12-2023

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Published in Journal of Consumer Research (2023) 50 (4), 787-809. DOI: 10.1093/jcr/ucad029

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*** First version: 3/12/2022 ***
*** Current version: 1/31/2023 ***
*** Please contact the authors for an updated version ***

Cross-Period Impatience: Subjective Financial Periods Explain Time-Inconsistent Choices

ABSTRACT

Inconsistency in consumer time preferences has been well-established and used to explain seemingly short-sighted behaviors (e.g., failures of self-control). However, prior research has conflated time-inconsistent preferences (discount rates that vary over time) with present bias (greater discounting when outcomes are delayed specifically from the present, as opposed to from a future time). This research shows that time-inconsistent preferences are reliably observed only when choices are substantially delayed (e.g., months into the future), which cannot be explained by present bias. This seeming puzzle is explained by a novel cross-period discounting framework, which predicts that consumers are more impatient when choosing between options occurring in different subjective financial periods. As a result, they display inconsistent time preferences and are less willing to wait for an equally delayed outcome specifically when a common delay to both options moves the larger-later option into a subsequent financial period. Six studies and multiple supplementary studies demonstrate that sensitivity to subjective financial periods accounts for time-inconsistent consumer preferences better than current models of time discounting based on present bias.

Keywords: intertemporal choice, time discounting, categorization, mental accounting, budgeting, impulsivity, present bias

Trade-offs between sooner and later benefits are fundamental to consumer decision-making. For example, by foregoing consumption now and spending less, a consumer can afford more consumption in the future. Consumers' time preferences, the degree to which they are willing to forgo smaller-sooner rewards for larger-later rewards, have been used to predict a wide array of consumer financial decisions including spending and saving (Bartels and Urminsky 2015), educational investment (Yoon, Yang and Morewedge 2022), mortgage repayment (Atlas, Johnson and Payne 2017), and retirement decisions (Bidewell, Griffin and Hesketh 2006).

Consumer time preferences have been characterized in terms of two distinct aspects: their *discount rate*, the degree to which consumers value earlier outcomes more than later outcomes in general, and their *present bias*, the degree to which they value an outcome more if it occurs in the present (see Frederick, Loewenstein and O'Donoghue 2002; Urminsky and Zauberman 2015 for reviews). The normative exponential discounting model assumes that consumers have stable time preferences, defined only by a constant discount rate, resulting in consistent preferences between options separated by a given delay, regardless of when the delay begins (Samuelson 1937). However, descriptive research has challenged this assumption, documenting evidence of hyperbolic discounting, such that people value options with short delays less than would be predicted by the normative model, relative to options with longer delays (Ainslie 1975; Thaler 1981). Present bias explains this deviation from normative choices as an additional devaluation of options when they are delayed from the *present*, over and above exponential discounting based on the length of the delay (Laibson 1997).

The construct of present bias has been widely applied as an explanation of consumer behaviors that suggest short-run impatience across a variety of financial decisions, including paying for costly monthly memberships instead of a cheaper annual membership (DellaVigna

and Malmendier 2006), failure to stick to debt-repayment plans (Kuchler and Pagel 2021), and food stamps recipients' failure to save sufficiently for end-of-month grocery purchases (Shapiro 2005). Measures of present bias predict various apparently short-sighted consumer financial decisions, such as failure to save (Bernheim, Skinner and Weinberg 2001), credit card borrowing (Meier and Sprenger 2010), and energy consumption (Werthschulte and Löschel 2021).

Prior theories have largely assumed that present-biased consumers tend to give in to impulsivity when faced with the possibility of an immediately available "present" option (Hoch and Loewenstein 1991). However, despite widespread reliance on the present bias construct, prior work on intertemporal choice has not precisely defined the "present" that consumers treat differently and has not empirically identified it. Recent research (Hershfield and Maglio 2020) has confirmed that most people see the present as short (e.g., commonly the current day or shorter), and finds a relationship between the length of the present and general future-minded preferences, but does not investigate present bias. Research adopting the assumption that the duration treated as the present is as brief as the current day (or briefer) has found quite mixed results when directly testing for present bias over this interval (Scholten and Read 2010).

We propose and test a novel and falsifiable account of time-inconsistent preferences, based on consumers' own subjective mental categorization of financial periods (Heath and Soll 1996; Henderson and Peterson 1992; Sussman and O'Brien 2016). In our *cross-period discounting* framework, consumers are more impatient specifically when choosing between two options that each occur in *different* subjective financial periods (e.g., compared to equivalent choices between options that both occur within the *same* subjective financial period), or in other words, exhibit *cross-period impatience*.

THEORETICAL BACKGROUND

Time Discounting, Time Inconsistency, and Present Bias

Positive financial outcomes that occur further in the future are objectively less valuable (e.g., due to opportunity costs, such as foregone interest earned). The normative exponential model predicts that the loss of value for an outcome due to a given delay should be the same regardless of when the delay occurs (Samuelson 1937). In this view, a person choosing whether to select a larger-later reward over a smaller-sooner one simply assesses whether the extra reward amount constitutes sufficient compensation, relative to the person's personal interest rate, for the additional delay.

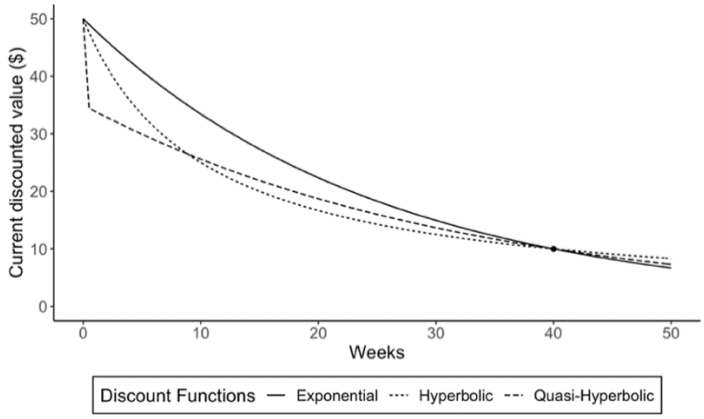
Descriptive research has instead found that people exhibit diminishing impatience, such that delayed outcomes lose less value per unit of time for longer delays (Ainslie 1975; Loewenstein and Prelec 1992; Thaler 1981). The tendency to more strongly favor a sooner over a later option the earlier the sooner option occurs has been explained as "a bias for the 'present' over the 'future'" (O'Donoghue and Rabin 1999), i.e., *present bias*. In this view, an outcome in the present is especially valued, and therefore greater value is lost when the outcome is delayed from the present than from other times. Present bias has been used as an explanation of self-control failure, such that temptations in the present are over-valued relative to the delayed consequences, resulting in impulsive behaviors that contradict consumers' own intentions to be far-sighted in the future (Ainslie 1975; Hoch and Loewenstein 1991; O'Donoghue and Rabin 1999).

The degree to which an outcome loses value due to a delay of length t can be expressed

as a discount factor, f(t), which is multiplied by the non-delayed value to compute the net present value of the delayed option (see Urminsky and Zauberman 2015 for a review). Early researchers proposed replacing the exponential discount factor, $f(t) = \delta^t$, with an entirely different, *hyperbolic* function, $f(t) = 1/(1+kt)$, based on prior descriptive research in animal behavior (Ainslie 1975; Mazur 1987). While highly influential in psychology, this approach confounds present bias with discount rates and cannot capture the possibility of normative exponential discounting. As a result, some researchers instead use the *quasi-hyperbolic* discounting model (Laibson 1997), which can be defined as $f(t) = \beta\delta^t$ when $t > 0$ and $f(0) = 1$ when $t = 0$ (i.e., in the present), to accommodate present bias. In this model, the parameter $\beta < 1$ captures the degree of present bias (i.e., the degree of departure from exponential discounting). Figure 1 illustrates the difference in the present value of $50 in t weeks, depending on the assumed model.

FIGURE 1

DISCOUNT FUNCTIONS



NOTE. For a hypothetical individual indifferent between $50 in 40 weeks and $10 today.

Measuring Present Bias

While time discounting has been estimated in various ways, the most direct test of

present bias specifically, as opposed to time inconsistency in general, is to compare people's choices between a smaller present option and a larger delayed option with their choices in another scenario, in which a "common delay" has been added to both options (i.e., making it a choice between a relatively less delayed and more delayed option). For example, present-biased consumers would be more likely to choose the smaller-sooner option when facing a choice between $100 now or $110 in 4 weeks, than they would when instead choosing between $100 in 26 weeks or $110 in 30 weeks (i.e., both options moved forward by a "common delay" of 26 weeks; Keren and Roelofsma 1995). This test of the *common delay effect* has found evidence for present bias in multiple studies (Coller and Williams 1999; Green, Fristoe and Myerson 1994; Keren and Roelofsma 1995; Kirby and Herrnstein 1995).

The common delay test also reveals an unresolved question in the existing models–how long must the common delay be before present bias for the sooner option is transcended and people's choices become more patient? Some theories suggest that present bias involves non-linear gradual change over time in psychological factors, such as subjective perceptions of time (Zauberman et al. 2009), the concreteness of the mental representation (Fujita et al. 2006), and connectedness to the future self (Bartels and Rips 2010). Other theories, however, have argued that present bias is due to unique psychological properties of the current moment, including certainty of immediate outcomes (Keren and Roelofsma 1995) and greater affective temptation for immediate rewards (Loewenstein 1996; Metcalfe and Mischel 1999). This stream of research suggests that even brief delays from the present should result in a one-time drop in subjective value for the outcome, a view increasingly adopted in economic theories of present bias (Direr 2020; Harris and Laibson 2013; O'Donoghue and Rabin 2015).

The empirical evidence has not resolved the question of when the "present" period ends.

Scholten and Read (2010) report mixed evidence for present bias in the prior literature, with some studies failing to find evidence of the common delay effect. In fact, studies that failed to detect present bias have been interpreted as providing support for normative time-consistent preferences for monetary rewards (Andreoni and Sprenger 2012; Augenblick, Niederle and Sprenger 2015; Holcomb and Nelson 1992).

Most recently, Hershfield and Maglio (2020) directly examined the mental construct of "the present," that is, when people perceive that the present moment ends and the future begins, in general. For the majority of their study participants, the present ended in less than a day, which is consistent with the assumption of some previous tests of present bias (e.g., treating "today" vs. "tomorrow" as in the present vs. future period). However, while they find that a shorter subjective present predicts generally far-sighted behaviors, they did not test whether rewards are more valued when occurring in the subjective present (vs. after the present). Other studies have found the common delay effect between choices involving only delayed options (Green et al. 1994; Green, Myerson and Macaux 2005; Scholten and Read 2006), which cannot be explained by present bias, defining the present period based on Hershfield and Maglio (2020).

Mental Accounting and the Categorization of Time

Our account begins from the premise that time inconsistency may be better understood in terms of how consumers mentally account for time. Consumers use categorization to manage their financial activities, organizing their income and expenditures into "mental accounts" (Heath and Soll 1996; Thaler 1999) and proactively using budget categories when making future financial plans (Zhang et al. 2022). Thinking in terms of categories allows consumers to consider

a narrower set of aggregate outcomes, reducing cognitive burden (Henderson and Peterson 1992). In a variety of domains, people have been found to narrowly-bracket outcomes, assessing costs and benefits within a temporal category, as opposed to interchangeably across time periods (Camerer et al. 1997; Lambrecht and Tucker 2012; Zhang 2017).

Research on memory has found evidence of spontaneous use of temporal categories, such that people can recall a broader temporal unit to which past events belong even when they fail to precisely recall the exact timing of the event (Huttenlocher, Hedges and Prohaska 1988; Robinson 1986). Consistent with the view that people think categorically about time, financial outcomes that co-occur are more likely to be categorized in the same mental account than events that are temporally distinct (Thaler and Johnson 1990), and conversely, people prefer similar events to be in the same temporal category (Evers, Imas and Kang 2022).

Such categorization can be shaped by salient external markers (e.g., the end of the hour or the month, or one's birthday), with consequences for consumer preferences and decisions (Dai, Milkman and Riis 2014; Donnelly, Compiani and Evers 2022; May 2017; Peetz and Wilson 2013, 2014; Soster, Monga and Bearden 2010; Tu and Soman 2014). Research on categorization shows that, in addition to externally defined categories, a category structure can be initially constructed based on salient goals (Barsalou 1983), and then established in memory, remaining stable over time (Barsalou 1995) and influencing consumer decisions (Reinholtz, Bartels and Parker 2015). This suggests that consumers managing their finances may learn what temporal categorization fits their goals, adopt that categorization, and reliably apply the categorization to their decisions.

Furthermore, the temporal categories people apply to financial decisions may vary across individuals. Indeed, survey-based research has found that people differ in their long-term

subjective financial planning horizons (between several months to several years) and that longer planning horizons predict a range of "farsighted" financial behaviors (for a review, see Hong and Hanna 2014). However, long-term financial planning (e.g., saving and investment plans over the period of several years) is distinct from shorter-term financial planning (e.g., managing one's expenses each month), which focuses on cash-flow and credit management (Hilgert, Hogarth and Beverly 2003). Accordingly, different financial management tasks may motivate different financial planning horizons. Lynch et al. (2010) find that some consumers endorse multiple planning horizons, in terms of days, months, and years, with distinct behavioral correlates.

Subjective Financial Periods and Cross-Period Discounting

Building on these insights from categorization and mental accounting research, we propose an alternative account of time inconsistency, based on consumers' mental accounting of outcomes into different time periods, specifically in financial planning (i.e., as opposed to a general sense of the present, as in Hershfield and Maglio 2020). Assuming that consumers prefer sooner to later outcomes, we posit that individual consumers making intertemporal choices on positive financial outcomes will additionally rely on their own subjective categorization of time into financial periods that aid in managing relevant financial affairs (e.g., their cash flow).

We define a subjective financial period as a type of mental account defined over a specific period of time. A key insight from mental accounting research is that people treat resources in different accounts as non-fungible. People set goals specific to a mental account, such as their earning target or budget for category-specific expenditures (Camerer et al. 1997; Soman and Cheema 2011). Therefore, the categorization of resources can affect people's

budgeting and tracking of their progress toward their financial goals. Such mental budgeting can also affect spending decisions. For example, people are reluctant to incur an additional expense in a category when doing so would exceed their mental budget for their category (Heath and Soll 1996) or when they perceive the expense to be made out of a smaller account or lower total balance (Morewedge, Holtzman and Epley 2007; Soster, Gershoff and Bearden 2014).

Similarly, people may group financial outcomes within each subjective financial period together and set period-specific financial goals. To the extent that they group and aggregate financial outcomes occurring at different times into the same period, the precise timing of the individual outcomes may be less relevant for their mental accounting. On the other hand, when people face a trade-off between benefits in different periods, they may consider them to be non-interchangeable, perceiving delaying a reward to a different financial period as having a larger impact on their financial planning and spending decisions than the reward being delayed by the same amount of time but remaining within the same financial period.

The novel insight in our account is that time-inconsistent choices can therefore be explained by *cross-period discounting*, an incremental discrete devaluation of the outcomes that occur in a later (vs. sooner) financial period, *over and above* any continuous discounting based on delay. Cross-period discounting implies that consumers will be less willing to wait for an outcome, holding objective delay constant, when it occurs in a later subjective financial period, and will therefore exhibit *cross-period impatience*. Contrary to the standard view that time-inconsistent preferences are caused by a present bias defined by immediacy, we propose that inconsistent preferences are instead explained by people's current subjective financial period, the time horizon most immediately relevant for managing their financial matters. Specifically, we predict that the common delay effect will be observed when the common delay is long enough

for the smaller-sooner outcome to no longer be perceived as in the current financial period.

We test our account in six pre-registered studies (N=4,540). We first demonstrate that the shift in preference from making a more impatient choice (preferring the smaller-sooner option) to a more patient choice (preferring the larger-later option) is only reliably observed when comparing present-future choices to future-future choices with a sufficiently long common delay (Study 1). These results are not predicted by either normative exponential discounting, which assumes time-consistent preferences, or the standard behavioral accounts (hyperbolic and quasi-hyperbolic discounting). These results confirm that while discounting is inconsistent over time, the pattern of inconsistency cannot be simply explained by present bias.

Next, we test for *cross-period impatience*: greater impatience when choosing between two options that occur in different (vs. the same) individual-specific time periods. In Study 2, we measure consumers' categorization of each option as belonging to either their current or future financial period and measure the degree of cross-period impatience, over and above present bias and stable time preferences. We confirm the predicted cross-period effect in Study 3, by eliciting each person's boundary between the current and future financial periods and using a repeated measures design. We further distinguish cross-period impatience from calendar-based categorization effects on time preference (Study 4). Then, we test cross-period impatience using experimentally manipulated subjective financial periods in budgeting, between a current and future period (Study 5) as well as among different future periods (Study 6).

To test our proposed process account, we examine the perception of non-fungibility of options across different financial periods as potentially underlying the cross-period effect. In Studies 3 and 5, we ask consumers about the impact of the option timing on how they manage their finances and on their spending decisions. We likewise test other psychological processes

that may depend on the financial period categorization and contribute to the cross-period effect, including perceived duration (Donnelly et al. 2022; May 2017; Zauberman et al. 2009), resource slack (Zauberman and Lynch 2005) and time-varying utility of money (Sharma, Tully and Wang 2019; Strotz 1955). We find both non-fungibility and perceived duration consistently contribute to cross-period discounting.

