follow-up survey. Similar to the baseline survey, our enumerators interviewed the students in their dorms from 7:30 p.m. to 10:30 p.m. between Feb. 25, 2019, and Apr. 10, 2019. In the follow-up survey, 1,679 (94%) of the participants had responded to the baseline survey.

Significant effort was made to decrease attrition between sessions and survey waves.[19] We created two WeChat groups for the students in the treatment groups. Our trainers made announcements in the WeChat groups both 1 week and 1 day before the session to remind participants to attend the trainings and submit their assignments. Our trainers also monitored attendance in each training session. If a participant was assigned to attend the training but missed a session, the trainer provided a makeup session.

IV. Descriptive Statistics and Cross-Sectional Determinants of Online Borrowing

Table 1 presents an overview of the participants in our study. Approximately 66% of the participants are female, and as noted, approximately 47% of

[19]The attrition between waves of the survey was very low. See Appendix A in the Supplementary Material for these tabulations.

TABLE 1
Summary Statistics

In Table 1, we report descriptive statistics (mean, median, minimum, and maximum) for all participants in wave 1 of the survey and subsequent interventions. For each individual, we observe the self-assessed financial and demographic characteristics from Sept. 2016.

Variable	Mean	Median	Minimum	Maximum
	1	2	3	4
MALE	0.34	0.0	0.0	1.0
BORROWED_ONLINE_IN_LAST_12_MONTHS	0.47	0.0	0.0	1.0
FINANCIAL_LITERACY_SCORE	3.35	4.0	0.0	6.0
PARENT_COLLEGE_EDUCATION	0.14	0.0	0.0	1.0
MONTHLY_EXPENSES	2.66	3.0	1.0	5.0
BUSINESS_MAJOR	0.52	1.0	0.0	1.0
CONFIDENCE_IN_DAILY_FINANCES	4.02	4.0	1.0	7.0
READ_FINANCIAL_NEWS	3.19	3.0	1.0	7.0
NUMERACY	4.29	4.0	1.0	7.0
FINANCIAL_LITERACY_TREATMENT	0.18	0.0	0.0	1.0
SELF_CONTROL_TREATMENT	0.18	0.0	0.0	1.0
CONTROL_TREATMENT	0.64	1.0	0.0	1.0
No. of obs.	1,792			

the participants have borrowed online in the past 12 months. The participants score relatively well on the financial literacy tests, with a median score of 4 out of 6 questions. On average, about half of the participants are business majors. Other participants are studying science, engineering, computer science, medicine, social science (excluding business), and art. Survey responses on self-assessed numeric ability and financial behaviors are plotted by gender in Figure 1. In general, we find small and insignificant gender differences in the pretreatment measures.[20]

In Table 2, we examine the cross-sectional determinants of the use of online borrowing. The dependent variable is an indicator for borrowing online in the previous 12 months. Columns 1–3 sample responses from the first survey in Sept. 2016, whereas columns 4–6 focus on the second survey in Feb. 2019. Column 7 pools both survey waves. We find that participants' financial literacy scores seem to have little explanatory power for past borrowing decisions. We also find that although there are fewer males in our sample, they are more likely to use online borrowing products than are females. As expected, participants with higher self-assessed monthly expenses are more likely to use online borrowing, and those who state higher levels of confidence in their ability to manage daily finances borrow at lower rates. Surprisingly, individuals with higher self-assessed numeracy levels are more likely to borrow, and business majors (who also have higher levels of financial literacy) seem to borrow at a lower rate. Hao et al. (2019) similarly examine online consumer credit among students in Beijing. Our findings provide confirmation to their study by showing that cross-sectional differences among education and financial support affect the demand for consumption-based borrowing.

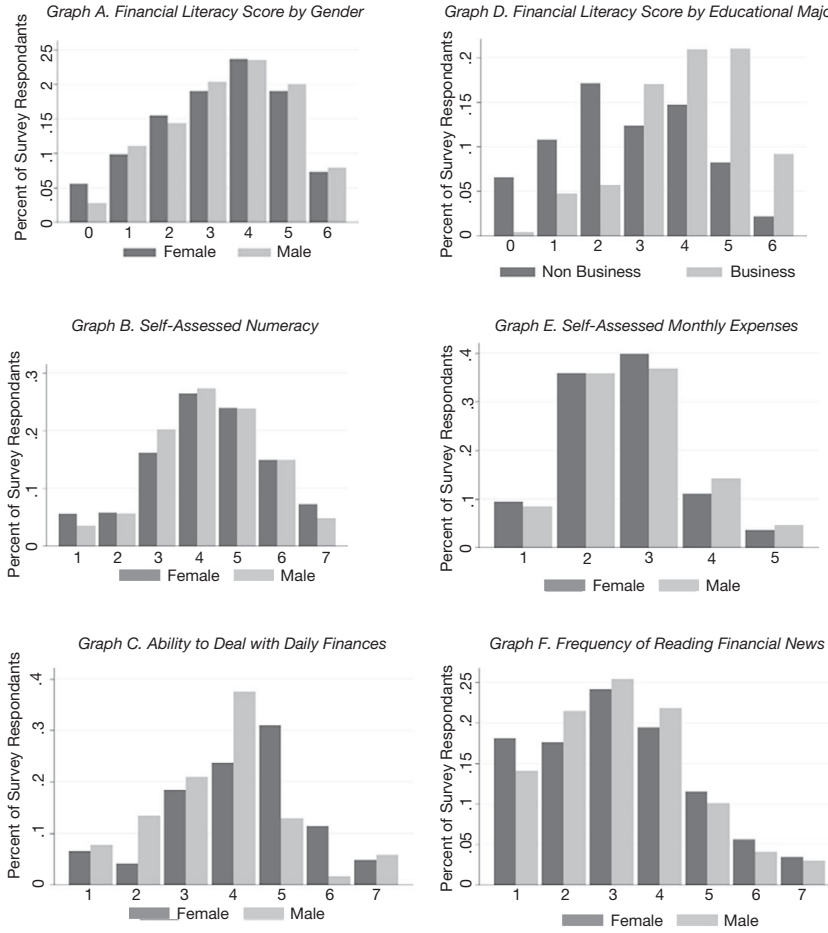
[20]Table A2 in Supplementary Material Appendix A presents demographic characteristics by treatment group, along with evidence that the sample is well balanced.

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FIGURE 1

Subjects' Financial Literacy and Financial Aptitude Prior to Interventions

In Figure 1, we plot participants' financial literacy from wave 1 of the survey (top to bottom, left to right) by gender (Graph A), self-assessed numeracy (Graph B), ability to deal with daily finances (Graph C), financial literacy by educational major (Graph D), monthly expenses (Graph E), and how often they read the financial news (Graph F).



V. Main Results

A. The Effect of Self-Control and Financial Literacy Treatments on Online Borrowing

If individuals are more likely to borrow online because they lack budgeting skills or basic financial literacy skills, our interventions should lead to reduced online borrowing following the 2 treatments. We first graphically examine this relationship in Figure 2. In Graph A, we find a large increase from the pre- to postintervention period for the participants in the control group. This is likely due to the general increasing trend in online payments, borrowing, and financial

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TABLE 2

Determinants of Past Online Borrowing

Table 2 provides the results of an analysis of the determinants of online borrowing. The dependent variable is an indicator for borrowing online in the previous 12 months. Columns 1–3 are sample responses from the first survey in Sept. 2016, columns 4–6 are from the survey wave 2 in Feb. 2019, and column 7 is a pool of results from both waves. The variable FINANCIAL_LITERACY_SCORE is the score the subject received on a survey-based quiz with 6 standard literacy questions. MONTHLY_EXPENSES represents a survey question where subjects can provide one of 5 bins for their estimated living expenses per month, PARENT_COLLEGE_EDUCATION indicates if at least one parent has at least a college education, and BUSINESS_MAJOR indicates that the participant studies business at the university. CONFIDENCE_IN_DAILY_FINANCES and NUMERACY represent self-assessed survey questions on how well the participant can manage their daily finances and how good their numeric thinking is. POST takes the value of 1 if the response is from wave 2 of the survey, and 0 otherwise. Across select specifications, we control for 3 regions in China where the participant is from (East, West, Central) and for participant dorm-fixed effects. Robust standard errors clustered at the participant–dorm level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	Survey Wave 1			Survey Wave 2			Pooled
	1	2	3	4	5	6	7
FINANCIAL_LITERACY_SCORE	−0.01	0.00	−0.00	−0.01	−0.01	−0.01	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
MALE	0.29***	0.22***		0.22***	0.18***		
	(0.02)	(0.03)		(0.03)	(0.03)		
MONTHLY_EXPENSES	0.02	0.01	0.03*	0.02*	0.02**	0.03**	0.04***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
PARENT_COLLEGE_EDUCATION		−0.03	−0.04		−0.04	−0.05	−0.04
		(0.03)	(0.04)		(0.03)	(0.05)	(0.04)
BUSINESS_MAJOR		−0.07***	−0.07*		−0.08***	−0.10**	−0.08***
		(0.02)	(0.04)		(0.02)	(0.04)	(0.03)
CONFIDENCE_IN_DAILY FINANCES		−0.12***	−0.13***		−0.07***	−0.06***	−0.09***
		(0.01)	(0.01)		(0.01)	(0.01)	(0.01)
NUMERACY		0.04***	0.04***		0.04***	0.05***	0.05***
		(0.01)	(0.01)		(0.01)	(0.01)	(0.01)
POST							0.08***
							(0.01)
Region fixed effects	No	Yes	Yes	No	Yes	Yes	Yes
Dorm fixed effects	No	No	Yes	No	No	Yes	Yes
R^2	0.08	0.23	0.54	0.05	0.11	0.47	0.45
No. of obs.	1,792	1,792	1,792	1,679	1,679	1,679	3,471

technology in China over the time period. The second bar shows, as hypothesized, that financial literacy reduces the growth in online borrowing relative to the control group. That is, these participants *increase* online borrowing at a slightly *lower* rate compared with the control group.

The last bar in Graph A of Figure 2 shows that participants in the self-control treatment group reduce their rate of online borrowing. We note that on the right graph, these effects relative to the control group are approximately –15 pp. In Graph B, we disaggregate this effect by gender and note that it seems to be driven by the males in the sample rather than the females. The rate of borrowing decreases by approximately 6 pp for women and 7 pp for men in the literacy treatment group and by approximately 10 pp for females and 20 pp for males in the self-control treatment group. We discuss this heterogeneity at length in a later subsection.

