# Virtues and Vices in Monetary Tradeoffs

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**Abstract**

Monetary intertemporal tradeoffs are a restricted, yet underexplored, domain. In this extended abstract, we provide an integrative analysis of monetary tradeoffs involving single dated outcomes, unmixed sequences, virtues (schedules of investment), and vices (schedules of debt). Results include debt aversion, aversion to vices (which adds to debt aversion) and *relative* vices, and attraction to virtues and *relative* virtues. The results motivate a comparative mental accounting model, which includes direct comparisons between the outcomes delivered by the options at consecutive delays. The model accommodates not only the results reported in this extended abstract, but also other puzzling phenomena in choices involving sequences.

**Keywords**: Intertemporal choice, discounting; virtues; vices; sequences; mental accounting.

Intertemporal choices are those in which outcomes of choice are traded off against their timing. One example is the choice between a chocolate mousse and a fruit salad for dessert, where immediate gratification may favor the former, but future health may favor the latter. Another example is the decision of whether to consume on credit now and pay off debt in the future or invest income now and consume more in the future. Again, there is a tradeoff between what is best now and what is best in the future.

The above choices can be viewed as choices between a *relative vice* and a *relative virtue* (Wertenbroch, 1998), where the relative vice is better in the short run but worse in the long run or overall, whereas the relative virtue is worse in the short run but better in the long run or overall. Many intertemporal choices fit this definition, and also elementary choices between single dated outcomes. Consider the choice between $150 today and $200 in 1 year. By the above definition, the smaller-sooner outcome is a relative vice, and the larger-later outcome is a relative virtue. The notion of relative virtues and vices is inherently *comparative* in nature. However, current models of intertemporal choice do not consider the possibility that people actually make the relevant comparisons, and frame the options as relative virtues and vices. For instance, the above choice between single dated outcomes may be represented as a decision of whether to accept or reject receiving $150 less today and $200 more in 1 year. This is a relative virtue: Less money in the short term (-$150), but more in the long term ($200) or overall ($50). Alternatively, the choice may be represented as a decision of whether to accept or reject receiving $150 more today and $200 less in 1 year. This is a relative vice: More money in the short term ($150), but less in the long term (-$200) or overall (-$50). These mental operations involve direct comparisons between the options: Comparisons between the outcomes available today ($150 and $0) and in 1 year ($0 and $200). The question is whether and when people perform these operations, and how it affects the decisions they make.

While most experimental research of intertemporal choice has focused on single dated outcomes, many real-life choices involve prospects of multiple outcomes. A distinction can be made between mixed and unmixed sequences. Unmixed sequences can be *goods*, which are composed of only positive outcomes, and *bads*, which are composed of only negative ones. Mixed sequences include, but are not restricted to, absolute virtues, or *virtues* in short, which exchange sooner costs for larger-later benefits, and absolute vices, or *vices* in sort, which exchange sooner benefits for larger-later costs.

With the exception of Prelec and Loewenstein's (1998) work on the mental accounting of investment and debt, experimental research on virtues and vices has focused almost exclusively on consumption, such as consumption of healthy or unhealthy food items (Read & van Leeuwen, 1998, and thereafter), as in the dessert example given above, and consumption of highbrow or lowbrow movies (Read, Loewenstein, & Kalyanaraman, 1999, and thereafter). In that research, there is no rigorous control over whether the options are treated as absolute or relative virtues and vices. Monetary tradeoffs, often the focus of experimental research on single dated outcomes and unmixed sequences, lend themselves perfectly for that purpose. One goal of this extended abstract is, therefore, to conduct an integrative analysis of choices involving single dated outcomes, unmixed sequences, virtues, and vices in monetary tradeoffs, where monetary virtues are *schedules of investment*, and monetary vices are *schedules of debt*.

As a whole, our results cannot be accommodated by

any current model of intertemporal choice, so that a new approach is needed. We propose an extension of Prelec and Loewenstein's (1998) *double-entry mental accounting model* of preferences for schedules of investment and debt. Essentially, the extension is that, in choices involving sequences, people *do* make direct comparisons between the outcomes available at consecutive delays, which often means that they reframe the options as relative virtues and vices. We discuss how this *comparative mental accounting model* accommodates the results reported in this extended abstract, and also results reported elsewhere.

We collected data from many samples in three nations (the United States, the United Kingdom, and Portugal), sometimes with paid, sometimes with unpaid participants, as we went along perfecting the experimental comparisons in order to counter, as much as possible, explanations offered by the current models of intertemporal choice. The comparisons that we report are the most challenging ones. This extended abstract, however, can only cover a few. All choices reported were part of surveys including a larger set of intertemporal choices, the order of which was randomized across participants.