All studies were pre-registered. Links to the pre-registrations and additional details of the studies and analyses are provided in the Web Appendix. Full data, study materials, and analysis codes are available in the OSF repository: https://tinyurl.com/crossperiod.

STUDY 1: VARYING COMMON DELAYS TO TEST TIME-INCONSISTENT PREFERENCES

To test for time inconsistency, we used the common delay paradigm (Green et al. 1994; Loewenstein and Prelec 1992). In a choice between two monetary rewards, we tested the effect of varying the timing for the smaller-sooner reward ("common delay"), with the larger-later reward always one month later, thereby holding the delay between the rewards ("inter-reward delay") fixed.

If consumers have time-consistent preferences (e.g., exponential discounting), their willingness to wait should be consistent regardless of the common delay. Present-biased preferences would instead imply a steep increase in preferences for the larger-later option when the timing of the smaller-sooner option initially changes from present to future, and either consistent preferences (quasi-hyperbolic) or smaller preference changes (hyperbolic) as the smaller-sooner option is further delayed into the future. In particular, based on an additional

assumption that the present is a very short time (Hershfield and Maglio 2020; O'Donoghue and Rabin 2015), present bias would imply fewer choices of the larger-later option when the smaller-sooner option is available *today*, compared to when the smaller-sooner option is delayed.

Method

We analyzed data from 1,318 online participants via Amazon Mechanical Turk (see Web Appendix A for pre-registrations and details about participant exclusions). We informed participants that they would be choosing between two monetary rewards that would be received at different times, and that some participants would receive one of the choices they had made as a bonus. Each participant chose between a smaller-sooner reward and a larger-later reward. The smaller-sooner reward was either $35, $40, or $45 (randomly assigned), to be received at the time determined by the randomly assigned common delay, either today (i.e., no common delay; baseline condition), in 2 weeks, or in 1, 3, 6, 9 or 12 months ("delayed" conditions). The larger-later reward was $50, to be received one month later than the smaller-sooner reward.

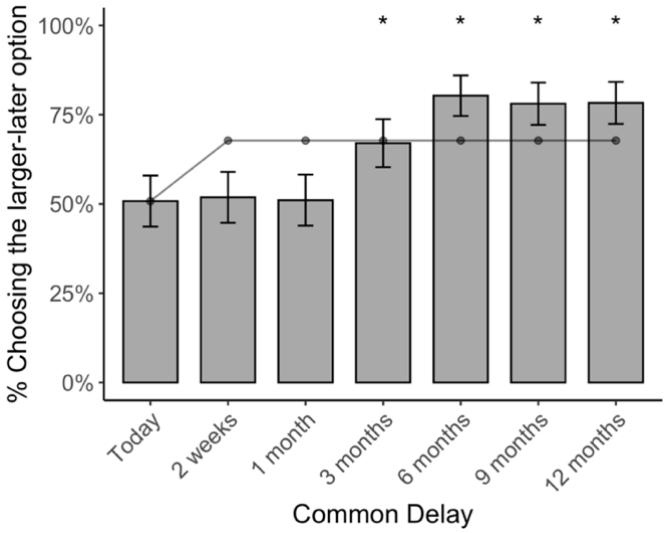
Results

In the baseline condition, when the smaller-sooner option was to be received today, 51% of participants chose the larger-later option (Figure 2). Choices of the larger-later option did not differ significantly from the baseline condition in the two-week (52% choosing the larger-later option, Fisher's exact test, OR = 1.04, $p = .92$) or one-month common delay condition (51%, OR = 1.01, $p = 1$). Thus, for common delays of one month or less, we fail to find the common delay

effect implied by models of time preference involving present bias.

FIGURE 2

CHOICE PROPORTIONS BY COMMON DELAY CONDITIONS (STUDY 1)



NOTE. Aggregated over smaller-sooner amount conditions. *: significantly different from the baseline ("today") condition ($p < .05$, pairwise Fisher's exact tests). The line shows the best-fit prediction from the quasi-hyperbolic model. Error bars show 95% confidence intervals.

However, we observed a significant increase in the preference for the larger-later option in conditions with three-month or longer common delays, relative to the baseline condition (3 months: 67%, OR = 1.97, $p = .002$; 6 months: 80%, OR = 3.94, $p < .001$; 9 months: 78%, OR = 3.44, $p < .001$; 12 months: 78%, OR = 3.48, $p < .001$). Because preferences for the larger-later option increased above 50% with longer common delays, these results cannot be explained by reversion to indifference when the common delay is longer (Franco-Watkins, Pashler and Rickard 2006). In addition, the pattern of results was consistent for both lower and higher magnitudes of the smaller-sooner reward amount (Web Appendix C).

Discussion

Theories of time-inconsistent preferences predict a higher preference for larger-later rewards when the smaller-sooner reward is delayed beyond the "present." While the length of the present period has been left unspecified in the quasi-hyperbolic model (Laibson 1997; O'Donoghue and Rabin 1999), most empirical research has operationalized the present as the day of the choice (Ahlbrecht and Weber 1997; Coller and Williams 1999; Green et al. 1994; Read and Roelofsma 2003). This assumption is consistent with recent evidence on individuals' perception of the present (Hershfield and Maglio 2020) and theories of impulsivity which posit psychological differences when making choices specifically for the here-and-now (Keren and Roelofsma 1995; Loewenstein 1996; Metcalfe and Mischel 1999).

In contrast to this prediction, our participants were no more impatient for a smaller-sooner reward today, on average, than when both options were delayed by two weeks or even one month. Based on similar empirical evidence using short common delays, some previous research has concluded that people have time-consistent preferences (0, 7 or 35-day common delays, Andreoni and Sprenger 2012; 0, 1 or 7 days, Holcomb and Nelson 1992; 0 or 60 days, Kable and Glimcher 2010). However, our results also contradict time-consistent preferences, based on the significant common delay effect when choices were sufficiently delayed (i.e., for more than one month). Nevertheless, both our results and these prior results are inconsistent with *present* bias, unless the present is defined to extend over a month.

These results suggest that consumers have time-inconsistent preferences that are not well-explained by the constructs of present bias and impulsivity. In the remaining studies, we test our alternative account of time inconsistency based on cross-period discounting. This approach can

explain how consumers might be both relatively insensitive to short-term common delays and be more patient over longer common delays, as observed in Study 1, based on how consumers subjectively categorize the timing of financial outcomes.

STUDY 2: CATEGORIZATION OF OPTIONS INTO CURRENT VS. FUTURE FINANCIAL PERIOD AND CROSS-PERIOD DISCOUNTING

Our cross-period discounting framework predicts that people will exhibit cross-period impatience, making more impatient choices between a sooner option in the current period and a later option in the future period, compared to an otherwise equivalent choice between options in the same period. To directly test this, we replicated and extended Study 1 by eliciting people's subjective categorization of the options as belonging to their current or future financial period.

Method

We analyzed data from 1,338 valid participants from MTurk. As in Study 1, participants made a potentially consequential choice between a smaller-sooner reward and a larger-later reward. They were randomly assigned a smaller-sooner reward amount ($35, $40, or $45) and timing (i.e., common delay; today (baseline), 2 weeks, 1, 3, 6, 9, or 12 months). The larger-later option was $50, to be received one month later.

After making their choice, participants categorized each option into either a current or a future financial period. Specifically, they read, "*We are interested in how people manage financial matters over time. Please think about what your current financial period is when you*

manage your financial matters (i.e., planning and budgeting), such as your income and expenditure." For each of the smaller-sooner option and the larger-later option in the choice they previously made, they were further asked, "*Do you consider receiving **[amount]** in **[timing]** to be in your current financial period or in a future financial period?"* and selected either current financial period or future (next or subsequent) financial period. For exploratory analyses, we also directly asked participants whether they considered the options to be in the same financial period or in different financial periods.

Results

Choice. We replicated the findings from Study 1. Choices of the larger-later option did not differ significantly from the baseline "today" condition in the two-week (53% vs. 46%, OR = 0.76, $p = .19$) or one-month common delay condition (56%, OR = 1.15, $p = .54$). Preferences for the larger-later option were significantly higher for three-month or longer common delays, relative to the baseline condition (3 months: 70%, OR = 2.06, $p < .001$; 6 months: 76%, OR = 2.84, $p < .001$; 9 months: 81%, OR = 3.81, $p < 001$; 12 months: 84%, OR = 4.76, $p < .001$).

Financial Period Categorization. A majority of the participants still considered the smaller-sooner option to be in their current financial period even with a two-week or one-month delay, but not for longer delays (smaller-sooner today: 93%, 2 weeks: 68%, 1 month: 61% vs. 3 months: 24%, 6 months: 17%, 9 months: 13%, 12 months: 13%). Choices were coded as *cross-period* if the participant considered only the smaller-sooner option to be in their current financial period and not the larger-later option (and as same-period otherwise). More participants

indicated that the choice crossed their current financial period in the today, two-weeks, and one-month common delay conditions (74%, 55%, 46% respectively) than in the longer common delay conditions (3 months: 13%; 6 months: 8%; 9 months: 7%; 12 months: 8%).

To test for present bias and cross-period impatience, we conducted a linear regression (i.e., a linear probability model, Heckman and Snyder 1997) on the choice of the larger-later option (Table 1). We first applied the test for present bias used in the prior literature by predicting choices based on a variable coded as 1 for the baseline "today" condition only and 0 otherwise (i.e., no common delay; *Present*), controlling for the amounts of the smaller-sooner option. Participants were, on average, more patient when both options were delayed, compared to when the smaller-sooner option was "today" (i.e., B_{Present} = -0.16, SE = 0.034, $t(1334)$ = -4.67, $p < .001$; Model 1 in Table 1), which has previously been interpreted as evidence of present bias.

TABLE 1

TEST OF PRESENT BIAS AND CROSS-PERIOD IMPATIENCE (STUDY 2)

Variable	Model 1	Model 2	Model 3
(Intercept)	0.87 (0.022)***	0.93 (0.022)***	0.79 (0.028)***
Present	-0.16 (0.034)***	-0.018 (0.036)	0.061 (0.037)
CrossPeriod		-0.28 (0.028)***	-0.20 (0.029)***
CommonDelay (in years)			0.27 (0.038)***
SS amount FE	Yes	Yes	Yes

NOTE. Standard errors are in parentheses. ***: $p < .001$

Next, we tested for cross-period impatience by adding the indicator variable for cross-period choices to the regression (Model 2 in Table 1). Participants were less likely to choose the larger-later option when the two options were categorized as in different financial periods ($B_{\text{CrossPeriod}}$ = -0.28, SE = 0.028, $t(1333)$ = -9.92, $p < .001$), controlling for present bias, which was no longer significant (B_{Present} = -0.018, SE = 0.036, $t(1333)$ = -0.51, $p = .61$). This suggests that the seeming evidence of present bias (with present defined as "today") in Model 1 was in fact confounded with and explained by the cross-period effect. These results are robust to also

controlling for the length of the common delay (Model 3), showing that the cross-period effect does not merely reflect impatience linearly diminishing with common delay.

Discussion

This study provides initial evidence for cross-period discounting. The effect of common delays we documented in Study 1 and replicated in Study 2 is clearly incompatible with exponential discounting, which would predict no differences across the conditions, given that the inter-reward delay was held constant at one month. The results are also incompatible with the typical understanding of present bias, in which the present is defined to be short, as we observed a significant reversal only with a longer common delay (3 months).

Our results suggest that people's idiosyncratic categorization of options into either current or future financial periods partially explains this pattern. The subjective financial periods, by identifying which choices involved options that spanned across current and future financial periods, better explained time inconsistency in participants' choices than did present bias.

While we mainly focus on the current financial period (vs. any future period) in the current study and studies that follow (Studies 3-5), it is possible that people also plan their finances across multiple future financial periods. In an exploratory analysis, among the participants in the delayed conditions who indicated that both options were in a future financial period (n=756), we tested the sensitivity of their choices to whether they considered the two future-period options to be in the same or in different future periods (when asked directly in a follow-up question). We found significantly lower patience among those who categorized the options into different future periods compared to those who categorized the options into the same

future period (72% vs. 81% preferring the larger-later option; OR = 0.60, p = .004). This provides suggestive evidence that the cross-period effect is not limited to the current subjective financial period but instead applies to perceived differences across any two subjective financial periods. We return to this question in Study 6.

STUDY 3: CURRENT-FUTURE PERIOD BOUNDARY AND POTENTIAL PROCESSES

In the studies thus far, different participants had been assigned different choice options. In Study 3, we expanded the scope of the delays and asked all participants to make the same set of choices in a repeated measures design. Then, instead of asking participants to categorize each of the specific choice options into the current or future financial period, we elicited their boundary between their current and future subjective financial periods. Based on each person's identified boundary for the current financial period, we classified each choice for that person as involving same-period or cross-period options. We used this coded variable to again test whether people were more impatient when a choice involved options they viewed as in different periods and whether that explained what would otherwise be interpreted as evidence of present bias.

Further, we explored the potential reasons for the cross-period effect. First, based on our theorizing that consumers mentally account for resources over time using subjective financial periods, we tested whether the cross-period effect on choice can be partly accounted for by perceiving the options in different subjective periods to be less fungible for managing their financial resources. We also tested three additional constructs that have been proposed to contribute to time inconsistency in prior literature: perceived duration between the timing of the options, usefulness of money, and perceived resource slack.

Prior research suggests that perceiving the time between the options to be longer can explain higher impatience in intertemporal choice (Zauberman et al. 2009). Furthermore, people perceive a duration to be longer when it is presented as spanning different fixed categories (e.g., hours; Donnelly et al. 2021) or punctuated by a larger number of events (May 2017). Correspondingly, people might perceive the time interval between the options to be longer when the options span across a subjective financial period boundary.

The last two constructs specifically pertain to the people's idiosyncratic beliefs about their needs for extra resources at different times (as opposed to a more general sense of non-fungibility resulting from mental accounting). People may have a salient consumption occasion on a specific date (Sharma et al. 2019; Strotz 1955). If subjective financial periods correlate with such salient needs, people may report that having extra money in the earlier subjective period would be more useful than in the later period. In addition, consumers' tendency to believe that they will have more "slack" in the future than in the present (i.e., fewer financial resources and more financial constraints in the present), has been found to underlie people's present-biased preferences (Zauberman and Lynch 2005). If consumers believe that they have fewer available resources and more financial constraints specifically throughout the current financial period as compared to during future financial periods, this could also contribute to the cross-period effect.

Method

We collected 519 valid participants from MTurk. Participants were first informed that one out of 100 participants would be selected at random to be paid out one of their choices. Each participant made 30 intertemporal choices, between $10 sooner and $20 later, in randomized

order. The delays associated with each option were constructed by crossing six different timings for the smaller-sooner option (common delay; today, one week, one month, six months, one year, or five years) with five different intervals between the smaller-sooner and larger-later options (inter-reward delay: one week, one month, six months, one year, or five years). For example, when the common delay was one month and the inter-reward delay was six months, participants chose between $10 in one month and $20 in seven months.

After making their choices, participants classified seven different times (today, one week, one month, three months, six months, one year, and five years) as either in the current or future financial period. We used the latest time categorized as the current financial period by a given participant, such that the subsequent time was categorized as a future financial period, as an approximate measure of the boundary between the current and future financial periods for that participant.

To examine potential mechanisms underlying the cross-period effect, we focused on one of two subsets of choices for each participant: six choices with one-month inter-reward delays and six choices with six-month inter-reward delays (with common delays varying within each subset). We selected the participants who exhibited time inconsistency (e.g., switching between choosing the smaller-sooner and choosing the larger-later option) within either of these subsets of choices (n=403). For those who demonstrated inconsistency in both one-month choices and six-month choices, one subset was randomly chosen. To avoid respondent fatigue, we collected five potential process measures, in random order, only for each of these six choices (rather than for the entire set of 30 choices) from each participant. This data enables testing whether the process measures partly explain the cross-period effect on this subset of choices.

First, we have posited that people may see financial resources received at different times

as less fungible with each other when they occur in different (vs. same) financial periods. As a consequence, they would perceive that the timing of the options matters more when the options span across a subjective period boundary. Therefore, we asked how much it would make a difference for their spending ("impact on spending") or for managing their finances and meeting their financial goals ("impact on managing finances") if they were to receive an extra $20 at one or the other of the two different times in each of the six focal choices (1: makes no difference, 10: makes a big difference; see Web Appendix B for the full wording).

Next, using a scale of subjective time from prior research (Donnelly et al. 2022; May 2017; Zauberman et al. 2009), we elicited the perceived duration of the time between the smaller-sooner and larger-later options, separately for the pairs of times used in the options in each of the six focal choices, on an unnumbered slider (0: very short, 100: very long).

Lastly, we measured two variables pertaining to the subjective value of extra money. First, we directly asked which of two times having extra money would be more useful (-5: more useful at the smaller-sooner timing, 5: more useful at the larger-later timing; for all six focal choices). Second, we measured at which of two times they anticipated having more "slack" in their financial resources (-5: more money available at the smaller-sooner timing, 5: more money available at the larger-later timing; for all six focal choices).