Table 3 presents these results in a regression framework. Specifically, we estimate the following regression:

$$Y_{i,t} = \beta_0 + \beta_1 X_{i,t} + \beta_2 C_j \times \varphi_t + \varepsilon_{i,j,t}, \quad (1)$$

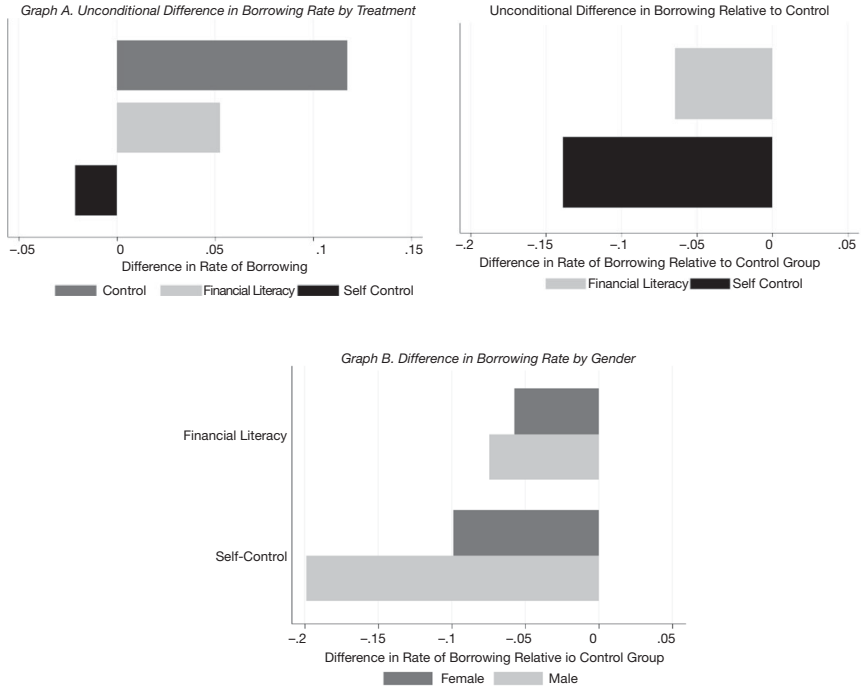
where $Y_{i,t}$ is an indicator for borrowing online in the last 12 months for subject i, $X_{i,t}$ represents a set of time-varying and invariant control variables, C_j is the

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FIGURE 2

The Effect of Interventions on Online Borrowing

In Graph A of Figure 2, we plot the average difference in online borrowing rates from the preintervention to the postintervention for the 3 randomly assigned groups: a control group, a financial literacy treatment group, and a self-control treatment group. In Graph B, we disaggregate the difference from the control group by gender.



intervention that subject i was allocated to, and φ_t captures the post trend for the follow-up survey. In all regressions, we control for individual fixed effects and allow for robust standard errors clustered at the individual level.[21] In Table 3, the results in columns 1–3 relate any treatment experience relative to the control group of subjects and show a large, negative, and statistically significant effect on the propensity to borrow online after our interventions. In columns 4–9, where we disaggregate the effect by financial literacy or self-control treatment, the effect for the financial literacy treatment is only marginally significant (relative to the control or self-control group), whereas the effect for the self-control group is significant at the 1% level.[22] In Table A.4 in the Supplemental Material, we jointly estimate both treatments and test for equivalence between financial literacy and self-control on subsequent borrowing. We note that in both the OLS and nonlinear estimations, we largely reject the hypothesis that the 2 treatment effects are equivalent.

[21] In unreported regressions, we cluster standard errors at varying levels (e.g., treatment cells), which does not have a quantitative effect on our results. However, given that the number of groups (11) is small, we present all tables and figures with our preferred individual-level cluster. In general, our results are highly robust to alternative choices of clustering.

[22] Table A3 in Supplementary Material Appendix A presents the marginal effects after a logistic regression as opposed to a linear probability model.

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TABLE 3

The Effect of Interventions on Online Borrowing

Table 3 presents the results of an analysis of the effect of various treatment interventions on participants' propensity to borrow online before and after participating in the interventions. The dependent variable is an indicator for borrowing online in the previous 12 months. In the regressions for each column, we include indicator variables for receiving a treatment and participating in an intervention (TREATED); the wave of the survey (POST); and the interaction of the two (TREATED × POST), our variable of interest. Columns 1–3 show the results for any intervention, either financial literacy or self-confidence. Columns 4–6 provide the results for the financial literacy intervention, and columns 7–9 provide the results for the self-control intervention. The sample includes data from both survey waves. We first present results without any control variables (columns 1, 4, and 7), then add individual fixed effects (columns 2, 5, and 8) and control variables (columns 3, 6, and 9) to account for changes in expenses, confidence, and numeric ability. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Variable	Any Treatment			Financial Literacy			Self-Control		
	1	2	3	4	5	6	7	8	9
TREATED	0.08***			0.04			0.08***		
	(0.02)			(0.03)			(0.03)		
POST	0.12***	0.12***	0.12***	0.09***	0.09***	0.09***	0.10***	0.10***	0.11***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
TREATED × POST	−0.10***	−0.10***	−0.11***	−0.03	−0.04	−0.05*	−0.12***	−0.12***	−0.11***
	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
FINANCIAL_LITERACY_SCORE			0.00			0.00			−0.00
			(0.01)			(0.01)			(0.01)
MONTHLY_EXPENSES			−0.01			−0.01			−0.01
			(0.02)			(0.02)			(0.02)
CONFIDENCE_IN_DAILY_FINANCES			−0.02**			−0.02**			−0.02*
			(0.01)			(0.01)			(0.01)
NUMERACY			0.01			0.01			0.00
			(0.01)			(0.01)			(0.01)
Individual fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
R^2	0.01	0.88	0.88	0.01	0.88	0.88	0.01	0.88	0.88
No. of obs.	3,471	3,471	3,471	3,471	3,471	3,471	3,471	3,471	3,471

One potential concern is that the growing trend in the control group's borrowing could be due to our selection of the sample and does not necessarily reflect the average household across China. However, the upward trend in borrowing over the time frame of our study is consistent with reports on debt usage, particularly online, from aggregate statistics. According to a recent e-commerce study reported by the state-owned news agent *People's Daily Online*, the compounded annual growth of consumers using online installment services from 2016 to 2019 was 68% ("Installment Payments Embrace High Popularity in China," *People's Daily Online*, Dec. 4, 2019, available at http://en.people.cn/n3/2019/1204/c90000-9638038.html). Similarly, an industry consulting group in China reports that the number of online consumer loan borrowers grew from 23 million individuals in 2015 to 382 million in 2020 (i.e., more than 25% of the entire population of China in 2020). At the intensive margin, consumer balances for online loans grew from 119 to 3,120 billion yuan (Liu (2019)). Additionally, Hancock and Wang (2018) report that a generation of young consumers is rejecting the thrifty habits of their elders, has become used to spending with borrowed money, and is accelerating the increase in consumer loans. Particularly, in online and peer-to-peer (P2P) lending platforms, "consumers in their twenties have been the core customers" (Hancock and Wang (2018)). These reports lend support to our finding that young adults and university students across China, like those in our control group, increased borrowing on online platforms from 2016 to 2019.

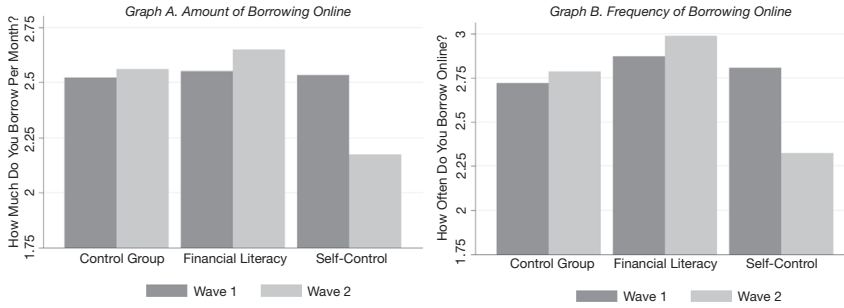
The results in Figure 2 and Table 3 suggest that our self-control intervention reduced the overall online borrowing of our participants; however, it may be

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FIGURE 3

The Effect of Interventions on the Intensive Margin of Online Borrowing

In Figure 3, we plot the average amount and frequency of online borrowing in the last 12 months before and after the interventions for the 3 randomly assigned groups: a control group, a financial literacy treatment group, and a self-control treatment group. The variable we use in Graph A to measure the amount of borrowing is the response to a survey question about how much (in RMB) per month on average the participants borrow online (where 1 = < 200, 2 = 200–600, 3 = 601–1,000, and 4 = ≥ 1,500); in Graph B, it is the response to a survey question about how many times per month the subject borrows online on average (where 1 = < 1, 2 = 1–2, 3 = 3–5, and 4 = ≥ 5). The dark-gray bars represent the mean financial literacy score before the intervention in wave 1, and the light-gray bars represent wave 2.



reasonable to expect that these individuals will continue to borrow but at a reduced amount. In Figure 3, we plot the average amount, in RMB, borrowed online and the average monthly frequency of borrowing by intervention treatment group. As noted previously, participants borrow roughly 570 RMB ($83) per month prior to the interventions. As shown in Graph A of Figure 2, the control group and the financial literacy intervention have no effect in decreasing the average amount borrowed conditional on borrowing. However, those in the self-control treatment group reduce the amount they borrow substantially. Furthermore, participants in our sample borrow online rather often, with a mean scale value of 2.75 (3 median), which corresponds to 1–2 times per month(3-5 times per month). Again, the self-control treatment is the only intervention that decreases the frequency of borrowing. Table 4 presents the OLS regression results using the mean survey response for the intensive margin of borrowing online. In Table A.5 in the Supplemental Material, we present ordered logistic regression results and provide the marginal effects for the outcomes associated with our variable of interest, TREATED × POST. Both specifications provide results consistent with the naive figures in which we plot the mean effect.

As discussed in Section III, one asset of our experimental design is that treatment intervention instructors were shared across treatment groups and oversaw both types of financial literacy and self-control sessions. This allows us to measure the within-instructor effect of the courses and to rule out the concern that the differential effect between interventions is driven by differences in instructor characteristics. In Table A.6 in the Supplemental Material, we present OLS and logistic regression results where we jointly estimate treatment and time trends for the financial literacy and self-control groups relative to a control group (columns 1, 2, and 5) and relative to each other (columns 3, 4, 6, and 7). We include 10 instructor fixed effects (11 when relating to a control group with no instructor

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TABLE 4

The Effect of Interventions on the Intensive Margin of Online Borrowing

Table 4 presents the results of an analysis of the effect of various treatment interventions on participants' online borrowing before and after participating in the interventions. The dependent variable in Panel A is the response to a survey question about how much (in RMB) per month the participant on average borrows online (where 1 = < 200, 2 = 200–600, 3 = 601–1,000, and 4 = ≥ 1,500); in Panel B, it is the response to a survey question about how many times per month the participant borrows online on average (where 1 = < 1, 2 = 1–2, 3 = 3–5, and 4 = ≥ 5). In the regression for the results in each column, we include indicator variables for receiving a treatment and participating in an intervention (TREATED); the wave of the survey (POST); and the interaction of the two (TREATED × POST), our variable of interest. Columns 1–3 show the results for any intervention, either financial literacy or self-confidence. Columns 4–6 provide the results for the financial literacy intervention, and columns 7–9 provide the results for the self-control intervention. The sample includes data from both survey waves. We first present results without any control variables (columns 1, 4, and 7), then add individual fixed effects (columns 2, 5, and 8) and control variables (columns 3, 6, and 9) to account for changes in expenses, confidence, and numeric ability. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	Any Treatment			Financial Literacy			Self-Control		
	1	2	3	4	5	6	7	8	9
Panel A. How Much Do You Borrow Online?									
TREATED	0.02			0.03			0.01		
	(0.08)			(0.09)			(0.09)		
POST	0.04	0.06	0.03	−0.04	−0.03	−0.06	0.05	0.08	0.05
	(0.04)	(0.07)	(0.07)	(0.04)	(0.06)	(0.06)	(0.04)	(0.05)	(0.06)
TREATED × POST	−0.16**	−0.15	−0.17*	0.14*	0.18	0.18	−0.41***	−0.44***	−0.43***
	(0.07)	(0.10)	(0.10)	(0.07)	(0.11)	(0.12)	(0.08)	(0.12)	(0.12)
FINANCIAL_LITERACY_SCORE			0.05			0.04			0.04
			(0.03)			(0.03)			(0.03)
MONTHLY_EXPENSES			0.01			0.01			0.00
			(0.10)			(0.10)			(0.10)
CONFIDENCE_IN_DAILY_FINANCES			0.01			0.02			0.02
			(0.03)			(0.03)			(0.03)
NUMERACY			0.02			−0.01			−0.00
			(0.04)			(0.04)			(0.03)
Individual fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
R^2	0.00	0.86	0.86	0.00	0.86	0.86	0.01	0.87	0.87
No. of obs.	1,786	1,786	1,786	1,786	1,786	1,786	1,786	1,786	1,786
Panel B. How Often Do You Borrow Online?									
TREATED	0.12*			0.13			0.05		
	(0.07)			(0.09)			(0.08)		
POST	0.07	0.10	0.08	−0.05	−0.04	−0.07	0.07**	0.11**	0.09
	(0.04)	(0.07)	(0.08)	(0.04)	(0.06)	(0.07)	(0.04)	(0.05)	(0.06)
TREATED × POST	−0.23***	−0.29***	−0.32***	0.16**	0.19**	0.20*	−0.55***	−0.68***	−0.68***
	(0.07)	(0.10)	(0.11)	(0.07)	(0.09)	(0.11)	(0.09)	(0.13)	(0.13)
FINANCIAL_LITERACY_SCORE			0.05*			0.04			0.04
			(0.03)			(0.03)			(0.03)
MONTHLY_EXPENSES			−0.01			−0.01			−0.02
			(0.11)			(0.11)			(0.10)
CONFIDENCE_IN_DAILY_FINANCES			0.00			0.02			0.02
			(0.04)			(0.04)			(0.04)
NUMERACY			0.03			−0.02			−0.02
			(0.04)			(0.04)			(0.03)
Individual fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
R^2	0.00	0.84	0.84	0.01	0.83	0.83	0.02	0.85	0.85
No. of obs.	1,786	1,786	1,786	1,786	1,786	1,786	1,786	1,786	1,786

