

A photograph showing three people sitting on a stone ledge. The person on the left is wearing a dark puffer jacket and tan pants. The person in the middle is wearing a dark leather jacket and distressed denim jeans, holding a smartphone. The person on the right is wearing a dark puffer jacket and blue jeans, also holding a smartphone. In the foreground, several colorful shopping bags (blue, green, orange, and plaid) are scattered on the ground. An orange arrow-shaped banner is overlaid on the top part of the image, containing the title text.

DYNAMIC BUDGET MONITORING: WHEN ACCESS TO BUDGET FEEDBACK LEADS TO INCREASE IN SPENDING

Technical Report

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**THINK
FORWARD** INITIATIVE

DYNAMIC BUDGET MONITORING: WHEN ACCESS TO BUDGET FEEDBACK LEADS TO INCREASE IN SPENDING*

TECHNICAL REPORT

Liang Huang and Anastasiya Pocheptsova Ghosh[†]

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Abstract

Consumers feel uncertain about their ability to successfully manage finances. One way in which consumers can deal with financial uncertainty is to monitor their spending through budgeting. Consumers are often advised to constantly check their budgets, and a cottage industry of banking and other FinTech applications are offered in the marketplace that allow real-time tracking of one's spending relative to the set budget. In this project, we examine the effectiveness of providing constant feedback during the budget period for consumers' financial management. We find that providing consumers with accurate information about their budget standing can lead to an increase in spending at the end of the budget period when there is money left in the budget, decreasing savings. We further demonstrate that allowing consumers to roll over the money in the budget to the next budget period, making the budget information less precise, and managing the budget with shorter time windows can attenuate the increase in spending. This project adds to research on financial decision making by highlighting the negative consequences of providing budgeting feedback to inform spending. It has important implications for helping consumers stay within their budgets and increase their financial well-being by modifying the way the feedback is presented.

Keywords: Budget management, Budget feedback, Financial decision-making, Consumer welfare

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1. Introduction

American consumers feel financially uncertain. At the individual level, approximately 73 million American adults reported either “finding it difficult to get by” or are “just getting by financially”, according to a nationally representative survey of adults ages 18 and older living in the United States (Board of Governors of the Federal Reserve System, 2017). Only half (55%) of American households can replace one month of their income with savings (The Pew Research Center, 2015), and 41% of consumers could not cover an immediate expense of \$400 (Report on the Economic Well-Being of U.S. Households, 2017). Looking at consumer financial health in aggregate, consumer revolving debt hit \$1.027 trillion in March 2018, with \$16,048 average credit card debt per household (Board of Governors of the Federal Reserve System, 2019).

To improve their financial status, many consumers have turned to financial technology (FinTech) to help them make better financial decisions: 83% of consumers ask financial institutions (e.g., banks and credit unions) for tools to help achieve their financial goals (CSI, 2018). In response, financial institutions and independent developers started offering personal finance applications to consumers. The first such software, Mint, was marketed in 2007 and offers consumers easy-to-access real-time spending records, bank and credit card information, and customized tips for savings. Major financial institutions followed with similar offerings. In 2019, virtually all major banks and many credit unions offered consumers some version of a financial management application. FinTech reached early mass adoption by 2017, with 33% of consumers being active users of FinTech services, 65% of consumers anticipating using FinTech services in the future, and 84% of customers being aware of FinTech services (FinTech Adoption Index, 2017).

The huge potential of the FinTech market is also attracting capital investments: FinTech companies hit \$57.9 billion in the first six months of 2018, and the global FinTech market is expected to remain strong (KPMG, 2018).

The most common functions offered by FinTech apps are setting budgets and monitoring spending. Budget management is often recommended by financial literacy advocates and financial advisors as a way to improve one’s financial situation. For example, Bank of America offers consumers eight tips to save money, with the first tip being “record your expenses”. The Consumer Financial Protection Bureau (2019) also suggests that “making and sticking to a budget is a key step towards getting a handle on your debt and working towards a savings goal.” Heeding this advice, 56% of Americans report having a budget (FINRA, 2016), and one-third keep a detailed budget (Jacobe, 2013). Further, 70% of millennial FinTech users report utilizing their devices to receive real-time spending information to stay within their budgets (TIAA, 2018).

Academic research similarly demonstrates the importance of budgeting in curbing spending and staying within budgets (Heath & Soll, 1996; Soman, 2001; Thaler, 1999; Van Ittersum et al., 2010). For successful budgeting, consumers need to monitor their spending relative to the predefined budget limit (Ülkümen et al., 2008). Errors in expense tracking and allocating expenses to budgeting categories cause failures in budget management and often lead to overspending (Cheema & Soman, 2006; Krishnamurthy & Prokopec, 2010; Soman, 2001; Van Ittersum et al., 2010). When errors are reduced, such as when past expenses happened relatively recently (Soman, 2001; Soman & Lam, 2002), and when expenses are easier to track (Health, 1995;

Krishnamurthy & Prokopetz, 2010; Soman, 2001), consumers reduce their spending.

Therefore, based on financial industry advice and academic work, one should expect that the effect of consumer adoption of FinTech, which provides consumers with accurate budget tracking, to be positive for curbing consumer spending and increasing the likelihood of staying within the budget. In the current research, we question this assumption.

While there is no academic research that directly tests the effect of using FinTech apps on consumer financial welfare, a survey by TIAA (2018) demonstrates that millennials who use FinTech are more likely to overdraw their checking accounts, borrow through financial services, and withdraw from retirement accounts compared with millennials who do not use FinTech. We are among the first to empirically test the effect of FinTech access on consumer budget performance.