In the questions asking about the impact of extra money (impact on spending, impact on finances, and usefulness), we kept the amount constant, since our goal was to measure the effect of timing independently of magnitude. We used the larger-later option amount since it should be able to also satisfy any need that could have also been fulfilled by the smaller dollar amount.

Results

Cross-Period Impatience. The median of the longest time still considered to be in the current financial period was one month, chosen by 38% of the participants for whom the boundary between current and future financial periods could be identified. Only 8% of the participants indicated that their current period ended in less than one week. After coding each of the thirty intertemporal choice questions as presenting a same-period or cross-period choice to the participant based on that participant's own definition of the current vs. future period, about 40% of the choices were cross-period for the median participant.

We conducted the same linear regression analyses as in Study 2 on the choice of the larger-later option, except that we clustered standard errors at the participant level to account for repeated measures. In our initial test for present bias, participants were, on average, more patient when both options were delayed (controlling for inter-reward delay), compared to when the smaller-sooner option was "today" (B_{Present} = -0.10, SE = 0.007, t(15567) = -14.51, $p < .001$; Model 1 in Table 2). Consistent with Study 2, participants were less likely to choose the larger-later option when the two options spanned different financial periods ($B_{\text{CrossPeriod}}$ = -0.22, SE = 0.009, t(15566) = -25.05, $p < .001$), controlling for inter-reward delay and present bias (Model 2). In fact, once we account for this cross-period effect, the test of present bias was substantially reduced (B_{Present} = -0.026, SE = 0.0069, t(15566) = -3.77, $p < .001$), suggesting that present bias in Model 1 was in fact confounded with and partially explained by the cross-period effect. The cross-period effect was robust to additionally controlling for the length of common delay, while present bias was no longer significant (Model 3).

Lastly, the cross-period effect was robust to controlling for the length of the subjective

current financial period for each participant (Model 4). This result suggests that the cross-period effect was not due to an overall higher impatience (i.e., across all choice options) among those with a shorter current period. Instead, consistent with our account, having a different length of the current period predicts greater patience for some choices (those that would be in the same period for the person) but greater impatience for other choices (those in different periods).[1]

TABLE 2

TEST OF CROSS-PERIOD IMPATIENCE (STUDY 3, ALL CHOICES)

Variable	Model 1	Model 2	Model 3	Model 4
(Intercept)	0.71 (0.0095)***	0.76 (0.0097)***	0.73 (0.01)***	0.71 (0.013)***
Present	-0.10 (0.0071)***	-0.026 (0.0069)***	-0.0082 (0.0066)	-0.0073 (0.0066)
CrossPeriod		-0.23 (0.0091)***	-0.20 (0.0094)***	-0.20 (0.009)***
CommonDelay (in years)			0.021 (0.0018)***	0.021 (0.0018)***
Length of current period				0.0024 (0.00091)**
InterrewardDelay (in years)	-0.13 (0.0022)***	-0.12 (0.0022)***	-0.13 (0.0022)***	-0.12 (0.0022)***
Clustered SE	Yes	Yes	Yes	Yes

NOTE. Standard errors are in parentheses. **: $p < .01$, ***: $p < .001$

Potential Processes. The internal consistency between the two non-fungibility measures was high (Cronbach's alpha = .77) and we averaged these measures into an index of perceived non-fungibility.[2] Overall, the variance inflation factors (VIFs) of the non-fungibility index (1.11), perceived duration (1.14), usefulness (1.08), and slack (1.03) when jointly entered into a regression predicting choice were all close to 1, confirming that these variables are non-redundant and explain distinct variation (see Web Appendix C for bivariate correlations and comparison of a one- vs. multi-factor model).

[1] We find consistent results when using linear regression with random intercepts to account for within-subject repeated measures instead, which accounts for potential aggregation bias. We also replicated these results in an additional study with the same design (N=285, Web Appendix D). In the replication study, we do not find a significant present bias effect after accounting for cross-period, whether or not we control for common delay length.
[2] While this was not part of our pre-registered plan, we combined the measures for simplicity and for consistency with Study 5. The pre-registered analysis using the two questions separately is reported in Web Appendix C and supports the same conclusions.

We first confirmed that the significant cross-period effect replicated in the subset of six choices per participant (either the choices with one-month inter-reward delay or six-month inter-reward delay, depending on the participant) for which we measured process variables. Applying the same regression as Model 3 to this smaller subset of choices, we confirmed a significant cross-period effect ($B_{\text{Cross-Period}}$ = -0.21, SE = 0.024, t(2413) = -8.71, p < .001), controlling for present bias, common delay, and inter-reward delay.

Using the same regression specification, we also found a significant effect of crossing financial periods on three of the potential process measures: perceived non-fungibility ($B_{\text{Cross-Period}}$ = 0.87, SE = 0.11, t(2413) = 7.96, p < .001), perceived duration ($B_{\text{Cross-Period}}$ = 6.86, SE = 1.09, t(2413) = 6.30, p < .001), and usefulness of money ($B_{\text{Cross-Period}}$ = -0.78, SE = 0.12, t(2413) = -6.50, p < .001). We did not find a significant effect of period-crossing on perceived slack in financial resources ($B_{\text{Cross-Period}}$ = 0.093, SE = 0.10, t(2413) = 0.91, p = .36), so we excluded this variable from subsequent analyses.

Exploratory mediation analyses using the significant measures confirmed that each measure significantly mediated the cross-period effect (Table 3) on its own, each explaining between 6-8% of the total effect.[3] Jointly including all three measures in the regression cumulatively explained about 18% of the cross-period effect on choice, which suggests that each of these measures independently accounts for some of the effect. Indeed, each measure had a significant indirect effect, controlling for each of the other process measures or both jointly (Table 3 (b)-(d)).

[3] In all mediation analyses we report in the paper, we used 5,000 bootstrapped samples.

TABLE 3

MEDIATION ANALYSES RESULTS (STUDY 3)

		Non-fungibility (combined)	**Perceived duration**	**Usefulness**
(a) Without control	Indirect effect (% mediated) 95% Bootstrap CI	-0.017 (8.0%) [-.025, -0.009]	-0.017 (8.1%) [-0.024, -0.009]	-0.015 (7.1%) [-0.022, -0.007]
(b) Controlling for perceived duration	Indirect effect (% mediated) (95% Bootstrap CI)	-0.013 (6.7%) [-0.02, -0.005]		-0.013 (6.2%) [-0.020, -0.005]
(c) Controlling for non-fungibility (combined)	Indirect effect (% mediated) (95% Bootstrap CI)		-0.015 (7.7%) [-0.022, -0.008]	-0.014 (7.1%) [-0.021, -0.005]
(d) Controlling for usefulness	Indirect effect (% mediated) (95% Bootstrap CI)	-0.015 (7.9%) [-0.023, -0.007]	-0.016 (8.0%) [-0.022, -0.008]	
(d) Controlling for two other variables together	Indirect effect (% mediated) (95% Bootstrap CI)	-0.012 (6.5%) [-0.019, -0.004]	-0.014 (7.6%) [-0.02, -0.007]	-0.012 (6.7%) [-0.019, -0.004]

Discussion

Using a within-subject design with more extensive delay lengths than in the prior studies, we again find that subjective financial periods better explain time inconsistency in participants' choices than does present bias, via identification of the cross-period choice options, even controlling for length of the common delay.

This study also provides initial support for the role of perceived fungibility in time-inconsistent intertemporal choice. When the options spanned across different financial periods, people perceived the difference in timing to have a larger impact on their finances, which partly accounts for the cross-period effect. In particular, perceived non-fungibility does not seem to necessarily rely on perceptions of the length of time or beliefs about different needs for money at different times. Nonetheless, multiple factors—perceptions of fungibility, usefulness, and perceived duration— all mediated the cross-period effect. These results suggest that the relationship between financial period categorization and patience is likely multiply determined. We further examine these potential mechanisms when we experimentally test for the causal effects of subjective financial periods in Study 5.

STUDY 4: DURATION VS. DATES AND SPONTANEOUS VS. PRESENTATION-DEPENDENT CATEGORIZATION

In everyday life, intertemporal choices often involve trade-offs between options represented in terms of dates, and previous research has found that using dates (vs. durations) affects discounting (i.e., higher patience, Leboeuf 2006; reduced hyperbolic discounting, Read et al. 2005). Thus, in Study 4, we varied how the delays are represented, either as durations or dates, to test the robustness of the cross-period effect to date formats.

In addition, we test whether consumers' subjective financial periods underlying the cross-period effect can be better explained as constructed using salient categorization cues, or as a relatively stable individual difference. People may use features of the stimulus in a "bottom-up" manner to create context-dependent categorizations (Kaplan and Murphy 2000). As the date format makes the calendar-based category cues (i.e., the boundary between months) more salient, compared to duration descriptions, people will be more likely to make decisions based on month categorization when shown dates, predicting a cross-month effect (additional discounting over month boundaries). If the cross-period effect relies on the subjective periods that are constructed based on these cues, the cross-month effect will coincide with the cross-period effect. Therefore, we test whether cross-period impatience, based on subjective financial periods, predicts intertemporal choices, over and above any effect of the month-boundary.

Method

To experimentally vary whether some choices involve crossing month boundaries,

keeping the relative delay from today constant, we collected 345 valid surveys from two non-overlapping Prolific (prolific.co) samples, one early in the month (August 4th, N=175) and one late in the month (August 21st, N=170).

Participants in each wave of the survey were randomly assigned to either the duration condition or the date condition. In the duration condition, as in the prior studies, the timing of each choice option was presented as the duration of time from today (e.g., "in 1 month"). In the date condition, the same time was instead presented as the date on which the outcome would occur (e.g., "on September 4, 2020"). This resulted in a 2 (survey date: early vs. late in the month) × 2 (presentation format: duration vs. date) between-subjects design.

Each participant made 33 choices, between $15 at an earlier date and $20 at a later date. Thirty pairs of choice options were created by crossing five timings of the sooner ($15) reward (i.e., common delays; today, 3 days, 1 week, 2 weeks, and 1 month) and six inter-reward delays (3 days, 1 week, 10 days, 2 weeks, 3 weeks, and 1 month). Three additional choices were constructed specifically so that both options were within the same month in one of the survey waves but over different months in the other wave of the survey (available in Web Appendix B). As in the prior studies, we elicited participants' subjective financial time periods by having them categorize a list of twenty different times, displayed in the same format as the times in the intertemporal choices (i.e., a duration or date), into either the current or future financial period.

This design enabled us to distinguish between *cross-period* effects (based on subjective financial periods, as in the prior studies) and *cross-month* effects. Consider a participant taking the survey on August 4th, who reports having a two-week current financial period. A choice between $15 in a week (August 11th) and $20 in two weeks (August 18th) would be a cross-period choice based on self-reported subjective period but not based on a calendar month (e.g.,

both options are in the same month). Conversely, for a participant on August 21st whose current period was longer than two weeks, choosing between $15 in a week (August 28th) and $20 in two weeks (September 4th) would be a cross-month choice (based on crossing from August into September) but would not be a cross-period choice based on self-reported subjective financial periods.

Results

Overall Differences Based on Presentation Format and Survey Timing. Overall, we found more choices of the larger-later options in the date (vs. duration) conditions (proportion of larger-later options per-person, averaged over participants: $M_{\text{Date}} = 0.76$ vs. $M_{\text{Duration}} = 0.57$, Welch's t-test, $t(341.73) = 5.59$, $p < .001$), replicating prior research on duration vs. date asymmetry (Leboeuf 2006; Read et al. 2005). There was no significant main effect of survey timing ($M_{\text{Early Month}} = 0.65$ vs. $M_{\text{Late Month}} = 0.67$, $t(342.14) = -0.57$, $p = .57$).

The majority of participants (73%) reported subjective current financial periods that differed from the salient calendar period (end of the month). While subjective financial periods matched the end of the month more in the date condition (44%) than in the duration condition (10%, $\chi^2(1) = 47.05$, $p < .001$; see Web Appendix C for details), the majority of the participants in the date condition (56%) reported a current period different from the end of the month.

Cross-Period and Cross-Month Effects. As our main tests, we compared choices that did vs. did not span relevant boundaries, based on either participants' self-reported categorization or the end of the month, separately for the duration and date conditions, using linear regression

predicting choices of the larger later option with standard errors clustered at the participant level. We coded two variables: *CrossPeriod* to indicate choices between options that were in different (vs. the same) subjective financial periods for the person, and *CrossMonth*, indicating choices between options in different (vs. the same) months. We first separately tested the cross-period effect (Model 1 in Table 4) and then the cross-month effect (Model 2), controlling for whether the choice involved a present option (*Present*), as well as the length of the common delay and inter-reward delay, and survey date. We then tested both cross-period and cross-month effects in a single regression (Model 3).

In the duration condition, we replicate our prior findings of a cross-period effect ($B_{\text{CrossPeriod}}$ = -0.091, SE = 0.024, $t(5769)$ = -3.75, $p < .001$), with no additional effect of present bias (B_{Present} = 0.0082, SE = 0.011, $t(5769)$ = 0.74, p = .46; Model 1). By contrast, there was no detectable cross-month effect ($B_{\text{CrossMonth}}$ = -0.0016, SE = 0.013, $t(5769)$ = -0.13, p = .90; Model 2). The cross-period effect persists ($B_{\text{CrossPeriod}}$ = -0.091, SE = 0.024, $t(5768)$ = -3.74, $p < .001$; Model 3) controlling for the non-significant cross-month effect, consistent with most participants not using month-ends as their current financial period when timings were expressed as delays.

In the date condition, we again replicated a significant cross-period effect ($B_{\text{CrossPeriod}}$ = -0.064, SE = 0.022, $t(5604)$ = -2.92, p = .004; Model 1). Additionally, we found a significant cross-month effect ($B_{\text{CrossMonth}}$ = -0.039, SE = 0.014, $t(5604)$ = -2.87, p = .004; Model 2), suggesting that when outcome timing was presented as dates, people were less likely to choose the larger-later option when it crossed into a different month, all else equal.

Because the end of the month often coincided with the end of the subjective financial period in this condition, we included both cross-month and cross-period in a joint regression. We find a strongly significant effect of cross-period controlling for cross-month ($B_{\text{CrossPeriod}}$ = -0.061,

SE = 0.023, $t(5603) = -2.69$, $p = .007$) while the cross-month effect controlling for cross-period was marginally significant ($B_{CrossMonth} = -0.026$, SE = 0.014, $t(5603) = -1.91$, $p = .057$; Model 3). This result suggests that subjective financial period categorization and month boundaries had parallel but largely distinct effects on intertemporal choice when people were prompted to think in calendar terms by presenting outcomes as dates.[4]

TABLE 4

TEST OF CROSS-PERIOD AND CROSS-MONTH EFFECTS (STUDY 4)

	Duration Condition			Date Condition		
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
(Intercept)	0.80 (0.035)***	0.79 (0.035)***	0.80 (0.035)***	0.92 (0.033)***	0.91 (0.033)***	0.92 (0.033)***
Present	0.0082 (0.011)	0.016 (0.011)	0.0085 (0.011)	-0.011 (0.012)	-0.01 (0.011)	-0.014 (0.012)
CrossPeriod	-0.091 (0.024)***		-0.091 (0.024)***	-0.064 (0.022)**		-0.061 (0.023)**
CrossMonth		-0.0016 (0.013)	0.002 (0.013)		-0.039 (0.014)**	-0.026 (0.014)+
CommonDelay (in years)	0.85 (0.25)***	1.3 (0.22)***	0.85 (0.25)***	-0.43 (0.18)*	-0.26 (0.16)	-0.46 (0.18)*
InterrewardDelay (in years)	-6.2 (0.46)***	-6.9 (0.42)***	-6.2 (0.47)***	-4.0 (0.45)***	-4.1 (0.46)***	-3.8 (0.45)***
Late (vs. Early) Month	-0.001 (0.051)	0.00001 (0.05)	-0.0018 (0.05)	0.045 (0.047)	0.056 (0.047)	0.055 (0.046)

NOTE. Standard errors are in parentheses. +: $p < 0.1$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Discussion

This study demonstrates the robustness of the cross-period effect. We consistently replicate the cross-period effect on intertemporal choices, regardless of salient cues (timing of outcomes presented as durations vs. dates) and when controlling for cross-month effects and the time of the month the survey was conducted. Overall, these results suggest that the cross-period effect we have documented thus far reflects sensitivity to a relatively stable categorization of subjective financial periods and does not merely reflect the effect of calendar boundaries. We do

[4] We reach the same conclusions when using a random intercept model, which accounts for potential aggregation bias, instead of clustered standard errors to address repeated measures (reported in Web Appendix C).
In a pooled analysis, using both conditions in the same regression and interacting all variables from Model 3 in Table 4 with duration vs. date conditions, we did not find significant differences between the conditions in the magnitude of either the cross-period effect ($p = .36$) or the cross-month effect ($p = .13$).

find sensitivity to contextual cues: making calendar timing more salient does increase the overlap between subjective financial periods, and calendar boundaries and makes choices directionally more sensitive to whether the options cross calendar boundaries. Nevertheless, we still find dissociable separate cross-months and cross-period effects. This is consistent with the notion that both stable construal of categories (e.g., subjective financial periods) and salient context-specific factors are jointly relevant to categorization-related reasoning (Isaac and Schindler 2014; Medin et al. 2003).

