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Time Preference in Decisions With Recurring Payoffs

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ABSTRACT

Time preference plays a central role in decision-making, shaping how individuals value outcomes that occur at different points in time. While most research on time preference focuses on one-off payoffs, many real-world decisions generate recurring consequences that unfold continuously over time. Despite their prevalence, little is known about how recurring payoff structures influence intertemporal preferences. We propose that recurring payoffs reduce discounting by promoting temporal integration. By highlighting the continuity of future consequences, recurring payoffs encourage individuals to form a more temporally integrated representation of outcomes rather than evaluating consequences as isolated events. Drawing on the choice isolation argument and the literature on choice bundling and choice bracketing, we argue that this representation reduces the salience of immediate-versus-delayed trade-offs and ultimately lowers discount rates. We test this hypothesis in two experiments involving 284 individuals. Participants completed intertemporal choice tasks in either the gain or loss domain, with choices varying along two additional dimensions: payoff structure (one-off vs. recurring) and outcome magnitude (small vs. large). Results revealed significantly lower discounting in recurring payoff conditions than in comparable one-off conditions. The findings are consistent with the proposition that recurring payoff structures encourage a more temporally integrated evaluation of future outcomes, leading individuals to place less weight on immediacy when making intertemporal choices. This study extends the time-preference literature by introducing recurring payoff structures as a distinct class of intertemporal outcomes and identifying temporal integration as a potential mechanism through which payoff structure influences discounting. It further demonstrates that the magnitude effect extends to recurring payoff environments, suggesting that outcome size continues to shape discounting even when consequences unfold repeatedly over time. These findings suggest that making the recurring nature of future consequences salient may be a promising avenue for promoting more future-oriented decision-making.

1 | Introduction

Time preference refers to the relative value placed on receiving rewards sooner rather than later, a concept that shapes decisions in areas ranging from financial planning to health (Jain and Chen 2023; Fuchs 1982; Thaler 1981; Hardisty, Thompson, et al. 2013; Kang and Ikeda 2016; Loewenstein and Elster 1992; Gülüm Taş et al. 2026; Gülüm et al. 2026). The discount rate is the dominant measure of time preference, providing a quantitative representation of individuals' intertemporal preferences and forming the basis for many theoretical and empirical interpretations of behavior over time (Mazur 1987; Samuelson 1937; Hardisty and Pfeffer 2017; Baron 2000). Higher discount rates indicate a stronger preference for immediate benefits over delayed ones and are often associated with more impatient and short-sighted behaviors, such as favoring smaller-sooner financial rewards and accumulating debt (Nguyen 2016; Chakraborty 2021), or avoiding preventive healthcare measures in favor of current comfort (Lee and Kim 2017; Tang et al. 2023).

A common approach to eliciting discount rates is to expose individuals to intertemporal choice scenarios that simulate

real-life problems (Doyle 2013; Hardisty Thompson, et al. 2013). Typically, these experiments begin by introducing a hypothetical case, such as winning money in a lottery or needing to pay an unexpected bill (Frederick et al. 2002; Rambaud et al. 2023; Thaler 1981). Participants are then presented with a series of choices between smaller-sooner (SS) and larger-later (LL) payoffs, enabling estimation of discount rates. This widely adopted approach has generated a substantial body of research, yielding valuable insights into the cognitive and behavioral processes underlying time discounting, contributing to theoretical models and empirical findings across multiple disciplines (Laibson 1997; Ainslie 2002; O'Donoghue and Rabin 2015; Hardisty, Appelt, and Weber 2013; Chapman 1996). Despite these significant contributions, as also acknowledged by Frederick et al. (2002) and Ainslie et al. (2018), much of the existing literature on time preference focuses on discrete, one-off payoffs while eliciting discount rates. By treating future consequences as isolated events, such elicitation tasks may encourage a narrow evaluative frame in which outcomes are detached from the broader streams of consequences that characterize many real-world decisions (Ainslie 1992; Loewenstein and Thaler 1989; Ainslie 2001). As a result, immediate outcomes may receive disproportionate weight, contributing to the relatively high discount rates frequently reported in time preference studies (Read 2001).

Although some real-life choices are indeed isolated incidents, most decisions we encounter result in recurring payoffs that unfold over extended periods (Kosíková et al. 2024; Herrnstein et al. 1997). For example, consider an individual who earns a regular salary and manages multiple financial commitments on varying schedules, such as monthly mortgage and utility payments, weekly grocery expenses, and daily commuting costs. In addition to these, they may receive supplemental income from side hustles or investment returns. They are also likely to maintain various subscriptions, such as internet, cable television, or health insurance, all of which involve recurring billing. These recurring patterns observed across many real-world decisions suggest a potential mismatch between the one-off payoffs commonly used in time-preference research and the recurring consequences that characterize many everyday choices. As a result, existing discounting estimates may not fully reflect how individuals evaluate future outcomes when consequences extend beyond a single occurrence. Building on this observation, we investigate whether and how recurring payoff structures influence intertemporal choice. Specifically, we propose *temporal integration* as a mechanism through which recurring payoffs influence intertemporal preferences. Under this account, recurring consequences encourage individuals to perceive future outcomes as part of a broader temporal stream, leading them to discount the future less steeply.

To develop a theoretical explanation for recurring payoff structures and the temporal integration idea, this study draws on *the choice isolation argument* (Frederick et al. 2002) and the theories of *choice bundling* (Ainslie 1992) and *choice bracketing* (Read et al. 1999). Frederick et al. (2002) note that experimental tasks often represent outcomes as isolated, instantaneous events, whereas real-world consumption and utility are typically continuous and interrelated. One influential theoretical response to this argument is Ainslie's concept of choice bundling, which refers to evaluating a single intertemporal decision not in isolation but as part of a series of similar future decisions (Ainslie 1992, 2001). By increasing the perceived value of sustained action, bundling promotes self-control and helps align choices with longer-term goals. Similarly, choice bracketing theory suggests that preferences may differ depending on whether outcomes are evaluated as isolated events or as part of a broader stream of consequences over time (Read et al. 1999; Webb and Shu 2017; Redelmeier and Tversky 1992). Although these concepts differ in their theoretical foundations, both suggest that broadening the temporal frame of evaluation shifts attention away from immediate outcomes and toward longer-term consequences, thereby promoting greater self-control and reducing excessive discounting (Ashe and Wilson 2020; Ainslie et al. 2018; Kirby and Guastello 2001). Building on these insights, we propose that recurring payoff structures encourage individuals to adopt a broader temporal perspective, evaluating future outcomes as part of a continuous stream of consequences rather than as isolated incidents.

While similar mechanisms, such as choice bundling and bracketing, emphasize the effects of evaluating multiple choices within a broader temporal context, our approach embeds recurrence directly into the payoff structure itself. Rather than requiring individuals to explicitly aggregate decisions or consequences across time, recurring payoffs may naturally encourage temporal integration by making the continuity of outcomes more salient by design. We therefore hypothesize that recurring payoffs will broaden the temporal frame of evaluation, reduce the salience of immediate-versus-delayed contrasts, and ultimately lead to lower discount rates.

