# Temporal Reframing and Savings: A Field Experiment

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**Abstract**. A growing percentage of American workers are now freelancers and thus responsible for their own retirement savings, yet they face a number of psychological hurdles that hamper them from saving enough money for the long-term. Although prior theory-derived interventions have been successful in addressing some of these obstacles, encouraging saving behavior at levels that will adequately fund future consumption is a challenging endeavor for policymakers and consumers alike. In a field setting, we test whether framing savings in more or less granular formats (e.g., saving daily versus monthly) can encourage continued saving behavior through increasing the take-up of a recurring deposit program. Among thousands of new users of a financial technology app, we find that framing deposits in daily amounts as opposed to monthly amounts quadruples the number of consumers who enroll. Further, framing deposits in more granular terms reduced the participation gap between lower and higher income consumers: three times as many consumers in the highest rather than lowest income bracket participated in the program when it was framed as a $150 monthly deposit, but this difference in participation was eliminated when deposits were framed as $5 per day.

**Keywords**: choice architecture, behavioral economics, saving, field experiment, financial technology

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## 1. Introduction

People often have difficulty saving money and marketers face problems convincing them to do so, a challenge that exists regardless of whether goals and time horizons are short- or long-term. For example, consumers have trouble saving for long-term goals like retirement (e.g., Benartzi and Thaler 2013) and college education (Madrian et al. 2017). But, people are also challenged by the prospect of saving for emergencies that may arise in the short-term: in a recent government report, nearly half of adults said they either could not handle an emergency expense of a few hundred dollars or would have to cover the emergency through selling something or borrowing money (Board of Governors of the Federal Reserve System 2016; see also Lusardi, Schneider, and Tufano 2011).

Prior behavioral economic interventions have been successful in addressing psychological obstacles that hamper people from both choosing to save and saving enough. Automatically enrolling eligible employees into employer-sponsored saving plans (i.e., defined contribution plans) results in a dramatically greater percentage of employees actively saving (Madrian and Shea 2001), although some plans still set default savings rates too low relative to what would be more effective (Beshears et al. 2009). The Save More Tomorrow program, for example, directly addresses psychological obstacles to saving, such as myopia, inertia, and loss aversion (Thaler and Benartzi 2004), by introducing pre-commitment and automatic savings rate escalators that are synchronized with future salary increases. Such programs have helped millions of Americans significantly increase their savings (Benartzi and Thaler 2013). But despite the success of these and similar programs, consumers and policy-makers still face major hurdles when it comes to encouraging saving behavior at levels that will adequately fund future consumption.

One of these hurdles, as typified in saving for retirement, is that existing solutions have largely focused on employees with access to a retirement savings plan (e.g., 401k plan). Furthermore, the solutions were designed for an era where employees were predominantly employed full-time and tended to receive paychecks on a regular but relatively infrequent basis, such as bi-weekly or monthly. These traditional employment arrangements are increasingly obsolete, as more workers are part of the so-called gig economy, which consists of more self-employed, part-time, and on-demand workers. Indeed, the U.S. Government Accountability Office estimated that "contingent workers" (i.e., on-call, part-time, and self-employed workers) make up more than a third of the total employment workforce (GAO 2013), and companies considered part of the on-demand economy (e.g., Uber, Lyft, Amazon Mechanical Turk) comprise around 21 million workers internationally (de Stefano 2015). One assessment even suggests that alternative employment arrangements accounted for nearly 85 percent of employment growth between 2005 and 2013 (Friedman 2014). This distinction between traditional employment arrangements and alternative arrangements is important as gig economy workers may be paid on more granular time intervals than traditional workers. For example, Uber drivers work when they want and get paid weekly (Cramer and Krueger 2016), and Amazon Mechanical Turk workers may complete tasks and have them approved by different task requesters in minutes, and request payment distributions and have them paid daily (Paolacci and Chandler 2014).

Given this shift toward more granular payment structures, we test whether framing savings in more or less granular formats (e.g., saving daily versus monthly) can encourage continued saving behavior through increasing the take-up of a recurring deposit program. Because people may create separate mental accounts for small compared to large losses of

money (e.g., Thaler 1985), our specific research objective is to test whether people are less sensitive to present-day losses (which will turn into future gains) when such losses are framed in a smaller, more granular format (e.g., $5 a day) compared to a larger, less granular format (e.g., $150 a month). We draw on two related literatures to generate this hypothesis.

First, financially equivalent sums of money can be presented in formats with different psychological associations. For example, when workers near retirement, they have the option to cash out their savings in a lump sum (e.g., $100,000) or purchase an annuity and receive an equivalent amount, spread out monthly for life (e.g., $500 per month from age 68 onward). Yet, consumers are more sensitive to changes in wealth when income is expressed in a monthly framing compared to a lump sum framing (Goldstein et al., 2016; Goda, Manchester, and Sojourner 2013). This leads to an "illusion of wealth," whereby lump sums seem more adequate than an equivalent monthly income at lower wealth levels (when consumers can adequately perceive just how *little* a monthly amount would afford), with a reversal of this pattern at higher levels of wealth (when consumers can adequately perceive just how *much* a monthly amount would afford). That is, at lower wealth levels, a lump sum may seem subjectively larger than its equivalent monthly amount, thus affording a perception of greater adequacy.

In the current investigation, we examine whether this same psychological phenomenon can be used to help people regularly contribute to a savings account in a field setting with consequential outcomes. If consumers perceive that lump sums afford greater spending power than equivalent amounts framed in more granular ways, then it stands to reason that parting with such lump sums should be more psychologically painful than giving up an equivalent amount of money spread out over time in a smaller, more granular format (i.e., a "pennies-a-day" framing; Gourville 1998). Concretely, when consumers enroll in some saving plans, they are given the

opportunity to set up a recurring deposit and regularly contribute a given amount of money to their account. These contributions are often framed in terms of a monthly contribution (e.g., $150 a month), likely reflecting traditional paycheck and banking norms where money is only transferred from one account to another on a monthly basis. But these same monthly contributions could be instead represented by weekly (e.g., $35 a week) or even daily (e.g., $5 a day) amounts. Goldstein et al. (2016) found that a lump sum of $100,000 felt subjectively larger than its equivalent annuity of $500 per month. Likewise, larger monthly amounts of money (e.g., $150) may be more psychologically painful to give up than equivalent, smaller weekly (e.g., $35) or daily ($5) amounts of money. As a result, we predict that consumers will be more likely to enroll in a recurring deposit program when deposits are framed in a more granular way (i.e., when parting with the recurring deposit seems less psychologically painful) than when deposits are framed in a less granular way.

Second, in research from the "pennies-a-day" literature, temporally reframing the cost of a product into more granular amounts increased purchase intent in laboratory settings, in part because doing so reduced the perceived cost of the deal (Gourville 1998, 1999; Nagle and Holden 1995). This general preference for less aggregate framing over more aggregate framing extended from days to larger units such as weeks and months (paying $1 per day is preferred to paying $365 per year), but this finding reverses with larger monetary amounts (paying $4,200 per year is preferred to paying $11.50 per day; Gourville 2003). Although much of the literature on temporal reframing has focused on cost perceptions in purchasing domains, we view these as relevant to saving decisions as well: when opting whether to save or spend money now, one factor that consumers must consider is how painful it will be to give up (i.e., "pay") a certain amount of money now for larger gains later. Indeed, people at least seem to think that such

framing can be helpful in the savings domain: Colby and Chapman (2013), for example, found that consumers thought they would be more likely to forgo small expenditures in order to put money toward a savings goal, but only when such goals were framed in a more granular format. Notably, the literature to date has not investigated the effectiveness of such temporal framing in a field setting with consequential financial outcomes.

Given the importance of investigating whether these effects extend to real-world settings as well as the practical implications of enhancing saving behavior, we set out to conduct a field study with a financial technology company (Acorns) that provides a mobile phone app allowing people to save and invest in small (e.g., spare change) and large amounts (e.g., thousands of dollars). In the course of our research, new users were given the opportunity to set up a recurring deposit program, in an effort to grow their savings over time. Critically, when users were invited to join the recurring deposit program, they were offered deposits in terms of either daily, weekly, or monthly amounts. Drawing on the various literature streams reviewed above, we hypothesized that users would be more likely to enroll in the recurring deposits program when deposits were framed as more granular, and less psychologically painful. That is, the probability of enrolling will be greater for daily over weekly over monthly framing of the same total amounts.

## 2. Method

Participants in the field study were new users to the Acorns app. We aimed to have approximately 2,000 users in each of five conditions, or run the sign-up period of the field study for approximately 4 weeks, whichever came first. The sign-up period ran from January 4$^{th}$ to January 31$^{st}$, 2017, and we concluded with 8,931 total participants.