Thus far, we have tested the cross-period effect relative to participants' actual self-reported subjective financial periods. In the final two studies, we employ a hypothetical scenario that enables us to experimentally manipulate the length of the current period, and thereby test the causal effect of differences in subjective financial periods on intertemporal choices.

STUDY 5: THE CAUSAL EFFECT OF FINANCIAL PERIOD CATEGORIZATION

To test for a causal effect of subjective financial period categorization on intertemporal choice, we presented participants with a novel scenario and instructed them to assume different hypothetical budget periods (2 vs. 6 weeks remaining). Participants then made scenario-specific intertemporal choices. According to cross-period discounting, we would expect people to discount differently when making choices for which manipulating the period boundary changes whether the options are cross-period (i.e., the choice options are in different periods in one condition but not the other). However, we would not expect the manipulation to impact intertemporal preferences in those choices where the manipulation does not affect whether the options are in different periods.

As a result, the manipulation would not necessarily make people more or less patient overall. For example, in our account, when making a choice between a smaller reward in one week and a larger reward in four weeks, participants who had been instructed that there are two weeks remaining in the current period would be less willing to wait (because the choice options are cross-period) than participants who were instead instructed that there are six weeks remaining (because both choice options are in the same period). However, a choice between rewards today or in one week would not be affected by the manipulation.

Method

We collected 601 valid complete surveys from Prolific. Participants were randomly assigned to one of two between-subjects conditions: a two-week-remaining or six-week-remaining current budget period. Participants first read the following, accompanied by a visual aid (Figure 3)*: "Imagine that you are using a budget planner that has eight weeks per page. For convenience, you balance the books every eight weeks in accordance with the planner's organization. [Six weeks/Two weeks] have already passed since you started the current budget period. Hence, the current budget period will end exactly [two weeks/six weeks] from today, as depicted in the picture below."*

Participants then reported the number of weeks remaining in the current budget period as a comprehension check. We held constant the total budget period at eight weeks in both conditions to avoid a potential confound (i.e., a longer total budget period signaling a longer time horizon in general).

FIGURE 3

HYPOTHETICAL BUDGET PERIODS IN STUDY 5

NOTE. Two-week current period condition (left) and six-week condition (right).

Choices. All participants answered 28 intertemporal choices, in a randomized order, each between $40 at a sooner time and $50 at a later time, with varying common delays and inter-reward delays (see Table 5 for the full set of choices). Fourteen of the choices served as *test choices* of the cross-period effect. Seven of these choices were designed so that the options crossed the two-week period boundary, but not the six-week period boundary ("cross-period in two-week condition"). Specifically, in each of these choices, the $40 option would be received at a specified time sooner than in two weeks, and the $50 option would be received at a specific later time, between two and six weeks from now. In a similar manner, another seven choices were instead designed so that the options crossed the six-week period boundary, but not the two-week period boundary ("cross-period in six-week condition").

The remaining 14 choices constituted *control choices*, in which the options did not cross either a two-week or six-week boundary. Specifically, in five of the choices both options were always in the current period (in less than two weeks; "current period in both conditions"), in another five choices both options were in the current period in the six-week condition but in the

next period in the two-week condition (between the two weeks and six weeks from now; "next period in two-week condition and current period in six-week condition"), and both options were always in the next period (more than six weeks from now) in the remaining four choices ("next period in both conditions").

TABLE 5

LIST OF CHOICES IN STUDY 5

	Test Choices			Control Choices	
	Smaller-sooner option (SS) time ($40)	**Larger-later option (LL) time ($50)**		**Smaller-sooner option (SS) time ($40)**	**Larger-later option (LL) time ($50)**
Cross-period in 2-week condition	today	in 2 weeks and 1 day	Current period in both conditions	today	in 1 week
	today	in 3 weeks		today	in 1 week and 3 days
	in 3 days	in 2 weeks and 4 days		in 3 days	in 1 week and 3 days
	in 3 days	in 3 weeks and 3 days		in 3 days	in 1 week and 6 days
	* in 1 week	in 2 weeks and 3 days		in 1 week	in 2 weeks
	* in 1 week	in 3 weeks and 1 day	Next period in 2-week/ current period in 6-week cond.	in 4 weeks	in 5 weeks
	in 1 week	in 4 weeks		in 4 weeks	in 5 weeks and 3 days
Cross-period in 6-week condition	* in 4 weeks	in 6 weeks and 1 day		in 4 weeks and 3 days	in 5 weeks and 3 days
	in 4 weeks	in 7 weeks		in 4 weeks and 3 days	in 5 weeks and 6 days
	in 4 weeks and 3 days	in 6 weeks and 4 days		in 4 weeks and 5 days	in 5 weeks and 5 days
	in 4 weeks and 3 days	in 7 weeks and 3 days	Next period in both conditions	in 6 weeks and 1 day	in 7 weeks and 1 day
	* in 4 weeks and 5 days	in 6 weeks and 1 day		in 6 weeks and 1 day	in 7 weeks and 4 days
	in 4 weeks and 5 days	in 6 weeks and 6 days		in 6 weeks and 1 day	in 8 weeks and 2 days
	in 4 weeks and 5 days	in 7 weeks and 5 days		in 6 weeks and 1 day	in 9 weeks and 1 day

NOTE. Total 28 choices. *: Choices used for the analyses of process measures.

Process Measures. As in Study 3, we collected process measures for a targeted subset of the choices. We selected two choices that would be cross-period only in the two-week condition ($40 in 1 week vs. $50 in 2 weeks and 3 days, $40 in 1 week vs. $50 in 3 weeks and 1 day) and two that would be cross-period only in the six-week condition ($40 in 4 weeks vs. $50 in 6 weeks and 1 day, $40 in 4 weeks and 5 days vs. $50 in 6 weeks and 1 day).

For each of these four choices, participants answered four of the potential process measures from Study 3: two measures of perceived fungibility (impact of timing on spending and impact on managing finances), perceived duration of the interval between the options, and usefulness of money (excluding perceived resource slack, because we found no effect of period-crossing in Study 3). The measures were nearly identical to Study 3, except that we asked

participants to think about receiving an extra $50 in the perceived fungibility and usefulness measures.

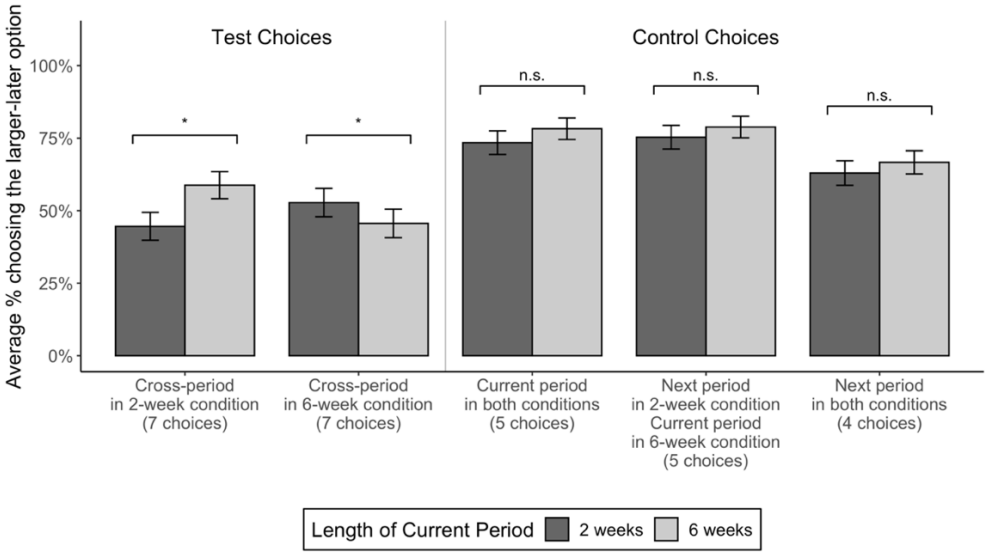
Results

Cross-Period Effect. We tested for the overall cross-period effect using regression analysis. We predicted participants' choices by whether the choice was cross-period in that participant's randomly assigned condition, controlling for the main effect of conditions, fixed effects for choices (to account for the different delays associated with each choice), and clustered standard errors at the participant level. We again found a significant cross-period effect ($B_{\text{CrossPeriod}}$ = -0.11, SE = 0.013, t(16798) = -8.11, p < .001), suggesting that preference for the larger-later option in a choice was on average 11% lower in the condition in which that choice's options were in different (vs. the same) periods. There was no significant effect of condition ($B_{6 \text{ week (vs. 2 week)}}$ = 0.038, SE = 0.027, t(16798) = 1.39, p = .16), suggesting that the manipulated remaining length of the current period did not make participants substantially more or less impatient overall, but affected choices only by changing whether the options were viewed as cross-period or not.

Specifically, as shown in Figure 4, people were less likely to choose the larger-later option in the two-week-remaining condition than in the six-week-remaining condition for choices that only crossed the two-week period ($M_{2 \text{ weeks}}$ = 0.45 vs. $M_{6 \text{ weeks}}$ = 0.59, t(597.48) = -4.15, p < .001). The opposite pattern was observed for choice options that only crossed the six-week period, with greater patience in the two-week-remaining condition ($M_{2 \text{ weeks}}$ = 0.53 vs. $M_{6 \text{ weeks}}$ = 0.46, t(598.82) = 2.037, p = .042).

FIGURE 4

CHOICE PROPORTIONS BASED ON LENGTH OF CURRENT PERIOD (STUDY 5)



NOTE. *: $p < .05$ (t-test). Error bars show 95% confidence intervals.

By contrast, there was no significant difference between the conditions in any of the three sets of control choices (both options in the current period in both conditions: 0.73 vs. 0.78, $t(591.24) = -1.72$, $p = .085$; both options in the next period in the two-week condition but in the current period in the six-week condition: 0.75 vs. 0.79, $t(590.85) = -1.25$, $p = .21$; both options in the next period in both conditions: 0.63 vs. 0.67, $t(596.17) = -1.25$, $p = .21$).[5]

Mediation. The internal consistency between the two measures of perceived fungibility (perceived impact on spending and impact on managing finances) was high (Cronbach's alpha = .89). As pre-registered, we averaged these measures into a single index of perceived nonfungibility. In a regression predicting choices, the variance inflation factors (VIFs) of the composite non-fungibility variable (1.36), perceived duration (1.39), and usefulness (1.04) were

[5] We found similar results in an exact replication study (N=532, Web Appendix D).

close to 1, confirming that these variables have independent explanatory variance, as in Study 3 (bivariate correlations and factor analyses results are available in Web Appendix C).

We first confirmed the significant cross-period effect on the four focal choices that we used to test the potential mechanism ($B_{\text{CrossPeriod}}$ = -0.11, SE = 0.016, t(2398) = -6.98, p < .001). Further, we found that period-crossing also significantly affected perceived fungibility, such that consumers perceived a larger impact on their spending and finances when the choices spanned across different financial periods compared to when they were within the same period ($B_{\text{CrossPeriod}}$ = 0.51, SE = 0.072, t(2398) = 7.18, p < .001). A follow-up mediation analysis confirmed that perceived fungibility significantly mediated the cross-period effect on choice, explaining about 30% of the total effect (Table 6 (a)).

Similarly, participants also reported perceiving the duration between the options to be longer when they occurred in different budget periods ($B_{\text{CrossPeriod}}$ = 2.87, SE = 0.69, t(2398) = 4.14, p < .001). Perceived duration, in turn, also significantly mediated the cross-period effect on choice, explaining about 20% of the total effect. We did not find a significant cross-period effect on the usefulness of money ($B_{\text{CrossPeriod}}$ = -0.095, SE = 0.08, t(2398) = -1.18, p = .24) and found no significant indirect effect of usefulness of money.

To test the extent to which perceived fungibility explained the cross-period effect beyond what is accounted for by perceived duration, we conducted additional mediation analyses for each of the measures, controlling for the other measure (Table 6 (b)-(c)). Perceived fungibility had a significant indirect effect, controlling for perceived duration, and vice versa, perceived duration also had a significant indirect effect, controlling for perceived fungibility. These results suggest that the cross-period effect is multiply determined, with cross-period differences in both perceived fungibility and perceived duration independently contributing to the effect.

TABLE 6

MEDIATION ANALYSES RESULTS (STUDY 5)

		Non-fungibility (combined)	**Perceived duration**	**Usefulness**
(a) Without control	Indirect effect (% mediated)	-0.034 (30%)	-0.022 (19.3%)	-0.004 (3.1%)
	95% Bootstrap CI	[-0.048, -0.019]	[-0.038, -0.006]	[-0.011, 0.005]
(b) Controlling for perceived duration	Indirect effect (% mediated)	-0.019 (20%)		-0.002 (2.4%)
	(95% Bootstrap CI)	[-0.027, -0.009]		[-0.007, 0.003]
(c) Controlling for perceived non-fungibility	Indirect effect (% mediated)		-0.017 (21%)	-0.003 (3.6%)
	(95% Bootstrap CI)		[-0.029, -0.004]	[-0.009, 0.004]

Discussion

Study 5 presents a precise causal test of the proposed cross-period effect. Manipulating the relevant financial period, we find that intertemporal choices differ by condition only in the test trials in which the manipulation shifted the cross-period timing, but not in the control trials. In particular, prompting people to adopt a longer current period for the task did not make them more or less patient overall. This potentially contrasts with some predictions, that when people believe that the "present" ends sooner, they will be more likely to make future-oriented choices, such as saving (Hershfield and Maglio 2020).

This study also provides additional evidence for mental accounting as a causal mechanism underlying time discounting and contributing to time-inconsistent choices: Different current budget periods influenced perceived fungibility of money across the options and explained the cross-period effect, without necessarily affecting the perception of the usefulness of money at different times (c.f., Study 3), beyond what can be explained by differences in the perceived duration between the options.

STUDY 6: BEYOND THE CURRENT BUDGET PERIOD

Thus far, in the studies that measured (studies 2-4) and manipulated (study 5) the subjective current financial period, our primary analyses distinguished between the current period and a future period, with all outcomes not in the current period treated as if they occur in the *same* future financial period. We took this simplified approach because we expected the duration of the current financial budget period to be particularly salient and relevant for financial decision-making. However, people may budget for more than one period ahead, distinguishing not only between the current period and the subsequent period, but also between a subsequent period and the one or more after that. To the degree that people think about their finances in terms of multiple periods, boundaries between different future subjective financial periods could similarly reduce patience for choices in which the options are on opposite sides of the boundary. Our exploratory result in Study 2 offered initial evidence of a multi-period effect, as participants who considered the options to be in different future periods were more impatient than those who considered them to be in the same future period.

In Study 6, we extended the design of Study 5 to test the generalizability of the cross-period effect to different future financial periods. As a conservative test, we used the same type of manipulation of the boundary between current and subsequent financial periods as in Study 5 but included intertemporal choice questions such that options involved times beyond the first (current) and second budget periods. This allows us to test whether people spontaneously extrapolate and are sensitive to the implied boundaries between future financial periods (e.g., the boundary between the first and second future budget periods).

Method

We collected 419 valid complete surveys from MTurk. We only excluded participants who failed the instructional attention check, to avoid a potential selective attrition bias (Zhou and Fishbach 2016), but the results were similar when excluding based on an additional attention check about the stimuli, as pre-registered.[6] Participants were randomly assigned to one of two conditions, either two-weeks-remaining or six-weeks-remaining in the current budget period. They were presented with the same instructions as in Study 5, except that the budget planner had six weeks per page in total. They made 64 intertemporal choices in randomized order.

As in Study 5, we employed a mix of intertemporal choices that varied in whether the options crossed a budget period boundary (and for which period) in a given condition (see Web Appendix B for the full list). Some choice options only crossed a boundary in the two-week condition ("cross-period in two-week condition," 15 choices), others in the six-week condition only ("cross-period in six-week condition," 5 choices), and others did not cross a boundary in either condition ("same period in both conditions," 28 choices). Extending Study 5, we predict higher impatience in the conditions in which a set of choices are categorized as cross-period, compared to the other condition, in which the same set of choices are categorized as same-period (test choices). By contrast, we predict no effect of condition for the sets of choices for which both options were in the same period in both conditions (control choices). Additionally, we included 16 choices that constitute a second type of control choice, different from those in Study

[6] Our original pre-registration did not clearly specify the role of future budget period boundaries and only addressed the distinction between current and future budget periods. An analysis that only coded for the current and future period distinction would be confounded by different future budget periods. The analyses we report here account for the future budget periods, and we therefore consider them to be more correct.

5, where the two options in each choice were in different periods consistently in both conditions ("cross-period in both conditions").

A subset of these choices allows us to evaluate participants' sensitivity to crossing specifically *future* financial boundaries. For three choices, the options crossed the boundary between the second and third periods in the two-week condition and did not cross any boundary in the six-week condition ("future-crossing in two-week condition and non-crossing in six-week condition"). Conversely, for six other choices, the options crossed a future-period boundary in the two-week condition (i.e., between the second and third periods) but crossed the current-period boundary in the six-week condition ("future-crossing in two-week condition and current-crossing in six-week condition").