2. Theoretical Framework

2.1. Consumer Budget Management

Budgeting is considered one of the most useful tools for consumer financial management (Heath & Soll, 1996; Thaler, 1999). Budgeting can be broadly categorized into two stages: budget setting and budget monitoring. In the first stage, consumers estimate their future spending and allocate limited resources to distinct expense categories, translating abstract financial goals into specific numerical representations of intended expenditures (Heath & Soll, 1996; Krishnamurthy & Prokopec, 2010). In the second stage, consumers monitor their spending relative to the set budget, evaluating purchase decisions relative to the previous spending in the same mental budget (Heath, 1995; Heath & Soll, 1996; Krishnamurthy & Prokopec, 2010).

Failure in adhering to budgets is often attributed to the monitoring stage, i.e., errors in recollecting of past expenses and assigning them to proper budget accounts. For example, Soman (2001) demonstrates that, when a payment mechanism is low in salience and vividness, such as credit cards, it results in weaker memory trace for the expense and increased spending likelihood as opposed to payment methods that require writing down the amount spent, such as with checks. Similarly, Soman and Lam (2002) show that consumers have a higher propensity to spend when past expenses happened in the relatively far rather than the recent time period. Expenses that occurred further in the past were less salient and less memorable for consumers. When consumers cannot fully recall their past spending, they tend to spend more. Thus, errors in recalling or calculating past expenses can increase spending.

Other research documented motivational biases in interpreting a static budget record. For example, Cheema and Soman (2006) show that consumers are motivated to assign expenses to a mental

account that allows for more spending: participants with a restaurant dinner opportunity are more likely to classify the expense as food when they have a surplus in the food account and as entertainment when they have a surplus in the entertainment account. Further, Sussman and Alter (2012) demonstrate that consumers perceive a purchase assigned to a narrow budget category to be more special (e.g., when categorizing a TV purchase as part of “home electronic budget” compared with “general home purchase budget”) and are willing to pay more for the purchase. In sum, prior literature shows that motivational biases in assigning expenses to budget categories can also increase spending.

Using FinTech apps to set budgets and monitor spending can solve biases in budget tracking and expense allocating: While consumers may make mistakes in remembering, calculating, and assigning past expenses, FinTech apps are able to document all transactions with full accuracy and assign them to appropriate budget categories without bias. While the correction of cognitive errors and motivational biases can potentially improve consumer financial decision making, we argue that FinTech can also increase consumer spending and negatively affect savings by increasing consumers’ certainty in the available money left in the budget. We discuss it in the next section.

2.2. Consumer Certainty in Available Money Left in the Budget

Having money available has a positive effect on consumer spending. For example, consumers spend more when large resources of money (such as their checking accounts) than when small resources of money (such as money available in their wallets) are more cognitively accessible (Morewedge et al., 2007). Similarly, consumers who have a larger

budget are more likely to make unplanned in-store purchases (Gilbride et al., 2015). Thus, when spending under budget constraints, knowing that one has money left in the budget should similarly increase spending. However, in the budgeting context, consumers do not always have access to accurate information about money left in the budget and often feel uncertain in their estimations due to difficulty remembering and calculating their cumulative expenses over time (Soman, 2001; Soman & Lam, 2002). To deal with this uncertainty, consumers decrease spending and end up spending less than the budgeted amount (Pennings et al., 2005). By the same token, when the uncertainty about past cumulative spending is reduced, for example by the use of smart shopping carts that display the total price of items acquired, it increases spending (Van Ittersum et al. 2013). We argue that using FinTech to check budget standing reduces consumers' uncertainty about money left in the budget, allowing consumers to spend more. Formally, we predict:

H1: Using FinTech apps to check budget standing leads to an increase in spending when there is money left in the budget.

H2: This happens because FinTech apps increase consumers' certainty in money left in the budget.

2.3. Dynamic Effect of Certainty on Consumer Spending Decisions

We further propose that an increase in spending when using FinTech apps will manifest itself at the end of the budget period but not at the beginning. This happens because certainty in available money left in the budget decreases as one moves from the beginning of the budget toward the end, suggesting that the use of FinTech (and the corresponding increase in certainty) would have a larger impact at the end than at the beginning of a budget period.

More specifically, at the beginning of the budget period, the budgeted amount is easily accessible to consumers. Because there is less time passed in the budget period, the cumulative spending is relatively

low, and spending occurs recently, making it easy for consumers to calculate the money left in the budget and assess their budget standing (Soman 2001). Thus, both FinTech users and non-users should have high certainty in their budget standing at the beginning of the budget period. In comparison, when consumers move toward the end of the budget period, they have a higher need to assess whether they are at the risk of breaking the budget by comparing their cumulative spending with the set budget. At the end of the budget period, consumers' cumulative spending has occurred less recently and is harder to assess. Thus, consumers' certainty in the available money in the budget should decrease. Because consumers are more uncertain about the money left in the budget at the end as compared to the beginning of the budget period, we propose that FinTech will have a greater impact in boosting consumers' certainty in money left in the budget as they approach the end of the budget period. As a result, we propose:

H3: Increase in spending when using FinTech apps on spending is more pronounced at the end than at the beginning of the budget period.

2.4. Studies Overview

To test our hypotheses, we ran three longitudinal field studies and two lab experiments. See table 1. The first two studies aimed to test our main hypotheses. Participants in these studies were randomly assigned to the information condition and presented with personalized spending information during the budget period or to the estimation condition and were asked to estimate their expenses. We expect consumers in the information condition to increase spending at the end of the budget period compared to consumers in the estimation condition.

In addition, studies 1 and 2 tested possible interventions aimed at moderating spending acceleration towards the end of the budget period. Specifically, in study 1 we reminded consumers that they can roll over the money left in the budget to the next budget period. We have predicted that the

increase in spending due to access to budget information happens at the end of the budget period. Thus, one way to attenuate the increase in spending for consumers in the information condition is to decrease consumers' focus on the end of the budget period and make the boundary of the budget period more flexible. We reasoned that reminding consumers that they can roll over the money left in the budget to the next budget period can make the boundary between two budget periods more flexible, thus, decreasing their likelihood to increase spending by the end of the first budget period. In study 2, instead, we divided the budget period into multiple small time windows. We expect that directing consumers' attention to each small time window will make the end of the overall budget period less salient, thus decreasing the spending acceleration at the end of the budget period.