### 2.1 Sample Characteristics

The average age of participants was 32.81 years (*SD* = 10.19 years). In terms of household income, 25.4% had less $25,000 a year, 37.8% had between $25,000 and $49,999, 29.5% had between $50,000 and $99,999, 6.9% had between $100,000 and $249,999, and .6% had above $250,000. Users were not required to report their sex, but of the 1,737 users who did, 551 were women (31.7% of the relevant data) and 1,186 were men (68.3% of the relevant sample).

To sign up for an Acorns account, a user has to download the Acorns app to his or her smartphone. From there, they must provide an email address for logging in, affirm they are a U.S. resident who is 18 years of age or older, agree to an Acorns program agreement, connect a bank account using their bank credentials, and provide some personal information (e.g., name, home address, phone number, and social security identification) to open an investment account. Users are also asked to furnish information about their income, net worth, and investment goals to help Acorns recommend a pre-designed investment portfolio, which reflects a mix of exchange traded funds (often representing an asset class or index like the S&P 500) in one of five configurations: conservative, moderately conservative, moderate, moderately aggressive, or aggressive. Fees for an Acorns account are $1 per month for an account less than $5,000 and 0.25% per year for an account greater than or equal to $5,000.

**2.2 Procedure**

After signing up for an account with Acorns and setting an initial deposit amount, users were then randomly assigned to receive one of five different treatments asking whether they would like to set up a recurring deposit that varied the dollar amount and temporal frame. This message represents the central component of the field study that we conducted. Because randomization was conducted using a truly random allocation procedure, the number of users

who were assigned to each condition was not equal across conditions. In three of the conditions, users would deposit a total of approximately $150 a month, but deposits were framed in daily, weekly, or monthly amounts: 1) $5 a day (1,772 users), 2) $35 a week (1,826 users), or 3) $150 a month (1,744 users), and in two additional conditions, users would deposit a total of approximately $30 a month, framed in weekly or monthly amounts: 4) $7 a week (1,817 users) and 5) $30 a month (1,772 users).[1] Users could elect to either enroll in the recurring deposit program or do so at a later time. Note that when users elect to participate in the recurring deposit program, money is pulled either on a daily, weekly, or monthly basis based on their assigned condition, provided that any weekend day pulls are postponed until the following Monday.

Once users had made their decision regarding recurring deposits, they were free to use the app as they wished. See Figure 1 for screenshots of the sign-up process, including the critical recurring deposit intervention. After this initial sign-up, we continued to monitor users for 3 months at approximately 5-week, 7-week, 8-week, 10-week, and 12-week intervals, during which we were able to assess whether users had left the recurring deposit feature on or turned it off (allowing us to assess retention as a function of condition). During this period of time, we also monitored total account balance[2].

**3. Results**

Our interest in conducting this field study concerned whether framing monetary contributions in a more granular manner would increase participation in a recurring deposit program. Thus, we treated the first three conditions ($5 a day, $35 a week, and $150 a month) as our primary conditions of interest, and the last two conditions ($7 a week and $30 a month) as a

[1] Note that we were unable to implement $1 per day due to technical limitations identified by Acorns.
[2] ACORNS also monitored weekly logins, withdrawals, and average weekly withdrawal amount, though these variables fell outside the scope of the current research project.

conceptual replication that was conducted simultaneously. Below, we separately report analyses for these two groupings of conditions.

### 3.1 $5 Per Day, $35 Per Week, and $150 Per Month Conditions

**3.1.1. Sign-ups**. To examine whether sign-up rates for the recurring deposit program differed as a function of condition, we conducted a logistic regression analysis with the decision to sign up as the dependent variable, and condition as a contrast-coded independent variable. Because we had hypothesized, *a priori*, that a more granular framing would result in increased sign-ups, we used contrast coding in which 1 = daily amount, 0 = weekly amount, and -1 = monthly amount, for ease of interpretation. In line with our hypothesis, condition was a significant predictor of the decision to sign up for the recurring deposit program, $b = .95$, Wald $\chi^2(1) = 310.39$, $p < .001$, with more people signing up under the daily framing (29.9% of those offered the daily framing) than the weekly (10.3%) or monthly framing (7.1%). Results held when we controlled for income and age, $b = .95$, Wald $\chi^2(1) = 310.04$, $p < .001$ (See Table 1).

**3.1.2. Retention**. We examined retention over three separate time points: approximately one month after registration, two months after registration, and three months after registration (See Table 2 for full logistic regression results). To examine whether retention differed as a function of condition, we conducted a logistic regression analysis with retention as the dependent variable (1 = still enrolled in recurring deposits; 0 = no longer enrolled in recurring deposits) and condition as a contrast-coded independent variable (again, with 1 = daily amount, 0 = weekly amount, and -1 = monthly amount). Of the participants who signed up for recurring deposits upon registration, retention rates at one month did differ as a function of condition, $b = -.43$, Wald $\chi^2(1) = 10.99$, $p < .001$, with fewer people remaining enrolled after one month in the daily framing (75%), than in the weekly framing (85%) or monthly framing (86%) conditions. Results

held when we controlled for income and age, $b$ = -.37, Wald $\chi^2(1) = 7.73$, $p < .01$. Importantly, we note that even despite lower retention rates in the daily versus weekly and monthly conditions, overall participation in the program was still higher in the daily condition (22% of consumers initially offered the daily framing) compared to the weekly (9%) and monthly (6%) conditions ($\chi^2(2, N = 5342) = 249.52$, $p < .001$; See Figure 2).

To assess retention from one month to two months, we again conducted a logistic regression and found no difference in retention between conditions, $b$ = -.16, Wald $\chi^2(1) = .79$, $p = .37$, with roughly the same percentage of users remaining enrolled in the recurring deposit program from one month to two months: (daily framing: 89%; weekly framing: 89%; monthly framing: 93%). Results held when we controlled for income and age, $b$ = -.15, Wald $\chi^2(1) = .67$, $p = .41$.

Finally, we conducted an additional logistic regression assessing retention from two months to three months. Again, there were no differences in retention between conditions, $b$ = .27, Wald $\chi^2(1) = 1.89$, $p = .17$, with roughly the same percentage of users remaining enrolled in the recurring deposit program from two months to three months: (daily framing: 94%; weekly framing: 92%; monthly framing: 90%). Results held when we controlled for income and age, $b$ = .29, Wald $\chi^2(1) = 2.15$, $p = .14$.

In short, although retention rates differed as a function of condition after one month, for the remainder of the longitudinal study, they remained consistent across conditions.

**3.1.3. Initial Deposit.** In an effort to better understand the differences in enrollment across conditions, we examined whether initial deposits differed as a function of condition and the decision to enroll in the recurring deposit program. To do so, we conducted a univariate ANOVA with two between-subjects factors (condition: daily, weekly, monthly; recurring deposit

enrollment: enrolled, not enrolled), and initial deposit as the dependent variable. There were 87 participants who had deposits that were 3 or more standard deviations above the mean. These 87 balances were replaced with the closest nonoutlying value in the sample (Tabachnick & Fidell, 2007).

The univariate ANOVA indicated that there were main effects of condition ($F(2, 5326) = 67.92$, $p < .001$, $\eta_p^2 = .03$) and recurring deposit enrollment, ($F(1, 5326) = 363.32$, $p < .001$, $\eta_p^2 = .06$), which were qualified by a significant Condition x Recurring Deposit Enrollment interaction ($F(2, 5326) = 71.92$, $p < .001$, $\eta_p^2 = .03$). The nature of this interaction is demonstrated in Figure 3: there are no differences across conditions in initial deposit among those who did not enroll in the recurring deposit program. Among consumers who did enroll, those in the $35 weekly (winsorized $M$ = $93.52, $SD$ = $124.76) and $150 monthly (winsorized $M$ = $102.74, $SD$ = $127.57) conditions did not differ in terms of their initial deposit ($t(310) = .63$, $p = .53$), but both had higher initial deposits than those in the $5 a day condition (winsorized $M$ = $41.16, $SD$ = $73.90; ts > 6.84, $p$s < .001). These results remained significant when we controlled for age and income ($p$s < .001). Put another way, the daily deposit framing seemed to open up the possibility to join the program for consumers who had a lower amount to initially deposit.