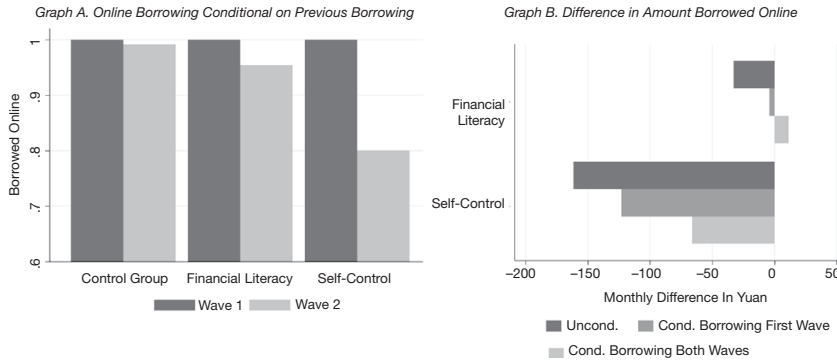
by design). We note a largely similar trend: The self-control treatment group decreases borrowing by 14 to 15 pp relative to the control group and by 7 to 8 pp relative to those in the financial literacy treatment group, even when holding the class instructor constant. The results in column 7, when we additionally control for university fixed effects, suggest that differences across institutions are also not driving the variations in our findings.

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FIGURE 4

The Effect of Interventions on Online Borrowing Conditional on Pervious Borrowing Behavior

In Graph A of Figure 4, we plot the average rate of online borrowing used for discretionary purposes in the last 12 months before and after the interventions for the 3 randomly assigned groups: a control group, a financial literacy treatment group, and a self-control treatment group conditional on borrowing in the 12 months before the first survey wave. In Graph B, we measure the average monthly difference in RMB borrowed online for the financial literacy and self-control groups relative to the control group, from wave 1 to wave 2. The 3 shaded bars represent the unconditional amount (dark gray), the amount conditional on borrowing in the first wave (middle-gray), and the amount conditional on borrowing in both periods (light gray).



One important question that arises is as follows: Which participants are driving the effect? Do the interventions affect all participants, or are the effects conditional on their previous experiences? In Figure 4, we plot the mean effect on the rate of online borrowing conditional on participants borrowing online in the first wave of the survey. We note that conditional on borrowing in the preintervention period, participants in the control group very slightly reduce their borrowing. This suggests that the increase in the overall borrowing rate discussed previously is mainly driven by new entrants. The effect for the financial literacy treatment is small and negative, whereas participants in the self-control treatment group, conditional on previous borrowing, decrease their borrowing by more than 20 pp.

In Figure 5, we disaggregate these total effects into who responds to the treatment. Graph A shows that the rate of borrowing among individuals sorted into the control group increases significantly (10%), and the bar with the lightest shade of gray indicates that this is made up of new entrants. For participants in the self-control treatment group, there is a strong decrease in borrowing for those who previously borrowed.

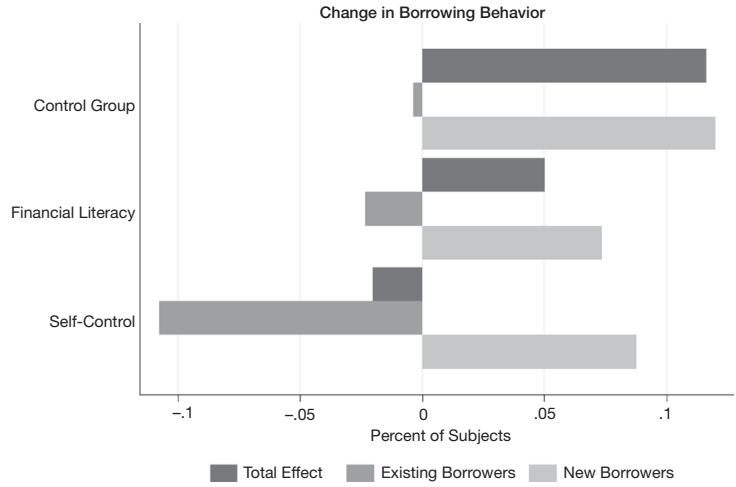
In Graph B of Figure 4, we relate these effects to an RMB value. Survey participants are asked to choose the bin corresponding to their monthly online borrowing (1 = < 200 RMB, 2 = 200–600 RMB, 3 = 601–1,000 RMB, and 4 = ≥ 1,500 RMB), and we approximate monthly borrowing by the midpoint of each range. Relative to the control sample, the unconditional effect across the sample amounts to a decrease in borrowing of approximately 150 RMB per month (approximately $250 per year). This is a significant effect, given that the average online loan in our setting is approximately 500 RMB, and compared with the effect of less than 50 RMB per month for individuals allocated to the financial literacy group.

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FIGURE 5

The Effect of Interventions by Borrowing Experience

In Figure 5, we plot the change in the rate of online borrowing before and after the interventions for the 3 randomly assigned groups: a control group, a financial literacy treatment group, and a self-control treatment group. We plot the change in the percentage of participants. We present the total (net) effect in dark gray, the change conditional on borrowing preintervention in middle-gray, and net new borrowers in light gray (i.e., those that did not borrow preintervention).



B. Online Borrowing Around Self-Control Treatments: Evidence from PFM Data

One inherent challenge associated with our baseline and follow-up surveys eliciting information about online borrowing behavior is that they are not externally verifiable. A participant may forget about specific borrowing choices or may want to avoid telling the truth about patterns of consumption that he or she later regrets. Furthermore, the timing of the follow-up survey is well after the third intervention and does not allow us to investigate the shorter-term effects.

To address these two concerns, we match participants from the self-control treatment group to their borrowing activity as collected by the third-party PFM mobile app. Each participant in the self-control intervention agreed to share their consumption and borrowing data with the researchers. We collected the data in 6 waves that coincided with 2 constraints. The first is that the PFM stores historical data for 6 months. The second constraint is that we are only allowed to monitor PFM data around the preset dates of our interventions.

Our detailed PFM data consist of the tracked information from individuals who gave us additional permission to use it (i.e., those selected for the self-control treatment group). Therefore, our analysis of these data is a single-difference estimation. The outcome variable is a measure of borrowing behavior conditional on individual fixed effects, and our variables of interest are indicator variables that capture different points in time around the different intervention dates (the self-control training sessions).

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TABLE 5

The Effect of Interventions on Third-Party App Borrowing Data

Table 5 presents the results of an analysis of the effect of the self-control intervention on participants' borrowing behavior over time. The dependent variable in the regression for column 1 is an indicator for borrowing online; in the regression for column 2, the dependent variable is the average monthly amount borrowed; and in the regression for column 3, the dependent variable is the average number of times borrowed in a month. The sample consists of participants in the self-control treatment group, and the underlying data are from the third-party app used in the program. The explanatory variables are indicators taking the value of 1 for the different time periods for which we can access data from the app. The first 3 time-period variables coincide with the timing of the self-control interventions. We present the coefficients of a linear regression including individual fixed effects. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	Borrowed Online	Average Amount Borrowed	Average Number of Times Borrowed
	1	2	3
Spending data 1: 3/17–5/17	—	—	—
	—	—	—
Spending data 2: 6/17–10/17	−0.02	−44.62***	−0.17***
	(0.02)	(12.85)	(0.05)
Spending data 3: 11/17–12/17	−0.06***	−80.75***	−0.33***
	(0.02)	(14.52)	(0.05)
Spending data 4: 6/18–10/18	−0.04	−50.98*	−0.21*
	(0.04)	(26.51)	(0.12)
Spending data 5: 11/18–12/18	−0.01	−39.10	−0.15
	(0.04)	(26.41)	(0.11)
Spending data 6: 1/19–5/19	−0.01	−28.99	−0.11
	(0.04)	(25.85)	(0.11)
Constant	0.53***	297.02***	1.46***
	(0.02)	(14.24)	(0.06)
Individual fixed effects	Yes	Yes	Yes
R^2	0.65	0.73	0.73
No. of obs.	1,698	1,698	1,698

Table 5 presents the results. The dependent variable in column 1 is an indicator for borrowing online; in column 2, it is the average monthly amount borrowed; and in column 3, it is the average number of times a participant borrows in a month. For each specification, we omit the first treatment time period and denote it as the baseline pretreatment window. The indicator variable captures the time span when participants first began recording their spending in the PFM, directly at the onset of the first class. In column 1, for example, we note that at the extensive margin, the probability of borrowing online decreases marginally in PFM activity following the second course and then by 6 percentage points following the third and final course. Spending data 5 and 6 are time periods between and during the follow-up survey.

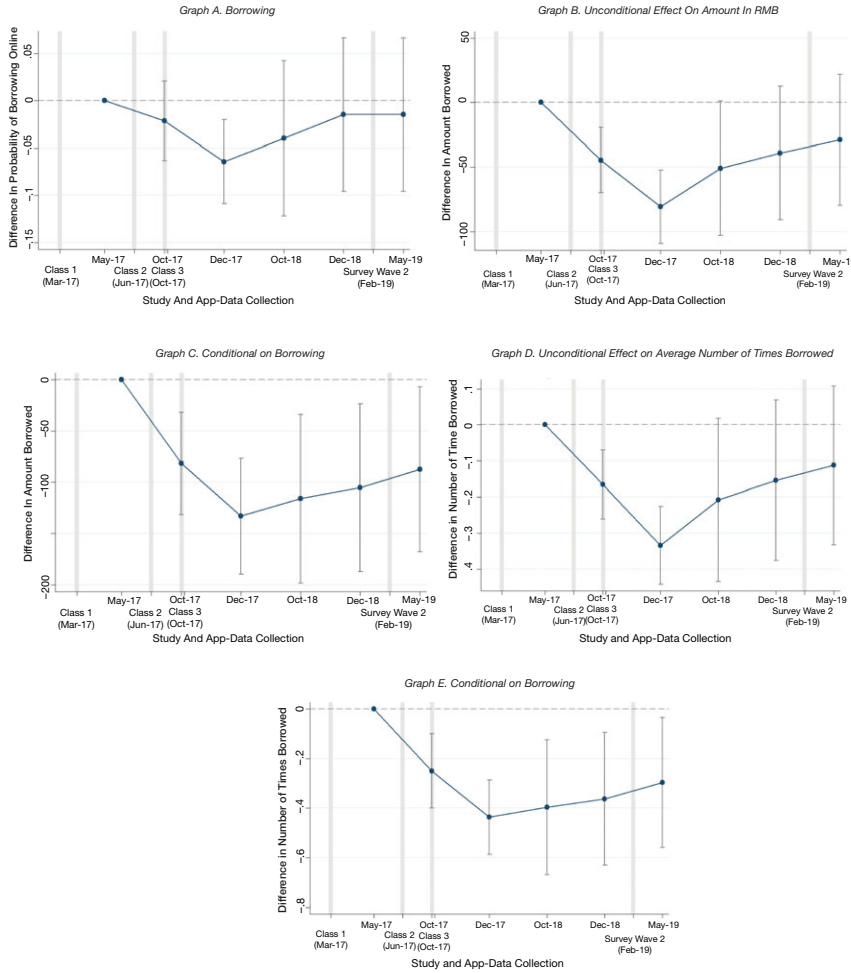
In columns 2 and 3 of Table 5, we examine the extensive margin of borrowing. Across columns, we note a downward effect in borrowing after the initial courses, and this effect statistically fades over time. These results, and the timing around the interventions, are best illustrated graphically. In Figure 6, we plot the marginal effects after these regressions. Graph A shows the average change in borrowing following the second and third classes at the extensive margin. Graphs B and C present the changes in dollar amounts borrowed following the self-control sessions. Graphs D and E show the change in the average number of times a participant borrowed in a month. In Graphs B and D, we include all participants in the self-control group, whereas in Graphs C and E, we include all participants conditional on borrowing. Across all graphs, we note a statistically significant and economically meaningful decline in borrowing behavior following the onset of the courses.