Study 2 also tested another intervention related to the flexibility of the budgeted amount. When managing a budget, consumers use the budgeted amount as a numerical reference point. When their spending does not match the reference point at the end of the budget period (i.e., when there is money left in the budget), consumers accelerate spending to deplete the money left in the budget. In the intervention, we allow consumers to adjust their budget amount during the budget period. Thus, the budgeted amount no longer serves as a fixed reference point for consumers to approach, which we expect should attenuate the increase in spending at the end of the budget period.

Studies 3 and 4 were conducted in the controlled lab setting and included only information condition from the studies 1-2, approximating consumers who rely on FinTech apps to inform their spending. In addition, Study 3 conceptually replicated the second intervention of study 2 by allowing participants to add

an extra amount to their initial budget, making the initial budgeted amount more flexible. Following the same logic, we expect that when consumers do not treat the initial budgeted amount as a fixed reference point, they are less likely to increase their spending to approach the budget.

Study 4 directly tested the effect of certainty in money left in the budget in driving the increase in spending in a different way. We have argued that because using FinTech to access budget information increase consumers' certainty in money left in the budget, it leads to an increase in spending at the end of the budget period. Thus, decreasing consumers' certainty in money left in the budget should be able to attenuate the effect. In study 4, we provided consumers with a range rather than a precise amount of their past spending in the intervention condition. We expected that consumers in this condition should be less certain about money left in the budget, and thus are less likely to accelerate spending.

Finally, in study 5, we explored how managing a single versus multiple budgets affects spending decisions over the budget period. Breaking one large budget into several smaller ones can affect consumer spending in two distinct ways. One possibility is that managing multiple smaller budgets will increase consumers' certainty that they will overall not break the budget because consumers can justify overspending in one category by believing they will be more conservative in the other categories. Another possibility is that breaking one big budget into multiple smaller ones is similar to breaking a budget into smaller time periods, an intervention used in study 2, resulting in attenuation of spending acceleration. We tested the two possibilities empirically.

Table 1: Studies Summary

	Effect of FinTech on spending	Intervention via budget timeframe	Intervention via budget amount	Intervention via certainty in money left
Field study 1				
Field Study 2				
Lab Study 3				
Lab Study 4				
Field Study 5				

3. Field Study 1

3.1. Study Objective

The field study 1 had two objectives. First, we wanted to test our main hypotheses that having access to budget information can lead to an increase in spending over the budget period when there is money left in the budget. Second, we aimed to test our first intervention that reminds consumers that they can roll over the money left in the budget to the next budget period. We have predicted that the increase in spending due to access to budget information mainly happens at the end of the budget period. We reasoned that this reminder made the boundary of a budget period more flexible, decreasing consumers' likelihood to increase their spending by the end of the budget period.

3.2. Method

The study employed a (condition: information vs. estimation vs. roll over budget intervention, between) X (time of the budget period, within) mixed design. Participants were randomly assigned to one of the three conditions.

Two hundred and eighty-three participants (51% female, Mage=34.1) from Prolific online panel living in the United States were recruited to participate in a budget management study for the "Food and Dining" spending category. To take part in the study, participants agreed that they were in charge of the spending in this category, had access to their bank or credit card spending records, and were not using cash or gift cards to make purchases during the study period.

During the sign-up, all participants who agreed to take the survey were asked to set their weekly budget for food and dining and answered demographic questions, including their age, gender, and income. We also measured participants' commitment to the budgeting goal and perceived difficulty in managing

their budget. Then, participants were told that their budget starts on Monday and were instructed to spend money as they normally do. Their goal was not to break the budget by the end of the week.

Participants received three identical follow-up surveys every two days on Wednesday, Friday, and Sunday, focused on the past two days of spending. The contents of follow-up surveys varied based on conditions. Specifically, participants in the information condition were asked to go to their online bank accounts and report all transactions in the food and dining category for the past two days. Based on participants' reported spending, we calculated money left in the budget and reported it back to participants, similar to budget information that is accessible to consumers who log in to FinTech App. Participants in the intervention condition followed the same procedure. In addition, they were told: "Please keep in mind that if you do not use all your budget for the week, the money left in the budget can roll over to the next week." Participants in the estimation condition were asked to report their estimated spending for past days based on memory without checking their bank information and they were provided with no information on their budget standing, similar to consumers who would not have access to FinTech apps.

The last follow-up survey was delivered on the following Monday morning after budget week was completed. Similar to earlier follow-up surveys, participants either reported (information and intervention conditions) or estimated (estimation condition) their spending on Sunday. In addition, participants in the estimation condition were instructed to log into their bank account and report their spending for each day from the past week. We do so to make sure we had access to all participants' accurate spending records, regardless of their condition. We used participants' actual spending at

different times of the budget period as our dependent variable.

3.2.1. Results and Discussion

Two hundred and twenty-five participants completed all four surveys (female: 48%; Mage = 34.56). Attrition rate did not differ by condition (17% for information condition, 26% for intervention condition and 16% for estimation condition; $p > .16$). Only participants who finished all four surveys were included in the main analyses². Additionally, four participants whose budgeted amount or total spending was 2.5 standard deviation greater than the average were excluded (Meyvis and Van Osselaer 2017), leaving us with 221 participants.

First, we analyzed if participants in different conditions differ in their budgeting goals and demographic information. The results showed that there was no difference in participants' budgeted amount, commitment to budgeting goal, perceived difficulty to keep the budget, and their monthly income between conditions (see table 2).