**3.1.4. Income**. To complement the analyses on initial deposits, we also examined whether there were any differences in the decision to enroll in the recurring deposit program as a function of both condition and household income. Again, we conducted a univariate ANOVA with condition and income bracket as between-subjects factors and decision to enroll as the dependent variable. As noted earlier, household income was coded categorically in five bins (1 = less than $25,000; 2 = $25,000 - $49,999; 3 = $50,000 - $99,999; 4 = $100,000 - $250,000; 5 = more than $250,000). Because there were so few consumers in the highest income bracket (i.e.,

$250,000+; n = 16), we combined this income bracket with the next highest one (i.e., $100,000 - $249,999) for this analysis. Doing so, we obtained main effects of Condition ($F(2, 5330) = 121.64$, $p < .001$, $\eta_p^2 = .04$), Income ($F(3, 5330) = 4.42$, $p < .01$, $\eta_p^2 = .002$), as well as a Condition by Income interaction ($F(6, 5330) = 4.23$, $p < .001$, $\eta_p^2 = .01$). As shown in Table 3, three times as many consumers in the highest rather than lowest income bracket participated in the program when it was framed as a $150 monthly deposit, but this difference in participation was eliminated when deposits were framed as $5 per day. Framing deposits in more granular terms, then, seems to reduce the participation gap between lower and higher income individuals in this recurring deposit program.

**3.1.5. Balance**. Finally, we assessed whether there were differences in account balances maintained, as a function of condition and enrollment in the recurring deposit program (see Table 4 for raw balance summary statistics across the duration of the study). To do so, we conducted three separate analyses that examined balance amount at one month, two months, and three months into the study. Specifically, we conducted univariate ANOVAs with two between-subjects factors (condition: daily, weekly, monthly; recurring deposit enrollment: enrolled, not enrolled), and balance as the dependent variable.

At one month into the program, there were 69 participants who had balances that were 3 or more standard deviations above the mean, and were replaced with the closest nonoutlying value in the sample (Tabachnick and Fidell 2007). The univariate ANOVA indicated that there were main effects of condition ($F(2, 5336) = 43.04$, $p < .001$, $\eta_p^2 = .02$) and recurring deposit enrollment, ($F(1, 5336) = 356.10$, $p < .001$, $\eta_p^2 = .06$), which were qualified by a significant Condition x Recurring Deposit Enrollment interaction ($F(2, 5336) = 44.10$, $p < .001$, $\eta_p^2 = .02$). The nature of this interaction is demonstrated in Figure 4A: while there are no differences in

balance among those who were not enrolled in the recurring deposit program at one month, among consumers who were still enrolled in the program, those in the $35 weekly and $150 monthly conditions had higher average balances than those in the $5 daily condition ($t(556) = 6.83$, $p < .001$, $d = .58$ and $t(503) = 2.41$, $p = .02$, $d = .22$, respectively).

Two months into the program, there were 60 participants who had balances that were 3 or more standard deviations above the mean, and these balances were accordingly winsorized. Again, the univariate ANOVA indicated that there were main effects of condition ($F(2, 5336) = 48.05$, $p < .001$, $\eta_p^2 = .02$) and recurring deposit enrollment, ($F(1, 5336) = 438.12$, $p < .001$, $\eta_p^2 = .08$), which were qualified by a significant Condition x Recurring Deposit Enrollment interaction ($F(2, 5336) = 45.73$, $p < .001$, $\eta_p^2 = .02$). As shown in Figure 4B, while there are no differences in balance among those who were not enrolled in the recurring deposit program at one month, among consumers who were still enrolled in the program, those in the $35 weekly and $150 monthly conditions had higher average balances than those in the $5 daily condition ($t(505) = 6.75$, $p < .001$, $d = .60$ and $t(461) = 3.49$, $p < .001$, $d = .33$, respectively).

Three months into the program, there were 74 participants who had balances that were 3 or more standard deviations above the mean, and these balances were accordingly winsorized. Again, the univariate ANOVA indicated that there were main effects of condition ($F(2, 5336) = 59.57$, $p < .001$, $\eta_p^2 = .02$) and recurring deposit enrollment, ($F(1, 5336) = 510.41$, $p < .001$, $\eta_p^2 = .09$), which were qualified by a significant Condition x Recurring Deposit Enrollment interaction ($F(2, 5336) = 57.76$, $p < .001$, $\eta_p^2 = .02$). Again, as shown in Figure 4C, while there are no differences in balance among those who were not enrolled in the recurring deposit program at one month, among consumers who were still enrolled in the program, those in the $35 weekly

and $150 monthly conditions had higher average balances than those in the $5 daily condition ($t(479) = 7.67$, $p < .001$, $d = .70$ and $t(437) = 3.09$, $p < .01$, $d = .30$, respectively).

Although we expand on these results in the General Discussion, the account balance analyses suggest that the consumers who enrolled in the recurring deposit program in the weekly and monthly framing had higher average balances – perhaps because of their higher incomes – than those who enrolled in the daily condition.

### 3.2. $7 Per Week and $30 Per Month Conditions

**3.2.1. Sign-ups**. We again conducted a logistic regression analysis with the decision to sign up as the dependent variable, and condition as a contrast-coded independent variable. Because we had hypothesized, *a priori,* that more a more granular framing would result in increased sign-ups, we used contrast coding in which 1 = weekly amount and -1 = monthly amount, for ease of interpretation. In line with our hypothesis, condition was a significant predictor of the decision to sign up for the recurring deposit program, $b = .43$, Wald $\chi^2(1) = 133.86$, $p < .001$, with more people signing up under the weekly framing (39.9%) than the monthly framing (21.8%). Results held when we controlled for income and age, $b = .46$, Wald $\chi^2(1) = 141.25$, $p < .001$ (See Table 5 for full logistic regression results).

**3.2.2. Retention**. As in the analyses for the $150 conditions, to examine whether retention differed as a function of condition, we conducted a logistic regression analysis with retention as the dependent variable (1 = still enrolled in recurring deposits; 0 = no longer enrolled in recurring deposits) and condition as a contrast-coded independent variable (1 = weekly amount, and -1 = monthly amount) (See Table 6 for full logistic regression results). Of the participants who signed up for recurring deposits upon registration, retention rates at one month did not differ as a function of condition, $b = -.09$, Wald $\chi^2(1) = 0.79$, $p = .37$, with roughly

the same proportion of people remaining enrolled after one month in the weekly framing (87%) and in the monthly framing (89%) conditions (See Figure 5). Results held when we controlled for income and age, $b$ = -.05, Wald $\chi^2(1) = 0.23$, $p$ = .63.

A similar pattern was obtained for retention from one month to two months, $b$ = -.02, Wald $\chi^2(1) = 0.01$, $p$ = .98, with 94% being retained in both conditions. Results held when we controlled for income and age, $b$ = .01, Wald $\chi^2(1) = 0.01$, $p$ = .94. Finally, a similar pattern was obtained for retention from two months to three months, with 94% being retained in the monthly condition and 95% being retained in the weekly condition, $b$ = .09, Wald $\chi^2(1) = 0.34$, $p$ = .56. Results held when we controlled for income and age, $b$ = .10, Wald $\chi^2(1) = 0.47$, $p$ = .49.

**3.2.3. Initial Deposit.** Again, in an effort to better understand the differences in balances across conditions, we examined whether initial deposits differed as a function of condition and the decision to enroll in the recurring deposit program. To do so, we conducted a univariate ANOVA with two between-subjects factors (condition: weekly, monthly; recurring deposit enrollment: enrolled, not enrolled), and initial deposit as the dependent variable. There were 53 participants who had deposits that were 3 or more standard deviations above the mean. These 53 balances were replaced with the closest nonoutlying value in the sample (Tabachnick and Fidell 2007).

Unlike the $150 conditions, the univariate ANOVA only indicated a significant main effect for recurring deposit enrollment, ($F(1, 3579) = 48.07$, $p < .001$, $\eta_p^2 = .01$), with those who enrolled in the recurring deposit program having a higher balance ($M$ = $55.86, $SD$ = $166.59) than those who did not enroll ($M$ = $25.34, $SD$ = $91.25). There were no other main effects or interactions ($p$s > .34). Figure 6 provides a graphical representation of these results.

**3.2.4. Income**. As in the $150 conditions, to complement the analyses on initial deposits, we also examined whether there were any differences in the decision to enroll in the recurring deposit program as a function of condition and income bracket. Doing so, we obtained the expected main effects of Condition ($F(1, 3581) = 103.94$, $p < .001$, $\eta_p^2 = .03$), Income ($F(3, 3581) = 39.22$, $p < .001$, $\eta_p^2 = .03$), and a Condition by Income interaction ($F(3, 3581) = 2.69$, $p < .05$, $\eta_p^2 = .002$). As shown in Table 7, almost three times as many consumers in the highest rather than lowest income bracket participated in the program when it was framed as a $30 monthly deposit, but this difference in participation was attenuated when deposits were framed as $7 per week.

**3.2.5. Balance**. Finally, we assessed whether there were differences in account balances maintained, as a function of condition and enrollment in the recurring deposit program (see Table 6 for raw balance summary statistics across the duration of the study). To do so, we conducted three separate analyses that examined balance amount at one month, two months, and three months into the study. Specifically, we conducted univariate ANOVAs with two between-subjects factors (condition: weekly, monthly; recurring deposit enrollment: enrolled, not enrolled), and balance as the dependent variable.