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FIGURE 6

The Effect of Interventions on Online Borrowing Using Third-Party Mobile App Data

In Figure 6, we plot the average change in borrowing behavior for participants in our self-control treatment group using third-party personal financial management (PFM) data from a mobile app. In Graph A, the dependent variable is an indicator for borrowing online; in Graphs B and C, it is the average monthly amount borrowed; and in Graphs D and E, it is the average number of times borrowed in a month. Graphs C and E are conditional on borrowing, whereas Graphs B and D are unconditional. The plotted points and 95% confidence intervals are the marginal effects from the specifications in Table 5 with individual fixed effects and robust standard errors clustered at the individual level.



In general, there is a slight uptick in borrowing over time (albeit statistically less than the preperiod), suggesting, unsurprisingly, that our interventions may have more of a short-term effect. Our results also echo the decay effects shown in the literature and therefore support the argument that "just-in-time" financial literacy or counseling, as shown in our effect sizes, directly following counseling sessions may be important for affecting field behavior (Fernandes et al. (2014)). The relatively short-lived nature of the treatment effect may also have important policy

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considerations. For example, financial literacy may be more one-off in the sense that once a general notion of finance can be sufficiently learned in a single treatment, there is less scope for repeated interventions unless the curriculum is sufficiently expanded. Counseling and self-control treatments, on the other hand, might require repeated interventions on a regular basis to further develop and curate financial behavioral skills, somewhat similar to psychological counseling sessions. If this is indeed the case, the effectiveness of each treatment relative to the total long-run cost must also be considered. We discuss this further in Section VII.

At the same time, it is unlikely that our main results are driven by Hawthorne effects, or that participants are responding to the monitoring effect of the treatment rather than the treatment itself. One way we can partially rule this out is that we observe the largest decrease in borrowing after the last treatment session, when students are no longer expected to further discuss their consumption and borrowing patterns. Furthermore, the follow-up survey is more than 1 full year later, and at this point, participants are not aware of the survey itself, its timing, or its content.

VI. What Drives the Effectiveness of Self-Control Treatment on Online Borrowing?

A. The Effect of the Interventions on Financial Knowledge

Having established that the self-control treatment significantly improves online borrowing behaviors, we next test whether the positive outcomes are due to the improved financial knowledge of the participants. One of the main hypotheses motivating this study was that improving literacy on general financial topics would be important for affecting the decision to borrow online because we believed that many students did not fully understand the details of the loan products. An important aspect of our article is therefore the investigation of how our educational treatment affects subsequent financial literacy scores. In Figure 7, we show the mean effect of our interventions on financial literacy test scores. The figure shows the average financial literacy scores before and after treatment interventions. The dark-gray bars represent the mean financial literacy score before the intervention in wave1, and the light-gray bars represent the average score in wave 2.

Figure 7 shows that participants in the financial literacy education treatment group demonstrate improved financial literacy test scores on the second survey. Table 6 presents the regression results. The financial literacy scores range from 0 to 6.[23] In the regression in each column, we include indicator variables for receiving a treatment and participating in an intervention (TREATED); the wave of the survey (POST); and the interaction of the two, TREATED × POST, our variable of interest. In columns 1–3, the treatment variable indicates any treatment, either financial literacy or self-control. We note that a treatment of any type increases participants' financial literacy test scores by approximately 0.4 points (out of a total of 6) relative to the control sample (column 1). This effect remains

[23]The questions and answers to the financial literacy segment of the survey can be found in Supplementary Material Appendix B.

FIGURE 7

The Effect of Interventions on Financial Literacy Test Scores

In Figure 7, we plot the average financial literacy score before and after the interventions for the 3 randomly assigned groups: a control group, a financial literacy treatment group, and a self-control treatment group. The dark-gray bars represent the mean financial literacy score before the intervention in wave 1, and the light-gray bars show wave 2.

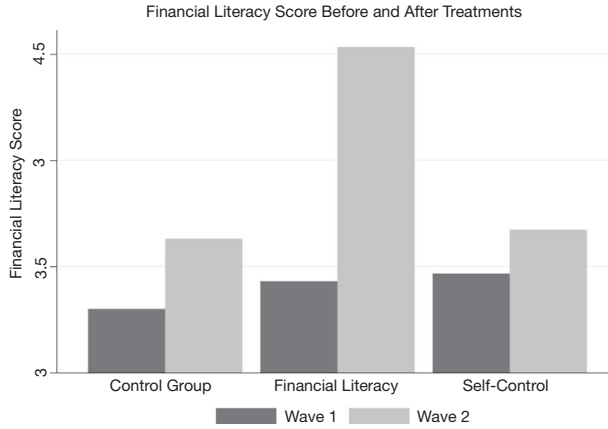


TABLE 6

The Effect of Interventions on Financial Literacy Test Scores

Table 6 analyzes the effect of various treatment interventions on subjects' responses to financial literacy questions. The dependent variable is the score individuals received on a financial literacy quiz included in the questionnaire. The score ranges from 0 to 6. In each column, we present indicator variables for receiving a treatment and participating in an intervention (TREATED); the wave of the survey (POST); and the interaction of the two (TREATED × POST), our variable of interest. In columns 1–3, the treatment variable indicates any treatment, either financial literacy or self-confidence. In columns 4–6, the treatment variable indicates the financial literacy treatment and includes subjects from the control and financial literacy treatments. In columns 7–9, the treatment variable indicates the self-control treatment and includes subjects from the control and self-control treatments. The sample includes data from both survey waves. We first present results without any control variables, then add individual fixed effects and control variables to account for changes in expenses, confidence, and numeric ability. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	Any Treatment			Financial Literacy			Self-Control		
	1	2	3	4	5	6	7	8	9
TREATED	0.20**			0.13			0.17		
	(0.08)			(0.10)			(0.10)		
POST	0.25***	0.25***	0.25***	0.33***	0.33***	0.32***	0.33***	0.33***	0.33***
	(0.05)	(0.07)	(0.08)	(0.05)	(0.07)	(0.08)	(0.05)	(0.07)	(0.08)
TREATED × POST	0.41***	0.41***	0.38***	0.77***	0.78***	0.78***	−0.12*	−0.12	−0.12
	(0.07)	(0.10)	(0.10)	(0.10)	(0.14)	(0.15)	(0.07)	(0.09)	(0.09)
MONTHLY_EXPENSES			−0.01			0.04			−0.01
			(0.11)			(0.12)			(0.11)
CONFIDENCE_IN_ DAILY_FINANCES			0.01			0.02			0.02
			(0.04)			(0.04)			(0.04)
NUMERACY			0.05			−0.01			−0.02
			(0.05)			(0.05)			(0.05)
Individual fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
R^2	0.03	0.79	0.79	0.05	0.75	0.75	0.01	0.80	0.80
No. of obs.	3,471	3,471	3,471	2,848	2,848	2,848	2,848	2,848	2,848

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approximately the same size when we control for individual fixed effects and control variables to account for changes in expenses, confidence, and numeric ability (columns 2 and 3). This last specification, which we estimate across various outcomes, has the benefit of controlling for important covariates that are suggested to be correlated with both financial literacy and downstream behavior and are often omitted from related studies (Fernandes et al. (2014)).

In columns 4–6 and 7–9 of Table 6, we distinguish between the two types of treatments that individuals could have received and relate the effects to the control group. First, in columns 4–6, the treatment variable indicates the financial literacy treatment. Comparing the TREATED × POST variable between columns 6 and 9, the financial literacy treatment has a strong effect on test scores, whereas the participants in the self-control group do slightly worse, relative to the control group, following the treatment. For participants in the financial literacy treatment group, the effect is 0.78 points out of 6, and relative to a mean preperiod score of 3.35, the treatment effect is approximately 23%.

Overall, our results reveal that our financial literacy treatment significantly improves participants' financial literacy test scores, whereas the self-control treatment does not. Therefore, the effectiveness of the self-control treatment on borrowing behaviors is not due to participants' improved financial knowledge. As opposed to a conventional literacy intervention, our self-control treatment aims to hone practical financial skills related to spending and borrowing. This seems to be an important contribution, paired with recent findings that agents, even when provided with theoretical knowledge, are often unable to map abstract knowledge onto concrete action and choice plans (D'Acunto, Hoang, et al. (2019), Ilut and Valchev (2020)).

B. The Role of Self-Tracking in Counseling Sessions

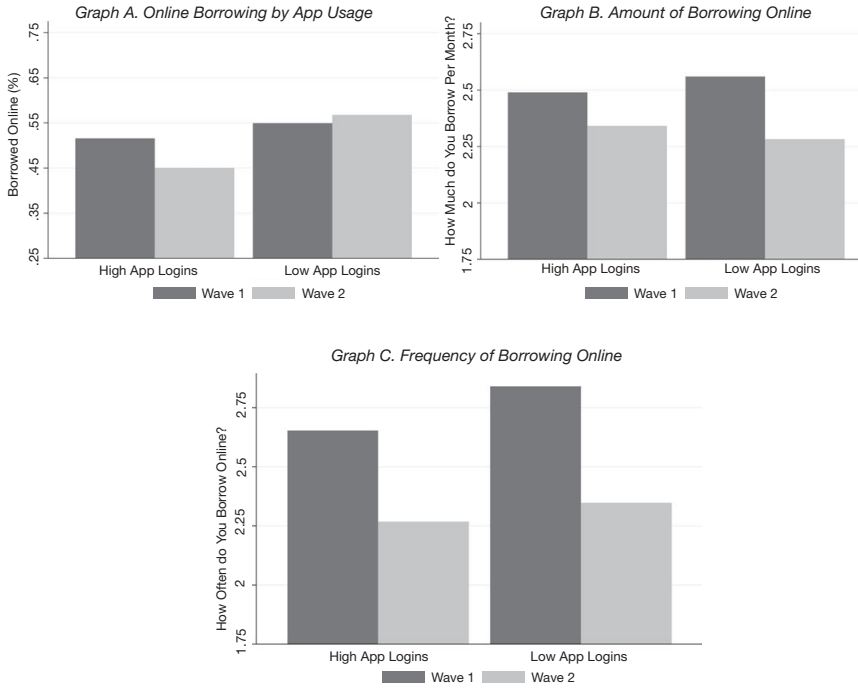
Our self-control treatment consisted of an intervention in which we combined both the self-tracking of expenses through a PFM and in-depth instructor-led sessions and small groups, with the aim of combining goal setting with monitoring because these are important aspects of self-regulation (Baumeister and Newman (1994), Carver and Scheier (1998), and Oaten and Cheng (2007)). At the same time, disentangling the effect of these 2 aspects of the intervention would help provide insight into the underlying channels that drive subjects' borrowing behavior. This could help inform policy, given that if self-tracking is an effective component of the intervention, without the need for in-person meetings, the intervention would be even more cost efficient. In order to provide insight into these 2 channels, we leverage the matched PFM data and examine heterogeneity in the treatment effect.

We examine the relationship between PFM mobile app logins and changes in borrowing behavior in the cross section. Specifically, if participants react to the in-person counseling aspect of the intervention, we would expect that those with few or relatively low app logins would show equivalent or higher rates of borrowing improvements compared to those with relatively high app logins. On the other hand, if the latter group shows a greater improvement in borrowing, it would suggest that

FIGURE 8

App-Usage Intensity and Self-Control Treatment Effect

In Figure 8, we plot the unconditional rate of online borrowing before and after the interventions for those in the self-control treatment group by high and low app-usage intensity. We measure high (low) app-usage intensity by indicating participants who were in the top 25th (bottom 25th) percentile of app logins during our sample period. Graph A presents online borrowing in the past 12 months, Graph B presents the conditional amount borrowed, and Graph C presents the conditional frequency of borrowing. The dark-gray bars represent the mean rate of online borrowing before the intervention in wave 1, and the light-gray bars represent borrowing in wave 2 after the intervention.



self-tracking is potentially a helpful addition to the in-person counseling sessions. Unfortunately, our intervention does not allow us to examine the role of self-tracking or a robo-based tool in isolation; however, this test of heterogeneity allows us to provide some evidence on the importance of the two channels.