Second, we examined spending patterns over budget time. We created two dummy variables for experimental conditions, using estimation condition as the baseline condition, the first dummy variable indicating the information condition (i.e., dummy_Info), and the second dummy variable indicating the intervention condition (i.e., dummy_Intervention). We used consumers' average daily spending in each time period as the dependent variable. We test the joint effect of experimental conditions and money left in the budget on consumer spending decisions. We ran separate regressions for each time period. See table 3 for results.

$$\text{Spending} = \alpha + \beta_1 * \text{Dummy_Info} + \beta_2 * \text{Dummy_Intervention} + \beta_3 * \text{MoneyLeft} +$$

$$\beta_4 * \text{Dummy_Info} * \text{MoneyLeft} + \beta_5 * \text{Dummy_Intervention} * \text{MoneyLeft} + \varepsilon$$

The results showed that at the beginning of the budget period (i.e., Monday to Tuesday), there was only an effect of money left in the budget on spending, as expected. During the middle of the week (i.e., Wednesday to Thursday), there was a significant interaction between information condition and money left, such that an increase in money left in the budget led to more spending when consumers had access to their spending information compared with when they estimated their spending ($\beta = .127$, $p < .05$). By contrast, there was no significant interaction between intervention condition and money left, indicating that when consumers were reminded that they can roll over the money left in the budget to the next budget period, their spending did not differ from consumers who estimated spending. During the late period of the week (i.e., Friday to Sunday), there was a significant interaction between information condition and money left and a significant interaction between intervention condition and money left, such that an increase in money left in the budget led to more spending for both information condition and intervention conditions as compared with the estimation condition. There was no difference between the information condition and intervention condition.

Finally, we examined whether differences in spending between conditions affected participants' likelihood of staying within budgets for all participants. We calculated the difference between consumers' total spending during the budget week and their set budget, with a positive number indicating the amount spent over budget and a negative number indicating the amount saved. See Figure 1. The results revealed a marginally significant difference between the information condition and the other two conditions ($t(218) = -1.89$, $p = .06$). Specifically, participants in the information condition

income between participants who finished the study and those who quitted the study early.

² We find no difference in participants' budgeted amount, commitment to budgeting goal, perceived difficulty to keep the budget, and their monthly

spent on average \$40 more than budgeted amount ($t(60) = 3.19, p = .002$); while participants in the intervention and estimation conditions did not overspend (Figure 1; $p > .94$). The results suggested that receiving spending feedback can potentially

negatively affect consumer budget adherence and that reminding consumers that they can roll over the money left in the budget to the next budget period can attenuate this effect.

Table 2: Field Study 1: Sample Statistics based on Conditions

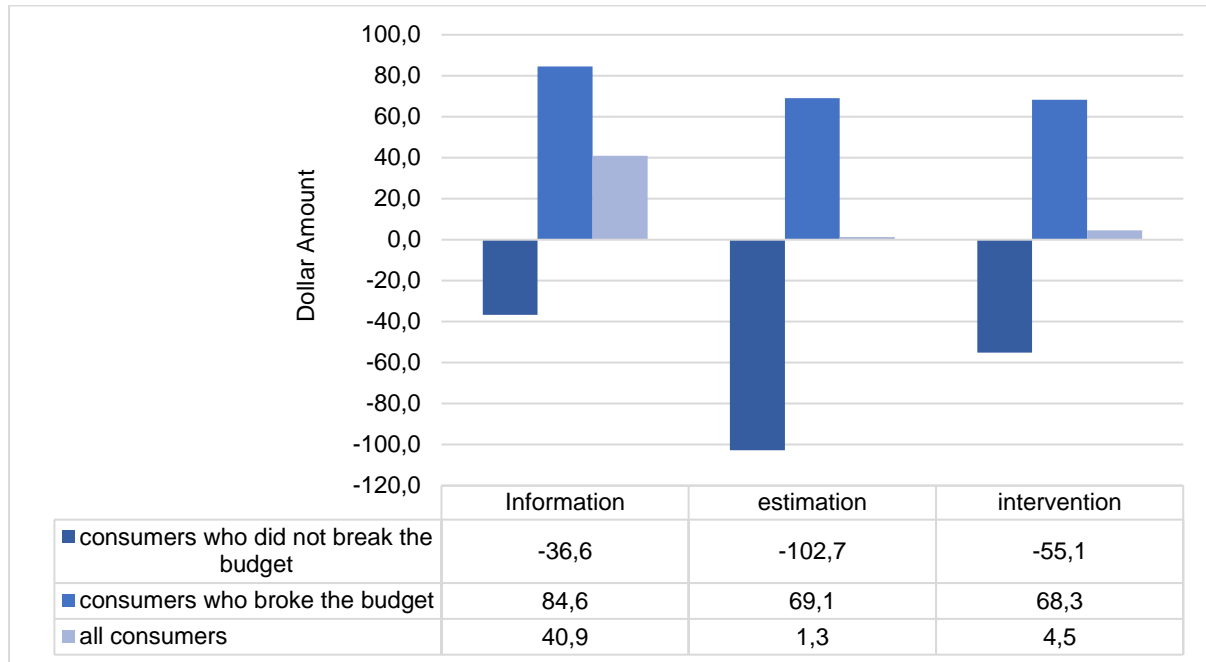
	Estimation	Information	Intervention	Significance
Budgeted Amount	132.98(152.54)	122.72(106.79)	134.21(139.73)	$F(2,218) = .145; p = .87$
Commitment to Budgeting Goal	6.03(1.06)	5.82(1.37)	5.90(1.23)	$F(2,218) = .501; p = .61$
Perceived Difficulty of Budget Management	3.80(1.58)	3.49(1.89)	3.38(1.70)	$F(2,218) = 1.229; p = .30$
Monthly Income	4376.63(9893.47)	3461.59(2698.80)	4581.85(7056.61)	$F(2,218) = .452; p = .64$