We test this hypothesis with two controlled experiments, one focused on gains and the other on losses. This distinction is important because of the well-documented *gain-loss asymmetry*, which refers to the tendency for individuals to be more impatient when evaluating gains than when evaluating losses (Kahneman and Tversky 1979; Hardisty, Appelt, and Weber 2013). Each experiment employed a fully within-subjects design, manipulating payoff structure (one-off vs. recurring) and payoff magnitude (small vs. large). By including payoff magnitude as an experimental factor, we also examine the well-established *magnitude effect*, whereby discounting varies with the objective size of outcomes, such that larger outcomes are generally discounted less steeply than smaller outcomes (Thaler 1981; Chapman 1996). To ensure conceptual clarity and experimental control, we implemented two structurally distinct conditions: one in which the payoff is delivered at a single point in time (one-off) and another in which an identical payoff recurs at fixed intervals (recurring). Although real-world outcomes often vary in timing and magnitude, recurring patterns such as salaries and subscriptions are common features of everyday life. By contrasting these payoff structures, the present study isolates the psychological shift associated with recurring outcomes, allowing for a precise examination of how recurrence influences discounting behavior.

This study makes three main contributions. First, it extends the time-preference literature beyond isolated, one-off payoffs by introducing recurring payoff structures as a distinct class of intertemporal outcomes and identifying temporal integration as a potential mechanism through which they influence discounting. Second, it provides empirical evidence that the temporal

structure of outcomes affects discounting, demonstrating that recurring and one-off payoffs lead to systematically different preferences. Third, the study extends the magnitude-effect literature by examining whether this well-established phenomenon generalizes to recurring payoff environments. In doing so, it broadens our understanding of how the size of outcomes influences discounting when consequences unfold repeatedly over time.

The remainder of the paper is structured as follows. Section 2 develops the hypotheses, while Section 3 presents the experimental studies and their results. Section 4 discusses the findings and their theoretical and practical implications. Finally, Section 5 concludes the paper and outlines directions for future research.

2 | Hypothesis Development

This section develops the theoretical argument underlying the proposed relationship between recurring payoff structures and discounting behavior and derives the research hypothesis.

The dominant approach in intertemporal choice research is to study decisions involving one-off outcomes that occur at specific time points. In these tasks, individuals typically choose between a smaller-sooner (SS) and a larger-later (LL) consequence, evaluating each outcome as a discrete event. Such representations emphasize the timing of outcomes and make the immediate-versus-delayed distinction particularly salient. However, many real-world consequences do not occur as isolated events. Salaries, rents, subscriptions, insurance payments, and many benefits and costs associated with long-term decisions unfold repeatedly over time. These recurring payoff structures differ fundamentally from the one-off outcomes typically examined in intertemporal choice research and may therefore invoke a different mode of evaluation.

The present study argues that the effect of recurring payoff structures arises through a change in the mental representation of intertemporal outcomes. Specifically, recurring outcomes encourage temporal integration, whereby consequences are evaluated as an interconnected stream unfolding across time rather than as isolated events occurring at a single point. By extending consequences across multiple periods, recurring payoffs make the continuity of time more salient and encourage individuals to think beyond a single future date. Instead of viewing the future as a discrete endpoint at which an outcome occurs, decision-makers may come to perceive it as an ongoing sequence of interconnected periods. By encouraging individuals to evaluate outcomes as part of a broader temporal stream rather than as isolated events, temporal integration reduces the salience of immediacy and increases the weight placed on longer-term consequences. As the salience of immediacy decreases and attention shifts toward future consequences, individuals should become less inclined to discount delayed outcomes, resulting in lower discount rates.

This argument is consistent with the choice isolation perspective, which proposes that traditional discounting tasks may encourage individuals to evaluate outcomes as isolated events, thereby increasing the salience of immediate consequences relative to delayed ones (Frederick et al. 2002). When choices are considered separately from their broader temporal context, immediate outcomes tend to receive disproportionate attention, increasing the attractiveness of sooner rewards. By contrast, expanding the temporal frame of evaluation encourages decision-makers to consider consequences beyond a single point in time, thereby reducing the salience of immediacy.

Further support for this reasoning can be found in the choice bundling and choice bracketing literature. Choice bundling suggests that when decisions are linked together and viewed as part of a larger sequence, individuals become more willing to prioritize long-term outcomes over immediate gratification (Ainslie et al. 2018). Similarly, choice bracketing demonstrates that broad evaluation of decisions often produces different preferences than evaluating each decision separately (Read et al. 1999). Although these theories differ in their specific mechanisms, they share a common insight: broadening the scope of evaluation encourages individuals to focus on aggregate consequences rather than isolated outcomes. From the perspective of the present study, the importance of these theories lies in their implication that temporal integration can systematically influence intertemporal preferences.

Our approach differs from traditional bundling and bracketing in an important respect. Existing studies typically rely on repeated decisions or explicit grouping of choices to induce a broader evaluation perspective. In contrast, our idea is based on a single decision whose consequences recur over time. Rather than bundling multiple choices or consciously extending the evaluative frame, recurrence is embedded directly into the payoff structure itself. We argue that this structure naturally encourages temporal integration because the outcome is experienced as a stream of connected consequences resolving over time rather than as a single future event experienced at a particular time point. By making long-term benefits more salient and reducing attention to isolated points in time, recurring payoffs may weaken the appeal of immediate gratification and promote greater consideration of long-term utility. Building on these insights, we argue that recurring payoff structures encourage temporal integration, reduce the salience of immediate-versus-delayed comparisons, and consequently lower discount rates. Therefore, we hypothesize that:

Hypothesis: Individuals will exhibit lower discounting when evaluating recurring payoffs than when evaluating comparable one-off payoffs.

Although the proposed mechanism is not expected to depend on outcome valence, examining gains and losses separately provides a stringent test of its generalizability. A large body of intertemporal choice research has documented a gain-loss asymmetry, whereby losses are typically discounted less steeply than gains and individuals exhibit greater sensitivity to potential losses than equivalent gains (Loewenstein and Prelec 1992; Hardisty, Appelt, and Weber 2013; Hardisty and Pfeffer 2017; Fan et al. 2025). If recurring payoff structures reduce discounting by encouraging a broader temporal representation of future consequences, their influence should extend across both domains despite these baseline differences in intertemporal preferences. Accordingly, we examine

recurring payoffs in both gain and loss contexts to assess whether the proposed mechanism operates similarly when individuals anticipate future benefits and future costs. In doing so, the study connects the temporal representation account of recurring outcomes to one of the most robust asymmetries in intertemporal choice.

In addition to outcome valence, we also examine the role of outcome magnitude. The magnitude effect is among the most robust findings in the intertemporal choice literature, with larger outcomes typically discounted less steeply than smaller ones (Thaler 1981; Green et al. 1997; Kirby and Maraković 1995). While this phenomenon has been extensively documented for one-off outcomes, its relationship with recurring payoff structures remains largely unexplored. Understanding this phenomenon is particularly important for the present study because recurring payoff structures may also alter how the overall value of future consequences is perceived. By encouraging individuals to evaluate outcomes as streams unfolding over time rather than as isolated future events, recurring payoff structures may naturally direct attention toward the total value accumulated across periods. This mechanism differs conceptually from the conventional magnitude effect. Whereas the latter concerns objective payoff size, recurring payoff structures change how outcomes are mentally represented. Thus, any increase in the perceived cumulative value of recurring outcomes is viewed not as a distinct psychological mechanism, but as one manifestation of the broader temporal integration process proposed here.