At one month into the program, there were 8 participants who had balances that were 3 or more standard deviations above the mean. These 8 balances were replaced with the closest nonoutlying value in the sample (Tabachnick and Fidell 2007). The univariate ANOVA indicated that there were main effects of condition ($F(1, 3585) = 6.80$, $p < .01$, $\eta_p^2 = .002$) and recurring deposit enrollment, ($F(1, 3585) = 134.49$, $p < .001$, $\eta_p^2 = .04$), which were qualified by a significant Condition x Recurring Deposit Enrollment interaction ($F(1, 3585) = 5.00$, $p = .03$, $\eta_p^2 = .001$). The nature of this interaction is demonstrated in Figure 7A: while there are no

differences in balance among those who were not enrolled in the recurring deposit program at one month, among consumers who were still enrolled in the program, those in the $30 monthly condition had trend-level higher average balances than those in the $7 weekly condition, $t(971) = 1.70$, $p = .09$, $d = .11$).

Two months into the program, there were 11 participants who had balances that were 3 or more standard deviations above the mean, and these balances were accordingly winsorized. The univariate ANOVA indicated that there were main effects of condition ($F(1, 3585) = 9.59$, $p < .01$, $\eta_p^2 = .003$) and recurring deposit enrollment, ($F(1, 3585) = 133.21$, $p < .001$, $\eta_p^2 = .04$), which were qualified by a significant Condition x Recurring Deposit Enrollment interaction ($F(1, 3585) = 7.77$, $p < .01$, $\eta_p^2 = .002$). The nature of this interaction is demonstrated in Figure 7B: while there are no differences in balance among those who were not enrolled in the recurring deposit program at one month, among consumers who were still enrolled in the program, those in the $30 monthly condition had higher average balances than those in the $7 weekly condition, $t(924) = 2.06$, $p = .04$, $d = .14$).

Three months into the program, there were 11 participants who had balances that were 3 or more standard deviations above the mean, and these balances were accordingly winsorized. The univariate ANOVA indicated that there were main effects of condition ($F(1, 3585) = 10.25$, $p < .001$, $\eta_p^2 = .003$) and recurring deposit enrollment, ($F(1, 3585) = 142.95$, $p < .001$, $\eta_p^2 = .04$), which were qualified by a significant Condition x Recurring Deposit Enrollment interaction ($F(1, 3585) = 6.00$, $p = .01$, $\eta_p^2 = .002$). The nature of this interaction is demonstrated in Figure 7C: while there are no differences in balance among those who were not enrolled in the recurring deposit program at one month, among consumers who were still enrolled in the program, those in

the $30 monthly condition had higher average balances than those in the $7 weekly condition, $t(882) = 2.17$, $p = .03$, $d = .15$).

**4. General Discussion**

The fields of marketing and behavioral economics have implemented a variety of solutions to help consumers overcome the many obstacles they face in pursuit of saving for the long-term. We add to this growing literature by examining the effectiveness of an intervention meant to encourage the take-up of a recurring deposit program. Namely, we asked new users of a financial tech app whether they wished to sign up for a recurring deposit program, but framed those recurring deposits in more or less granular terms. In a departure from the existing literature on temporal framing of financial outcomes, here we examined consequential decisions in a field setting. In the three central conditions, we found that take-up was approximately four times higher when deposits were framed in daily terms (i.e., $5 per day) compared to monthly terms (i.e., $150 per month), and approximately three times higher when compared to a weekly framing (i.e., $35 per week). We replicated this basic effect with two additional conditions that framed deposits in lower overall amounts (i.e., take-up was approximately twice as high when deposits were framed as $7 per week compared to $30 per month). Taken together, temporally reframing a recurring deposit in a more granular manner led to increased take-up of the program.

Due to the longitudinal nature of this study, we were also able to investigate the extent to which the initial framing of recurring deposits prompted continued enrollment in the program. Results indicated that after one month, there was a higher drop-out rate in the daily framing condition compared to the weekly or monthly conditions. Whereas approximately a quarter of the consumers who enrolled in the daily condition ended up dropping out after one month, only approximately 15% dropped out in the daily and weekly conditions. But, as noted above, due to

large difference in enrollment between conditions, even with this higher drop-out rate in the daily amount condition, there were still more consumers from the daily conditions enrolled in the recurring deposits program after one month (and also for the rest of the program) than for the weekly and monthly conditions. At subsequent periods of 2 and 3 months, retention remained the same across conditions. It may be the case, then, that a higher proportion of consumers who sign up for a recurring deposit program when it is framed in a granular way regret doing so after a short period of time (i.e., a month). After this time period, however, enrollment remained stable regardless of initial condition. Taken together, at the end of the three-month study, 19% of consumers who were exposed to the $5 per day framing were still enrolled, compared to just 5% in the $150 per month condition. Thus, approximately four times as many consumers continued to be engaged in the recurring deposit savings program when it was framed in more rather than less granular terms.

We also wish to note here that our replications conditions that involved much lower amounts of money ($7 per week and $30 per month) showed no differences in retention at any of the time periods. Although this higher retention rate is promising, these consumers are clearly depositing much lower amounts of money into their accounts than those in the $5 per day/$35 per week/$150 per month conditions. Just the same, even in these conditions with lower deposit amounts, less granular framing resulted in almost two times as many consumers who were still engaged at the end of the 3-month study: the $7 per week condition resulted in a 31% enrollment rate at the study's conclusion compared to 17% enrollment rate in the $30 per week condition.

Drawing on prior work regarding temporal reframing (e.g., Gourville 1999) as well as how consumers view lump sums versus annuitized streams of money (Goldstein et al. 2016), we suggested that one reason why a more granular framing would be effective for encouraging

enrollment was because giving up small amounts of money on a daily basis might seem less psychologically painful and more feasible than giving up a large amount of money on a monthly (or weekly) basis. Although the field study context of this study did not allow us to directly probe this psychological mechanism, an analysis of average initial deposit as well as enrollment differences as a function of income provided some compelling indirect evidence for this proposition. Namely, if smaller, more granular amounts do in fact seem less psychologically painful and more feasible than larger, less granular amounts, then framing recurring deposits in terms of smaller, daily deposits should be appealing to consumers across the income spectrum. Likewise, if larger, less granular amounts seem more psychological painful and less feasible, then framing recurring deposits in such terms should be primarily appealing to a segment with higher income (i.e., a segment that could feasibly make such large deposits). Put differently, signing up for the recurring deposit program when framed in weekly or monthly terms may seem like a more burdensome responsibility, leading to take-up only among consumers who already felt like they had sufficient resources to participate. Indeed, the consumers who participated in the recurring deposit program when it was framed in weekly or monthly terms made higher initial deposits than those who participated when it was framed in daily terms. More to the point, the recurring deposit program seemed to appeal to a wide set of customers, independent of income, but the weekly and monthly framing only appealed to a segment of higher income customers. A major issue that faces policy makers concerns how best to encourage engagement in saving programs across the income spectrum. The results of this work suggest that one way to reduce the income gap in saving behavior is by framing recurring savings programs in more granular ways: not only did this framing encourage more people to save, it may have encouraged those who tend to struggle the most to start saving.

Perhaps because of these income differences, we also found that consumers who enrolled in the recurring deposit savings program via less granular conditions (i.e., $35 weekly, $150 monthly, and $30 monthly) had higher average balances than consumers who enrolled via the more granular conditions. Nonetheless, inspecting Tables 4 and 8 suggests that because of the larger portion of consumers who remained enrolled in these more granular conditions, their sum of assets was larger. Thus, while more granular framing does not lead to more per capita dollars, it does lead to more total dollars contributed.

Despite the promise of temporal reframing on encouraging user take-up of recurring deposit programs, we nonetheless acknowledge the limitations of the current research. First, the research was conducted on a self-selected group of users who were already interested in signing up for a financial technology application. We question whether take-up rates would be quite so high in a sample of users who were not already interested in better organizing their finances. But, even though overall take-up rates may be lower in a broader sample, we suspect that the between-group differences in take-up would remain. Future research should thus examine whether more granular framing is similarly effective for a broader, more representative sample.

Given that more consumers dropped out of the program after one month in the $5 per day condition, but not in the $7 per week condition, future research should also attempt to identify an optimal recurring deposit amount that maximizes overall contributions but minimizes drop-out. Additionally, although we were able to track users for a period of three months, it is possible that retention rates could change over a longer period of time, or one that includes the holiday season or other periods of time when consumers may wish to spend more of their earnings. Future work may thus want to track users over a longer time interval (e.g., a year or longer).