Table 3: Field Study 1: Consumer Spending over Budget Periods

	Early Period	Mid Period	Late Period
Dummy_Info	-1.623(6.456)	-1.513(7.711)	-6.605(5.497)
Dummy_Intervention	-2.646(5.541)	.026(6.712)	-7.706(4.885)
MoneyLeft	.036(.020)*	.001(.027)	.038(.020)*
Dummy_Info x MoneyLeft	.057(.037)	.127(.054)**	.130(.046)**
Dummy_Intervention x MoneyLeft	.027(.028)	.029(.038)	.065(.029)**
R-square	.101	.054	.206

* $p < .1$; ** $p < .05$; *** $p < .01$

Figure 1: Field Study 1: \$(Total Spending – Budgeted Amount)



4. Field Study 2

4.1. Study Objective

We had two objectives for Field study 2. First, we aimed to replicate our main hypothesis that access to budget information can lead to an increase in spending at the end of the budget period, compared to when consumers estimate their expenses. Second, we wanted to test two new interventions. The first intervention tested if letting consumers manage their budget over smaller time windows can make the end of the budget period less salient, thus decreasing the spending acceleration at the end of the budget period. The second intervention explored the role of budget flexibility in driving the increase in spending at the end of the budget period. We argued that allowing consumers to flexibly adjust their budget during the budget period can make the initial budget amount less of a fixed reference point that consumers would approach at the end of the budget period, attenuating the increase in spending.

4.2. Method

The study employed a (condition: information vs. estimation vs. flexible budget intervention vs. small budget window intervention, between) X (time of the budget period, within) mixed design. Participants were randomly assigned to one of the four conditions.

Three hundred and sixty-three participants (48% female, $M_{age}=36.9$) from Prolific online panel living in the United States were recruited to participate in a budget management study for the "Food and Dining" spending category. The procedure of field study 2 is identical to field study 1 except that we tested two new interventions. In the first intervention group, the flexible budget group, participants received their personalized budget information as in the information condition. In addition, they were also given an

opportunity to update their weekly budget every time they finished the follow-up survey. In the second intervention group, the small budget window group, we divided the one-week budget period into four windows (i.e., Mon-Tue; Wed-Thu; Fri-Sat; Sun), based on the time participants received follow-up surveys. We calculated and reminded participants of their sub-budget for each time window based on their weekly budget (e.g., if one had a budget of \$70 for the week, then his budget for Monday and Tuesday would be \$20). The information and estimation conditions were identical to study 1.

4.3. Results and Discussion

Two hundred and eighty-five participants completed all four surveys (female: 49%; $M_{age} = 37.2$). Attrition rate did not differ by condition (19.5% for information condition, 18.2% for estimation condition, 23.3% for flexible budget condition, and 26.5% for small budget window condition; $p=.61$)³. Only participants who finished all four surveys were included in the main analyses.

We analyzed consumers' spending patterns over the budget period as study 1. We created three dummy variables for experimental conditions, using estimation condition as the baseline condition, the first dummy variable indicating information condition (i.e., `dummy_Information`), the second dummy variable indicating flexible budget intervention condition (i.e., `dummy_FlexibleBudget`), and the third dummy variable indicating the small window intervention condition (i.e., `dummy_SmallWindow`). We used consumers' average daily spending in each time period as the dependent variable. We test the joint effect of experimental conditions and money left in the budget on consumer spending decisions. We ran separate regressions for each time period. See

monthly income between participants who finished the study and those who quit the study early.

³ As in study 1, we find no difference in participants' budgeted amount, commitment to budgeting goal, perceived difficulty to keep the budget, and their

table 4 for the results.

$$\begin{aligned} \text{Spending} = & \alpha + \\ & \beta_1 * \text{Dummy_Info} + \\ & \beta_2 * \text{Dummy_FlexibleBudget} + \\ & \beta_3 * \text{Dummy_SmallWindow} + \\ & \beta_4 * \text{MoneyLeft} + \\ & \beta_5 * \text{Dummy_Info} * \text{MoneyLeft} + \\ & \beta_6 * \text{Dummy_FlexibleBudget} * \text{MoneyLeft} + \\ & \beta_7 * \text{Dummy_SmallWindow} * \text{MoneyLeft} + \epsilon \end{aligned}$$

The results replicated findings of study 1 and showed that at the beginning of the budget period (i.e., Monday to Tuesday), access to spending information (information condition) did not affect spending. During the middle of the week (i.e., Wednesday to Thursday), there was a significant interaction between information condition and money left, such that an increase in money left in the budget led to more spending when consumers had access to their spending information compared with when they estimated their spending ($\beta=.107, p<.05$). By contrast, there was no significant interaction between intervention conditions and money left, indicating that when consumers have more flexibility in their budget and when consumers were reminded about their smaller budget timeframe, their spending pattern did not differ from consumers who estimated spending. The same results were observed in the late budget

period.

Next, we examined whether differences in spending between conditions also affected consumers' likelihood of staying within budgets. We calculated the difference between consumers' total spending during the budget week and their set budget, with a positive number indicating the amount spent over budget and a negative number indicating the amount saved. See Figure 2. The results revealed a significant difference between the information condition and the other three conditions ($t(281)=-2.36, p=.019$). Specifically, consumers in the information condition overspent their budget by \$32.0 on average (compared with \$0, $t(98) = 3.19, p = .002$). By comparison, consumers in the estimation and two intervention conditions did not overspend (estimation condition: \$2.5, flexible budget condition: -\$5.2, small window condition -\$6.2; all $p>.65$).