This distinction also motivates our examination of outcome magnitude. Accordingly, we investigate whether the conventional magnitude effect extends to recurring payoff structures and whether the proposed effect of recurrence persists across different levels of objectively manipulated payoff magnitude. Examining recurrence across different levels of objective payoff magnitude, therefore, provides a more stringent test of whether the proposed temporal integration mechanism generalizes beyond a particular payoff size, while extending the magnitude-effect literature to recurring payoff structures.

3 | Experimental Studies

To empirically test the hypothesis outlined in the previous section, we conducted two behavioral experiments: one focused on gains and the other on losses. Each experiment employed a 2 × 2 within-subjects design, manipulating payoff structure (one-off vs. recurring) and outcome magnitude (small vs. large). This resulted in four conditions per study: one-off small magnitude, recurring small magnitude, one-off large magnitude, and recurring large magnitude.

We adopted a within-subjects design to maximize experimental sensitivity and control for individual differences. Our primary goal is to examine how intertemporal evaluation changes as individuals shift from considering isolated one-off outcomes to recurring payoff structures. Because the proposed mechanism involves a change in how future consequences are mentally represented, observing both evaluations within the same individual is essential. A within-subjects design allows participants to serve as their own controls, thereby reducing variability arising from stable individual differences in preferences, cognitive styles, and discounting tendencies (Keren 2014). It also enables direct observation of how equivalent outcomes are evaluated when framed as isolated events versus recurring streams of consequences, providing a more precise test of the proposed temporal integration mechanism than would be possible with a between-subjects design (Greenwald 1976; Charness et al. 2012).

In line with the proposed temporal integration mechanism, the order of conditions was intentionally fixed rather than randomized. Recurring payoff structures were hypothesized to encourage individuals to shift attention toward streams of outcomes by mentally aggregating consequences across periods. Accordingly, the recurring condition was conceptualized as an extension of the one-off condition rather than as an independent and interchangeable treatment. Participants therefore evaluated one-off outcomes first, allowing them to consider consequences in isolation, consistent with the conventional framing used in intertemporal choice research. The recurring conditions were then presented as a broader temporal representation of the same underlying outcomes. This treatment order was thus theoretically motivated by the proposed directional psychological process underlying the study hypotheses. At the same time, because the order was not counterbalanced, differences between the one-off and recurring conditions may partly reflect order-related influences. The limitations of this design choice are discussed further in Section 5. The scenarios were otherwise designed to differ only in whether outcomes were presented as isolated events or as recurring streams of consequences.

In the one-off scenarios, participants completed standard delay-discounting tasks by identifying indifference values between SS and LL outcomes. These scenarios were framed as single, hypothetical events, such as surprisingly receiving a lottery reward or winning a contest in the gains experiment, and facing an unexpected bill payment in the losses experiment. The task and scenario framing for one-off decisions align with widely preferred approaches to studying time preference (Frederick et al. 2002; O'Donoghue and Rabin 1999; Hardisty, Appelt, and Weber 2013). On the other hand, to capture how temporal preferences may shift across the frequency of payoffs, the recurring payoff scenarios were designed as direct counterparts to their one-off equivalents, using identical monetary values and delay intervals. For instance, in the one-off loss scenario involving small magnitudes, participants identify an indifference value at which paying an unexpected bill of €100 on the 1st of the month is equally preferable to paying a larger amount on the 30th, assuming the decision is made on the 1st. The corresponding recurring payoffs scenario involves the same task but framed as a recurring health insurance payment–requiring participants to identify an indifference value between paying €100 on the 1st of each month versus a larger amount on the 30th of each month. By presenting the one-off scenarios first, followed by their recurring-payoff counterparts, we aim to examine how an extended time perspective and a focus on recurrence influence discounting behavior. Holding both outcome magnitudes and delay intervals constant across scenarios allows us to prioritize examining recurrence while controlling for other decision variables.

In each task, participants indicated the amount that made them indifferent between an immediate and a delayed outcome,

and these indifference points served as the primary measure of discounting. Because the delay interval was fixed across all scenarios and a single intertemporal trade-off was observed for each participant, indifference points provide a direct behavioral measure of how individuals trade off present and future consequences. To facilitate comparison with prior discounting studies and with the intertemporal-choice literature, we additionally transformed indifference points into discounting parameters (k). Given the fixed delay interval, these values should be interpreted as implied discounting parameters derived from participants' indifference points rather than as fully estimated individual discount functions. Accordingly, analyses were conducted using both raw indifference points and implied discounting parameters.

For one-off scenarios, implied discounting parameters were derived using the hyperbolic discounting model proposed by Ainslie (1975) and shown in Equation (1).

$$V(D) = \frac{A}{1 + kD}, \tag{1}$$

where A denotes the objective monetary amount, D is the delay, and k is an individual-specific discounting parameter. Larger values of k indicate steeper discounting and a stronger preference for immediacy.

To operationalize the temporal integration mechanism underlying the study hypothesis, recurring payoffs were modeled using the choice bundling framework proposed by Ainslie et al. (2018), which assumes that sequences of outcomes are evaluated jointly across time. Participants were presented with recurring-payoff scenarios and were asked to indicate the recurring delayed payment amount L that would make them indifferent to receiving a fixed, smaller-sooner payment SS each month starting immediately. Then the subjective value of a recurring stream was represented as the sum of the discounted values of its component payments. Thus, for a sequence of payments $\{A_t\}$ received at times $\{t\}$, the total present value was identified by Equation (2).

$$PV = \sum_t \frac{A_t}{1 + kt} \tag{2}$$

Given a participant's reported indifference point L, we recovered the implied discounting parameter k by numerically solving for the value of $k \geq 0$ that equates the present values of the two recurring streams over a horizon of T periods as shown in Equation (3).

$$\sum_{t=0}^{T-1} \frac{SS}{1 + kt} = \sum_{t=1}^{T} \frac{L}{1 + kt} \tag{3}$$

Accordingly, the earlier stream is discounted from ($t = 0$), whereas the later stream is discounted from ($t = 1$), reflecting the one-month delay between the two alternatives in the experimental tasks.

The implied discounting parameter (k) was recovered by defining a root-finding problem in which the difference between the present values of the sooner and later streams was set equal to zero. Unlike the one-off condition, where (k) can be obtained directly from the hyperbolic discounting equation, the recurring formulation contains multiple discounted components and does not admit a closed-form analytical solution for (k). Accordingly, individual-level estimates were obtained numerically using a bisection root-finding procedure.

The bisection method was selected because the objective function is continuous and monotonic over the feasible range ($k \geq 0$), ensuring convergence to a unique solution whenever an indifference point exists. The procedure iteratively narrowed the interval containing the root until the difference between the present values of the two streams fell below a predefined numerical tolerance. As a validation check, each recovered k value was substituted back into the present-value equation to verify equivalence between the sooner and later streams within the specified tolerance.