Our general cross-period discounting framework predicts more impatience in the two-week condition for the three future-crossing vs. non-crossing choices (i.e., because a future boundary is crossed in the two-week condition but not in the six-week condition). By contrast, our account predicts no difference in patience between conditions for the six future-crossing vs. current-crossing choices. However, if people are only sensitive to crossing the current period boundary but are not sensitive to future period boundaries (e.g., as in an account of present bias that defines the current period as the present), we should observe the exact opposite effects. Specifically, we should see no differences in the three future-crossing vs. non-crossing choices because the choices do not differ in terms of crossing the *current* period boundary across the two-week and six-week conditions. By contrast, participants in the six-week condition should be more impatient in the six future-crossing vs. current-crossing choices because the choices are cross-period relative to the current period boundary in the six-week condition, but not in the two-week condition.

Results

Using a similar regression framework as in Study 5, we replicated the cross-period effect based on crossing any (either current or future) period boundaries ($B_{\text{CrossPeriod}}$ = -0.099, SE = 0.015, t(26750) = -6.77, p < .001), representing a 10% lower preference for the larger-later option in cross-period choices on average. We found no overall effect of conditions ($B_{\text{6 week (vs. 2 week)}}$ = 0.021, SE = 0.027, t(26750) = 0.77, p = .44).

To test whether the cross-period effect extends to crossing future period boundaries, we repeated the regression analysis, separately defining one variable for crossing the current period boundary only (*CrossCurrentPeriod)* and another for crossing the boundary between any two future periods (*CrossFuturePeriod*). We find a significant effect of both types of cross-period effects ($B_{\text{CrossCurrentPeriod}}$ = -0.10, SE = 0.015, t(26749) = -6.70, p < .001; $B_{\text{CrossFuturePeriod}}$ = -0.087, SE = 0.023, t(26749) = -3.73, p < .001). Adding *CrossFuturePeriod* significantly improved the fit of the baseline model with only *CrossCurrentPeriod* ($\chi^2(1) = 24.31$, p < .001). These results suggest that the cross-period effect is not limited to crossing the current period but extends to boundaries between subsequent periods.

We also investigated the specific choices which provide a direct test of sensitivity to future financial period boundaries. For the three future-crossing vs. non-crossing choices, participants in the two-week condition, for whom the choices crossed a future period boundary, were significantly less likely to choose the larger-later option than those in the six-week condition, for whom both options were in the second period (0.43 vs. 0.53, t(416.62) = -2.40, p = .017). This result is consistent with a general definition of cross-period discounting, in which people are sensitive to future financial period boundaries.

By contrast, there was no significant difference between the conditions in the six future-crossing vs. current-crossing choices (0.28 vs. 0.30, $t(416.81) = -0.44$, $p = .66$), consistent with similar sensitivity to both current and future boundaries in cross-period discounting. This pattern of results is the opposite of what would be predicted if people specifically valued outcomes in the current period more (i.e., if they were "present-biased" with regards to the "present" period) but were not sensitive to differences between subsequent periods.

Discussion

We replicated the causal current vs. future cross-period effect from Study 5 and extended the findings to a further cross-period effect across boundaries between future periods. The additional discounting over future periods cannot be explained by present bias (which assumes additional discounting only after the present period) or other existing accounts of non-stationary time discounting. Our findings suggest that cross-period impatience, as we have theorized, is not only relevant to correcting our understanding of "present" bias but can more broadly explain discontinuities in people's intertemporal preferences.

GENERAL DISCUSSION

Trading off benefits that occur at different times is a fundamental feature of many consumer financial decisions. By foregoing a smaller benefit that would occur sooner, consumers are often able to receive a larger benefit later. For example, choosing an advanced tax refund incurs fees or interest payments, reducing the total amount, as opposed to waiting to receive the

full amount later. When consumers are time-inconsistent in these intertemporal choices, such that they make different choices about trading off a fixed delay depending on how far off the options are in the future, their preferences at the time of choice may not represent their general preferences, leading to short-sighted behavior and subsequent regret.

Time-inconsistent preferences have typically been attributed to present bias. In this interpretation, which has been widely used as a model of a more general self-control failure (Ainslie 1975; Hoch and Loewenstein 1991), people have an impulsive preference for present outcomes. Present bias has been widely proposed as a model of many decisions consequential for consumers' well-being, such as home financing, credit card debt, investment in education, and retirement savings. Some tests of the common delay effect have provided support for this view, by showing that people are more likely to choose a sooner outcome when it is in the present (e.g., as opposed to an equivalent trade-off between two options that are both in the future). However, the prior literature, including formal models, has left the timing of a "present" outcome undefined, typically assuming that outcomes involving even a brief delay (e.g., after a few hours, or the next day) are no longer favored as being in the present.

The Cross-Period Effect and Mental Accounting of Time

We find that people's intertemporal preferences are not well explained by prior theories involving impulsivity and present bias. We find no significant evidence for the shifts in preference when adding moderate delays to both options (i.e., common delays) that would be predicted by present bias (e.g., higher discounting for outcomes delayed from the present). Instead, we find a reliable increase in patience only for the longer common delays (e.g., more

than a month) that better correspond to differences in people's subjective financial planning periods (Studies 1-2).

We propose and find evidence for *cross-period impatience*, in which decision makers are more impatient specifically when choice options fall on different sides of the boundary between their own subjective financial periods (Studies 2-3), which is robust to time of month and presentation mode (duration vs. date, Study 4). Further, we find causal effects of shifting the boundary between financial periods, experimentally manipulating financial budgeting periods in a decision scenario (Studies 5-6). We find that the effect is partially mediated by consumer perceptions of cross-period options as less fungible with each other, even controlling for perceived time, which also contributes to the effect (Studies 3, 5).

Implications for Short-Sighted Consumer Decision-Making

Intertemporal Choice. Our findings, including that people have heightened impatience when choosing between options that span two future financial periods (Studies 2 and 6) and that people are also sensitive to timing within a financial period, contradict widely used models of present bias, such as the quasi-hyperbolic model (see Web Appendix F for a more detailed discussion). The cross-period effect may also help account for other prior findings that contradict standard models, such as the lack of a common delay effect in some studies with short delays and even instances of *reverse* time inconsistency (greater impatience with a common delay; Read 2001), depending on the timing of people's subjective financial periods (see additional results from Study 5 in Web Appendix C for an example).

Our cross-period discounting framework may also be relevant to prior findings of

heterogeneity across participants in their present bias. For example, differences across people in the common delay until a preference reversal (Kirby and Herrnstein 1995) may be explained by heterogeneity in the subjective current financial period. More generally, heterogeneity in discount rates may confound differences in patience with differences in financial periods, particularly when using a single item or a limited set of items that do not sufficiently vary in timing. Additional research would be needed to develop a fully detailed framework for predicting intertemporal preferences, including extending the findings to other kinds of choices (e.g., including losses), a more limited form of present bias (e.g., impatience for "as short as possible" delays, such as the end of the experiment vs. end of the day; Balakrishnan, Haushofer and Jakiela 2020; Imai, Rutter and Camerer 2021), and identifying whether people are differentially sensitive to different financial period boundaries (e.g., current vs. future period boundaries, or multiple boundaries).

Impulsivity and Self-control. Present bias has often been described as a failure of self-control, occurring due to a variety of factors, including greater temptation and emotional processing of immediate outcomes and undervaluing future outcomes. Our research suggests that, instead of consistently undervaluing future outcomes, consumers behave as if outcomes that are in different periods are less fungible, resulting in a lower valuation when the future outcome is in another subjective period. This suggests the need for future research to move beyond the use of time-discounting as a metaphor for self-control and instead distinguish between these psychological constructs and their potentially distinct consequences for consumer decisions.

In particular, attempts to correct consumers' present-biased preferences have focused on reducing impulsivity and shortsightedness, and on putting the future on an "equal footing"

psychologically with the present (e.g., via mental construal of outcomes, Zhao, Hoeffler and Zauberman 2007; salience of future preferences, Hershfield et al. 2011). Our findings suggest a different set of approaches, such as shifting how time is categorized, reducing the reliance on categorization in intertemporal decisions, or changing the salience of time-period boundaries.

Consumer Budgeting. Inconsistent time preferences may also be a consequence of an otherwise beneficial heuristic, with consumers consistently using subjective periods as mental accounts to simplify managing their finances. These subjective periods may be relatively stable goal-derived categories, rather than ad hoc categorizations that are constructed as needed. Consistent with this view, the cross-period effect is largely robust to contextual cues (e.g., salient month boundary in date formats, Study 4) and framing or salience manipulations (additional studies described in Web Appendix G).

Thus, our findings suggest a need to better understand how people mentally budget across time periods and the factors that determine people's subjective financial periods. Survey evidence from Zhang et al. (2022) shows that people vary in their budget period, and further finds a correlation between their budget period and pay frequencies, suggesting that financial periods may be determined in part by fixed timing aspects of the consumers' financial situation. However, in a supplementary study (Web Appendix E), we find that subjective financial periods are largely stable over time for many people (two-week apart test-retest $r = .80$), consistent with many consumers reporting their subjective financial periods as the same length of time from the current day, despite time having passed. The possibility that the subjective current period may often be *rolling* (i.e., having approximately the same length regardless of the current date, as opposed to ending at a *fixed* point in time) is consistent with Lynch et al. (2010)'s finding that

consumers' propensity to plan for a given time horizon remains largely consistent over time. Future research should investigate the causes of heterogeneity in the length and type of consumers' subjective financial periods.

Consumer Behavior. Consumers' mental accounting of time can have broad consequences for their financial behavior (De La Rosa and Tully 2022; Donnelly et al. 2022; Zhang 2017). Our findings have important implications for firms and policymakers facing trade-offs between consumers' impatience and other factors. Viewing consumers through the lens of present bias may create a mistaken belief that providing immediacy will be disproportionately valued by consumers. This may lead firms to over-value the benefit of providing financial resources (e.g., rebates, refunds, incentives) to consumers immediately, when consumers may in fact be relatively patient as long as the benefits are received sometime during their current financial period. Firms and policymakers may be able to leverage this, based on an understanding of the length of consumers' current period, by incorporating it into modeling and predicting consumers' valuations to schedule benefits late in the current period but payments early in the subsequent period. This may require testing the implications of our framework in a broader range of settings, including those involving losses as well as gains.

The current research has focused specifically on financial choices in the domain of gains, and future research could further explore whether the use of categorization of time in intertemporal choice extends beyond the financial domain. While the construct of present bias has been widely applied across financial and non-financial contexts, prior research has neither precisely defined the present nor considered the possibility of a domain-specific present period. It is possible that people use a different, domain-specific categorization scheme for other

domains. In the context of consumer goods, expediting delivery can be nonlinearly costly, such that further reducing delivery times becomes disproportionately more expensive. While faster shipping may be a competitive advantage overall, it is notable that the "immediate gratification" business model (e.g., Kozmo.com, Bensinger 2012) has not proven viable. To the degree that our cross-period discounting framework extends to the timing of non-financial tangible goods, it would suggest that consumers may have a "current period" during which they are less sensitive to the precise timing of when goods are received. Firms might be better off providing "just-in-time" delivery (e.g., "Amazon Day Delivery" that includes a feature allowing customers to choose their delivery date), rather than expediting delivery across the board.

Our research provides a new perspective on intertemporal choices, based on the mental accounting of time, explaining choices that seem like present bias as instead due to cross-period differences in evaluations of delayed rewards. Our results suggest that people are particularly likely to make more impatient choices when one option is seen as in an earlier financial period than another. In effect, consumers are often quite willing to wait, as long as doing so doesn't relegate a desirable outcome to an entirely different financial period. One key to understanding and addressing short-sighted consumer behaviors may lie in identifying how consumers idiosyncratically partition time into financial periods.

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Cross-Period Impatience: Subjective Financial Periods Explain Time-Inconsistent Choices

WEB APPENDIX

This Web Appendix includes supplementary information to the studies presented in the main text. Additional information (e.g., exploratory analyses, pre-registered analyses not discussed in the manuscript) and supplementary studies are available on the OSF repository (osf.io/xb458/?view_only=832be76abf8f4e56bb7b3750a50ab483, or tinyurl.com/crossperiod).

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WEB APPENDIX A. EXCLUSION OF PARTICIPANTS

Study	Complete[1]	Passed attention check(s)[2]	Current period identified[3]	Final sample	Note (demographics and pre-registration)
Study 1	1319	1318	N/A	1318	51% women (11 other) M_{age} = 40.25, SD_{age} = 12.96 https://aspredicted.org/D6V_4DK
Study 2	1406	1338	N/A	1338	57% women (16 other) M_{age} = 40.93, SD_{age} = 12.87 https://aspredicted.org/KRG_1XG
Study 3	544	541	519	Part 1: 519 Part 2: 403[4]	54% women (5 other) M_{age} = 41.26, SD_{age} = 13.24 https://aspredicted.org/8X8_T9N
Study 4	435	403[5]	345	345	56% female M_{age} = 32.52, SD_{age} = 12.55 https://aspredicted.org/VQH_UIM
Study 5	642	601[6]	N/A	601	49% women (13 other; recruited a gender balanced sample) M_{age} = 35.31, SD_{age} = 13.26 https://aspredicted.org/LY2_58Y
Study 6	425	419[7]	N/A	419	41% female (4 other) M_{age} = 36.60, SD_{age} = 11.86 https://aspredicted.org/HAE_GJQ

[1] Complete from unique IP addresses
[2] Instructional attention check (Oppenheimer, Meyvis, and Davidenko 2009)
[3] A participant's current-future financial period categorization was considered valid if the boundary between the current and future financial periods could be identified (i.e., meeting the following criteria: a. today is categorized as belonging to the current period, b. if a time is categorized to be in one's future period, no later time can be in the current period, c. at least one time is categorized as belonging to a future period).
[4] Participants who demonstrated time inconsistency in the set of choices with either 1-month or 6-month inter-reward delay and to be included in the analyses of potential processes
[5] Based on two types of attention checks: general instructional attention check and reporting today's date (only included if it matches the actual date of the survey)
[6] Based on two types of attention checks: general instructional attention checks (three attention checks throughout the survey) and an attention check about the stimuli (report the length of the current period provided in the scenario)
[7] Study 6 included both a general instructional attention check and an attention check about the stimuli, but only the instructional attention check was used due to the asymmetric attrition rate from the stimuli attention check. The results are similar, however, even when we exclude participants based on this check (Web Appendix C).

WEB APPENDIX B. SAMPLE STIMULI AND QUESTIONS

Complete surveys are available on the OSF repository (tinyurl.com/crossperiod).

Example of Current-Future Period Boundary Elicitation (below is from Study 3):
When you think about financial matters, such as financial planning or budgeting, how do you think about the current financial period and future financial periods?

For each of the following times, please indicate whether you would consider that time part of the current financial period, or part of a future financial period.

	Current financial period	Future financial period
Today	○	○
One week from now	○	○
One month from now	○	○
Three months from now	○	○
Six months from now	○	○
One year from now	○	○
Five years from now	○	○

List of Intertemporal Choices in Study 3:

No.	Smaller-sooner option timing (SS time)	Larger-later option timing (LL time)
1	today	in a week (1 week)
2	in a week (1 week)	in two weeks (2 weeks)
3	in a month (about 4.5 weeks)	in a month and a week (about 5.5 weeks)
4	in six months (about 26 weeks)	in six months and a week (about 27 weeks)
5	in a year (about 52 weeks)	in a year and a week (about 53 weeks)
6	in five years (about 260 weeks)	in five years and a week (about 261 weeks)
7	today	in a month (about 4.5 weeks)
8	in a week (1 week)	in a month and a week (about 5.5 weeks)
9	in a month (about 4.5 weeks)	in two months (about 9 weeks)
10	in six months (about 26 weeks)	in seven months (about 30.5 weeks)
11	in a year (about 52 weeks)	in a year and a month (about 56.5 weeks)
12	in five years (about 260 weeks)	in five years and a month (about 264.5 weeks)
13	today	in six months (about 26 weeks)
14	in a week (1 week)	in six months and a week (about 27 weeks)
15	in a month (about 4.5 weeks)	in seven months (about 30.5 weeks)
16	in six months (about 26 weeks)	in a year (about 52 weeks)
17	in a year (about 52 weeks)	in a year and six months (about 78 weeks)
18	in five years (about 260 weeks)	in five years and six months (about 286 weeks)
19	today	in a year (about 52 weeks)
20	in a week (1 week)	in a year and a week (about 53 weeks)
21	in a month (about 4.5 weeks)	in a year and a month (about 56.5 weeks)
22	in six months (about 26 weeks)	in a year and six months (about 78 weeks)
23	in a year (about 52 weeks)	in two years (about 104 weeks)
24	in five years (about 260 weeks)	in six years (about 312 weeks)
25	today	in five years (about 260 weeks)
26	in a week (1 week)	in five years and a week (about 261 weeks)
27	in a month (about 4.5 weeks)	in five years and a month (about 264.5 weeks)
28	in six months (about 26 weeks)	in five years and six months (about 286 weeks)
29	in a year (about 52 weeks)	in six years (about 312 weeks)
30	in five years (about 260 weeks)	in ten years (about 520 weeks)

NOTE. For each participant, process variables were measured on either choices 7-12 (one-month inter-reward delay) or 13-18 (six-month inter-reward delay).