In summary, this field experiment demonstrates the power of temporal reframing to boost savings. Among new users of savings app, we quadrupled the number of savers by framing deposits in daily amounts as opposed to monthly amounts. We also increased the number of low income savers, and showed that daily framing could eliminate the income gap in saving behavior. While automatic enrollment in 401(k)s has been shown to reduce the income gap in saving behavior (Madrian and Shea, 2001), this temporal reframing intervention can reduce savings disparities among workers without access to an employer-provided retirement plan. These results are especially relevant given current trends in the labor market, as a growing percentage of workers are now freelancers and are responsible for their own retirement savings. By better understanding the information and choice architectures that influence financial decision-making, we can improve the design of websites and apps that will play an increasingly important role in shaping the financial future of American workers.

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Table 1

*Logistic Regression Predicting Sign-Up Decision, $5/Day, $35/Week and $150/Month Conditions (N = 5,342)*

| Predictor | *B* | *SE B* | $e^B$ | *B* | *SE B* | $e^B$ |
|---|---|---|---|---|---|---|
| Condition | .95*** | .05 | 2.59 | .95*** | .05 | 2.59 |
| Age | | | | .00 | .00 | 1.00 |
| Income | | | | .10* | .05 | 1.11 |
| Constant | -1.88 | | | -2.17 | | |
| $\chi^2$ | | 361.75 | | | 368.44 | |
| *df* | | 1 | | | 3 | |

*Note:* $e^B$ = exponentiated *B*. Condition coded as -1 = $150 per month, 0 = $35 per week, and 1 = $5 per day. Income coded on a categorical scale in which 1 = less than $25,000; 2 = $25,000 - $49,999; 3 = $50,000 - $99,999; 4 = $100,000 - $250,000; and, 5 = more than $250,000.
*$p < .05$. **$p < .01$. ***$p < .001$

Table 2

*Logistic Regression Predicting Retention at One, Two, and Three Months, $5/Day, $35/Week and $150/Month Conditions*

| | One Month | | | | | | Two Months | | | | | | Three Months | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Predictor | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ |
| Condition | -.43** | .13 | .65 | -.37** | .13 | .69 | -.16 | .18 | .85 | -.15 | .18 | .86 | .27 | .20 | 1.89 | .29 | .20 | 1.24 |
| Age | | | | .00 | .01 | 1.00 | | | | .02 | .02 | 1.02 | | | | -.01 | .02 | .99 |
| Income | | | | .37** | .11 | 1.45 | | | | -.02 | .15 | .98 | | | | .15 | .18 | 1.16 |
| Constant | 1.57 | | | .62 | | | 2.25 | | | 1.61 | | | 2.48 | | | 2.42 | | |
| $\chi^2$ | | 12.13 | | | 16.96 | | | .82 | | | 3.21 | | | 1.82 | | | 2.54 | |
| *df* | | 1 | | | 3 | | | 1 | | | 3 | | | 1 | | | 3 | |
| *N* | | | | 841 | | | | | | 665 | | | | | | 607 | | |

*Note*: $e^B$ = exponentiated *B*. Condition coded as -1 = $150 per month, 0 = $35 per week, and 1 = $5 per day. Income coded on a categorical scale in which 1 = less than $25,000; 2 = $25,000 - $49,999; 3 = $50,000 - $99,999; 4 = $100,000 - $250,000; and, 5 = more than $250,000.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 3

*Sign-up Rate as a Function of Income and Condition, $5/Day, $35/Week and $150/Month Conditions*

| | Condition | | |
|---|---|---|---|
| | $5 per day | $35 per week | $150 per month |
| < $25k | 31% | 10% | 5% |
| $25k-$49.9k | 32% | 7% | 5% |
| $50k-$99.9k | 26% | 12% | 10% |
| $100k+ | 30% | 21% | 15% |

Table 4

*Summary Statistics for Account Balance at One, Two, and Three Months, $5/Day, $35/Week and $150/Month Conditions*

| | | One Month | | Two Months | | Three Months | |
|---|---|---|---|---|---|---|---|
| | | Did not Enroll | Still Enrolled | Did not Enroll | Still Enrolled | Did not Enroll | Still Enrolled |
| $5 Per Day | *M* | $62.07 | $109.07 | $97.99 | $190.02 | $122.60 | $235.80 |
| | *SD* | $117.17 | $162.17 | $171.29 | $271.17 | $252.99 | $303.60 |
| | **Total** | **$85,282.90** | **$43,411.25** | **$138,072.87** | **$68,977.52** | **$174,579.93** | **$82,057.14** |
| $35 Per Week | *M* | $62.81 | $250.30 | $100.96 | $418.68 | $124.72 | $523.53 |
| | *SD* | $138.54 | $474.92 | $223.97 | $679.22 | $260.69 | $670.47 |
| | **Total** | **$104,636.22** | **$40,047.28** | **$169,821.23** | **$60,290.26** | **$211,142.89** | **$69,629.83** |
| $150 Per Month | *M* | $64.16 | $161.08 | $124.81 | $319.11 | $134.77 | $322.99 |
| | *SD* | $131.14 | $266.41 | $383.87 | $578.94 | $311.57 | $326.83 |
| | **Total** | **$105,021.92** | **$17,236.08** | **$205,191.77** | **$31,911.23** | **$222,767.41** | **$29,392.10** |

*Note*. Statistics based on raw balances prior to winsorizing outliers.

Table 5

*Logistic Regression Predicting Sign-Up Decision, $7/Week and $30/Month Conditions (N = 3,589)*

| Predictor | *B* | *SE B* | $e^B$ | *B* | *SE B* | $e^B$ |
|---|---|---|---|---|---|---|
| Condition | .43*** | .04 | 1.54 | .46*** | .04 | 1.58 |
| Age | | | | .01 | .00 | 1.01 |
| Income | | | | .39*** | .05 | 1.45 |
| Constant | -.85 | | | -2.13 | | |
| $\chi^2$ | | 138.72 | | | 264.22 | |
| *df* | | 1 | | | 3 | |

*Note:* $e^B$ = exponentiated *B*. Condition coded as -1 = $30 per month, and 1 = $7 per week. Income coded on a categorical scale in which 1 = less than $25,000; 2 = $25,000 - $49,999; 3 = $50,000 - $99,999; 4 = $100,000 - $250,000; and, 5 = more than $250,000.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Table 6

*Logistic Regression Predicting Retention at One, Two, and Three Months, $7/Week and $30/Month Conditions*

| | One Month | | | | | | Two Months | | | | | | Three Months | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Predictor | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ | B | *SE B* | $e^B$ |
| Condition | -.09 | .10 | .92 | -.05 | .10 | .95 | -.02 | .15 | .98 | .01 | .15 | 1.01 | .09 | .15 | 1.09 | .10 | .15 | 1.11 |
| Age | | | | .02 | .01 | 1.02 | | | | .03 | .02 | 1.03 | | | | .02 | .02 | 1.02 |
| Income | | | | .37** | .11 | 1.45 | | | | .20 | .17 | 1.23 | | | | .11 | .17 | 1.11 |
| Constant | 1.99 | | | .45 | | | 2.82 | | | 1.38 | | | 2.82 | | | 1.82 | | |
| $\chi^2$ | | .80 | | | 24.61 | | | .01 | | | 7.65 | | | .34 | | | 3.64 | |
| *df* | | 1 | | | 3 | | | 1 | | | 3 | | | 1 | | | 3 | |
| *N* | | | | 1,110 | | | | | | 973 | | | | | | 926 | | |

*Note*: $e^B$ = exponentiated *B*. Condition coded as -1 = $30 per month, and 1 = $7 per week. Income coded on a categorical scale in which 1 = less than $25,000; 2 = $25,000 - $49,999; 3 = $50,000 - $99,999; 4 = $100,000 - $250,000; and, 5 = more than $250,000.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Table 7

*Sign-up Rate as a Function of Income and Condition, $7/Week and $30/Month Conditions*

| | Condition | |
|---|---|---|
| | $7 per week | $30 per month |
| < $25k | 28% | 13% |
| $25k-$49.9k | 40% | 17% |
| $50k-$99.9k | 45% | 31% |
| $100k+ | 59% | 37% |

Table 8

*Summary Statistics for Account Balance at One, Two, and Three Months, $7/week and $30/month Conditions*

| | | One Month | | Two Months | | Three Months | |
|---|---|---|---|---|---|---|---|
| | | Did not Enroll | Still Enrolled | Did not Enroll | Still Enrolled | Did not Enroll | Still Enrolled |
| $7 Per Week | *M* | $50.96 | $175.02 | $99.83 | $242.93 | $117.63 | $297.13 |
| | *SD* | $114.21 | $1,308.71 | $606.14 | $1,379.85 | $611.70 | $1,431.05 |
| | **Total** | **$60,485.87** | **$110,260.47** | **$121,695.97** | **$145,274.07** | **$146,332.33** | **$170,256.24** |
| $30 Per Month | *M* | $58.29 | $134.13 | $95.04 | $221.18 | $115.24 | $279.67 |
| | *SD* | $199.88 | $224.57 | $239.75 | $376.25 | $247.05 | $424.41 |
| | **Total** | **$83,292.60** | **$46,007.52** | **$137,244.48** | **$72,546.89** | **$168,371.60** | **$86,976.49** |

*Note*. Statistics based on raw balances prior to winsorizing outliers.