To examine the magnitude effect for one-off payoffs, we followed the logic of the magnitude-effect paradigm proposed by Kirby (1997). Specifically, discounting parameters were estimated separately for small (€100) and large (€1000) outcomes while holding the delay structure constant. Under this approach, a systematic decrease in the implied discounting parameter as outcome magnitude increases constitutes evidence of a magnitude effect.

We extended the same logic to recurring payoff sequences. For each magnitude condition, participants completed an intertemporal trade-off between an SS bundle and an LL bundle with an identical temporal structure. Consistent with the bundled hyperbolic framework described above, implied discounting parameters were recovered by equating the discounted present values of the two bundles. This yielded separate discounting estimates for small- and large-magnitude recurring sequences. As in the one-off case, a systematic decrease in the implied discounting parameter with increasing bundle magnitude was interpreted as evidence of a magnitude effect.

All participants reported demographic information, including age, gender, income, perceived financial security, and education. Although these variables were not part of the theoretical framework or hypothesis development, they were included as control variables in supplementary analyses to assess the robustness of the observed recurrence effects, account for potential individual heterogeneity (Cohen 1988), and strengthen the generalizability of the findings across diverse participant profiles (Falk et al. 2018). The following sections detail the experimental procedures, analyses, and results for the loss and gain experiments.

3.1 | Study 1: One-Off vs. Recurring Losses

Participants were residents of the Netherlands and were recruited via Prolific, an online data collection platform. They received £0.50 for their participation, consistent with prior research showing that fair compensation improves engagement and data quality in online studies (Buhrmester et al. 2011; Peer et al. 2021; Douglas et al. 2023). The intertemporal choices themselves were hypothetical rather than incentive-compatible,

a common approach in delay discounting research that allows precise control over temporal and payoff structures (Johnson and Bickel 2002; Madden et al. 2003). Eligibility criteria required participants to be at least 18 years old, provide informed consent prior to participation, and complete the study for the first time using their unique Prolific ID.

An a priori analysis was conducted for both experiments using G*Power as suggested by Faul et al. (2007) to determine the minimum sample size required to achieve adequate statistical power. In each case, the final sample size exceeded the estimated requirement, ensuring sufficient power to detect the effects of interest.

To ensure participants clearly understood the task of providing indifference points for outcomes occurring at different times, the experiment began with a detailed explanation and a step-by-step example. They were required to carefully read the instructions, review illustrative examples, and type the word "confirm" to indicate that they had read and understood the task. Participants were then presented with an example indifference-point question, for which the correct answer was explicitly stated in the instructional text. This question served as a comprehension and attention check, as only participants who understood the concept of indifference would be able to provide the correct response. In addition, the data were screened for quality to identify implausible or non-informative responses. Participants who provided extreme or random numerical responses outside the acceptable range (e.g., values inconsistent with the monetary amounts under evaluation) were excluded from the analysis. The final sample consisted of 151 participants (mean age = 31.67, SD = 9.47) whose demographic characteristics are summarized in Table 1.

The experiment utilized a 2 (payoff type: one-off vs. recurring) × 2 (outcome magnitude: small vs. large) within-subjects design. Every participant responded to four decision scenarios that required indifference points for one-off and recurring losses, with small and large outcome magnitudes. In the one-off scenario with small magnitudes, participants read:

> *"Imagine that you are making the following decision on the* 1st *of the month. You are given a choice between paying an unexpected €100 bill immediately or another larger amount on the* 30th *of the month. You should specify the magnitude of the delayed payment that would make these two options equally preferable to you."*

After providing an answer for this one-off scenario, participants move to its recurring equivalent, where they read:

> *"Imagine you have been using the same health insurance package for five years, costing you €100 per month. You have been paying your insurance bill on the* 1st *of each month. Recently, your insurance provider has offered new payment schedules. You now have the option to pay your monthly insurance later, on the* 30th *of every month, with a slight increase in its price. The price you identify for the new payment date will be valid for the next two years. You should specify the magnitude of the delayed payment that would make these two options equally preferable to you."*

TABLE 1 | Demographic characteristics of participants in Study 1 ($N = 151$).

Characteristics	Categories	*n* (%)
Education	High school	36 (23.84%)
	Bachelor's	60 (39.74%)
	Master's	45 (29.80%)
	PhD	10 (6.62%)
Age	18-22	21 (13.91%)
	23-28	43 (28.48%)
	29-34	43 (28.48%)
	35-40	18 (11.92%)
	41+	26 (17.22%)
Gender	Female	66 (43.71%)
	Male	84 (55.63%)
	Non-binary	1 (0.66%)
Employment status	Unemployed	17 (11.26%)
	Homemaker	2 (1.32%)
	Self-employed	11 (7.28%)
	Employed part-time	46 (30.46%)
	Employed full-time	75 (49.67%)
Annual income (after tax)	Below €30.000	41 (27.15)
	€30.000–€49.999	44 (29.14%)
	€50.000–€69.999	27 (17.88%)
	€70.000–€89.999	22 (14.57%)
	€90.000–€119.999	11 (7.28%)
	€120.000 and more	6 (3.97%)
Feeling financial security	No	44 (29.14%)
	Unsure	27 (17.88%)
	Yes	80 (52.98%)

After completing these two tasks concerning small outcome magnitudes, participants moved to the large magnitude cases and again started with the one-off case, where they read:

> *"Imagine that you are making the following decision on the* 1st *of the month. You are given a choice between paying an unexpected €1000 bill immediately or another larger amount on the* 30th *of the month. You should specify the magnitude of the delayed payment*

TABLE 2 | Mean indifference points for loss conditions ($N = 151$).

Magnitude	One-off mean (SD)	Recurring mean (SD)	Difference (one-off-recurring)
Small	€108.43 (22.72)	€102.63 (8.84)	+5.80
Large	€1037.33 (66.67)	€1011.52 (27.85)	+25.81

Note: For losses, lower indifference points indicate lower discounting.

> *that would make these two options equally preferable to you."*

This was followed by the recurring loss, large magnitude scenario, which reads:

> *"Imagine you have been living in the same apartment for five years, and your current rent is €1000, which you have always paid on the* 1st *of each month. Your landlord is now considering changes to your payment schedule. You have the option to pay your rent later on the* 30th *of each month with a slight price increase. The price you identify for the new payment date will be valid for the next two years. You should specify the magnitude of the delayed payment that would make these two options equally preferable to you."*

After completing the four scenarios, participants answered a demographic questionnaire before submitting the survey.