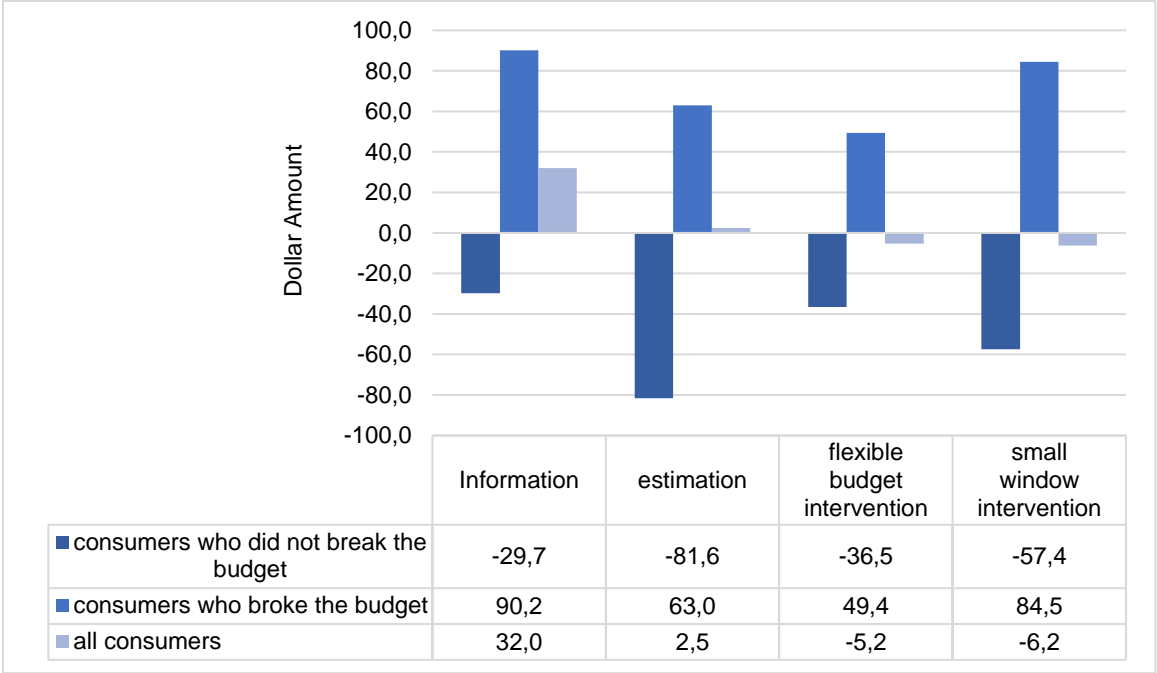
The field study 2 replicated the main effect in study 1 that access to budget information, such as when consumers can check their budget standing using FinTech apps, led to an increase in spending at the end of the budget period when there was available money in the budget. Further, we showed that having a more flexible budget and a smaller budget window can attenuate the increase in spending.

Table 4: Field Study 2: Consumer Spending Over Budget period

	Early Period	Mid Period	Late Period
Dummy_Info	-4.205(5.450)	-2.211(4.520)	-7.316(4.049)
Dummy_FlexibleBudget	-7.037(8.908)	1.114(7.626)	-7.296(7.242)
Dummy_SmallWindow	-12.723(7.130)	-.650(6.220)	-7.927(5.651)
MoneyLeft	0.67(.018)**	.010(.018)	.052(.017)**
Dummy_Info x MoneyLeft	.044(.034)	.107(.036)**	.115(.038)**
Dummy__FlexibleBudget x MoneyLeft	.068(.048)	.010(.052)	.100(.064)
Dummy_ SmallWindow x MoneyLeft	.071(.033)*	.074(.038)	.077(.041)
R-square	.184	.096	.193

* $p<.05$; ** $p<.01$

Figure 2: Field Study 2: \$(Total Spending – Budgeted Amount)



5. Lab Study 3

5.1. Study Objective

Study 3 aimed to conceptually replicate the flexible budget intervention in field study 2 in a more controlled lab setting. Specifically, we asked half of the participants to add an extra amount to their regular budget, making the budgeted amount more flexible. We expected that participants in the flexible budget condition would not treat the initial budgeted amount as a fixed reference point, and thus would be less likely to increase their spending at the end of the budget period.

5.2. Method

The study employed a 2(budget: regular vs flexible, between) x 2(time of spending: early vs late, within) mixed design. Participants were randomly assigned to one of two budget conditions.

Ninety-nine participants (53% female, $M_{age}=33.8$) from Prolific online platform participated in the study in exchange for a small payment. All participants set a weekly budget for food and dining, including all expenses from bars, coffee shops, fast food, groceries, and restaurants. Participants in the regular budget condition were asked to set a regular budget as they normally do. Participants in the flexible budget condition were asked to add an extra of \$25

to their regular budget. All participants received sending information, like they would if using FinTech apps, on Wednesday (early period) and Saturday (late period). Then, participants indicated their likelihood to eat out the next day (i.e., on Thursday and Sunday, respectively) on a seven-point scale (1 = not likely at all; 7 = very likely).

5.3. Results and Discussion

We ran a repeated ANOVA using budget type as the independent variable and consumer spending likelihood in the early and late period of the week as repeated dependent variables. The results revealed a marginally significant interaction between budget type and time of spending ($F(1,97)=3.30$, $p=.07$). Specifically, participants in the regular budget condition reported a higher likelihood of spending in the late than the early stage of the budget period ($M_{regular_early} = 3.04$, $STD = 1.68$; $M_{regular_late} = 4.02$, $STD = 1.91$; $F(1,97) = 13.27$, $p<.001$; Cohen's $d = .54$), replicating our earlier studies. In comparison, participants in the flexible budget condition did not accelerate their spending at the end of the budget period ($M_{extra_early} = 2.88$, $STD = 1.64$; $M_{extra_late} = 3.16$, $STD = 1.97$; $F(1,97) = 1.11$, $p = .30$), replicating the effect of flexible budget amount intervention in study 2.

6. Lab Study 4

more controlled lab setting. Specifically, we manipulated consumers' certainty in money left in the budget by varying how we display the information about past spending. We expected that providing consumers with a range of their spending rather than a precise amount should decrease consumers' certainty in money left in the budget, attenuating the increase in spending.

6.2. Method

The study employed a 2 (budget information: specific vs. range) x 2 (time of spending: early vs late, within) mixed design. Participants were randomly assigned to one of two budget information conditions.