Measurement of Potential Process Variables in Study 3:

Construct		Measure	Scale
Perceived non-fungibility	Impact on spending	*Would it make much of a difference for how you spend an extra $20 if you were to get it [SS time] or instead get it [LL time]*	1: makes no difference for how I would spend it 10: makes a big difference for how I would spend it
	Impact on managing finances	*Would it make much of a difference for how you manage your finances and for meeting your financial goals if you were to get an extra $20 [SS time] or instead get the extra $20 [LL time]?*	1: makes no difference for managing my finances 10: makes a big difference for managing my finances
Usefulness of money		*Between having an extra $20 [SS time] and having an extra $20 [LL time], which do you think would be more useful to you?*	-5: Having $20 in [SS time] is more useful 0: About the same 5: Having $20 in [LL time] is more useful
Perceived financial slack (Zauberman and Lynch 2005)		*Think about your likely expenses and your available spare money [SS time] and [LL time]. On which day do you expect to have more financial reserves?"*	-5: Much more money available in [SS time] 0: About the same 5: Much more money available in LL time]
Perceived duration (Donnelly et al. 2021; May 2017; Zauberman et al. 2009)		*How long does the duration between the time [SS time] and the time [LL time] feel? In other words, how close or far do you feel the times "[SS time]" and "[LL time]" are from each other?*	0: very short (very close to each other) 100: very long (very far from each other) (on a slider)

List of Intertemporal Choices in Study 4:

No	SS time ($15)	LL time ($20)	Date of SS (early-month)	Date of LL (early-month)	Date of SS (late-month)	Date of LL (late-month)
1	today	in 3 days	August 4, 2020	August 7, 2020	August 21, 2020	August 24, 2020
2	today	in 1 week	August 4, 2020	August 11, 2020	August 21, 2020	August 28, 2020
3	today	in 10 days	August 4, 2020	August 14, 2020	August 21, 2020	August 31, 2020
4[1]	today	in 11 days	August 4, 2020	August 15, 2020	August 21, 2020	September 1, 2020
5	today	in 2 weeks	August 4, 2020	August 18, 2020	August 21, 2020	September 4, 2020
6	today	in 3 weeks	August 4, 2020	August 25, 2020	August 21, 2020	September 11, 2020
7	today	in 1 month	August 4, 2020	September 4, 2020	August 21, 2020	September 21, 2020
8	in 3 days	in 6 days	August 7, 2020	August 10, 2020	August 24, 2020	August 27, 2020
9	in 3 days	in 10 days	August 7, 2020	August 14, 2020	August 24, 2020	August 31, 2020
10[1]	in 3 days	in 11 days	August 7, 2020	August 15, 2020	August 24, 2020	September 1, 2020
11	in 3 days	in 13 days	August 7, 2020	August 17, 2020	August 24, 2020	September 3, 2020
12	in 3 days	in 2 weeks and 3 days	August 7, 2020	August 21, 2020	August 24, 2020	September 7, 2020
13	in 3 days	in 3 weeks and 3 days	August 7, 2020	August 28, 2020	August 24, 2020	September 14, 2020
14	in 3 days	in 1 month and 3 days	August 7, 2020	September 7, 2020	August 24, 2020	September 24, 2020
15	in 1 week	in 10 days	August 11, 2020	August 14, 2020	August 28, 2020	August 31, 2020
16[1]	in 1 week	in 11 days	August 11, 2020	August 15, 2020	August 28, 2020	September 1, 2020
17	in 1 week	in 2 weeks	August 11, 2020	August 18, 2020	August 28, 2020	September 4, 2020
18	in 1 week	in 2 weeks and 3 days	August 11, 2020	August 21, 2020	August 28, 2020	September 7, 2020
19	in 1 week	in 3 weeks	August 11, 2020	August 25, 2020	August 28, 2020	September 11, 2020
20	in 1 week	in 4 weeks	August 11, 2020	September 1, 2020	August 28, 2020	September 18, 2020
21	in 1 week	in 1 month and 1 week	August 11, 2020	September 11, 2020	August 28, 2020	September 28, 2020
22	in 2 weeks	in 2 weeks and 3 days	August 18, 2020	August 21, 2020	September 4, 2020	September 7, 2020
23	in 2 weeks	in 3 weeks	August 18, 2020	August 25, 2020	September 4, 2020	September 11, 2020
24	in 2 weeks	in 3 weeks and 3 days	August 18, 2020	August 28, 2020	September 4, 2020	September 14, 2020
25	in 2 weeks	in 4 weeks	August 18, 2020	September 1, 2020	September 4, 2020	September 18, 2020
26	in 2 weeks	in 5 weeks	August 18, 2020	September 8, 2020	September 4, 2020	September 25, 2020
27	in 2 weeks	in 1 month and 2 weeks	August 18, 2020	September 18, 2020	September 4, 2020	October 5, 2020
28	in 1 month	in 1 month and 3 days	September 4, 2020	September 7, 2020	September 21, 2020	September 24, 2020
29	in 1 month	in 1 month and 1 week	September 4, 2020	September 11, 2020	September 21, 2020	September 28, 2020
30	in 1 month	in 1 month and 10 days	September 4, 2020	September 14, 2020	September 21, 2020	October 1, 2020
31	in 1 month	in 1 month and 2 weeks	September 4, 2020	September 18, 2020	September 21, 2020	October 5, 2020
32	in 1 month	in 1 month and 3 weeks	September 4, 2020	September 25, 2020	September 21, 2020	October 12, 2020
33	in 1 month	in 2 months	September 4, 2020	October 4, 2020	September 21, 2020	October 21, 2020

NOTE. Participants in the date condition were shown the dates corresponding to their survey date condition.

[1] Additional choices not constructed from crossing the five common delays (today, 3 days, 1 week, 2 weeks, and 1 month) and six inter-reward delays (3 days, 1 week, 10 days, 2 weeks, 3 weeks, and 1 month).

List of Intertemporal Choices in Study 6 (64 Choices):

(a) Test Choices

	Smaller-sooner option (SS) time ($40)	Larger-later option (LL) time ($50)	Period crossing in 2-week condition	Period crossing in 6-week condition
Cross-period in 2-week condition	today	in 3 weeks	Crossing current period	Non-crossing
	today	in 4 weeks		
	today	in 6 weeks		
	in 3 days	in 2 weeks and 3 days		
	in 3 days	in 3 weeks and 3 days		
	in 3 days	in 4 weeks and 3 days		
	in 5 days	in 2 weeks and 5 days		
	in 5 days	in 3 weeks and 5 days		
	in 5 days	in 4 weeks and 5 days		
	in 1 week	in 3 weeks		
	in 1 week	in 4 weeks		
	in 1 week	in 5 weeks		
	[1] in 7 weeks	in 9 weeks	Crossing future (second) period	
	[1] in 7 weeks	in 10 weeks		
	[1] in 7 weeks	in 11 weeks		
Cross-period in 6-week condition	in 3 weeks	in 7 weeks	Non-crossing	Current period
	in 4 weeks	in 7 weeks		
	in 4 weeks	in 8 weeks		
	in 5 weeks	in 7 weeks		
	in 5 weeks	in 8 weeks		

[1] Choices used to test the effect of future budget period boundaries, where the options crossed the boundary between the second and third periods in the two-week condition and did not cross any boundary in the six-week condition ("future-crossing in two-week condition and non-crossing in six-week condition").

(b) Control Choices: Cross-Period in Both Conditions

	Smaller-sooner option (SS) time ($40)	Larger-later option (LL) time ($50)	Period crossing in 2-week condition	Period crossing in 6-week condition
Cross-period in both conditions	today	in 8 weeks	Crossing current period	
	in 3 days	in 6 weeks and 3 days		
	in 5 days	in 6 weeks and 5 days		
	in 1 week	in 7 weeks		
	in 3 days	in 8 weeks and 3 days	Crossing current and future (second) period	Crossing current period
	in 5 days	in 8 weeks and 5 days		
	in 1 week	in 9 weeks		
	[2] in 3 weeks	in 9 weeks	Crossing future (second) period	Crossing current period
	[2] in 3 weeks	in 11 weeks		
	[2] in 4 weeks	in 10 weeks		
	[2] in 4 weeks	in 12 weeks		
	[2] in 5 weeks	in 9 weeks		
	[2] in 5 weeks	in 11 weeks		
	in 5 weeks	in 13 weeks		Crossing current and future (second)
	in 7 weeks	in 13 weeks		Crossing future (second) period
	in 7 weeks	in 15 weeks	Crossing future (second and third) periods	Crossing future (second) period

[2] Choices used to test the effect of current budget period boundary vs. future budget period boundary, where the options crossed a future-period boundary in the two-week condition (i.e., between the second and third periods) but crossed the current-period boundary in the six-week condition ("future-crossing in two-week condition and current-crossing in six-week condition").

(c) Control Choices: Same Period in Both Conditions

	Smaller-sooner option (SS) time ($40)	Larger-later option (LL) time ($50)	Period crossing in 2-week condition	Period crossing in 6-week condition
Current period in both conditions	today	in 3 days	Non-crossing	
	today	in 5 days		
	today	in 1 week		
	today	in 2 weeks		
	in 3 days	in 6 days		
	in 3 days	in 1 week and 1 day		
	in 3 days	in 1 week and 3 days		
	in 5 days	in 1 week and 1 day		
	in 5 days	in 1 week and 3 days		
	in 5 days	in 1 week and 5 days		
	in 1 week	in 1 week and 3 days		
	in 1 week	in 1 week and 5 days		
	in 1 week	in 2 weeks		
Next (second) period in 2-week condition Current period in 6-week condition	in 3 weeks	in 3 weeks and 3 days		
	in 3 weeks	in 3 weeks and 5 days		
	in 3 weeks	in 4 weeks		
	in 3 weeks	in 5 weeks		
	in 3 weeks	in 6 weeks		
	in 4 weeks	in 4 weeks and 3 days		
	in 4 weeks	in 4 weeks and 5 days		
	in 4 weeks	in 5 weeks		
	in 4 weeks	in 6 weeks		
	in 5 weeks	in 5 weeks and 3 days		
	in 5 weeks	in 5 weeks and 5 days		
	in 5 weeks	in 6 weeks		
Next (second) period in both conditions	in 7 weeks	in 7 weeks and 3 days		
	in 7 weeks	in 7 weeks and 5 days		
	in 7 weeks	in 8 weeks		

WEB APPENDIX C. ADDITIONAL RESULTS FROM THE MAIN STUDIES

Study 1 Additional Results

In Study 1, we found a significant difference in the proportion of participants choosing the larger-later option between the 'today' condition and each of the longer common delay conditions (3 months and longer), but not the shorter common delay conditions (2 weeks, 1 month). This pattern is consistent in each of the smaller-sooner amount conditions:

(a) SS: $35 condition (N=440)

	N	LL	LL proportion	OR	p-value
Today	68	47	0.69	-	-
2 weeks	66	45	0.68	0.96	1
1 month	65	45	0.69	1.01	1
3 months	58	50	0.86	2.77	.033
6 months	58	54	0.93	5.95	.00071
9 months	58	51	0.88	3.23	.017
12 months	67	60	0.90	3.79	.0052

(b) SS: $40 condition (N=438)

	N	LL	LL proportion	OR	p-value
Today	59	25	0.42	-	-
2 weeks	51	28	0.55	1.65	.25
1 month	54	31	0.57	1.82	.13
3 months	71	43	0.61	2.08	.052
6 months	74	60	0.81	5.74	< .001
9 months	62	52	0.84	6.94	< .001
12 months	67	53	0.79	5.07	< .001

(c) SS: $45 condition (N=440)

	N	LL	LL proportion	OR	p-value
Today	62	24	0.39	-	-
2 weeks	72	25	0.35	0.84	.72
1 month	69	20	0.29	0.65	.27
3 months	59	33	0.56	2	.07
6 months	56	37	0.66	3.05	.0034
9 months	67	43	0.64	2.81	.0048
12 months	55	35	0.64	2.75	.0095

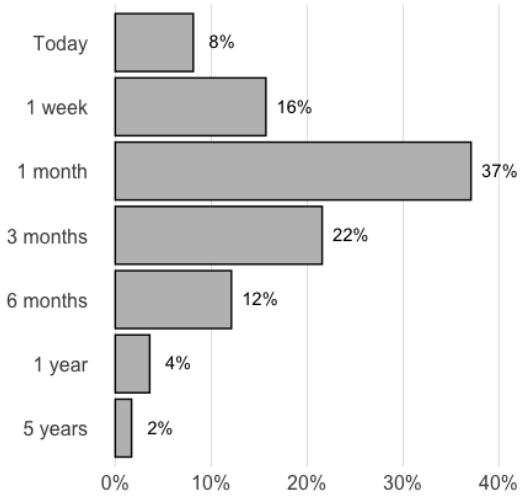
Study 2 Additional Results

See the table below for the participants' categorization of the options into their current or future financial period in each common delay condition.

Common Delay	**Categorized as current period (vs. future)**		**Cross-Period** (coded)	**N**
	Smaller-sooner option	Larger-later option		
Today	93.3% (181/194)	19.1% (37/194)	74.2% (144/194)	194
2 weeks	67.9% (129/190)	13.7% (26/190)	54.7% (104/190)	190
1 month	60.8% (115/189)	15.9% (30/189)	46% (87/189)	189
3 months	24.6% (47/191)	12% (23/191)	13.1% (25/191)	191
6 months	16.8% (32/191)	9.4% (18/191)	7.9% (15/191)	191
9 months	12.9% (25/194)	10.3% (20/194)	6.7% (13/194)	194
12 months	12.7% (24/189)	6.3% (12/189)	7.9% (15/189)	189

Study 3 Additional Results

Subjective Financial Periods. The distribution of the measured current subjective financial periods is displayed in the figure below.



NOTE. N=528. Those who indicated that 5 years from today (9 participants) belongs to the current financial period were further excluded from analyses (since their current-future period boundary could not be estimated).

Correlations Among the Potential Process Variables. The table below presents the bivariate correlations (accounting for within-subject repeated measures) between the potential process variables.

		Non-fungibility				
		Impact on Finance	Impact on Spending	**Perceived Duration**	**Usefulness**	**Slack**
Non-fungibility	Impact on Finance	1.00	0.49	0.35	-0.37	0.12
	Impact on Spending	-	1.00	0.33	-0.38	0.14
Perceived Duration		-	-	1.00	-0.33	0.12
Usefulness		-	-	-	1.00	-0.10
Slack		-	-	-	-	1.00

NOTE. Calculated using R ‘rmcorr’ package. All coefficients are statistically significant ($p < .05$).

Exploratory factor analyses (using R ‘psych’ package; not accounting for repeated measures design) show that the one-factor model explains 29% of the total variance while the four-factor model cumulatively explains 52% of the total variance.

Cross-Period Effect on the Potential Process Variables. The table below presents the results from regression analyses testing the effect of options crossing the boundary of subjective financial periods (CrossPeriod variable in the table) on each of the potential process measures. We find a significant effect of period-crossing on all variables except for resource slack.

Variable	Non-fungibility			Usefulness	Slack	Perceived Duration
	Impact on Spending	Impact on Managing Finances	*Combined* (average)			
(Intercept)	3.3 (0.18)***	3 (0.17)***	3.2 (0.17)***	-1.4 (0.17)***	0.55 (0.14)***	33 (1.5)***
Present	1 (0.11)***	0.83 (0.093)***	0.92 (0.083)***	-0.92 (0.088)***	0.13 (0.086)	3.2 (0.88)***
CrossPeriod	0.86 (0.13)***	0.88 (0.12)***	0.87 (0.11)***	-0.78 (0.12)***	0.093 (0.1)	6.9 (1.1)***
CommonDelay (in years)	-0.22 (0.023)***	-0.17 (0.021)***	-0.19 (0.018)***	0.22 (0.023)***	-0.059 (0.02)**	-3.1 (0.31)***
InterrewardDelay Condition: 6 (vs. 1) month	0.078 (0.22)	-0.24 (0.21)	-0.081 (0.2)	-0.49 (0.2)*	0.66 (0.17)***	17 (1.7)***

NOTE. Standard errors were clustered at the participant level.
*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Additional Mediation Results. The table below presents mediation results for each of the two measures of perceived fungibility separately.

		Non-fungibility	
		Impact on Spending	Impact on Managing Finances
Without control	Indirect effect (% mediated) 95% Bootstrap CI	-0.010 (4.9%) [-0.017, -0.003]	-0.017 (8.1%) [-0.025, -0.009]
Controlling for perceived duration	Indirect effect (% mediated) (95% Bootstrap CI)	-0.007 (3.7%) [-0.013, -0.0006]	-0.014 (7.0%) [-0.021, -0.006]
Controlling for usefulness	Indirect effect (% mediated) (95% Bootstrap CI)	-0.009 (4.6%) [-0.015, -0.002]	-0.016 (8.2%) [-0.023, -0.008]
Controlling for perceived duration and usefulness	Indirect effect (% mediated) (95% Bootstrap CI)	-0.006 (3.4%) [-0.012, 0.0003]	-0.013 (7.1%) [-0.020, -0.005]

Replication of the Regression Analyses Using a Random Intercept Model. In the paper, we reported linear regression results with clustered standard errors to account for the potentially correlated errors across observations, due to the repeated measures design. With repeated measures designs, another concern is that the heterogeneity across participants could confound the cross-period effect because cross-period was coded differently across participants (i.e., causing heterogeneity or aggregation bias). To address this concern, we replicated the key regression analyses reported in the paper using a random intercept model, with an intercept for each participant. Our conclusions are consistent whether we use clustered standard errors or random intercepts.