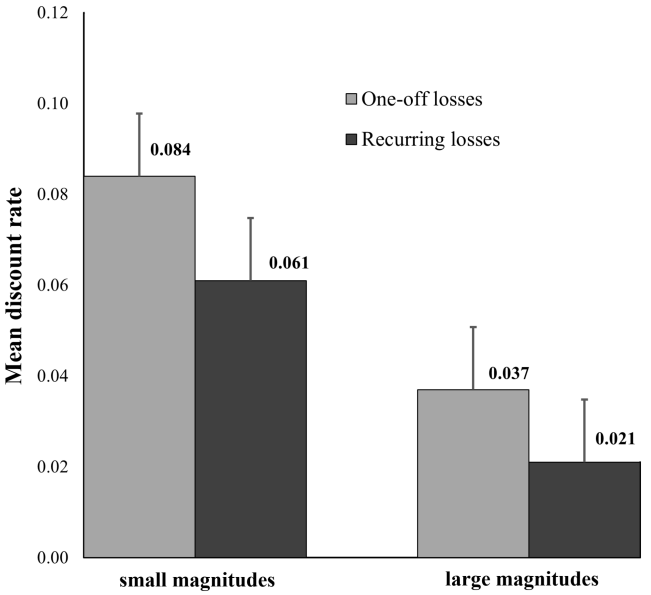

FIGURE 1 | Average discount rates for one-off vs. recurring losses with small and large outcome magnitudes *Note:* Error bars indicate ± 1 standard error.

3.1.1 | Study 1 Results

The average time to complete the study was 5 minutes. For each participant, an indifference point was obtained for each of the four scenarios and subsequently converted into a corresponding implied discount rate (k). Table 2 presents the mean indifference points. Across both outcome magnitudes, recurring losses produced lower indifference points than one-off losses. For the small-loss condition, the mean indifference point decreased from €108.43 to €102.63, while for the large-loss condition it decreased from €1037.33 to €1011.52. Because lower indifference points indicate lower discounting for losses, these descriptive results suggest that participants discounted future losses less when they were presented as recurring payments rather than as isolated one-time expenses.

To determine whether these differences were statistically significant, Wilcoxon signed-rank tests were conducted. This test was selected because the paired differences between the one-off and recurring conditions deviated significantly from normality in both the small- and large-magnitude scenarios (all $p < 0.01$). Wilcoxon signed-rank tests indicated that the recurring framing significantly reduced indifference points in both conditions. For the small-magnitude scenario, indifference points were significantly lower in the recurring condition than in the one-off condition, $Z = -5.82$, $p < 0.001$, $r = 0.47$. A similar pattern emerged for the large-magnitude scenario, where recurring losses also produced significantly lower indifference points than one-off losses, $Z = -5.57$, $p < 0.001$, $r = 0.45$. As a robustness check, paired-samples t-tests were also conducted. Consistent with the Wilcoxon results, the recurring conditions produced significantly lower indifference points than the corresponding one-off conditions in both magnitude scenarios (all $p < 0.001$), indicating robust findings across parametric and nonparametric analyses. These findings suggest that participants discounted future losses significantly less when the losses were presented as recurring payments rather than as isolated one-time expenses, providing support for our hypothesis.

The analyses were then repeated using the implied discounting parameters (k) derived from participants' indifference points. As shown in Figure 1, average discount rates varied across payoff types (one-off vs. recurring) and outcome magnitudes (small vs. large). The highest mean discount rate was observed in the one-off, small-magnitude condition ($M = 0.084$, $SD = 0.227$), followed by the recurring small-magnitude condition ($M = 0.061$, $SD = 0.289$). In contrast, larger magnitudes were associated with lower discount rates: the one-off large-loss condition yielded a mean of $M = 0.037$ ($SD = 0.069$), while the recurring large-loss condition showed the lowest average discount rate ($M = 0.021$, $SD = 0.055$).

At the within-subject level, 36.42% of participants exhibited a lower discount rate for recurring payoffs than for one-off payoffs, while 29.14% showed no change in their discount rate between the two payoff structures. A significant difference in

discount rates was observed between one-off and recurring losses at both magnitude levels. For small magnitudes, discount rates were higher in the one-off condition than in the recurring condition ($Z = -2.44$, $p = 0.015$, $r = 0.24$). A similar but stronger pattern was observed for large magnitudes ($Z = -2.98$, $p = 0.003$, $r = 0.30$), indicating lower discounting when losses were experienced as recurring rather than one-off.

Using Kirby's approach, we also examined the magnitude effect. In the one-off payoff case, of the 151 participants, 40 (26.49%) produced identical discount rates in the small- and large-magnitude conditions for one-off scenarios. Among the remaining 111 participants, 72 (64.86%) exhibited the magnitude effect ($k_{small} > k_{large}$), whereas 39 (35.14%) showed the opposite pattern. An exact binomial test on the non-tied cases indicated that the proportion exhibiting the magnitude effect was greater than chance (two-sided $p = 0.002$). For recurring payoffs, we conducted the same analysis to assess the magnitude effect. Of the 151 participants, 73 (48.34%) reported identical discount rates in the small- and large-magnitude conditions. Among the remaining 78 participants, 76 (97.44%) exhibited the magnitude effect ($k_{small} > k_{large}$), whereas only 2 (2.56%) showed the opposite pattern. An exact binomial test on the non-tied cases indicated that the proportion exhibiting the magnitude effect for recurring payoffs was significantly greater than chance (two-sided $p < 0.001$). These findings extend the magnitude effect phenomenon from one-off payoffs to recurring scenarios.

Additional analyses were conducted to assess whether the observed effects remained robust after controlling for participants' income, education level, and employment status. We initially classified income into six ranges–from "below €30,000" to "€120,000 and more." To ensure each subgroup had a sufficient sample size, we consolidated these into two broader categories. Specifically, the "below €30,000", "€30,000-€49,999", and "€50,000-€69,999" ranges were grouped as low income, while the "€70,000-€89,999", "€90,000-€119,999", and "€120,000 and more" ranges were combined into the high-income category. A Mann-Whitney U test indicated that income level did not significantly influence the within-subject difference in discount rates between one-off and recurring payoffs for either small ($U = 2116.50$, $Z = -0.21$, $p = 0.835$) or large magnitudes ($U = 1810.50$, $Z = -1.48$, $p = 0.140$). Similarly, for both small and large magnitudes, Kruskal–Wallis tests revealed no significant effects of education level or employment status on within-subject differences in discount rates between one-off and recurring payoffs (all $p > 0.10$).

TABLE 3 | Demographic characteristics of participants in Study 2 ($N = 133$).

Characteristics	Categories	*n*(%)
Education	High school	28 (21.05%)
	Bachelor's	59 (44.36%)
	Master's	42 (31.58%)
	PhD	4 (3%)
Age	18–22	19 (14.28%)
	23–28	37 (27.82%)
	29–34	33 (24.82%)
	35–40	19 (14.28%)
	41+	25 (18.8%)
Gender	Female	64 (48.12%)
	Male	68 (51.13%)
	Non-binary	1 (0.75%)
Employment status	Unemployed	24 (18.04%)
	Homemaker	3 (2.26%)
	Self-employed	11 (8.27%)
	Employed part-time	34 (25.56)
	Employed full-time	61 (45.87%)
Annual income (after tax)	Below €30.000	43 (32.33)
	€30.000–€49.999	31 (23.31%)
	€50.000–€69.999	19 (14.29%)
	€70.000–€89.999	21 (15.79%)
	€90.000–€119.999	9 (6.76%)
	€120.000 and more	10 (7.52%)
Feeling financial security	No	35 (26.32%)
	Unsure	26 (19.54%)
	Yes	72 (54.14%)