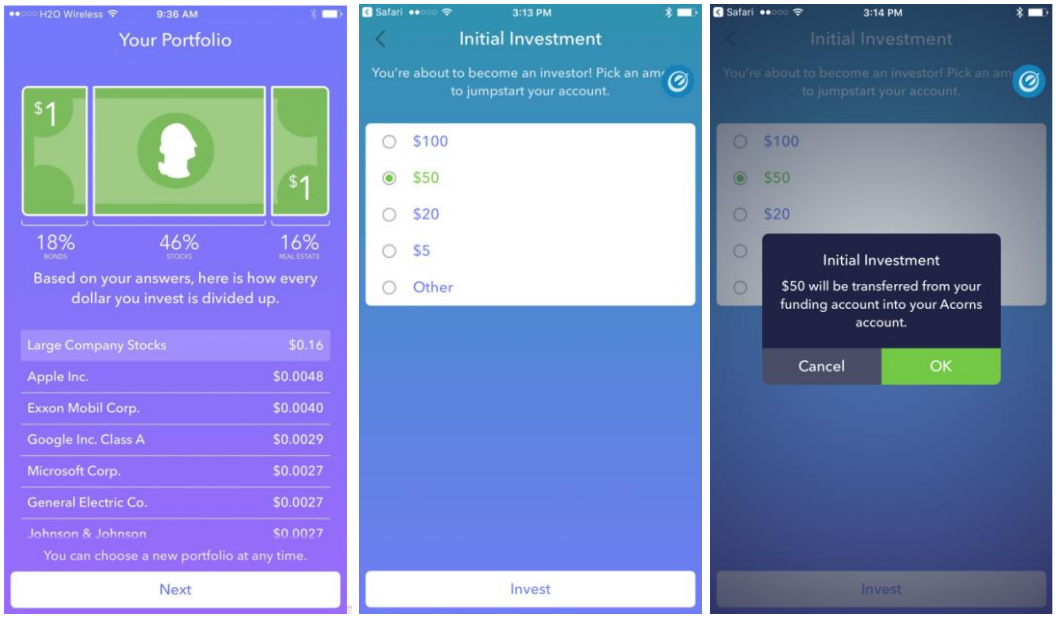
Figure 1

Screenshots from the Acorns Sign-Up Process and Recurring Deposit Intervention

A. New user links bank account and finishes registration with pre-designed portfolio

B. New user sets up a one-time, initial deposit

C. New user receives confirmation of one-time, initial deposit




D. User is randomly assigned to a condition and given an opportunity to make recurring deposits

$5 per day framing

$35 per week framing

$150 per month framing

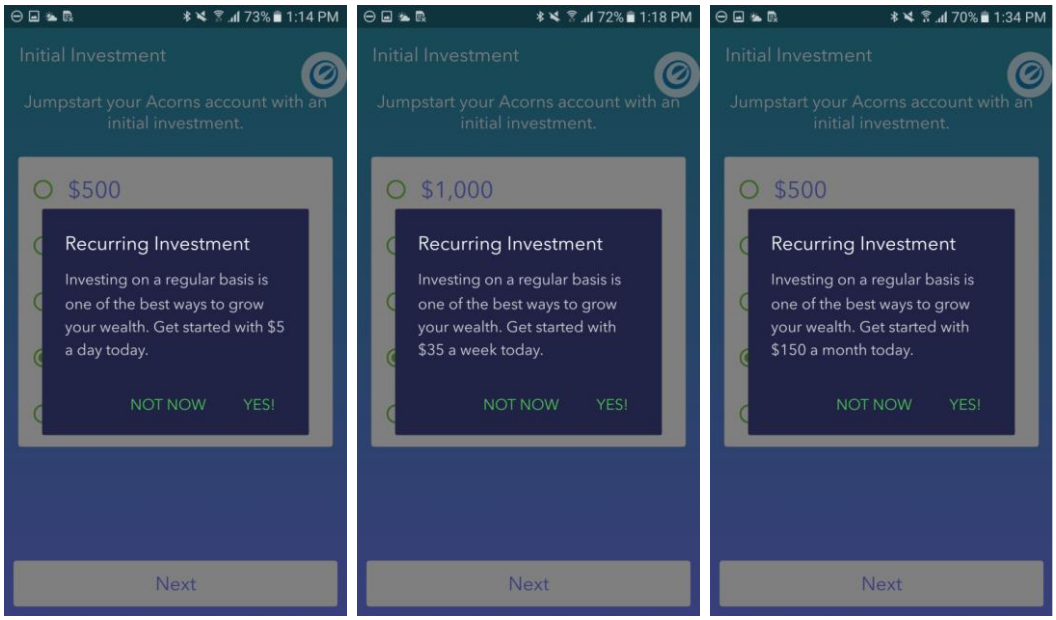


Figure 2

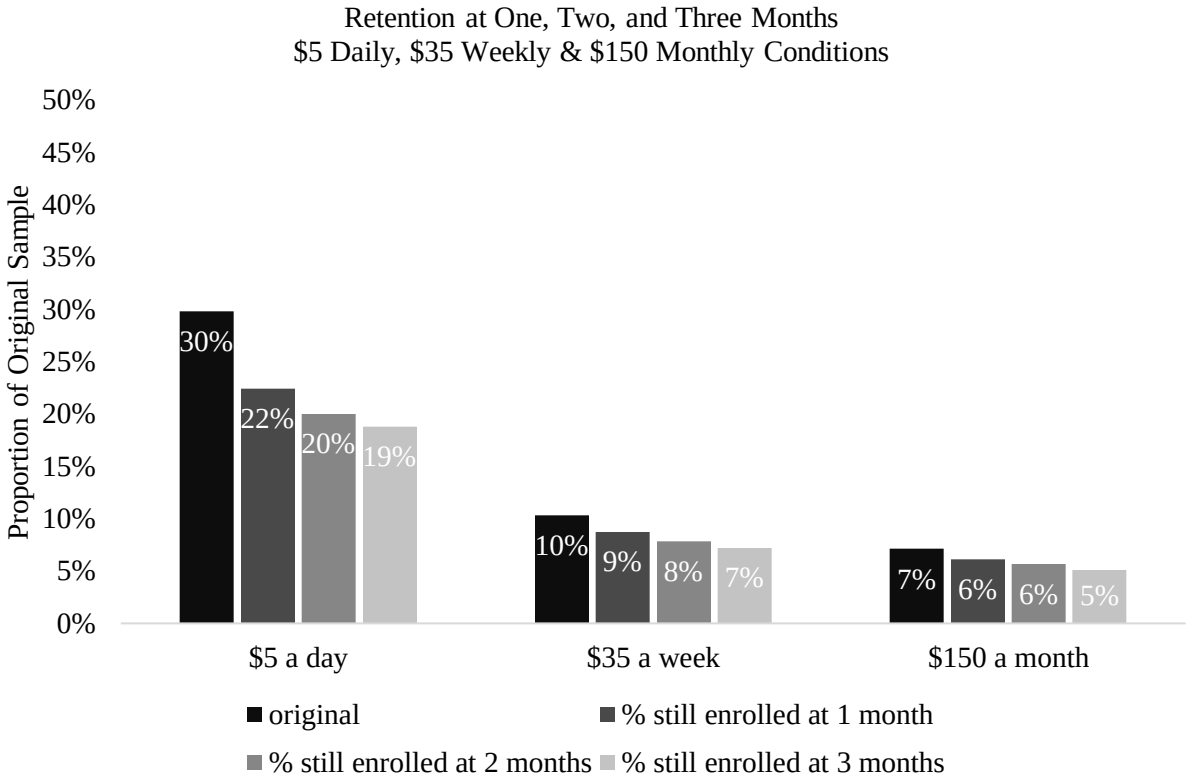

Retention at One, Two, and Three Months
$5 Daily, $35 Weekly & $150 Monthly Conditions
Proportion of Original Sample
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
30%
22%
20%
19%
10%
9%
8%
7%
7%
6%
6%
5%
$5 a day
$35 a week
$150 a month
original
% still enrolled at 1 month
% still enrolled at 2 months
% still enrolled at 3 months