## Debt aversion

A basic assumption underlying models of intertemporal choice is positive time preference: People would prefer a gain sooner rather than later (*impatience*), and a loss later rather than sooner (*procrastination*). To test this assumption, we presented 36 participants with different timings of receiving €100 and 78 participants with different timings of paying €100. The results were as follows:

**Set 1**
W Receive €100 in 1 year (11%)
B Receive €100 today (89%)

**Set 2**
W Pay €100 today (65%)
B Pay €100 in 1 year (35%)

Here and elsewhere, B denotes the best option in the long run, whereas W denotes worst option in the long run. An overwhelming chose B among receipts (positive time preference), $\chi^2(1) = 21.78$, $p < .005$ (Pearson's $\chi^2$), but a smaller yet significant majority chose W among payments, $\chi^2(1) = 7.38$, $p < .05$ (negative time preference).

The observed pattern of results can be explained by combining the discounting of delayed outcomes with an aversion to delayed losses, or *debt aversion*. Discount-ing favors immediate gains over delayed ones, and delayed losses over immediate ones. Debt aversion, however, favors immediate losses over delayed ones, thus countervailing discounting. Therefore, while choice is not conflicted for different timings of a gain, because discounting unambiguous-ly favors the immediate gain, it *is* conflicted for different timings of a loss, because discounting, which favors the delayed loss, is countervailed by debt aversion, which favors the immediate loss. In this study, discounting was outweighed by aversion to delayed losses.

Debt aversion operates in addition to loss aversion, which is that the pain of loss is greater than the pleasure of an equal gain (Kahneman & Tversky, 1979). We next report an aversion to vices, which operates in addition to debt aversion.

## Aversion to Vices

We asked 429 participants to choose from the following pairs of options:

**Set 3**
*Referent pair*
W Pay $600 in 1 year (26%)
B Pay $450 today (74%)
*Target pair*
W Receive $50 today and pay $600 in 1 year (20%)
B Pay $450 today (80%)

W in the target pair is obtained from W in the referent pair by adding an immediate $50. Because W in the target pair dominates W in the referent pair, it should be more popular. However, the opposite was true, $\chi^2(1) = 7.72$, $p < .05$ (McNemar's $\chi^2$ for dependent samples), suggesting that a later payment, or a debt, hurts more when it is the cost of a sooner benefit than when it is an uncompensated loss. This is *aversion to vices.*

One possible explanation is offered by Loewenstein and Prelec's (1993) sequences model, according to which people have a preference for improvement tempered by a preference for spreading. A vice, however, exhibits deterioration, which decreases preference for it. Another possible explanation is offered by Prelec and Loewenstein's (1998) double-entry mental accounting model: The pleasure of the immediate benefit is attenuated by the pain of the delayed cost (debt), and the experience of the immediate benefit may, through attenuation, change into a negative one.

## Attraction to Virtues

Two principles of outcome valuation are loss aversion and diminishing sensitivity (Kahneman & Tversky, 1979): The impact of a loss is greater than that of an equivalent gain, and the marginal impact of an outcome decreases with its magnitude. In the following set, we see both principles being violated. We asked 435 participants to choose from the following option pairs:

**Set 4**
*Referent pair*
W Receive €450 today (54%)
B Receive €600 in 1 year (46%)

*Target pair*
W Receive €300 today (46%)
B Pay €150 today and receive €600 in 1 year (54%)

The target pair is obtained from the referent pair by subtracting a common amount ($150) from both options in period 1. This does not change the interest rate implied by the options (33%), so that, objectively, the preference between W and B should not change. Moreover, by loss aversion and diminishing sensitivity, the value difference between 300 and -150 in the target pair is more strongly in favor of W than the value difference between 450 and 0 in the referent pair, so that W should be more popular, and B less popular, in the target pair than in the referent pair. Instead, B was more popular in the target pair than in the referent pair, $\chi^2(1) = 4.90$, $p < .05$, suggesting that the same receipt is more appealing when it is the benefit of an investment than when it is an uncompensating gain. This is *attraction to virtues*.

One possible explanation is offered by the sequences model: Preference for improvement. Another possible explanation is offered by the mental accounting model: The pain of the immediate cost (investment) is buffered by the pleasure of the delayed benefit, and the experience of the immediate cost may, through buffering, change into a positive one.

## Unmixed Sequences

We asked the same 435 participants from the section on attraction to virtues to choose from the following option pairs:

**Set 5**
*Referent pair*
W Receive €75 today (68%)
B Receive €100 in 1 year (32%)
*Target pair*
W Receive €300 today (57%)
B Receive €225 today and receive €100 in 1 year (43%)

The target pair is obtained from the referent pair by adding a common amount (€225) to both options in period 1. This does not change the interest rate implied by the options (33%), so that, objectively, the preference between W and B should not change. However, B was more popular in the target pair than in the referent pair, $\chi^2(1) = 9.33$, $p < .005$.