3.2 | Study 2: One-Off vs. Recurring Gains

The second experiment retests the same hypothesis for gains. Participants were residents of the Netherlands and were recruited via Prolific. Recruitment procedures, compensation, eligibility criteria, instruction protocols, comprehension checks, and data exclusion criteria were identical to those used in Study 1. Only participants who successfully passed the comprehension check were included in the final analyses. After applying these criteria, the final sample consisted of 133 participants (mean age = 32.36, SD = 9.97) whose demographic characteristics are reported in Table 3. As in Study 1, we utilized a 2 (payoff type: one-off vs. recurring) × 2 (outcome magnitude: small vs. large) within-subjects design. In the one-off scenario with small gains, participants read the instructions:

> *"Imagine that you are making the following decision on the* 1st *of the month. You are given a choice between receiving €100 unexpected reward from a lottery on the* 30th *of the same month or another smaller amount immediately. You should specify the magnitude of the immediate reward that would make these two options equally preferable to you."*

This was followed by the recurring payoff equivalent of the scenario where participants read the instructions:

TABLE 4 | Mean indifference points for gain conditions ($N = 133$).

Magnitude	One-off mean (SD)	Recurring mean (SD)	Difference (one-off-recurring)
Small	€91.04 (17.14)	€97.50 (7.75)	−6.46
Large	€956.05 (92.12)	€979.80 (40.90)	−23.75

Note: For gains, higher indifference points indicate lower discounting.

> *"Imagine that for the past five years, you have been supplementing your income by writing short articles for an online content platform. Each month, you consistently earn €100 from your published stories. Payments are transferred to your bank account on the* 30th *of each month. The platform is now considering adjusting its payment schedule, offering you the option to receive your earnings earlier, on the* 1st *of every month, in exchange for a slight decrease in the amount. The amount you identify for the earlier payment date will be valid for the next two years. You should specify the magnitude of the sooner income that would make these two options equally preferable to you."*

After completing these two tasks, participants move to the large magnitudes case, where they read:

> *"Imagine that on the* 1st *of the month, you win an unexpected contest that will pay you €1000 reward on the* 30th *of the same month. Alternatively, you can choose to receive a smaller amount immediately. You should specify the magnitude of the immediate reward that would make these two options equally preferable to you."*

This was followed by the recurring payoff version, which reads:

> *"Imagine that for the past five years, you have been receiving €1000 monthly interest income from a fixed deposit account with a bank. The interest payments are deposited into your bank account on the* 30th *of each month. The bank now offers you the option to receive your interest payments earlier on the* 1st *of each month, with a slight reduction in the payment amount. The new payment amount you identified for the earlier date will be valid for the next two years. You should specify the magnitude of the sooner income that would make these two options equally preferable to you."*

Consistent with the previous study, the primary dependent variable was the indifference point elicited from participants in each scenario. These indifference points were subsequently used to calculate the corresponding implied discount rates, providing an additional measure of intertemporal preference.

3.2.1 | Study 2 Results

On average, participants completed the study in approximately 5 minutes. As in Study 1, the mean indifference points were calculated for each condition and presented in Table 4. Across both magnitude levels, participants reported higher indifference points in the recurring condition than in the one-off condition. For small gains, the mean indifference point increased from €91.04 in the one-off condition to €97.50 in the recurring condition. A similar pattern emerged for large gains, where the mean indifference point increased from €956.05 to €979.80. Given that higher indifference points indicate lower discounting, these descriptive results suggest that participants discounted recurring gains less heavily than equivalent one-off gains, and that this pattern was observed consistently across both small- and large-magnitude outcomes.

To assess whether the observed differences in indifference points were statistically significant, Wilcoxon signed-rank tests were conducted. Consistent with Study 1, paired-samples t-tests were performed as a supplementary robustness check to support the nonparametric results. Wilcoxon signed-rank tests indicated that the recurring framing significantly increased indifference points in both conditions. For the small-magnitude gain scenario, indifference points were significantly higher in the recurring condition than in the one-off condition ($Z = -6.14$), ($p < 0.001$), ($r = 0.53$). A similar pattern emerged for the large-magnitude scenario, where recurring gains also produced significantly higher indifference points than one-off gains ($Z = -6.28$), ($p < 0.001$), ($r = 0.54$). Consistent with the Wilcoxon results, paired-samples t-tests indicated that indifference points were significantly higher in the recurring condition for both the small- and large-magnitude scenarios (all $p < 0.001$). These findings indicate that participants discounted future gains less when outcomes were presented as recurring payments rather than as isolated one-time rewards, providing support for the study hypothesis.

A similar analysis was repeated using the implied discounting parameters (k) calculated from the indifference points. Figure 2 illustrates the mean discount rates obtained across the different decision scenarios. The highest average discount rate was observed in the one-off, small-magnitude condition ($M = 0.136$, $SD = 0.227$), followed by the recurring small-magnitude condition ($M = 0.087$, $SD = 0.331$). In contrast, larger magnitudes were associated with lower rates: the one-off large-gain condition yielded a mean discount rate of $M = 0.058$ ($SD = 0.132$), while the recurring large-gain condition exhibited the lowest average discount rate ($M = 0.047$, $SD = 0.124$).

At the within-subject level, 56.39% of participants exhibited a lower discount rate for recurring gains than for one-off gains

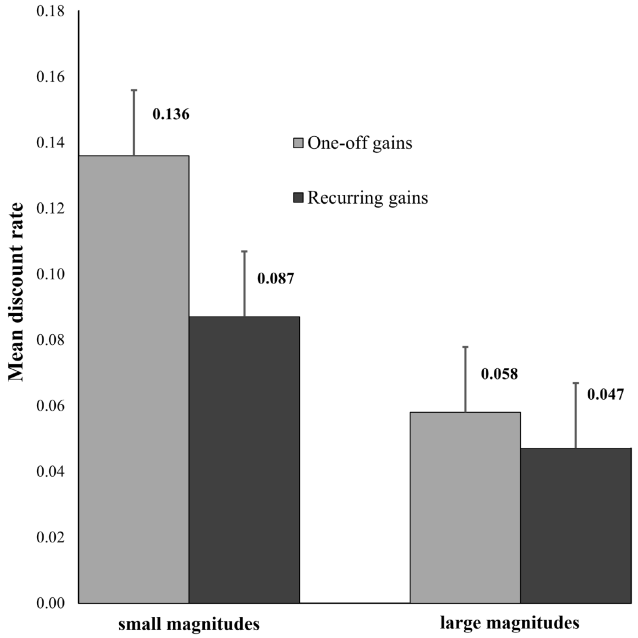

FIGURE 2 | Discount rates for one-off vs. recurring gains with small and large magnitudes *Note:* Error bars indicate ± 1 standard error.

in the small-magnitude condition. At the same time, 18.05% showed no change in their discount rate across the two payoff structures. For large magnitudes, 45.11% of participants exhibited a lower discount rate under recurring gains, whereas 33.08% showed no change, and 21.80% exhibited a higher discount rate. A significant difference in discount rates was observed between one-off and recurring gains at both magnitude levels. For small magnitudes, discount rates were significantly higher in the one-off condition than in the recurring condition $((Z = -4.47), (p < 0.001), (r = 0.39))$. A similar pattern emerged for large magnitudes $((Z = -2.81), (p = 0.005), (r = 0.24))$, indicating lower discounting when gains were experienced as recurring payments rather than as isolated one-off rewards.