Choice

Variable	Model 1	Model 2	Model 3	Model 4
(Intercept)	0.71 (0.0088)***	0.77 (0.0091)***	0.73 (0.0096)***	0.71 (0.012)***
Present	-0.1 (0.0084)***	-0.022 (0.0084)**	-0.0053 (0.0085)	-0.0052 (0.0085)
CrossPeriod		-0.24 (0.0068)***	-0.21 (0.0073)***	-0.21 (0.0073)***
CommonDelay (in years)			0.02 (0.0019)***	0.02 (0.0019)***
Length of current period				0.0025 (0.00074)***
InterrewardDelay (in years)	-0.13 (0.0017)***	-0.12 (0.0016)***	-0.12 (0.0016)***	-0.12 (0.0016)***

NOTE. N=519, 30 choices per participant. Linear regression with participant-level random intercepts on the choice of the larger later option (1: larger-later option is chosen; 0: smaller-sooner option is chosen). Significance tests are conducted with R 'lmerTest' package. The model was fit by maximum likelihood. Standard errors are in parentheses.

***: $p < 0.001$

Potential Processes

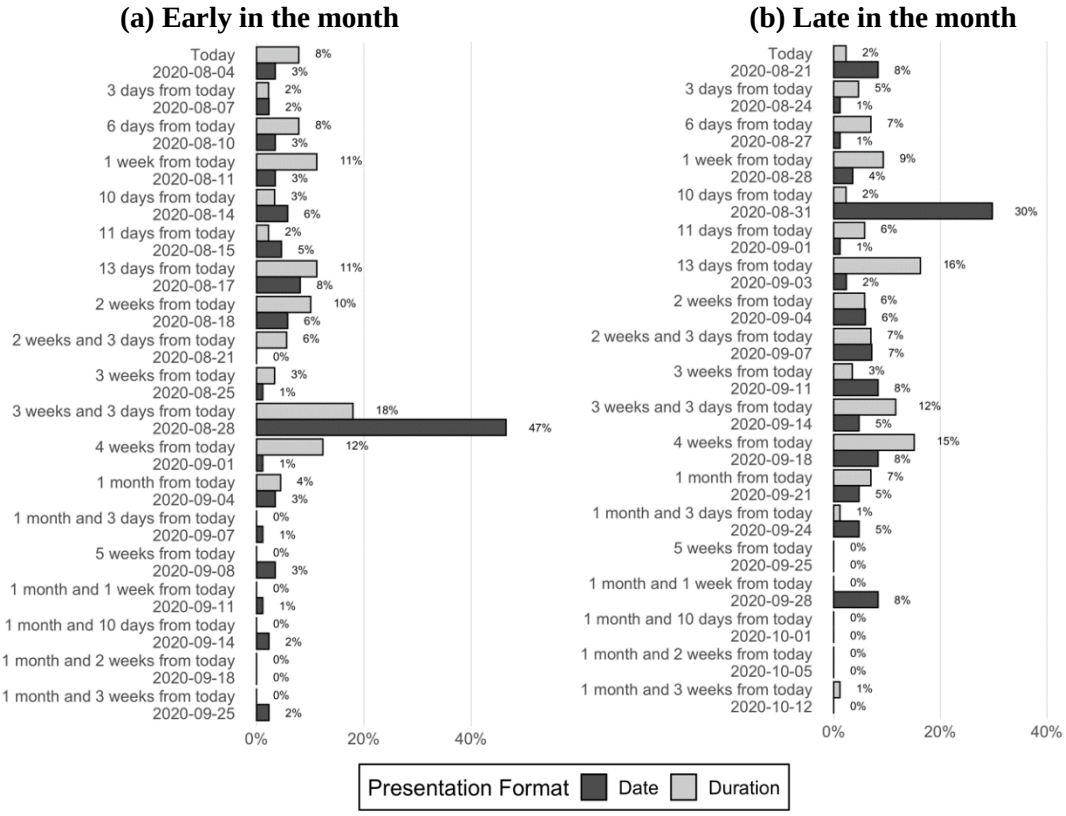
Variable	Non-fungibility			Usefulness	Slack	Perceived Duration
	Impact on Spending	Impact on Managing Finances	*Combined* (average)			
(Intercept)	3.3 (0.18)***	3.1 (0.17)***	3.2 (0.16)***	-1.4 (0.16)***	0.56 (0.14)***	33 (1.4)***
Present	1 (0.1)***	0.84 (0.097)***	0.92 (0.083)***	-0.92 (0.097)***	0.14 (0.089)	3 (1.1)**
CrossPeriod	0.84 (0.092)***	0.83 (0.086)***	0.83 (0.073)***	-0.82 (0.086)***	0.046 (0.079)	7.5 (0.95)***
CommonDelay (in years)	-0.22 (0.024)***	-0.18 (0.022)***	-0.2 (0.019)***	0.22 (0.022)***	-0.064 (0.02)**	-3 (0.24)***
InterrewardDelay Condition=6 months (vs. 1 month)	0.082 (0.22)	-0.23 (0.21)	-0.072 (0.2)	-0.48 (0.19)*	0.67 (0.17)***	16 (1.7)***

NOTE. N=403, 6 observations per participant. Linear regression with participant-level random intercepts on the corresponding dependent variable. Significance tests are conducted with R 'lmerTest' package. The model was fit by maximum likelihood. Standard errors are in parentheses.

*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Study 4 Additional Results

Subjective Financial Periods. The distributions of the measured current subjective financial periods are displayed in the figure below. The median length of current periods was 14 days for both survey date conditions in the duration condition and late-month conditions in the date condition. The median length of the current period in the early-month, date condition was 24 days. In the early-month condition, for 18% of the participants in the duration condition and 47% in the date condition, the end of the current financial period matched the end of the current month (end of August). In the late-month condition, the end of the current financial period matched the end of the current month for only 2% of the participants in the duration condition and 30% of participants in the date condition. Additionally, 8% of participants in the date condition chose the next month's boundary (end of September) to be the end of the current period. Across both survey date conditions, matching between subjective period and month-end was more common in the date condition than in the duration condition (44% vs. 10%, $\chi^2(1) = 47.05$, $p < .001$).



NOTE. The vertical axis denotes the last time to be categorized as current period, with the subsequent time as future period. N=345 (28 participants reported two months from now, the last time in the list, is current financial period are excluded from the chart and the final sample).

Interactions. The table below presents the results from a linear regression analysis using data from both duration and date conditions, interacting all variables in Model 3 in Table 4 in the paper with the framing conditions. We found no significant differences between the duration and date conditions in the magnitude of either the cross-period effect (p = .36) or the cross-month effect (p = .13; but see below for the result from using a random intercept model where this interaction was marginally significant).

Variable	Coefficient (SE)
(Intercept)	0.8 (0.035)***
Present	0.0085 (0.011)
CrossPeriod	-0.091 (0.024)***
CrossMonth	0.002 (0.013)
CommonDelay (in years)	0.85 (0.25)***
InterrewardDelay (in years)	-6.2 (0.47)***
Late-in-the-month (vs. Early)	-0.0018 (0.05)
Date (vs. Duration)	0.12 (0.048)*
Present x Date	-0.023 (0.016)
CrossPeriod x Date	0.03 (0.033)
CrossMonth x Date	-0.028 (0.019)
CommonDelay x Date	-1.3 (0.31)***
InterrewardDelay x Date	2.5 (0.65)***
Late-in-the-month x Date	0.057 (0.068)

NOTE. Standard errors are clustered at the participant level.
+: $p < 0.1$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Replication of the Regression Analyses Using a Random Intercept Model. The qualitative conclusions from using the random intercept model are consistent with those from using clustered standard errors (as reported in the paper). See the tables below for the regression results.

Duration vs. Date conditions

(a) Duration condition

Variable	Model 1	Model 2	Model 3
(Intercept)	0.8 (0.037)***	0.79 (0.037)***	0.8 (0.037)***
Present	0.012 (0.012)	0.016 (0.012)	0.012 (0.012)
CrossPeriod	-0.049 (0.011)***		-0.049 (0.011)***
CrossMonth		-0.002 (0.012)	0.0003 (0.012)
CommonDelay (in years)	1.1 (0.17)***	1.3 (0.17)***	1.1 (0.17)***
InterrewardDelay (in years)	-6.5 (0.19)***	-6.9 (0.23)***	-6.5 (0.24)***
Late-in-the-month (vs. Early)	-0.0009 (0.051)	-0.00001 (0.051)	-0.001 (0.051)

(b) Date condition

Variable	Model 1	Model 2	Model 3
(Intercept)	0.92 (0.034)***	0.91 (0.034)***	0.92 (0.034)***
Present	-0.008 (0.01)	-0.01 (0.01)	-0.012 (0.01)
CrossPeriod	-0.039 (0.0095)***		-0.034 (0.01)***
CrossMonth		-0.039 (0.011)***	-0.032 (0.011)**
CommonDelay (in years)	-0.34 (0.15)*	-0.26 (0.14)+	-0.37 (0.15)*
InterrewardDelay (in years)	-4.3 (0.17)***	-4.1 (0.2)***	-3.9 (0.2)***
Late-in-the-month (vs. Early)	0.044 (0.047)	0.056 (0.047)	0.055 (0.047)

Combined (Interactions)	
Variable	**Coefficient (SE)**
(Intercept)	0.8 (0.035)***
Present	0.012 (0.011)
CrossPeriod	-0.049 (0.01)***
CrossMonth	0.00029 (0.012)
CommonDelay (in years)	1.1 (0.16)***
InterrewardDelay (in years)	-6.5 (0.22)***
Late-in-the-month (vs. Early)	-0.00098 (0.049)
Date (vs. Duration)	0.12 (0.05)*
Present x Date	-0.024 (0.016)
CrossPeriod x Date	0.015 (0.015)
CrossMonth x Date	-0.032 (0.017)+
CommonDelay x Date	-1.4 (0.23)***
InterrewardDelay x Date	2.6 (0.32)***
Late-in-the-month x Date	0.056 (0.07)

NOTE. Linear regression with participant-level random intercepts on the choice of the larger later option (1: larger-later option is chosen; 0: smaller-sooner option is chosen), 33 choices per participant. Significance tests are conducted with R 'lmerTest' package. The model was fit by maximum likelihood. Standard errors are in parentheses.

+: $p < 0.1$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Study 5 Additional Results

Correlations Among the Potential Process Variables. The table below presents the bivariate correlations between the potential process variables.

	Non-fungibility			
	Impact on Finance	Impact on Spending	**Perceived Duration**	**Usefulness**
Impact on Finance	1.00	0.64	0.33	-0.15
Impact on Spending	-	1.00	0.33	-0.12
Perceived Duration	-	-	1.00	-0.12
Usefulness	-	-	-	1.00

NOTE. Correlation coefficients accounting for within-subject repeated measures. Calculated using R 'rmcorr' package. All coefficients are statistically significant ($p < .05$).

Exploratory factor analyses (using R 'psych' package; not accounting for repeated measures design) show that the one-factor model explains 48% of the total variance while the three-factor model cumulatively explains 64% of the total variance.

Cross-Period Effect on the Potential Process Variables. The table below presents the results from regression analyses testing the effect of options crossing the boundary of subjective financial periods (CrossPeriod variable in the table) on each of the potential process measures. We find a significant effect of period-crossing on all variables except for resource slack.

	Non-fungibility				
Variable	Impact on Spending	Impact on Managing Finances	*Combined* (average)	**Usefulness**	**Perceived Duration**
(Intercept)	3.3 (0.15)***	3.7 (0.15)***	3.5 (0.14)***	-1.7 (0.14)***	35 (1.4)***
CrossPeriod	0.58 (0.079)***	0.45 (0.076)***	0.51 (0.072)***	-0.095 (0.081)	2.9 (0.69)***
Condition: 6-week	-0.097 (0.2)	-0.0054 (0.2)	-0.051 (0.19)	0.052 (0.18)	-1.3 (1.9)
Choice FE	Yes	Yes	Yes	Yes	Yes

NOTE. Standard errors were clustered at the participant level. The models included fixed effects for the corresponding intertemporal choice question.

*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Additional Mediation Results. The table below presents mediation results for each of the two measures of perceived fungibility separately.

		Non-fungibility	
		Impact on Spending	Impact on Managing Finances
Without control	Indirect effect (% mediated)	-0.034 (30%)	-0.027 (24%)
	95% Bootstrap CI	[-0.048, -0.020]	[-0.041, -0.012]
Controlling for perceived duration	Indirect effect (% mediated)	-0.018 (20%)	-0.014 (15%)
	(95% Bootstrap CI)	[-0.026, -0.010]	[-0.022, -0.005]

Replication of the Regression Analyses Using a Random Intercept Model. We replicated the regression analysis that tests the overall cross-period effect using a random intercept model. We predicted participants' choices by whether the choice was cross-period in that participant's randomly assigned condition, controlling for the main effect of conditions, fixed effects for choices, and participant-level random intercepts. We find results consistent with clustered standard errors (as reported in the paper). The cross-period effect was significant ($B_{\text{CrossPeriod}}$ = -0.11, SE = 0.007, $t(16230) = -14.77$, $p < .001$), while there was no significant main effect of condition ($B_{\text{6 week (vs. 2 week)}} = 0.038$, SE = 0.027, $t(601) = 1.39$, $p = .16$).

A Case of Reverse Time-Inconsistency. Our cross-period discounting account can accommodate instances of *reverse* time-inconsistency (greater impatience with a common delay; Read 2001; Read, Frederick and Airoldi 2012; Sayman and Öncüler 2009; Takeuchi 2010). If adding a common delay shifts the choice options from both being in the current period to instead being split across periods (e.g., only the larger-later option occurring in the future period), people may be less willing to wait for the larger-later outcome.

We present an example of how cross-period impatience could lead to reverse time-inconsistency (i.e., *increasing* impatience with a common delay, rather than decreasing, which is the opposite of the prediction from present bias), using the individual choice results from Study 5. Note that this is only an illustrative example since we exogenously imposed a budget period categorization on the participants in Study 5 and made it salient to them. We focus on the cases where, keeping the inter-reward delay constant, the options are within the same period with no or

relatively short common delay, but a longer common delay leads to a shift from choosing between options in the same period to choosing between cross-period options.

For the participants in the two-week current period condition, this occurs for choices with a 10-day inter-reward delay. The choice of the larger-later option in the two-week condition was significantly lower with a 1-week common delay, where the common delay shifted the larger-later option into the second budget period (56%) compared to choices with shorter common delays with options remaining in the same (current) period (no common delay: 70%; 3 days common delay: 69%; $p < .001$ for both). Similarly, in the six-week condition for these choices, the larger-later option crossed over to the next period with a common delay of 4 weeks and 5 days, at which point, we observe higher impatience than with shorter common delays (see table below).

SS time ($40)	**LL time ($50)**	**2-week condition**		**6-week condition**	
		Budget period	% choosing LL	Budget period	% choosing LL
today	in 1 week and 3 days	Same (current) period	70% (206/295)	Same (current) period	75% (230/306)
in 3 days	in 1 weeks and 6 days	Same (current) period	69% (205/295)	Same (current) period	74% (225/306)
in 1 week	in 2 weeks and 3 days	Cross-period	56% (165/295)	Same (current) period	74% (226/306)
in 4 weeks	in 5 weeks and 3 days	Same (next) period	71% (208/295)	Same (current) period	75% (229/306)
in 4 weeks and 3 days	in 5 weeks and 6 days	Same (next) period	71% (208/295)	Same (current) period	75% (229/306)
in 4 weeks and 5 days	in 6 weeks and 1 day	Same (next) period	59% (175/295)	Cross-period	54% (166/300)

Study 6 Additional Results

Replication of the Regression Analyses Using a Random Intercept Model. We replicated the regression analyses reported in the paper, using random intercepts rather than clustering standard errors. We found results consistent with the analysis using clustered standard errors as reported in the paper. For the main test of the cross-period effect, we found the significant cross-period effect but not an effect of experimental conditions ($B_{\text{CrossPeriod}} = -0.099$, SE = 0.008, $t(26400) = -12.09$, $p < .001$; $B_{\text{6 week (vs. 2 week)}} = 0.021$, SE = 0.027, $t(420.8) = 0.76$, $p = .45$).

Testing the cross-period effect for current and future boundaries separately also produced consistent results ($B_{\text{CrossCurrentPeriod}} = -0.10$, SE = 0.008, $t(26400) = -12.14$, $p < .001$; $B_{\text{CrossFuturePeriod}} = -0.087$, SE = 0.014, $t(26400) = -6.22$, $p < .001$).

Additional Exclusion Based on an Attention Check About the Stimuli. This survey included an attention check that asked participants to enter the length of the current period they had been presented with. There was a different rate of failing this check between the two between-subject conditions (50/206 in two-week condition, 22/213 in six-week condition, Fisher's exact test: $p < .001$). Therefore, in the main analyses reported in the paper, we did not exclude any responses based on this check. We suspect it was easier to pass the comprehension check even with a misunderstanding in the six-week condition than in the two-week condition. Since our comprehension check asked participants to enter the weeks remaining in the current budget period, the correct answer is 2 in the two-week condition and 6 in the six-week condition. However, some participants could have misunderstood the question and instead entered the

length of each budget period (6 weeks in both conditions). We retained participants that failed this check to avoid excluding substantially more participants in one condition than in the other.