Figure 3

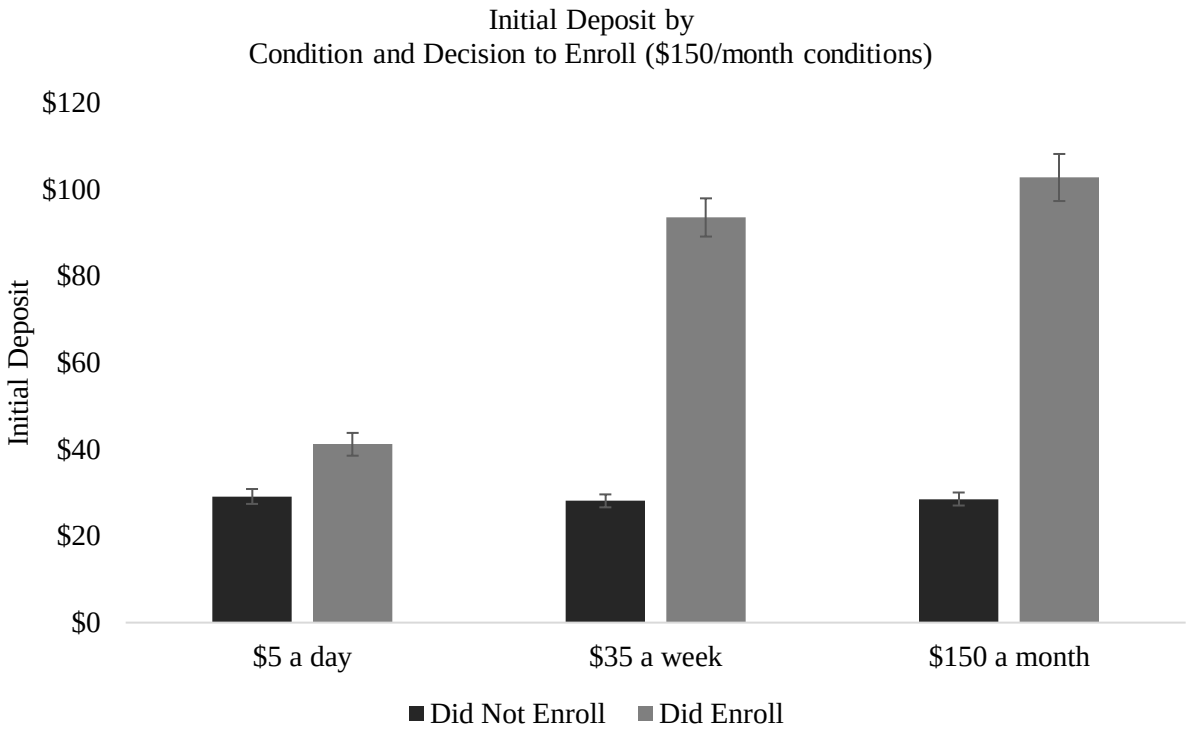

Initial Deposit by
Condition and Decision to Enroll ($150/month conditions)
$120
$100
$80
$60
$40
$20
$0
Initial Deposit
$5 a day
$35 a week
$150 a month
Did Not Enroll
Did Enroll

Figure 4

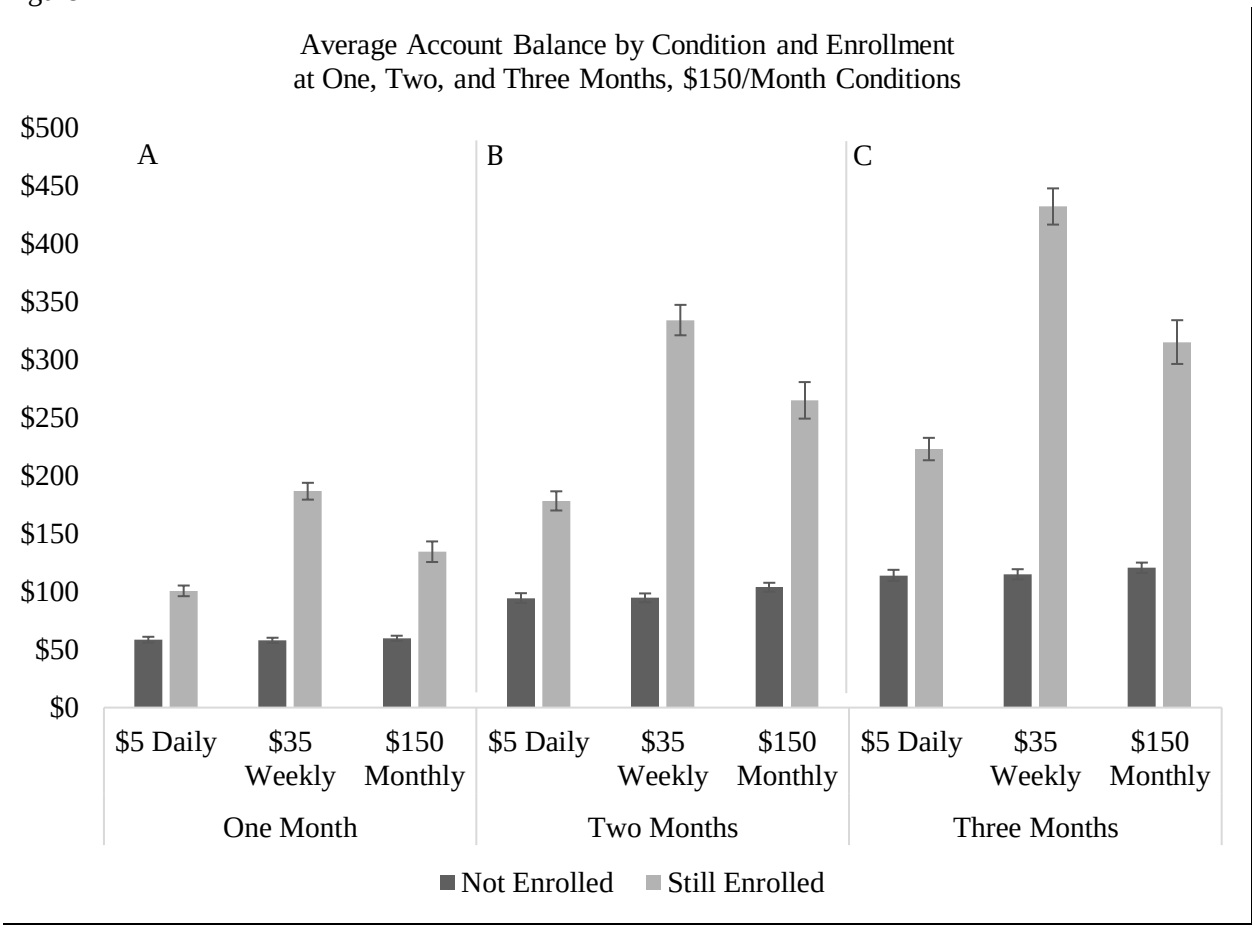

Average Account Balance by Condition and Enrollment
at One, Two, and Three Months, $150/Month Conditions
$500
$450
$400
$350
$300
$250
$200
$150
$100
$50
$0
A
B
C
$5 Daily
$35 Weekly
$150 Monthly
$5 Daily
$35 Weekly
$150 Monthly
$5 Daily
$35 Weekly
$150 Monthly
One Month
Two Months
Three Months
Not Enrolled
Still Enrolled