As in Study 1, the magnitude effect was examined using Kirby's approach by comparing individual discount rates across two within-subject scenarios that differed only in the magnitudes of the gains. In the one-off scenarios, 31 of the 133 participants (23.31%) produced identical discount rates in the small- and large-magnitude conditions. Among the remaining 102 non-tied cases, 80 participants (78.43%) exhibited the magnitude effect ($k_{small} > k_{large}$), whereas 22 participants (21.57%) displayed the opposite pattern. An exact binomial test conducted on the non-tied cases showed that the proportion of participants exhibiting the magnitude effect was significantly greater than would be expected by chance (two-sided $p < 0.001$). For the recurring gains, 61 participants (45.86%) produced identical discount rates in the small- and large-magnitude conditions. Among the remaining 72 non-tied cases, 50 participants (69.44%) exhibited the magnitude effect ($k_{small} > k_{large}$), whereas 22 participants (30.56%) showed the opposite pattern. An exact binomial test on the non-tied cases indicated that the proportion exhibiting the magnitude effect was significantly greater than chance (two-sided $p = 0.0013$).

In the small-magnitude condition, income level influenced within-subject differences in discount rates between one-off and recurring payoffs. A Mann-Whitney U test indicated that high-income participants exhibited larger reductions in discount rates than low-income participants when moving from one-off to recurring gains ($U = 1416.50$, $Z = -2.32$, $p = 0.020$). In contrast, income level did not significantly influence within-subject changes in discount rates for large gains ($U = 1819.50$, $Z = -0.45$, $p = 0.652$).

The education level did not significantly influence within-subject differences in discount rates between one-off and recurring gains for either small or large magnitudes (both $p > 0.10$). Employment status likewise showed no significant effect for large gains. However, for small gains, employment status was associated with significant differences. Specifically, a Kruskal–Wallis test indicated that the reduction in discount rates from one-off to recurring small gains differed by employment category ($H(3) = 8.63$, $p = 0.035$). No corresponding effect was observed for large gains ($p = 0.104$). Taken together, these results suggest that while education does not systematically shape how individuals respond to payoff recurrence, employment status may moderate the impact of recurrence for small gains, consistent with the idea that individual circumstances matter most when outcomes are relatively modest.

4 | General Discussion

The present findings demonstrate that recurring payoff structures systematically influence intertemporal preferences. Across two experiments examining losses and gains, participants consistently exhibited lower discount rates when outcomes were recurring rather than one-off. This pattern emerged across both small and large outcome magnitudes and was observed using both indifference points and implied discounting parameters as dependent variables, providing robust support for the hypothesis that recurring payoff structures reduce discounting.

The findings are consistent with the temporal integration mechanism proposed in the hypothesis development section. We argued that recurring outcomes encourage individuals to perceive consequences as an ongoing stream unfolding across time rather than as isolated future events. By making the continuity of time and related outcomes more salient, recurring payoff structures appear to shift attention away from immediate-versus-delayed comparisons and toward longer-term consequences. This broader temporal representation reduces the relative weight placed on immediacy, leading to less steep discounting. Importantly, the effect was observed in both gain and loss domains, suggesting that the influence of recurrence operates despite well-established differences in how individuals evaluate future costs and benefits.

This interpretation is consistent with the choice isolation argument advanced by Frederick et al. (2002), which suggests that intertemporal outcomes are often evaluated as isolated events, thereby increasing the salience of immediacy. The present findings indicate that this tendency can be attenuated when recurrence is embedded directly into the payoff structure. More

specifically, the results are broadly consistent with the theoretical logic underlying choice bundling and choice bracketing. Both perspectives suggest that when consequences are evaluated within a broader temporal frame, attention shifts toward consequences unfolding over time (Ainslie 1992; Read et al. 1999). Although these theories have traditionally focused on repeated decisions and explicit choice grouping, our findings suggest that a similar effect may emerge from the structure of a single decision when its consequences recur over time.

The findings of our experiments may also be viewed in the context of a broader set of anomalies in the time-preference literature. Research on outcome sequences has repeatedly shown that preferences depend not only on the objective value and timing of outcomes, but also on how those outcomes are organized across time (Loewenstein and Prelec 1993; Read and Powell 2002; Guyse et al. 2002; Scholten et al. 2016; Scholten et al. 2025). For example, the improving sequence effect demonstrates that individuals often prefer sequences that improve over time, even when such preferences are inconsistent with standard discounted utility models (Loewenstein and Prelec 1993; Guyse et al. 2020). Likewise, studies of the spread effect suggest that individuals may assign greater value to desirable outcomes when they are distributed across multiple periods rather than concentrated into a single time point, despite no change in the aggregate amount or objective consequences (Ariely and Zauberman 2000; Read et al. 1998; Guyse et al. 2002; Loewenstein and Prelec 1991). These findings indicate that the temporal organization of outcomes can influence valuation independently of their objective magnitude and timing. Although the present study does not directly examine sequence trajectories or temporal spreading, the observed reduction in discounting for recurring payoffs is consistent with the broader idea that temporal structure shapes valuation. Recurring payoff streams may encourage individuals to evaluate consequences as integrated sequences rather than isolated events, thereby reducing the salience of immediacy and increasing attention to long-term outcomes. From this perspective, the present findings extend existing evidence on sequence-related anomalies by showing that transforming a one-off outcome into a recurring stream can systematically alter intertemporal preferences.

The findings also extend the literature on the magnitude effect (Benzion et al. 1989; Kirby and Maraković 1996). Consistent with prior research, larger outcomes were generally discounted less than smaller outcomes. More importantly, this pattern remained evident when outcomes were embedded within recurring payoff streams. The persistence of the magnitude effect in recurring environments suggests that temporal integration does not eliminate established determinants of intertemporal choice. Instead, the payoff structure and the magnitude of the outcome appear to exert independent influences on discounting behavior. At the same time, the recurrence effect remained observable across both magnitude levels, indicating that recurring payoff structures influence discounting above and beyond differences in outcome size.

4.1 | Theoretical Implications

This study offers several theoretical implications for understanding intertemporal decision-making. The results demonstrate that the temporal structure of outcomes influences discounting behavior, suggesting that intertemporal preferences depend not only on outcome magnitude and delay but also on how consequences are represented and unfold over time. Incorporating such contextual features into theories of intertemporal choice may therefore provide a more complete account of how individuals evaluate future consequences and make intertemporal trade-offs.

The distinction between one-off and recurring payoffs also relates to the concepts of choice bundling and choice bracketing. Prior research has shown that evaluating decisions within a broader temporal frame can shift attention toward longer-term consequences. While these theories have primarily focused on repeated decisions or the explicit grouping of choices, the present findings suggest that similar effects may arise from the structure of a single decision when its consequences recur over time. From this perspective, recurrence embedded in payoff structures may function as an implicit form of bundling, broadening evaluative perspectives without requiring explicit grouping or conscious aggregation. This observation opens new avenues for theorizing about recurring bundles or bracketing decisions involving recurring consequences and may contribute to the further development of bundling and bracketing theories.