Figure 8 and Table 7 present the results. In Graph A of Figure 8, we plot the difference from pre- to postintervention rates of borrowing between participants who logged in frequently to the mobile app (in the top 25th percentile) compared with those who logged in infrequently (those in the bottom 25th percentile). In Graphs B and C, we examine the intensive margin of borrowing in terms of the amount borrowed and the frequency of borrowing. Table 7 presents regression counterparts including control variables (columns 4–6), as well as results based on median splits (columns 1–3). We find that although the difference in borrowing from pre- to postintervention is 6 percentage points between low and high app usage, it is not statistically significant at standard levels (t-statistic = –0.79). Intensive margin results are highly similar between groups. In general, our results suggest that self-tracking of expenses (as proxied by app logins and usage) is likely to be an important component of our intervention *in addition*

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TABLE 7

App-Usage Intensity and Self-Control Intervention Effect

Table 7 analyzes the effect of the self-control treatment intervention on subjects' online borrowing by high and low app-usage intensity. We measure above-median app-login usage in columns 1–3 and interact it with a posttreatment indicator. In columns 4–6, we measure high app-usage intensity by indicating subjects who were in the top 25th percentile of app logins during our sample period relative to those in the bottom 25th percentile. The dependent variable in columns 1 and 4 is an indicator for having borrowed online in the past 12 months. In columns 2 and 5, the dependent variable is the response to a survey question about on average how much (in RMB) per month the subject borrows online (where 1 = < 200, 2 = 200–600, 3 = 601–1,000, and 4 = ≥ 1,500); in columns 3 and 6, it is the response to a survey question about on average how many times per month the subject borrows online (where 1 = < 1, 2 = 1–2, 3 = 3–5, and 4 = ≥ 5). The sample includes data from both survey waves for individuals in the self-control treatment. Specifications include individual fixed effects and control variables to account for changes in expenses, confidence, and numeric ability. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	Borrow Online	Amount Borrowed	Borrow Frequency	Borrow Online	Amount Borrowed	Borrow Frequency
	1	2	3	4	5	6
POST	0.02	−0.40**	−0.63***	0.03	−0.23	−0.58**
	(0.07)	(0.18)	(0.18)	(0.08)	(0.19)	(0.23)
POST × ABOVE_MEDIAN_LOGIN	−0.05	0.27	−0.02			
	(0.07)	(0.22)	(0.25)			
POST × TOP_25TH_PERC_LOGIN				−0.06	0.08	−0.18
				(0.10)	(0.26)	(0.35)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.82	0.90	0.84	0.82	0.94	0.85
No. of obs.	623	330	330	358	186	186

to in-person counseling because those who do not regularly use the app alongside counseling sessions do not decrease borrowing (see "Low app logins" in Graph A of Figure 8). Participants who use both tools seem to show the largest improvements in borrowing behavior; however, the differences we observe are not statistically significant.[24]

Self-tracking with a PFM tool or app echoes advances in other financial technologies, such as robo-advising for investments. One main advantage of such technologies is their cost efficiency (see D'Acunto and Rossi (2020) for a recent overview). Although we cannot examine this directly, the results suggest that a robo-advised product in isolation may be less successful than one combined with in-person counseling (albeit, significantly more cost efficient). In-person counseling meetings can be organized more regularly compared with the ad hoc usage of a robo-advisor. Moreover, it could be that in-person meetings have stronger adherence than a self-directed app. Relatedly, active participation with an app is an endogenous decision, and as in other domains, those who are motivated to improve their behavior may not be those who are most in need of improving their behavior. Additionally, morality concerns may be stronger in in-person counseling when monitoring by a third party rather than an app (e.g., see Dang and Nguyen (2020)). In general, such a comparison is central to understanding the relative trade-offs that are associated with the higher costs of in-person counseling and is an important avenue for future research.

[24]We also examine the time-series correlation between app logins and borrowing, at both the extensive and intensive margins (unreported for brevity). We find no systematic relationship, suggesting that our results are unlikely to be driven by self-tracking alone.

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C. The Effect of the Interventions on Entertainment-Related Consumption

Individuals may borrow online not because they lack knowledge of online financial products but because of consumption choices. In Table 8, we investigate the reasons individuals borrow in pre- and postintervention periods and examine whether our interventions can affect participants' purchasing behavior.

The dependent variable in columns 1–3 of Table 8 is an indicator for using online borrowing for entertainment-related expenses, for example, dining out or purchasing items such as phones, games, and clothing, as measured with a survey question on what borrowing is generally used for. In columns 4–6, it indicates using credit for medical, education, and other expenses. The benefit of using survey data on consumption choices as opposed to data from the PFM is that we obtain responses for all participants, regardless of their assigned treatment group. Columns 1 and 4 provide the results for the full sample, whereas the results in columns 2 and 5 are conditional on borrowing in the first period, and columns 3 and 6 are conditional on borrowing for entertainment, or other reasons, in the first period, respectively. The variables of interest, TREATED_SC and TREATED_FL, denote the self-control and financial literacy interventions, respectively.

We find that participants in the self-control interventions considerably reduce their entertainment-related borrowing, more so than those in the financial literacy

TABLE 8

The Effect of Interventions on Entertainment-Based Borrowing

Table 8 analyzes the effect of the financial literacy and self-control treatment interventions on subjects' entertainment-related borrowing behavior. The dependent variable in columns 1–3 is an indicator for using online borrowing for entertainment-related expenses, for example, dining out or purchasing items such as phones, games, and clothing, as measured in the survey. In columns 4–6, it indicates using the credit for medical, education-related, or other expenses. Columns 1 and 4 are the full sample, columns 2 and 5 are conditional on borrowing in the first period, and columns 3 and 6 are conditional on borrowing for entertainment or other reasons in the first period, respectively. TREATED_SC and TREATED_FL indicate the self-control and financial literacy interventions, respectively. We present the coefficients of a linear regression including individual fixed effects. *F*-statistics from a test of differences between TREATED_SC × POST and TREATED_FL × POST and the test's *p*-value are presented at the bottom. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	Entertainment Reasons			Other Reasons		
	1	2	3	4	5	6
POST	0.09***	−0.00	−0.00	0.03***	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.02)
TREATED_SC × POST	−0.10***	−0.14***	−0.20***	−0.04*	−0.05**	−0.17**
	(0.03)	(0.04)	(0.06)	(0.02)	(0.02)	(0.08)
TREATED_FL × POST	−0.07***	−0.04	−0.05	−0.01	−0.00	−0.01
	(0.03)	(0.03)	(0.03)	(0.02)	(0.00)	(0.02)
FINANCIAL_LITERACY_SCORE	−0.00	−0.00	−0.00	0.00	0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
MONTHLY_EXPENSES	−0.00	0.01	0.01	−0.00	−0.01	−0.03
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.05)
CONFIDENCE_IN_DAILY_FINANCES	−0.01	−0.01	−0.01	−0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.02)
NUMERACY	0.01	−0.00	−0.00	−0.00	−0.00	−0.00
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	0.43	4.69	6.17	1.29	4.01	4.11
p-value	0.51	0.03	0.01	0.26	0.05	0.04
R^2	0.90	0.95	0.57	0.92	0.99	0.58
No. of obs.	3,471	1,641	1,290	3,471	1,641	351

treatment. *F*-statistics from a test of differences between TREATED_SC × POST and TREATED _FL × POST and the test's *p*-values are presented at the bottom of Table 8. We largely reject the coefficients' equivalence. Finally, we find that in columns 4–6, the effect on other-related borrowing is negative but of much less economic significance relative to entertainment-related consumption. Taken together, we provide evidence that the lower rates of online borrowing after our self-control intervention are mainly driven by a reduction in entertainment-related spending.

D. Heterogeneity

We explore several dimensions of heterogeneity in participants' characteristics to understand who responds more strongly to which treatments and why. In Table 9, we investigate a number of dimensions: gender, field of study, and consumption behavior from the PFM app itself. In Panel A, the dependent variable in the regressions across columns 1–4 is an indicator for having borrowed online in the

TABLE 9

Heterogeneity in Participants' Characteristics and the Intervention Effect on Borrowing Outcomes

Table 9 analyzes the treatment effect of interventions by heterogeneity in subjects' characteristics. In Panel A, the dependent variable in columns 1–4 is an indicator for having borrowed online in the past 12 months. In columns 5–8, the dependent variable is the response to a survey question about on average how much (in RMB) per month the subject borrows online (where 1 = < 200, 2 = 200–600, 3 = 601–1,000, and 4 = ≥ 1,500). TREATED_SC × POST and TREATED_FL × POST indicate the post periods for individuals in the self-control and financial literacy interventions, respectively. To examine heterogeneity in gender and field of study, we run regressions on subgroups where the sample includes women in columns 1 and 5, men in columns 2 and 6, individuals from nonbusiness majors in columns 3 and 7, and individuals from business majors in columns 4 and 8. In Panel B, the sample consists of individuals in our self-control treatment, and the variable POST × HIGH_PRE_ENTERTAINMENT_SHARE interacts the postintervention period with a dummy if the subject had an above-median share of consumption to entertainment and gaming in the first period. All specifications include control variables and individual fixed effects. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Heterogeneity in Participants' Characteristics

Variable	Borrow Online				Amount Borrowed			
	Women	Men	Nonbusiness	Business	Women	Men	Nonbusiness	Business
	1	2	3	4	5	6	7	8
POST	0.14***	0.09***	0.13***	0.11***	0.01	0.04	0.06	0.00
	(0.02)	(0.03)	(0.03)	(0.02)	(0.12)	(0.10)	(0.10)	(0.11)
TREATED_FL × POST	−0.09**	−0.06*	−0.04	−0.10***	−0.04	0.26	−0.05	0.19
	(0.04)	(0.03)	(0.05)	(0.04)	(0.18)	(0.18)	(0.16)	(0.19)
TREATED_SC × POST	−0.08	−0.20***	−0.12*	−0.14***	−0.56***	−0.27	−0.31*	−0.49***
	(0.05)	(0.06)	(0.06)	(0.05)	(0.18)	(0.18)	(0.18)	(0.18)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.87	0.90	0.87	0.89	0.87	0.87	0.88	0.86
No. of obs.	2,296	1,175	1,658	1,813	982	804	922	864

Panel B. The Intervention Effect Based on Participants' Consumption Patterns

Variable	Borrow Online	Amount Borrowed	Borrowing Frequency
	1	2	3
POST	0.09	−0.25	−0.54**
	(0.06)	(0.18)	(0.22)
POST × HIGH_PRE_ENTERTAINMENT_SHARE	−0.18**	−0.04	−0.14
	(0.07)	(0.22)	(0.27)
Controls	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
R^2	0.82	0.90	0.84
No. of obs.	623	330	330

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past 12 months, whereas in columns 5–8, we focus on the intensive margin by studying the conditional amount borrowed. As in Table 8, our variables of interest are TREATED_SC × POST and TREATED_FL × POST, which indicate the treatment effect on borrowing outcomes in the postintervention periods. To study heterogeneity in participants' characteristics, we run separate regressions by subgroup of interest. We first examine gender by regressing treatment indicators on future borrowing by females and males separately and present the results in columns 1 and 2, respectively. We find that males appear to be significantly more responsive to the self-control treatment than females; however, they are less responsive to the financial literacy treatment. When we examine the intensive margin in columns 5 and 6, we find the opposite: Females seem to be more responsive to the self-control treatment than males. Overall, males are less likely to borrow following the self-control intervention, but females borrow less, conditional on borrowing. This is likely driven by the fact that preintervention, males borrow at a much higher rate than females (76% vs. 37%), suggesting that males may be more likely to reduce unnecessary borrowing. It seems plausible that, on average, males and females may borrow for different reasons. If on average, females borrow for purchases deemed to be necessities, they may reduce the amount borrowed following the treatment rather than cutting necessary purchases completely. We note that when we compare the share of entertainment-related expenses preintervention, the share of consumption to entertainment and gaming is approximately 12% for men, whereas for women, it is approximately 6%. Psychology studies have also posited that females, on average, show greater levels of self-discipline (e.g., Duckworth and Seligman (2006)), and our findings may also be related to studies suggesting that females are more risk averse than males (Croson and Gneezy (2009), Charness and Gneezy (2012)). At the extensive margin, females are slightly more responsive to the financial literacy treatment than males, which could potentially be explained by the fact that preintervention, females have slightly lower levels of financial literacy and demonstrate the highest increase in literacy scores as a result of the financial literacy intervention. This also resonates with previous studies on gender effects in financial literacy (e.g., Lusardi and Mitchell (2014)).