Figure 5

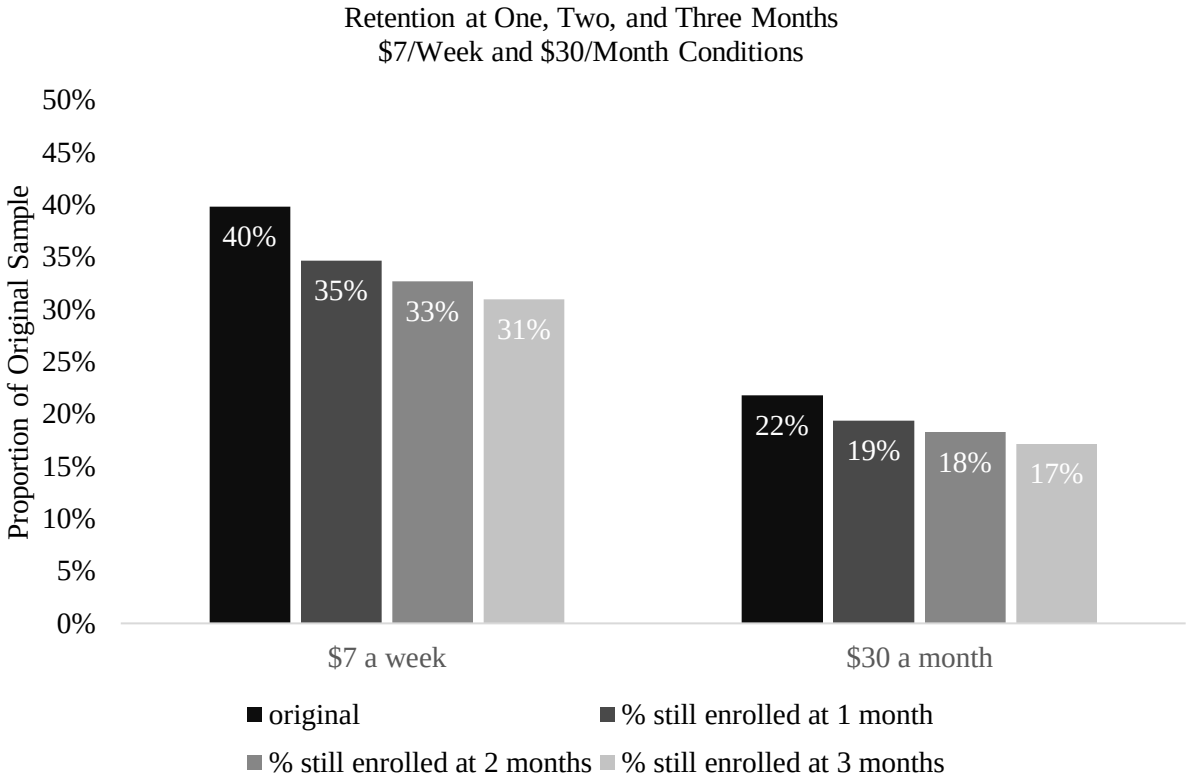

Retention at One, Two, and Three Months
$7/Week and $30/Month Conditions
Proportion of Original Sample
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
40%
35%
33%
31%
22%
19%
18%
17%
$7 a week
$30 a month
original
% still enrolled at 1 month
% still enrolled at 2 months
% still enrolled at 3 months

Figure 6

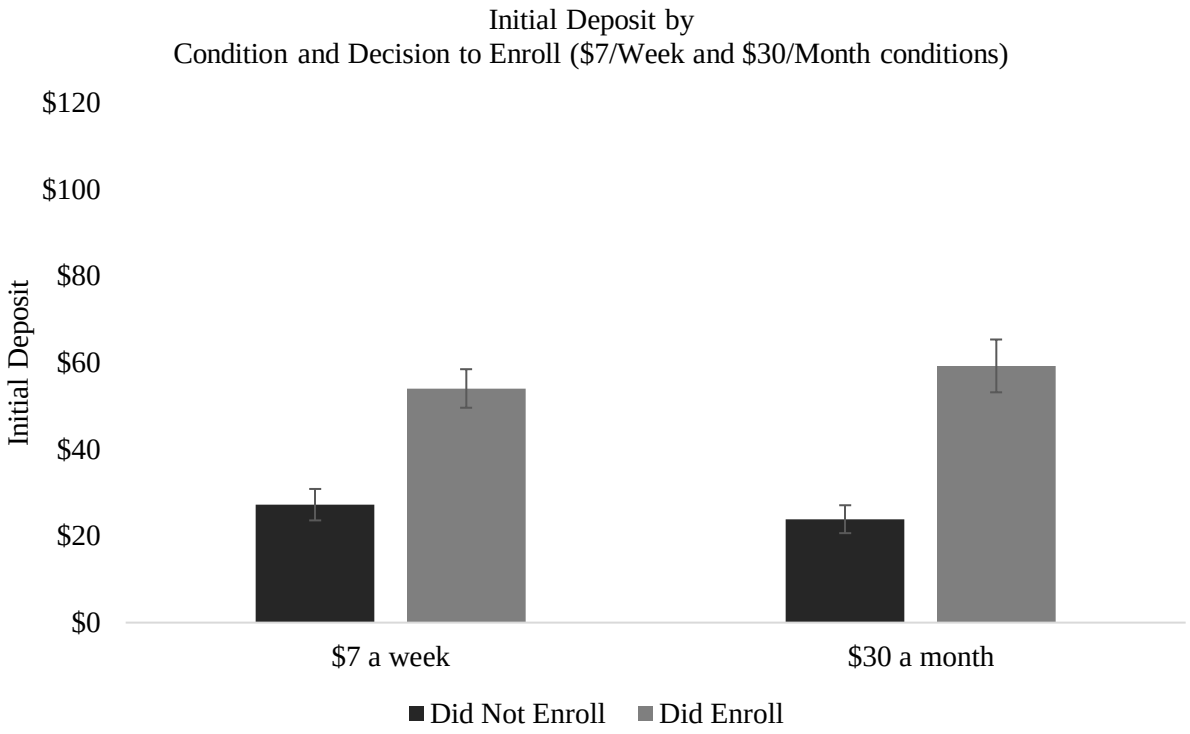
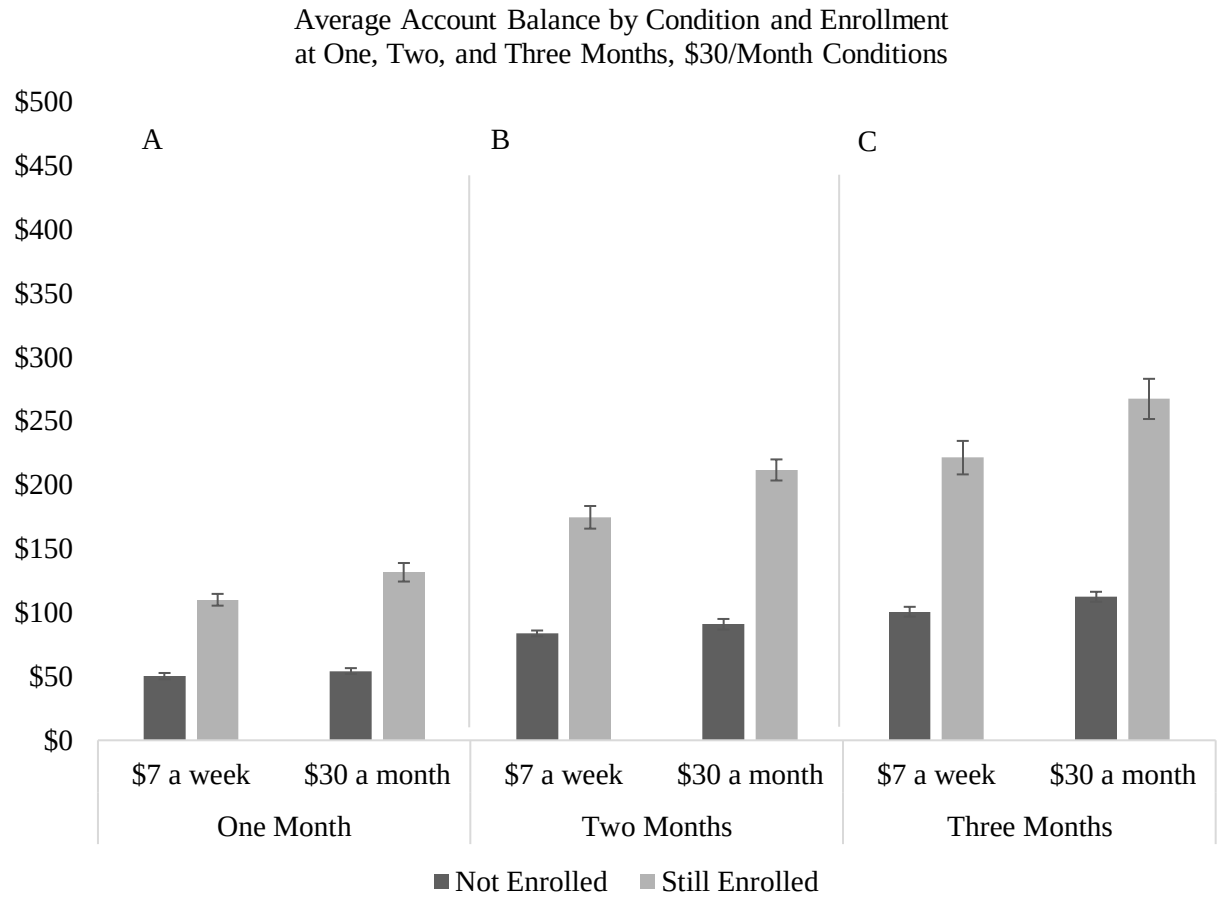

Initial Deposit by
Condition and Decision to Enroll ($7/Week and $30/Month conditions)
$120
$100
$80
$60
$40
$20
$0
Initial Deposit
$7 a week
$30 a month
Did Not Enroll
Did Enroll

Figure 7


Average Account Balance by Condition and Enrollment at One, Two, and Three Months, $30/Month Conditions
$500
$450
$400
$350
$300
$250
$200
$150
$100
$50
$0
A
B
C
$7 a week
$30 a month
$7 a week
$30 a month
$7 a week
$30 a month
One Month
Two Months
Three Months
Not Enrolled
Still Enrolled