Finally, although the present study focuses on monetary outcomes, the underlying mechanisms may generalize to other domains characterized by intertemporal trade-offs. In areas such as health behavior and environmental decision-making, individuals frequently encounter recurring consequences rather than isolated outcomes. As such, a recurrence-based perspective may provide a useful theoretical lens for understanding decision-making in temporally extended environments.

4.2 | Practical Implications

Beyond informing theory and empirical frameworks, this study offers actionable insights for shaping real-world decision-making. By emphasizing the recurring nature of payoffs, decision scenarios can encourage individuals to adopt more future-oriented perspectives. For instance, a savings app could present enrollment in an automatic savings plan not as a one-off choice but as a decision that yields recurring benefits, such as weekly savings growth. Framing decisions in terms of repeated outcomes may enhance the perceived value of long-term choices and increase engagement with commitment tools.

Our findings also carry implications for managing losses and obligations. Individuals were less willing to delay debts when the negative consequences recurred over time. From this perspective, highlighting the recurring nature of financial obligations could motivate earlier repayment and reduce procrastination behaviors. Policy-makers and financial advisors could leverage this insight through targeted reminders or communication strategies designed to emphasize the ongoing costs of delayed action.

The recurring-payoff structures may further improve the design of policies and programs that involve routine decisions,

such as tax payments, subscription renewals, or public health interventions. By making the recurring nature of benefits or costs salient, authorities could reduce procrastination and encourage timely compliance. Likewise, marketing and behavioral strategies, such as loyalty programs or subscription services, could benefit from highlighting recurring rewards so that consumers perceive them as delivering consistent value, potentially increasing retention and engagement. Collectively, these findings demonstrate that incorporating the temporal structure of payoffs into decision design can yield scalable interventions that foster more consistent, future-oriented decision-making.

5 | Conclusion

This study investigated whether intertemporal preferences differ when outcomes are presented as recurring payoffs rather than isolated one-off events. Across both gain and loss domains, recurring payoff structures consistently reduced discounting relative to comparable one-off outcomes. The findings are consistent with the proposition that recurring outcomes encourage temporal integration by highlighting the continuity of time, shifting evaluation toward broader outcome streams, and reducing the salience of immediacy. In addition, the study replicated the magnitude effect in both one-off and recurring conditions, demonstrating its robustness across payoff structures.

Despite these findings, several limitations should be acknowledged, each of which suggests promising directions for future research. Recurring payoff scenarios necessarily incorporate characteristics commonly associated with real-life recurring outcomes, such as familiarity, predictability, routine integration, and perceived obligation. Although we interpret these characteristics as theoretically consistent with the proposed mechanism of temporal integration, the present design does not fully disentangle their effects from recurrence itself. Future research could independently manipulate these phenomena to better isolate their respective contributions. In addition, recurring payoff structures may encourage individuals to mentally aggregate outcomes across time, increasing the salience of cumulative consequences. While the present design differentiates recurrence from the conventional manipulation of objective payoff magnitude, it does not fully disentangle the proposed temporal integration mechanism from the possibility that recurring outcomes increase perceived cumulative value. Future research could address this issue by manipulating perceived cumulative value independently of recurrence. For example, participants could evaluate recurring payoff streams while varying whether cumulative totals are explicitly displayed, or one-off outcomes could be framed in terms of equivalent cumulative consequences. Such designs would help determine whether cumulative valuation mediates the relationship between recurrence and discounting or, as proposed here, represents one manifestation of the broader process of temporal integration.

Several additional design considerations should also be noted. In our experiments, recurring payoff scenarios were represented using fixed recurrence cycles and outcome magnitudes. Although this structure reflects many common financial situations, such as salaries, subscriptions, and insurance payments, it does not capture the full complexity of recurring decisions encountered in everyday life, where both the timing and magnitude of outcomes may vary. Future research could extend the current framework by examining more dynamic recurring payoff structures that incorporate variability in recurrence intervals and outcome amounts. Interactive or game-based experimental environments may be particularly valuable for studying such settings, as they allow participants to experience and adapt to evolving payoff streams over time. In addition, the experiments employed a fixed-order within-subject design. Although this design was theoretically motivated to reflect the proposed progression from one-off to recurring evaluation, it does not allow the effects of recurring payoff structures to be fully separated from potential order-related influences, such as learning, increased task familiarity, or demand characteristics. Accordingly, the observed differences should be interpreted as being consistent with the proposed temporal integration mechanism, while recognizing that alternative sequence-related explanations cannot be completely ruled out. Future research could test the robustness of these findings using counterbalanced within-subject or between-subject designs to isolate the unique contribution of recurring payoff structures.

Another limitation of the study is the exclusive focus on recurring monetary outcomes. While this approach allowed precise control over the temporal structure of recurring and one-off outcomes, caution is warranted when generalizing the findings. Future research could examine whether similar recurrence effects emerge in incentive-compatible settings, repeated decision environments, and naturally occurring financial decisions. From a similar perspective, the present study focused exclusively on recurring monetary outcomes. However, recurring consequences are common across many domains of everyday life, such as health and environmental decision-making. Future research could examine whether recurring non-monetary outcomes similarly encourage individuals to evaluate consequences within a broader temporal framework. Establishing whether the observed reduction in discounting extends beyond financial decisions would provide a stronger test of the temporal integration mechanism proposed in this study and help assess its broader applicability across decision-making contexts.

In both experiments, participants were recruited from a single country through an online crowdsourcing platform, which may limit the extent to which the results generalize to other populations. Replicating the study across more diverse cultural, socioeconomic, and professional groups would provide a stronger test of the robustness and generalizability of the observed recurrence effects, particularly given documented cross-cultural differences in intertemporal preferences.

Beyond addressing these limitations, several promising theoretical extensions emerge from the present findings. In developing our hypothesis, we drew on the theoretical frameworks of choice bundling and bracketing. While prior studies on these concepts have focused on considering multiple separate decisions, our experiment shows that even single decisions generating recurring payoffs can influence time preferences and promote a broader evaluative perspective. Building on this insight, future work could examine scenarios such as "recurring

bundles" or "bracketing recurring outcomes," where multiple problems with recurring payoffs are considered together. Investigating these structures may further advance theories of choice bundling and bracketing and provide insights into complex decision-making processes.

In conclusion, we expect this paper to inspire further research on the role of recurring payoffs in decision-making, advance theoretical and empirical understanding of intertemporal choice, and inform the development of interventions that help individuals and organizations make more informed long-term decisions.

Author Contributions

Pelin Gülüm: conceptualization, literature review, experiment design, data collection, methodology, analysis, writing (original draft), editing. **Yousef Maknoon:** conceptualization, methodological guidance, editing, supervision. **Gilberto Montibeller:** conceptualization, methodological guidance, editing, supervision. **Jafar Rezaei:** conceptualization, methodological guidance, analysis support, editing, supervision.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study will be openly available in *4TU.ResearchData* after an embargo period.

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