Next, we examine participants who are business majors compared with those who study other subjects. We find in columns 5 and 6 of Table 9 that the interaction term TREATED_SC × POST is similar in magnitude for both business students and those in other fields, respectively, suggesting that for the decision to borrow, participants seem to reduce borrowing relatively similarly following the self-control intervention. Business majors are also slightly more responsive to the financial literacy intervention than others, albeit the 2 groups are gender balanced. Examining the intensive margin (columns 7 and 8), we find that business majors seem to react slightly more by reducing the amount borrowed relative to those in other fields. It may be the case that business students have a better grasp of finance-related concepts and benefit from the literacy trainings. At the same time, these students seem more able to turn these concepts into action after the self-control training.

Finally, in Panel B of Table 9, we examine the response to the self-control intervention based on participants' consumption patterns. Recall that we only have detailed consumption data from the individuals who participated in the

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self-control intervention and thus focus on cross-sectional heterogeneity within this group. We use PFM data from the first month of the intervention as a baseline to sort participants by their share of consumption devoted to entertainment and gaming expenses as categorized by the PFM. The variable POST × HIGH_PRE_ENTERTAINMENT_SHARE interacts the postintervention period with a dummy if the participant had an above-median share of entertainment consumption. We find that participants who began the program with a higher share of these expenses seem to be the most responsive to the interventions by decreasing borrowing at the extensive margin. This suggests that the participants are able to reduce potentially unnecessary borrowing following the intervention.

VII. Additional Discussion

A. Do the Interventions Target the Right Participants?

If individuals are able to perfectly smooth consumption, conveniently borrowing online may not be a threat to welfare and may not be an area best suited for interventions. Although the media conveys the potential harms associated with overconsumption and the potential debt burden from online platforms, it is important that we investigate overall welfare in our setting.

We next make use of survey responses on liquidity constraints and self-assessed levels of stress associated with participants' debt levels. When we investigate the treatment response of the financial literacy and self-control interventions by monthly income relative to expenditures in Table 10, we find a larger effect of self-control training and financial education on borrowing among more liquidity-constrained participants. We define liquidity-constrained participants as those who respond to a survey question on monthly balances with either "my expenditure occasionally exceeds expenditure" or "my expenditures always exceed my income." Similarly, unconstrained students are defined by the responses of "most of the time, my income exceeds my expenditures" or "I usually break even." We find that after the self-control intervention, participants reduce borrowing by 16 pp if they are liquidity constrained preintervention, compared with 11 pp for unconstrained subjects. The financial education interventions also decrease the borrowing of liquidity-constrained individuals. The results in columns 4–6 relate future borrowing to how "stressful" subjects assess their previous online borrowing behavior to be. We find that the main reduction in online borrowing postintervention appears to be driven by participants who are the *least* stressed about borrowing. These results together suggest that participants who are liquidity constrained are able to reduce borrowing in the future, and they appear to be borrowing at a level that they feel comfortable with (i.e., they have enough flexibility in their debt-based consumption that they can potentially act on the self-control trainings).

We next examine, in Table 11, the potential harm associated with online borrowing by investigating the fees incurred by delinquency status with online lenders. The dependent variable is an indicator that takes the value of 1 if a subject accumulated a late-fee payment in month m around the time of the self-control interventions. The sample consists of participants in the self-control treatment

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TABLE 10

The Effect of Interventions, Liquidity Constraints, and Self-Perceived Stress from Debt

Table 10 analyzes the effect of the financial literacy and self-control treatment interventions on subjects' rate of online borrowing by heterogeneity in liquidity constraints and self-perceived levels of stress related to borrowing online. The dependent variable is an indicator for borrowing online in the previous 12 months. Column 1 presents our baseline result, and columns 2 and 3 divide the sample by constrained versus unconstrained subjects based on their survey responses in the initial wave. Columns 4–6 divide the sample by a survey question in wave 1 regarding the amount of stress that subjects feel from their online borrowing. TREATED_SC and TREATED_FL indicate the self-control and financial literacy interventions, respectively. We present the coefficients of a linear regression including individual fixed effects. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable		Monthly Income to Expenses		Stress from Loans		
	Baseline	Constrained	Unconstrained	Low	Medium	High
	1	2	3	4	5	6
POST	0.12***	0.16***	0.10***	0.01	−0.03	0.02
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
TREATED_SC × POST	−0.13***	−0.16**	−0.11**	−0.27***	−0.16***	−0.13
	(0.04)	(0.06)	(0.05)	(0.09)	(0.06)	(0.09)
TREATED_FL × POST	−0.08**	−0.13**	−0.05	−0.02	−0.03	−0.10
	(0.03)	(0.06)	(0.04)	(0.03)	(0.03)	(0.08)
FINANCIAL_LITERACY_SCORE	−0.00	0.00	−0.00	−0.01	0.01**	−0.01
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
MONTHLY_EXPENSES	−0.01	0.03	−0.03	−0.03	0.03	−0.01
	(0.02)	(0.05)	(0.03)	(0.05)	(0.03)	(0.05)
CONFIDENCE_IN_DAILY_FINANCES	−0.02*	−0.01	−0.03***	0.01	−0.00	−0.03
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
NUMERACY	0.01	0.02	0.01	−0.01	−0.00	0.01
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.88	0.84	0.88	0.61	0.56	0.58
No. of obs.	3,471	1,167	2,304	412	917	312

TABLE 11

Borrowing Late Fees, Liquidity Constraints, and Self-Perceived Stress from Debt

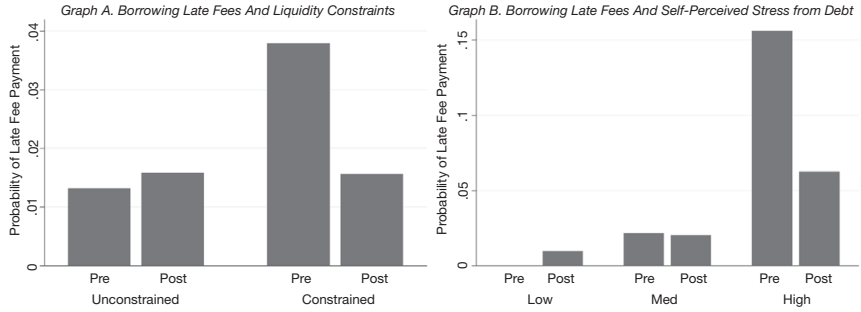
Table 11 analyzes the effect of the financial literacy and self-control treatment interventions on subjects' late fees linked to their online debt. The dependent variable is an indicator that takes the value of 1 if a subject accumulated a late-fee payment in month m around self-control treatments, and 0 otherwise. The sample consists of individuals in the self-control treatment, and the underlying data come directly from the third-party app used in the program. The variable AFTER_SELF_CONTROL_TREATMENTS takes the value of 1 in months following the third treatment and conclusion of the self-control program, and 0 otherwise. We present the coefficients of a linear regression including individual fixed effects. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable		Monthly Income to Expenses		Stress from Loans		
	Baseline	Constrained	Unconstrained	Low	Medium	High
	1	2	3	4	5	6
AFTER_SELF_CONTROL_TREATMENTS	−0.01	−0.07**	0.01	0.05	0.02	−0.28***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.09)
FINANCIAL_LITERACY_SCORE	−0.00	−0.02	0.00	0.01	−0.04	0.08***
	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	(0.02)
MONTHLY_EXPENSES	0.01	0.03*	0.00	−0.02	0.00	0.12*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.06)
CONFIDENCE_IN_DAILY_FINANCES	−0.00	0.01	−0.01	−0.01	−0.02	0.02
	(0.00)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
NUMERACY	−0.00	0.01	−0.01	−0.00	0.00	0.00
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.24	0.25	0.25	0.15	0.22	0.30
No. of obs.	6,114	2,074	4,040	984	1,700	612

FIGURE 9

Borrowing Late Fees, Liquidity Constraints, and Self-Perceived Stress from Debt

In Figure 9, we plot the unconditional probability of having a late fee associated with delinquent online borrowing. The sample consists of participants in the self-control treatment group, and data are collected using a third-party personal financial management (PFM) mobile app. In Graph A, we disaggregate the sample into pre– and post–self-control intervention months and by liquidity-constrained and unconstrained participants. In Graph B, we disaggregate the sample by pre- and post-intervention and the self-perceived level of stress caused by online borrowing.



group because the underlying data come directly from the third-party app used in the program. The variable of interest, AFTER_SELF_CONTROL_TREATMENTS, takes the value of 1 in the months following the third intervention and the conclusion of the self-control program. In column 2, we note that liquidity-constrained participants reduce the probability of incurring late fees by approximately 7 pp from the pre- to postintervention period. Columns 4–6 examine late-fee payments by levels of participants' perceived stress caused by online borrowing. We note that those who state high levels of stress associated with online borrowing reduce the probability of incurring late charges by almost 30 pp following the self-control intervention. The unconditional results from this analysis are graphically displayed in Figure 9. In sum, we note that for some of the participants in our sample, online borrowing can indeed cause high levels of stress and can be linked to additional delinquency costs. Our findings suggest that our interventions may help reduce both stress and delinquency costs.

B. Spillover Effects

A large literature in economics and finance has examined the role of spillover or peer effects in behavioral interventions (e.g., see Beshears et al. (2018) and Kuchler and Stroebel (2020) for reviews of this literature in household finance). Although this is not our main focus, our setting is well suited to examine such effects because one student per dormitory room was allocated to either the financial literacy or the self-control intervention. As noted previously, the control group incurs a large increase in borrowing over our study period, suggesting that such spillover effects are likely to be limited; however, it is worthwhile to investigate the comparative effect of each intervention.

We examine such comparative spillover effects in Table 12. The sample consists of participants in the control group, and variation comes from design because we allocated one participant per room to either intervention. The variable

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TABLE 12

Spillover Effects of Interventions on Borrowing Outcomes

Table 12 analyzes the spillover effects of the financial literacy and self-control treatment interventions on the borrowing behavior of individuals allocated to the control treatment. The dependent variable in column 1 is an indicator for having borrowed online in the past 12 months. In column 2, the dependent variable is the response to a survey question about on average how much (in RMB) per month the subject borrows online (where 1 = < 200, 2 = 200–600, 3 = 601–1,000, and 4 = ≥ 1,500); in column 3, it is the response to a survey question about on average how many times per month the subject borrows online (where 1 = < 1, 2 = 1–2, 3 = 3–5, and 4 = ≥ 5). The sample consists of individuals in the control treatment, and the variable SELF_CONTROL_DORM_CONTROL × POST indicates control individuals who have a dormmate in the self-control treatment in the postintervention period. This interaction term provides the spillover effect of the self-control treatment relative to the financial literacy treatment for control subjects. All specifications include control variables and individual fixed effects. Robust standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	Borrow Online	Amount Borrowed	Borrowing Frequency
	1	2	3
POST	0.10***	0.18**	0.33***
	(0.02)	(0.09)	(0.09)
SELF_CONTROL_DORM_CONTROL × POST	0.04	−0.32**	−0.46***
	(0.03)	(0.14)	(0.14)
FINANCIAL_LITERACY_SCORE	−0.00	0.04	0.04
	(0.01)	(0.04)	(0.04)
MONTHLY_EXPENSES	−0.01	0.02	−0.10
	(0.03)	(0.15)	(0.15)
CONFIDENCE_IN_DAILY_FINANCES	−0.01	0.01	0.01
	(0.01)	(0.04)	(0.05)
NUMERACY	0.01	−0.02	−0.02
	(0.01)	(0.04)	(0.05)
Individual fixed effects	Yes	Yes	Yes
R^2	0.90	0.85	0.82
No. of obs.	2,121	1,066	1,066

SELF_CONTROL_DORM_CONTROL × POST indicates control group participants who have a dormmate in the self-control treatment group in the postintervention period. This interaction term therefore provides the spillover effect of the self-control intervention relative to the financial literacy intervention on the control group. We find that there are no significant spillover effects at the extensive margin. The control-group dormmates of participants in the self-control treatment group do not borrow any less than those of the control-group dormmates of the financial literacy group. A lack of spillover effects in financial education is consistent with other recent findings in interventions, such as those of Grill and Bhattacharya (2019) and Field, Jayachandran, Pande, and Rigol (2016). However, we do find some minimal spillover effects at the intensive margin. These subjects appear to borrow less, and less often, conditional on borrowing online. Taken together, our results suggest that the self-control treatment may have some minor positive externalities on the intensive-margin borrowing decisions of peers and less so on the decision of whether or not to borrow, relative to standard financial literacy interventions.