One hundred and ninety-eight participants from the Prolific online panel (48% female, $M_{age}=35.98$) participated in the study for a small payment. Participants were given a monthly budget of \$200 for entertainment. All participants received spending information like they would if using FinTech apps. However, we manipulated how this information was presented. Participants in the specific information condition were presented with their cumulative spending amount once every five days, with a specific dollar amount (e.g., "Till the fifth day of the

month, you have spent \$30 on entertainment"), just like in our earlier studies. Participants in the range information condition were presented with a spending range, with \$15 below and above the accurate spending record in the other condition (e.g., "Till the fifth day of the month, you have spent between \$15 and \$45 on entertainment"). The average of the range of spending information was equal to the precise spending information we provided in the other condition. All participants indicated their desired spending amount on day 6 and day 26.

6.3. Results and Discussion

We conducted a repeated-measure ANOVA, with budget information conditions as the independent variable and intended spending amount on day 6 and day 26 as the repeated dependent variables. The results revealed a significant interaction between information type and time of spending ($F(1,196)=4.47$, $p=.036$). Specifically, participants in the precise information condition wanted to spend more in the late than the early stage of the budget period ($M_{precise_day6} = \$18.06$, $STD = 11.18$; $M_{precise_day26} = \$22.32$, $STD = 11.87$; $F(1,196) = 13.42$, $p<.001$; Cohen's $d = .37$). By contrast, the increase in spending was attenuated for participants who were provided with a spending range ($M_{range_day6} = \$19.88$, $STD = 11.04$; $M_{range_day26} = \$20.68$, $STD = 10.86$; $p>.49$), consistent with a decrease in certainty in the money left in the budget.

7. Field Study 5

7.1. Study Objective

Field study 5 had two objectives. First, we extend the budget period from one week to two weeks to be able to observe consumer budgeting behavior over a longer period of time. Second, we aimed to explore how managing a single versus multiple budgets affect spending decisions over the budget period. Breaking one large budget into several smaller ones can affect consumer spending in two distinct ways. One possibility is that managing multiple smaller budgets will increase consumers' certainty that they will overall not break the budget because consumers can justify overspending in one category by believing they will be more conservative in the other categories. Another possibility is that breaking one big budget into multiple smaller ones is similar to breaking a budget into smaller time periods, an intervention used in study 2, resulting in attenuation of spending acceleration. We tested the two possibilities empirically.

7.2. Method

The study employed a (budget type: single vs. multiple, between) X (time of the budget period, within) mixed design. Participants were randomly assigned to one of the two budget type conditions.

Two hundred and fifty-one participants (54% female, $M_{\text{age}}=32.5$) from Prolific online panel living in the United States were recruited to participate in a budget management study for the "Food and Dining" spending category. Participants set their budget as in field studies 1 and 2, with two exceptions. First, instead of using a weekly budget, participants set a budget for two weeks. Second, participants in the multiple budget condition, in addition to set the

overall food and dining budget, were asked to break the overall budget into two sub-categories: a budget for groceries and a budget for eating out and taking out from restaurants, bars, coffee shops.

All the participants in this study were receiving spending information, approximating consumers using FinTech apps to inform their budget standing. Participants received a follow-up survey every Thursday and Monday, focused on the past spending from Monday to Wednesday and from Thursday to Sunday. Participants in the single budget condition were asked to go to their online bank accounts and report all transactions in the food and dining category for the past three or four days. Based on participants' reported spending, we calculated money left in the general food and dining budget and reported it back to participants. Participants in the multiple budget condition also reported all transactions in the food and dining category. In addition, they were asked to categorize their expenses into the two sub-budgets. Based on their reported spending, we calculated money left in each of the sub-budgets and reported it back to participants, instead of providing them with money left in their overall food and dining budget.

7.3. Results and Discussion

One hundred and ninety-four participants completed all surveys (female: 58%; $M_{\text{age}} = 32.6$). The attrition rate did not differ by condition (26.4% for the single budget and 18.9% for the multiple budget condition; $p>.16$). Only participants who finished all four surveys were included in the main analyses⁴. Additionally, four participants whose budgeted amount or total spending was 2.5 standard deviation greater than the average were excluded (Meyvis and Van Osselaer 2017), leaving us with 190 participants.

However, participants who quitted the study early perceived it to be more difficult to keep the budget ($M_{\text{quit}}=3.68$ vs. $M_{\text{remain}}=3.06$, $p<.05$)

⁴ We find no difference in participants' budgeted amount, commitment to budgeting goal, and their monthly income between participants who finished the study and those who quitted the study early.

We first examined whether managing a single versus multiple budgets affected consumers' budget adherence. We calculated consumers' budget breaking amount by comparing their total spending over two weeks to their budgeted amount, with positive numbers indicating going over the budget. The results showed that consumers who managed multiple budgets went over their budgets significantly more than consumers who managed one overall budget ($M_{\text{single}} = \$-2.28$, $M_{\text{multiple}} = \$26.72$, $t(188) = -2.04$, $p = .04$). See Figure 3. Next, we analyzed if participants in the multi-budget condition overspent in both of their sub-budgets or only in one of them. The results showed that participants in multi-budget condition spent significantly more than budgeted amount in the restaurant category ($M_{\text{budget_R}} = \$60.21$, $M_{\text{spent_R}} = \$72.96$, $t(96) = -2.43$, $p = .017$) and marginally so in the grocery category ($M_{\text{budget_R}} = \$150.77$, $M_{\text{spent_R}} = \$164.75$, $t(96) = -1.65$, $p = .1$), suggesting it is unlikely that consumers are compensating their overspending in one budget category by cutting their consumption in another category.