Nevertheless, excluding participants based on this comprehension check did not affect our conclusions (N=347). Pooling all the data and using linear regression including fixed effects for choices and clustering standard errors at the participant level, we confirmed a significant cross-period effect ($B_{\text{CrossPeriod}}$ = -0.12, SE = 0.016, t(22142) = -7.32, p < .001), where cross-period was defined generally as crossing current period boundary or any future period boundaries. We found no overall effect of a longer current period ($B_{\text{6 week (vs. 2 week)}}$ = 0.005, SE = 0.031, t(22142) = 0.17, p = .87).

The results when we separately define crossing current period boundary and future period boundary were also consistent ($B_{\text{CrossCurrentPeriod}}$ = -0.12, SE = 0.017, t(22141) = -7.22, p < .001; $B_{\text{CrossFuturePeriod}}$ = -0.11, SE = 0.026, t(22141) = -4.42, p < .001; $B_{\text{6 week (vs. 2 week)}}$ = 0.006, SE = 0.031, t(22142) = 0.20, p = .84).

WEB APPENDIX D. REPLICATIONS OF STUDIES 3 AND 5

Replication of Study 3

We replicated the cross-period effect on intertemporal choice in a direct replication of Study 3 (N=285, MTurk; Supplementary Study A1 on the OSF repository). The only differences from Study 3 were that the rewards were described as hypothetical and we only measured intertemporal choice, not potential process variables. The table below presents the results from the series of regression analyses, equivalent to the analyses reported in Study 3. Unlike Study 3, we do not find significant present bias (i.e., negative coefficient on *Present*) once accounting for the cross-period effect.

Variable	Model 1	Model 2	Model 3
(Intercept)	0.69 (0.017)***	0.73 (0.018)***	0.7 (0.018)***
Present	-0.06 (0.0079)***	-0.0022 (0.0084)	0.014 (0.008)+
CrossPeriod		-0.17 (0.013)***	-0.15 (0.014)***
CommonDelay (in years)			0.019 (0.0025)***
InterrewardDelay (in years)	-0.12 (0.0038)***	-0.11 (0.0037)***	-0.12 (0.0037)***
Clustered SE	Yes	Yes	Yes

Replication of Study 5

We also replicated the causal effect of financial periods, using hypothetical budget periods in a direct replication of Study 5 (N=532, Prolific; Supplementary Study A2 on the OSF repository), measuring intertemporal choices only (without the process measures). In a linear regression with fixed effects for choices and clustering standard errors at the participant level, we found a significant cross-period effect ($B_{\text{CrossPeriod}}$ = -0.12, SE = 0.015, t(14866) = -7.80, p < .001): Choices of the larger-later option were on average 12% lower in the condition in which the choice options were in different periods (vs. in the same period). There was no significant main effect of condition ($B_{\text{6 week (vs. 2 week)}}$ = 0.01, SE = 0.027, t(14866) = 0.37, p = .71). We find similar results using a random intercept model. The results broken down into categories of choices based on whether the choice is boundary-crossing are also consistent with those of Study 5 (see table below).

Choices		Welch's t-test
Test choices	Cross-period in 2-week condition	$M_{\text{2 weeks}}$ = 0.48 vs. $M_{\text{6 weeks}}$ = 0.61, t(530) = -3.66, p < .001
	Cross-period in 6-week condition	$M_{\text{2 weeks}}$ = 0.56 vs. $M_{\text{6 weeks}}$ = 0.45, t(528.98) = 3.07, p = .002
Control choices	Current period in both conditions	$M_{\text{2 weeks}}$ = 0.78 vs. $M_{\text{6 weeks}}$ = 0.80, t(530) = -0.62, p = .54
	Next period in 2-week condition Current period in 6-week condition	$M_{\text{2 weeks}}$ = 0.81 vs. $M_{\text{6 weeks}}$ = 0.81, t(529.74) = 0.026, p = .98
	Next period in both conditions	$M_{\text{2 weeks}}$ = 0.66 vs. $M_{\text{6 weeks}}$ = 0.67, t(527.69) = -0.45, p = .65

WEB APPENDIX E. STABILITY OF SUBJECTIVE CURRENT PERIOD

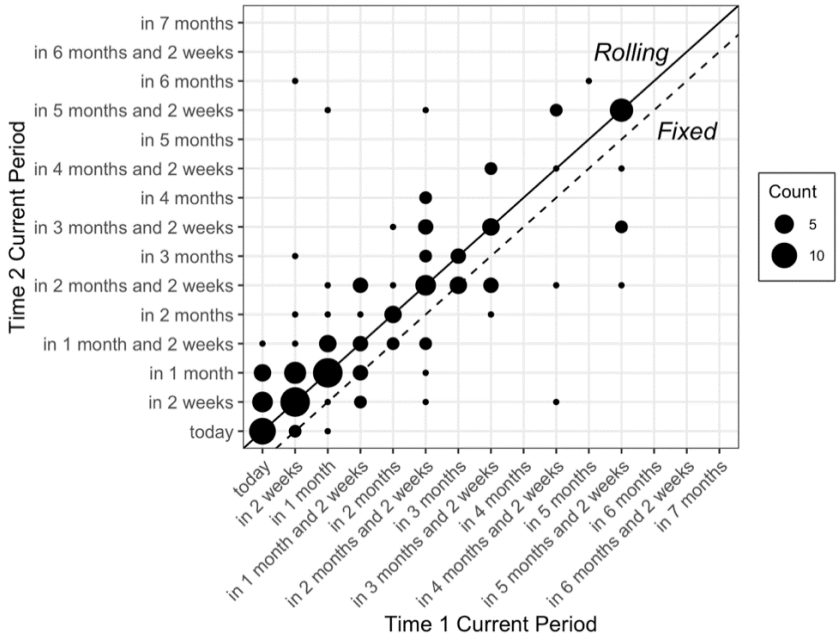
In a supplementary study, we explored whether subjective financial periods were more consistent with a *fixed* categorization based on external cues (e.g., salient calendar dates, such as the end of a month, or the timing of paychecks or major expenses) or a *rolling* definition of the category (e.g., a constant duration, such that the end date changes over time, consistent with goal-based categorization). We measured the current financial period from the same participants twice, two weeks apart (N=145; more details about the study are available on the OSF repository as Supplementary Study A3).

Test-retest reliability of the length of the current financial period was fairly high (r = .80, $t(143) = 15.03$, $p < .001$), suggesting a largely stable categorization of current period. The correlation remained unchanged even after excluding participants who reported having a two-week current period at both times (i.e., for whom it is unclear whether it is rolling or fixed).

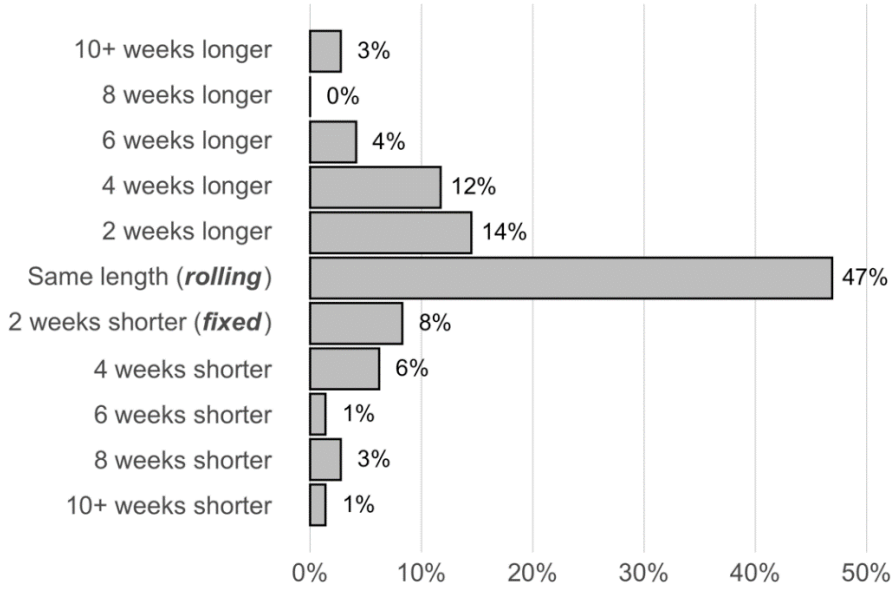
We found much stronger evidence for rolling categories than for fixed categories: 47% reported the same length of financial period two weeks later vs. 8% reported a two-week shorter period two weeks later ($\chi^2(1) = 37.81$, $p < .001$). In fact, directionally fewer people reported a two-week shorter period (consistent with a fixed period categorization) than a two-week longer period (14%), suggesting that even the 8% estimate of people with fixed periods is likely to be overstated.

Many participants (45%) reported different lengths of the current period in the two waves of the survey. One possibility is that the differences reflect measurement error. Another possibility is that the financial period is not strictly rolling and the length of the period is adjusted by the person over time. To the degree that the length of the period does meaningfully vary, this could reflect changes in major structural factors over time (e.g., new upcoming expenses or deadlines causing a revision of the period length).

Current period at time 1 and time 2 (i.e., last time in the current period)



Difference in the length of the current period between time 1 and time 2



NOTE. N=145.

WEB APPENDIX F. WITHIN-PERIOD DISCOUNTING

Cross-Period Discounting vs. Quasi-Hyperbolic Discounting

Could our results still be accommodated by the quasi-hyperbolic model, but simply by using a broader definition for the present period (t=0)? One difference between our account and the quasi-hyperbolic model is that our account predicts additional discounting whenever the delayed option is in a period later than the period of the smaller-sooner option, not limited to cases when the smaller-sooner option is in the current period (we find evidence for the cross-period effect extending beyond the current period in Studies 2 and 6 in the paper). In contrast, in the quasi-hyperbolic model, present bias applies only to the present period (t=0). Second, the quasi-hyperbolic model assumes no discounting within the same time period, while we conceptualize cross-period discounting as an additional discounting on top of the discounting by the delay between the options. We discuss this second point in detail below.

Under the quasi-hyperbolic model, the discount factor follows $f(D) = \beta\delta^D$, where $\beta = 1$ if $D = 0$, $\beta < 0$ if $D > 0$, where D denotes discrete time periods, D = 0, 1, 2, … . We can define each unit of D to be length k in actual (continuous) time t. For instance, D = 0 corresponds to $0 \leq t < k$, D = 1 to $k \leq t < 2k$, and so on. Then, the discount factor would be constant for any delays *within* the unit of D, that is $0 \leq t < k$ or $k \leq t < 2k$, and so on (note that we can even allow k to vary such that each time period has a different length, and the argument below still holds). For instance, if we let k = 30 days (1 month), then the discount for the delay is the same for any reward that occurs between now and one month from now, between one month and two months from now, etc. So, if we assume that the present period is one month long (i.e., to rationalize the findings of Studies 1 and 2), the quasi-hyperbolic model would predict insensitivity to the timing of choice options that involve delays up to one month (e.g., $10 today vs. $20 in two weeks, $10 today vs. $20 in one month).

To further illustrate, we tested this implication using our data from Study 3. For a direct comparison with cross-period discounting with subjective financial periods, we could even further assume that k is individually defined, such that the present period for an individual (D = 0) lasts from $0 \leq t < k =$ *end of that person's current financial period*.

We conducted a linear regression on the choice of larger-later option from Study 3, *NotCurrent* (0: both options are within the current financial period, 1: otherwise; individually defined), *InterrewardDelay* (delay between the two options; in terms of years), and the interaction between *NotCurrent* and *InterrewardDelay* (with standard errors clustered at the participant level). Under this formulation, the first-order variable *InterrewardDelay* tests whether choice depends on the delay between the options when both options are within the participant's current financial period. *InterrewardDelay* was statistically significant (B = -0.75, SE = 0.13, $t(15656)$ = -5.96, $p < .001$; see table below), rejecting the null hypothesis that there is no discounting within the current financial period. This demonstrates that the quasi-hyperbolic model (in the basic form suggested by Laibson 1997 that has been popularized since then) is insufficient to fully capture time discounting.

Variable	Coefficient (SE)
(Intercept)	0.89 (0.012)***
Not Current	-0.24 (0.013)***
Interreward Delay (in years)	-0.75 (0.13)***
Not Current x Interreward Delay	0.62 (0.13)***

NOTE. ***: $p < .001$

WEB APPENDIX G. BRIEF SUMMARY OF SUPPLEMENTARY STUDIES

We provide a summary of nineteen supplementary studies, which include replication studies (Studies A1-2, Web Appendix D), test-retest of subjective financial periods (Study A3, Web Appendix E), additional studies similar to Study 1 (Studies S1a-c) and Study 3 (Studies S2a-b), and exploratory studies that further test whether the cross-period effect generalizes to different settings (Studies S3a-b, 4-5) and whether the current subjective period is constructed and susceptible to subtle salience manipulations (Studies S6a-b).

We find a significant overall cross-period effect in all studies, except for Study S2b (non-significant effect controlling for the common delay) and S9b-c (discussed more below), which suggest potential boundary conditions. Data, survey materials, and a detailed discussion of each study are available on the OSF repository (tinyurl.com/crossperiod).

Replication Studies (Studies A1-2): Studies A1-2 replicated Study 3 and Study 5, respectively (see Appendix D).

Stability of Current Period (Study A3): Study A3 measured subjective financial periods from the same participants twice, two weeks apart. We find that subjective periods are largely stable over time (e.g., *rolling*; see Appendix E).

Additional Studies on the Common Delay Effect (Studies S1a-c): Studies S1a-b replicated Study 1 (i.e., varying only the common delay between-subjects) using hypothetical rewards with an online sample and find similar results. Study S1c surveyed a community sample in-person, varying the common delay within-subjects. In all of Studies S1a-c, we do not find a significant increase in patience with a short common delay (e.g., two weeks) as predicted by present bias, but instead a significant increase in patience with longer common delays (e.g., 3 months and longer).

Additional Studies on the Correlational Cross-Period Effect (Studies S2a-b): Study S2a replicated the significant cross-period effect based on elicited current-future period boundaries using repeated choices as in Study S3, varying both the common delays and inter-reward delays, but using shorter common delays (up to 1 year) than in Study 3. In Study S2b, we find a weaker cross-period effect (non-significant after controlling for the common delay). We used a constant inter-reward delay and only varied the common delay in Study S2b, which could explain a stronger common delay effect than the cross-period effect (via increasing sensitivity to the common delay). Study S2b also included measures of potential process variables.

Extension to Restricted Funds (Studies S3a-b): Studies S3a-b explored whether the general cross-period effect extends to earmarked funds (i.e., choosing credits for utility payments or groceries). We find a significant cross-period effect in Study S3a for both grocery credits and utility credits. Study S3b offers partial evidence that the relevant budget periods explain choices for the earmarked category.

Different Elicitation Modes (Studies S4-5): In Study S4, a consistent cross-period effect is observed whether the dollar amounts vary across choices or not in the repeated-measures design.

Study S5 provides suggestive evidence that the cross-period effect might be mitigated when choices are instead presented as titration tasks.

Salience Manipulation for Subjective Periods (Studies S6a-b): Studies S6a-b tested a simple manipulation of current periods by making different lengths of time salient to different participants (i.e., prompting participants to consider their own actual income and expenses in either the next two- or eight-week period). Preferences were not significantly affected by this salience-based manipulation. The cross-period effect based on measured subjective financial periods was replicated and was robust to the manipulation.

Studies with Design Issues (Studies S7-8): Study S7 was an initial version of Study 5 (hypothetical budget periods). We found asymmetric attrition across conditions based on the attention check about the manipulated period. We suspect it was easier for those in the six-week condition to pass the check without paying full attention than the two-week condition (since the total length of each budget period was also six weeks). Unlike Studies 5-6 and A2, participants were precluded from the survey after failing the attention check, likely resulting in an asymmetric proportion of inattentive participants across conditions. This issue was addressed by changing the total length of each budget period in Studies 5 and A2, and by allowing participants to take the survey despite failing the attention check in Studies 5-6 and A2. Study S8 had a similar design as Study 4 (duration vs. date), but due to a mistake in the survey design, in the second wave of the survey participants in the date condition were asked about past dates, which were also different from those in the duration condition, when reporting subjective financial periods. Therefore, the elicited current-future boundary was invalid. Due to these issues, we believe these studies are not informative. We share the data and results from these studies for transparency.

Customized Common Delay (Study S9a) **and Non-replications** (Studies S9b-c): Studies S9a-c randomly assigned participants into one of 3 between-subject conditions (within-current-period, within-future-period, cross-periods). The options were then customized by setting a common delay for each participant based on the participant's subjective period and the condition so that the options would either both be in the current period, cross-period, or both in the future period, maintaining a two-week interval between the options. While we observed a significant cross-period effect in Study S9a (higher impatience in the cross-period condition vs. within-period conditions), this effect was not significant in two replications (Studies S9b-c). The limitation of these studies is that the conditions are confounded by having different average common delays and the relatively short interval between the options, which may be a boundary condition.