C. External Validity and Cost Efficiency

An important question arising from our study is whether or not our results are externally valid and if there are attributes of our setting that may cast doubt on replicability. In this subsection, we focus on 2 main questions: i) if subjects and consumers in China may differentially adhere to our interventions and ii) if financial

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literacy and self-control interventions could be done at scale and their relative cost effectiveness.

Although online borrowing and consumer credit are important areas of debt financing and household consumption globally, our participants in China may react differentially to our interventions with regard to their borrowing and spending behavior. Specifically, it could be that they are more likely to conform to authority or are more swayed by instructors, by researchers, or by the use and collection of data. We believe our article has several important aspects that allow us to sidestep such concerns. First, both the financial literacy and self-control interventions feature a discussion on online consumer lending products and the potential harms caused by overborrowing. If the effect we find from the self-control intervention is solely driven by participants conforming to authority, participants in the financial literacy intervention should react similarly to such content, yet we find no evidence of this. Second, all instructors were volunteers from WUST, and their basic contact information was disclosed to participants. In Table A.6 in the Supplemental Material, we show that university-level variation does not affect our general results, and in unreported specifications, we note a strong and uniform treatment effect from each university estimated individually when we compare WUST to all other universities in the sample. If the treatment effect is caused by participants' beliefs about authority, the effect from instructors on WUST students would likely be much stronger than that for non-WUST students.

In China, each year, governments and universities invest a significant amount of money and effort in financial literacy, especially for young adults and university students. Normally, this type of education includes basic financial literacy terms and topics and a focus on borrowing and debt. However, it is unclear if an alternative approach may be more beneficial. Our study aimed to expand on these traditional programs of financial literacy with a self-control training program. Importantly, at least in our experiment, the cost of running the three financial literacy training sessions was equivalent to running the three self-control training sessions and used the same personnel. Specific and heterogeneous instructor training may prove valuable but was not required in our setting. However, it is important to note that we find short-term gains from our self-control intervention and find that recurring counseling and more of a "just-in-time" curriculum may prove to be additionally beneficial. This, of course, comes with additional costs above and beyond a more standardized, one-time financial literacy course. Future iterations of such a program or research initiative should examine how a robo-based counselor may affect borrowing and spending behavior. Such a robo-based offering has significant cost efficiencies (D'Acunto and Rossi (2020)) but is likely to come with trade-offs in adherence and, ultimately, behavior.

At the other side of the spectrum, the app used in the self-control training is not necessarily a requirement. Although a mobile app is easily scalable (e.g., Gargano and Rossi (2021)) and may be a way to deliver the training, self-reported consumption could also work and was used in the initial work of Oaten and Chang (2007). Although recent research points to individuals' value for privacy in lending markets (Tang (2020)), we do not believe that data collection with the app had a harmful effect on our participants' behavior because it was a minor detail of the sessions rather than the focus. Participants who were required to use the app had previously

acknowledged that the data would be used for research purposes at the onset, and there were no complaints or questions related to the use of data. Additionally, participants did not necessarily expect that their debt behavior following the training would be the focus of the research. Finally, it seems at odds that subjects would behave differentially with the self-control treatment's app, given that they are already comfortable with online spending and borrowing with apps that use their data to offer personalized credit.

VIII. Conclusions

In this article, we present the short- and medium-term effects of financial literacy and self-control training on students' online borrowing behavior. Our study is one of the first large-scale field experiments examining the effect of information-based interventions on consumers' borrowing choices. Online consumer credit is offered by the financial arms of large e-commerce retailers in China and is extended to potential borrowers based on their purchase behavior and histories across the products and services offered by the retailer conglomerates. Although the business model and product offerings are currently unique to the Chinese landscape, it seems likely that elements of them could and will be used in other regions of the world. The use of customer data or digital footprints for credit scoring already occurs in both the United States and Germany (Berg et al. (2018), Bartlett et al. (2019)), and the shift of large technology companies toward creating nonbank financial products is also a worldwide trend (e.g., cryptocurrencies, Facebook's Libra).

We find that although financial literacy interventions improve literacy test scores, they have only a marginal effect on changing field behavior related to borrowing on e-commerce platforms. The self-control training, conversely, seems to be more strongly linked to improved outcomes with online consumer credit, potentially because the training sessions hone soft skills focused on budgeting and consumption. Perhaps it is not entirely surprising that our intervention on financial literacy did not result in dramatic improvements in field behavior. Indeed, Fernandes et al. (2014) find very small effects of financial education on downstream financial behavior in a meta-analysis of more than 200 studies. In fact, they find smaller effects when they look at a subset of articles that use the "gold-standard for causal inference," randomized control experiments, also consistent with other reviews of the literature in consumer finance (Collins and O'Rourke (2010)). Shefrin (2019) argues that financial literacy focuses more on knowledge, whereas self-control, budgets, and heuristics are more focused on action. And knowledge must be combined with action-oriented behavior to be beneficial in household financial decisions. This also echoes Fernandes et al. (2014) and others who have touted the "just-in-time" financial education approach but, of course, comes with a challenge often associated with self-improvement: that those who would benefit most may not choose to do so. As such, future work should build on our intervention by designing additional treatments that i) combine financial literacy and self-control treatments, ii) isolate the self-tracking aspect of our treatment from the in-person counseling aspect, and iii) compare the effectiveness of a robo-based "counselor" to that of a human counselor.

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There are several key takeaways from our work that motivate future research, policy, and potential product design in relation to online consumer credit. The first is that university students and young adults are users of potentially costly credit, which is often used for entertainment and conspicuous consumption and is offered based on purchase patterns directly at the point of sale. These products are designed to be easy to use and instantaneous, and they likely cater to those with somewhat impulsive spending habits. Individuals who lack financial sophistication or the budgeting skills associated with good financial practices may become easily indebted. On the bright side, the second key takeaway our study finds is that this may be remediable through individualized and, relative to financial literacy, cost-effective training. We find that to some extent, basic quantitative skills developed through educational training and, most importantly, soft skills such as budgeting can be improved by focusing on goal planning and spending decisions.

Supplementary Material

To view supplementary material for this article, please visit http://doi.org/10.1017/S0022109021000314.

References

Agarwal, S.; S. Alok; P. Ghosh; and S. Gupta. "Financial Inclusion and Alternate Credit Scoring for the Millennials: Role of Big Data and Machine Learning in Fintech." Working Paper, National University of Singapore, Indian School of Business, Indian Institute of Management, and Fordham University (2020).

Agarwal, S.; G. Amromin; I. Ben-David; S. Chomsisengphet; and D. D. Evanoff. "Financial Education versus Costly Counseling: How to Dissuade Borrowers from Choosing Risky Mortgages?" *American Economic Journal: Economic Policy*, 12 (2020), 1–32.

Agarwal, S.; J. C. Driscoll; X. Gabaix; and D. Laibson. "Learning in the Credit Card Market." NBER Working Paper No. 13822 (2008).

Allen, H.; A. Swanson; J. Wang; and T. Gross. "Early Medicaid Expansion Associated with Reduced Payday Borrowing in California." *Health Affairs*, 36 (2017).

Ambec, S., and N. Treich. "ROSCAs as Financial Agreements to Cope with Self-Control Problems." *Journal of Development Economics*, 82 (2007), 120–137.

Ashraf, N.; D. Karlan; and W. Yin. "Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines." *Quarterly Journal of Economics*, 121 (2006), 635–672.

Bartlett, R.; A. Morse; R. Stanton; and N. Wallace. "Consumer-Lending Discrimination in the FinTech Era." NBER Working Paper No. w25943 (2019).

Baumeister, R. F.; M. Gailliot; C. N. DeWall; and M. Oaten. "Self-Regulation and Personality: How Interventions Increase Regulatory Success, and How Depletion Moderates the Effects of Traits on Behavior." *Journal of Personality*, 74 (2006), 1773–1802.

Baumeister, R. F., and L. S. Newman. "Self-Regulation of Cognitive Inference and Decision Processes." *Personality and Social Psychology Bulletin*, 20 (1994), 3–19.

Becchetti, L.; S. Caiazza; and D. Coviello. "Financial Education and Investment Attitudes in High Schools: Evidence from a Randomized Experiment." *Applied Financial Economics*, 23 (2013), 817–836.

Berg, T.; V. Burg; A. Gombović; and M. Puri. "On the Rise of FinTechs—Credit Scoring Using Digital Footprints." NBER Working Paper No. w24551 (2018).

Bertrand, M., and A. Morse. "Information Disclosure, Cognitive Biases, and Payday Borrowing." *Journal of Finance*, 66 (2011), 1865–1893.

Beshears, J.; J. J. Choi; C. Harris; D. Laibson, B. C. Madrian; and J. Sakong. "Self-Control and Commitment: Can Decreasing the Liquidity of a Savings Account Increase Deposits?" NBER Working Paper No. w21474 (2015).

https://doi.org/10.1017/S0022109021000314 Published online by Cambridge University Press