Next, the same as in the field studies 1 and 2, we analyzed consumers' spending patterns over the budget period. We created a dummy variable for experimental conditions (0-single budget, 1-multiple budgets). We used consumers' spending in each time period as the dependent variable. We tested the

joint effect of experimental conditions and money left in the budget on consumer spending decisions. We ran separate regressions for each time period. See table 5 for the results.

$$\text{Spending} = \alpha + \beta_1 \text{Dummy_multi} + \beta_2 \text{MoneyLeft} + \beta_3 \text{Dummy_multi} \times \text{MoneyLeft} + \epsilon$$

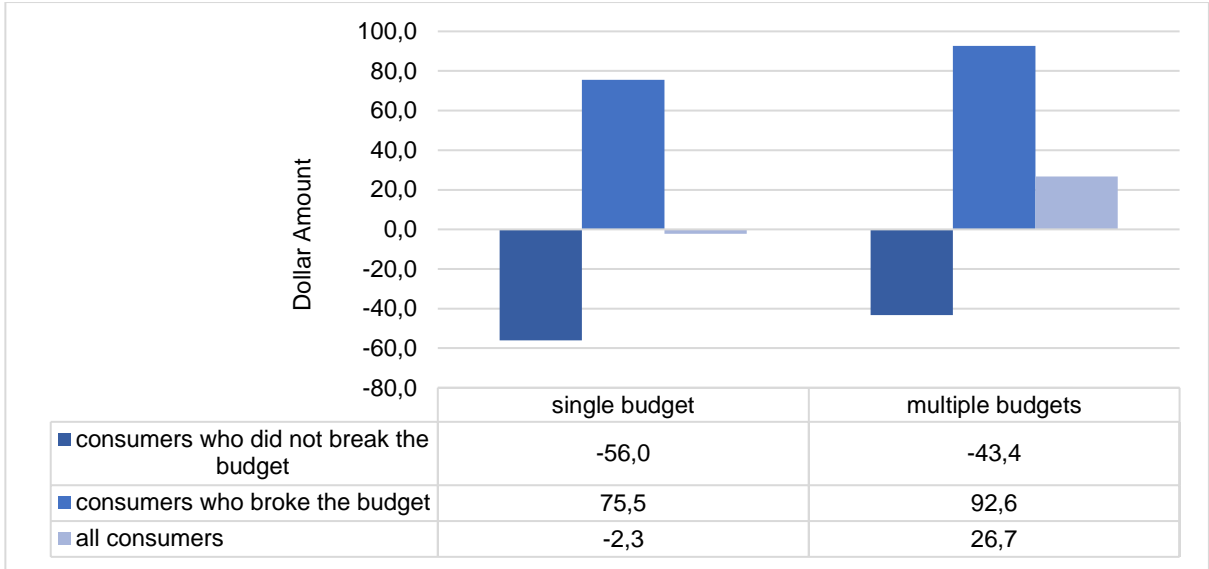
The results showed that money left in the budget had a positive effect on consumer spending, consistent with previous studies. Further, there was a positive interaction between money left in the budget and experimental conditions in the early part of the budget period (i.e., the first week in the budget period), indicating that an increase in money left in the budget led to more spending among consumers who managed multiple sub-budgets compared to consumers who managed one overall budget. However, this pattern was not observed during the late part of the budget period (i.e., the second week in the budget period). This finding was consistent with our speculation that consumers who have multiple budgets rather than one had a higher sense of certainty that they would not break the budget, but only when there was still a lot of money left in the budget. However, as budgets got depleted over time, the difference between the two conditions became less pronounced while the general tendency to increase spending over time remained.

Table 5: Field Study 5: Consumer Spending Over the Budget Period

	period 1 (Mon-Wed, week1)	period 2 (Thu-Sun, week1)	period 3 (Mon-Wed, week2)	period 4 (Thu-Sun, week2)
Dummy_multi	-43.811(16.193)*	19.093(14.617)	1.247(10.256)	16.048(11.604)
Money left	.030(.044)	.264(.048)**	.166(.044)**	.419(.062)**
Interaction	.277(.066)**	.213(.077)*	.005(.085)	-.138(.119)
R-square	.19	.34	.11	.28

* $p < .05$; ** $p < .01$

Figure 3: Field Study 5: \$(Total Spending – Budgeted Amount)



8. Summary

The FinTech industry is revolutionizing the way people manage their finances. It is critical for consumers, FinTech developers, and government agencies to understand how the adoption of FinTech devices affects consumer financial welfare. This paper is the first to empirically test how accessing budget standing information through FinTech apps affects consumer budget adherence. Across three field studies and two lab experiments, we show that having access to budget information can lead to an increase in spending over the budget period, negatively influencing the potential for saving money.

We further showed that the acceleration of spending can be attenuated (a) when the end of the budget period was less salient, such as when consumers could roll over money to the next period or when they split the budget period into smaller timeframes. (b) The effect was also attenuated when budget or spending information was less precise, such as when consumers updated the budget during the budget period, added extra amount to their regular budget, or received spending information as a range rather than a precise amount. However, the effect amplified when consumers instead split their budget into multiple categories.

From the consumers' perspective, knowing how FinTech affects spending can improve consumers'

financial decision making. For example, we show that the increase in spending happens only when consumers approach the end of the budget period. Thus, consumers may strategically change their usage frequency of FinTech devices during the later parts of the budget period. They can also strategically set their budget using smaller budget windows.

From the financial services industry perspective, our findings suggest that FinTech apps can better serve consumers' financial needs by changing the way personalized budget information is conveyed to consumers, such as providing consumers with less precise budget information, by allowing consumers to update their budget during the budget period and by reminding consumers that they can roll over the money left in the budget into next budget period.

Our findings also have implications outside the contexts where consumers self-impose a budget to control spending. For example, banks may set a spending limit for consumers on certain accounts and credit card companies have credit line amounts. These limits are meant to prevent consumers from overspending but may be perceived by customers as 'permission' on how much one is allowed to spend. Based on our research, if consumers treat these spending limits as their budget, they may end up spending more.

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