Beshears, J.; J. J. Choi; D. Laibson; and B. C. Madrian. "Behavioral Household Finance." In *Handbook of Behavioral Economics: Applications and Foundations 1*, Vol. 1, B. D. Bernheim, S. DellaVigna, and D. Laibson, eds. Amsterdam, Netherlands: North-Holland (2018).
Braeuer, K.; A. Hackethal; and T. Hanspal. "Consuming Dividends." SAFE Working Paper No. 280 (2019).
Brugiavini, A.; D. Cavapozzi; M. Padula; and Y. Pettinicchi. "On the Effect of Financial Education on Financial Literacy: Evidence from a Sample of College Students." *Journal of Pension Economics and Finance*, 19 (2018), 344–352.
Bu, D., and Y. Liao. "Shaming Microloan Delinquents: Evidence from a Field Experiment in China." *Management Science*, forthcoming (2022).
Bucher-Koenen, T., and A. Lusardi. "Financial Literacy and Retirement Planning in Germany." *Journal of Pension Economics & Finance*, 10 (2011), 565–584.
Burke, K.; J. B. Leary; and J. Wang. "Information Disclosure and Payday Lending in Texas." NBER Working Paper No. 28765 (2016).
Cadena, B. C., and B. J. Keys. "Can Self-Control Explain Avoiding Free Money? Evidence from Interest-Free Student Loans." *Review of Economics and Statistics*, 95 (2013), 1117–1129.
Carlin, B.; A. Olafsson; and M. Pagel. "FinTech and Consumer Well-Being in the Information Age." Working Paper, UCLA, Copenhagen Business School, and Columbia University (2018).
Carver, C. S., and M. F. Scheier. *On the Self-Regulation of Behavior*. New York, NY: Cambridge University Press (1998).
Charness, G., and U. Gneezy. "Strong Evidence for Gender Differences in Risk Taking." *Journal of Economic Behavior & Organization*, 83 (2012), 50–58.
Clark, R. L.; M. S. Morrill; and S. G. Allen. "Effectiveness of Employer-Provided Financial Information: Hiring to Retiring." *American Economic Review*, 102 (2012), 314–318.
Cole, S.; A. Paulson; and G. K. Shastry. "Smart Money? The Effect of Education on Financial Outcomes." *Review of Financial Studies*, 27 (2014), 2022–2051.
Cole, S.; T. Sampson; and B. Zia. "Prices or Knowledge? What Drives Demand for Financial Services in Emerging Markets?" *Journal of Finance*, 66 (2011), 1933–1967.
Collins, J. M., and C. M. O'Rourke. "Financial Education and Counseling—Still Holding Promise." *Journal of Consumer Affairs*, 44 (2010), 483–498.
Croson, R., and U. Gneezy. "Gender Differences in Preferences." *Journal of Economic Literature* 47(2009), 448–474.
D'Acunto, F.; D. Hoang; M. Paloviita; and M. Weber. "IQ, Expectations, and Choice." NBER Working Paper No. 25496 (2019).
D'Acunto, F.; T. Rauter; C. K. Scheuch; and M. Weber. "Perceived Precautionary Savings Motives: Evidence from FinTech." NBER Working Paper No. w26817 (2020).
D'Acunto, F.; A. Rossi; and M. Weber. "Crowdsourcing Financial Information to Change Spending Behavior." Chicago Booth Research Paper 19-09 (2019).
Dang, H., and H. D. Nguyen. "Social Collateral." Working Paper, Purdue University and Foreign Trade University (2020).
Duckworth, A. L., and M. E. Seligman. "Self-Discipline Gives Girls the Edge: Gender in Self-Discipline, Grades, and Achievement Test Scores." *Journal of Educational Psychology*, 98 (2006), 198.
Duflo, E., and E. Saez. "The Role of Information and Social Interactions in Retirement Plan Decisions: Evidence from a Randomized Experiment." *Quarterly Journal of Economics*, 118 (2003), 815–842.
Eisenberg, I. W.; P.G. Bissett; A. Z. Enkavi; J. Li; D. P. MacKinnon, L. A. Marsch; and R. A. Poldrack. "Uncovering the Structure of Self-Regulation through Data-Driven Ontology Discovery." *Nature Communications*, 10 (2019), 2319.
Farrell, L.; R. L. Tim; and L. Risse. "The Significance of Financial Self-Efficacy in Explaining Women's Personal Finance Behavior." *Journal of Economic Psychology*, 54 (2016), 85–99.
Fernandes, D.; J. G. Lynch Jr.; and R. G. Netemeyer. "Financial Literacy, Financial Education, and Downstream Financial Behaviors." *Management Science*, 60 (2014), 1861–1883.
Field, E.; S. Jayachandran; R. Pande; and N. Rigol. "Friendship at Work: Can Peer Effects Catalyze Female Entrepreneurship?" *American Economic Journal: Economic Policy*, 8 (2016), 125–153.
Gargano, A., and A. G. Rossi. "There's an App for That: Goal-Setting and Saving in the FinTech Era." Working Paper, University of Houston and Georgetown University (2020).
Gargano, A., and A. G. Rossi. "Correcting Present Bias in Saving Decisions with FinTech." Working Paper, University of Melbourne (2021).
Gathergood, J. "Self-Control, Financial Literacy and Consumer Over-Indebtedness." *Journal of Economic Psychology*, 33 (2012), 590–602.
Gomes, F.; M. Haliassos; and T. Ramadorai. "Household Finance." *Journal of Economic Literature*, 59 (2021), 919–1000.

https://doi.org/10.1017/S0022109021000314 Published online by Cambridge University Press

Grill, A., and R. Bhattacharya. "The Effects of a Financial Literacy Intervention on the Financial and Economic Knowledge of High School Students." *Journal of Economic Education*, 50 (2019), 215–229

Grinblatt, M.; M. Keloharju; and J. Linnainmaa. "IQ and Stock Market Participation." *Journal of Finance*, 66 (2011), 2121–2164.

Guiso, L., and T. Jappelli. "Financial Literacy and Portfolio Diversification." Working Paper, European University Institute (2008).

Hancock, T., and X. Wang. "China Millennials' Love of Credit Cards Raises Debt Fears." *Financial Times* (2018). Available at https://www.ft.com/content/bb3166ea-8b1f-11e8-b18d-0181731a0340.

Hao, Y.; S. Liu; Z. L. Jiesisibieke; and Y. J. Xu. "What Determines University Students' Online Consumer Credit? Evidence from China." *SAGE Open*, 9 (2019), 2158244019833594.

Heidhues, P., and B. Kőszegi. "Exploiting Naivete about Self-Control in the Credit Market." *American Economic Review*, 100 (2010), 2279–2303.

Ilut, C. L., and R. Valchev. "Economic Agents as Imperfect Problem Solvers." NBER Working Paper No. w27820 (2020).

Jaroszek, L. "Think Twice or Be Wise in Consumer Credit Choices." Working Paper, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2278835 (2019).

Kaiser, T.; A. Lusardi; L Menkhoff; and C. J. Urban. "Financial Education Affects Financial Knowledge and Downstream Behaviors." NBER Working Paper No. w27057 (2020).

Karlan, D.; M. McConnell; S. Mullainathan, and J. Zinman. "Getting to the Top of Mind: How Reminders Increase Saving." *Management Science*, 62 (2016), 3393–3411.

Klein, A. "Is China's New Payment System the Future?" Available at https://www.brookings.edu/research/is-chinas-new-payment-system-the-future/ (2019).

Kuchler, T., and M. Pagel. "Sticking to Your Plan: The Role of Present Bias for Credit Card Paydown." NBER Working Paper No. w24881 (2018).

Kuchler, T., and J. Stroebel. "Social Finance." NBER Working Paper No. w27973 (2020).

Kuhnen, C. M., and B. T. Melzer. "Noncognitive Abilities and Financial Delinquency: The Role of Self-Efficacy in Avoiding Financial Distress." *Journal of Finance*, 73 (2018), 2837–2869.

Laudenbach, C.; J. Pirschel; and S. Siegel. "Personal Communication in a Fintech World: Evidence from Loan Payments." CESifo Working Paper Series 7295 (2018).

Leary, J., and J. Wang. "Liquidity Constraints and Budgeting Mistakes: Evidence from Social Security Recipients." Working Paper, Consumer Financial Protection Bureau (2016).

Liu, J. "Analysis of Market Share and Prosperity of Internet Credit Payment Products: Huabei and Baitiao." Available at http://www.qianzhan.com/wenda/detail/190715-3c6d4bf6.html (2019).

Lown, J. M. "Development and Validation of a Financial Self-Efficacy Scale." *Journal of Financial Counseling and Planning*, 22 (2011), 54–63.

Lührmann, M.; M. Serra-Garcia; and J. Winter. "Teaching Teenagers in Finance: Does It Work?" *Journal of Banking & Finance*, 54 (2015), 160–174.

Lusardi, A. "Financial Literacy and the Need for Financial Education: Evidence and Implications." *Swiss Journal of Economics and Statistics*, 155 (2019), Article 1.

Lusardi, A., and O. S. Mitchell. "The Economic Importance of Financial Literacy: Theory and Evidence." *Journal of Economic Literature*, 52 (2014), 5–44.

Lusardi, A., and P. Tufano. "Debt Literacy, Financial Experiences, and Overindebtedness." *Journal of Pension Economics & Finance*, 14 (2015), 332–368.

Meier, S., and C. Sprenger. "Present-Biased Preferences and Credit Card Borrowing." *American Economic Journal: Applied Economics*, 2 (2010), 193–210.

Morse, A. "Payday Lenders: Heroes or Villains?" *Journal of Financial Economics*, 102 (2011), 28–44.

Muraven, M.; R. F. Baumeister; and D. M. Tice. "Longitudinal Improvement of Self-Regulation Through Practice: Building Self-Control Strength through Repeated Exercise." *Journal of Social Psychology*, 139 (1999), 446–457.

Nakamura, Y. "Internet Lending Is Booming in China." Available at http://asia.nikkei.com/Business/Business-trends/Internet-lending-is-booming-in-China2 (2018).

Oaten, M., and K. Cheng. "Improved Self-Control: The Benefits of a Regular Program of Academic Study." *Basic and Applied Social Psychology*, 28 (2006a), 1–16.

Oaten, M., and K. Cheng. "Longitudinal Gains in Self-Regulation from Regular Physical Exercise." *British Journal of Health Psychology*, 114 (2006b), 717–733.

Oaten, M., and K. Cheng. "Improvements in Self-Control from Financial Monitoring." *Journal of Economic Psychology*, 28 (2007), 487–501.

O'Cass, A., and H. McEwen. "Exploring Consumer Status and Conspicuous Consumption." *Journal of Consumer Behaviour: An International Research Review*, 4 (2004), 25–39.

Olafsson, A., and M. Pagel. "The Liquid Hand-to-Mouth: Evidence from Personal Finance Management Software." *Review of Financial Studies*, 31 (2018), 4398–4446.

https://doi.org/10.1017/S0022109021000314 Published online by Cambridge University Press

Organisation for Economic Co-operation and Development. "OECD/INFE Report on Financial Education in APEC Economies: Policy and Practice in a Digital World." Available at https://www.oecd.org/financial/education/2019-financial-education-in-apec-economies.pdf (2019).
Parise, G., and K. Peijnenburg. "Noncognitive Abilities and Financial Distress: Evidence from a Representative Household Panel." *Review of Financial Studies*, 32 (2019), 3884–3919.
Parlour, C. A.; U. Rajan; and H. Zhu. "FinTech Disruption, Payment Data, and Bank Information." NBER Working Paper (2019).
People's Daily Online. "Installment Payments Embrace High Popularity in China, Spur Consumption Upgrade." Dec. 4, 2019, Available at http://en.people.cn/n3/2019/1204/c90000-9638038.html.
Podoshen, J. S.; L. Li; and J. Zhang. "Materialism and Conspicuous Consumption in China: A Cross-Cultural Examination." *International Journal of Consumer Studies*, 35 (2011), 17–25.
Ru, H., and A. Schoar. "Do Credit Card Companies Screen for Behavioral Biases?" NBER Working Paper No. w22360 (2016).
Sayinzoga, A.; E. H. Bulte; and R. Lensink. "Financial Literacy and Financial Behaviour: Experimental Evidence from Rural Rwanda." *Economic Journal*, 126 (2016), 1571–1599.
Shefrin, H. "Broadening the Scope of Financial Literacy to Incorporate Self-Control, Budgeting, and Heuristics." Working Paper, available at https://ssrn.com/abstract=3438681 (2019).
Shen, S.; R. Woo; and C. Leng. "China's Debt Collectors Flourish as Consumers Flounder in a COVID-Hit Economy." Available at https://uk.reuters.com/article/uk-china-lending-consumer-analysis-idUKKCN258323 (2020).
Stegman, M. A. "Payday Lending." *Journal of Economic Perspectives*, 21 (2007), 169–190.
Tang, H. "The Value of Privacy: Evidence from Online Borrowers." Working Paper, HEC Paris (2020).
Thaler, R. H., and H. M. Shefrin. "An Economic Theory of Self-Control." *Journal of Political Economy*, 89 (1981), 392–406
Van Rooij, M.; A. Lusardi; and R. Alessie. "Financial Literacy and Stock Market Participation." *Journal of Financial Economics*, 101 (2011), 449–472.
Von Gaudecker, H-M. "How Does Household Portfolio Diversification Vary with Financial Literacy and Financial Advice?" *Journal of Finance*, 70 (2015), 489–507.
Xiao, J. J. *Handbook of Consumer Finance Research*, J. J. Xiao, ed. New York, New York: Springer (2008).
Xie, S. Y. "A $7 Credit Limit: Jack Ma's Ant Lures Hundreds of Millions of Borrowers." *Wall Street Journal*, Dec. 8, 2019. Available at http://www.wsj.com/articles/a-7-credit-limit-jack-mas-ant-lures-hundreds-of-millions-of-borrowers-11575811989.
Xu, L., and B. Zia. "Financial Literacy around the World: An Overview of the Evidence with Practical Suggestions for the Way Forward." Policy Research Working Paper No. 6107, World Bank (2012).

https://doi.org/10.1017/S0022109021000314 Published online by Cambridge University Press