One possible explanation for the above result is diminishing sensitivity: The value difference between 300 and 225 in the target pair is less strongly in favor of W than the value difference between 75 and 0 in the referent pair, so that W should be less popular, and B more popular, in the target pair than in the referent pair. However, diminishing sensitivity is being violated by the results below:

**Set 6**
*Referent pair*
W Receive €300 today (58%)
B Receive €400 in 1 year (42%)
*Target pair*
W Receive €300 today and receive €300 in 1 year (47%)
B Receive €700 in 1 year (53%)

The target pair is obtained from the referent pair by adding a common amount (€300) to both options in period 2. This does not change the interest rate implied by the options (33%), so that, objectively, the preference between W and B should not change. However, B was more popular in the target pair than in the referent pair, $\chi^2(1) = 21.59$, $p < .005$. By diminishing sensitivity, the value difference between 700 and 300 in the target pair is less strongly in favor of B than the value difference between 400 and 0 in the referent pair, so that B should be less popular in the target pair than in the referent pair.

The above results are incompatible with the sequences model: In Set 5, B deteriorates and yet it gained popularity, and, in Set 6, W neither deteriorates nor improves, and yet it lost popularity. The results cannot be explained by the mental accounting model either, because, in the absence of mixed sequences, i.e., schedules of costs and benefits, this model reduces to a standard delay discounting model.

The results are consistent with the notion that choice involving sequences promotes comparative accounting. In the choice between a single immediate outcome and a sequence (Set 5), the sequence is framed as a relative virtue ('€75 less today and €100 in 1 year'), and attraction to virtues increases the preference for this option. In the choice between a single delayed outcome and a sequence (Set 6), the sequence is framed as a relative vice ('€150 today and €200 less in 1 year'), and aversion to vices decreases the preference for this option.

## A Core Anomaly

We asked the same 429 participants from the section on aversion to vices to choose from the following option pair:

**Set 7**
Receive $500 in 1 year and receive $500 in 3 years (29%)
Receive $1,000 in 2 years (71%)

A large and significant majority preferred the single delayed receipt to the flat sequence of delayed receipts, $\chi^2(1) = 74.69$, $p < .005$. We call this a core anomaly, because no model of intertemporal choice accounts for it. As to standard delay discounting models, such as Loewenstein and Prelec's (1992) hyperbolic discounting model, discounting per se contributes to a preference for the sequence, which is compounded by hyperbolic discounting and diminishing sensitivity. As to the

sequences model, the sequence neither improves nor deteriorates, which contributes to indifference between the sequence and the single delayed receipt. Finally, the mental accounting model reduces to a standard delay discounting model, because the choice does not involve mixed sequences. In the next section, we try to account for the whole set of results.

## Theory

Our theory is an extension of Prelec and Loewenstein's (1998) mental accounting model of investment and debt. In this model, sooner benefits are attenuated by later costs, and sooner costs are buffered by later benefits. This, by itself, accounts for aversion to vices and attraction to virtues, as observed in Sets 3 and 4. The model incorporates loss aversion, in that negative experiences are augmented relative to positive ones. Negative experiences include sooner benefits when their attenuation by later costs results in a sign reversal, and positive experiences include sooner costs when their buffering by later benefits results in a sign reversal. Experiences in each period are discounted as a function of the delay to the experiences, and the option with the highest discounted value is chosen.

Our extension of the mental accounting model draws on two considerations. First, operating in addition to loss aversion is debt aversion, meaning that delayed costs are augmented relative to immediate ones. This accommodates the preference observed in Set 2. It also increases the aversion to vices observed in Set 3.

Second, the option that has the longest interval between its soonest and latest outcome, i.e., the longest duration, becomes the target option, the outcome of which in any given period is compared with the outcome of the referent option in that period. Thus, for instance, in the choice between a sequence and a single dated outcome, the sequence becomes the target option, and the single dated outcome becomes the referent option. In the choice between two single dated outcomes, neither option has duration, and so there is no targeting and referencing. In the choice between options of equal duration, either option can become the target option.

From the vantage point of the extended mental accounting model, the preference pattern observed in Set 5 shows *attraction to relative virtues*. In the target pair, the sequence is the target option and the single immediate receipt is the referent option. Thus, the choice is framed as whether to accept or reject the prospect of 'receiving €75 less today and receiving €100 in 1 year.' To the degree that the immediate comparative loss is buffered by the delayed receipt, possibly resulting in a positive experience of the immediate comparative loss, the tendency will be to accept this prospect.

The preference pattern observed in Set 6 shows *aversion to relative vices*. In the target pair, the sequence is the target option and the single delayed receipt is the referent option. Thus, the choice is framed as whether to accept or reject the prospect of 'receiving €300 today and receiving €400 less in 1 year.' To the degree that the immediate receipt is attenuated by the delayed comparative loss, the tendency will be to reject this prospect.

Finally, our explanation of the preference observed in Set 7 is that, the sequence was framed as two gains interleaved with a comparative loss, and that, due to attenuation of the gain in period 1 and aversion the comparative loss in period 2, the tendency was to reject the mixed prospect, notwithstanding a buffering of the comparative loss in period 2 by the gain in period 3.

## Some Implications

The comparative mental accounting model resolves several puzzles. Consider, for instance, the widely investigated preference for improving sequences over deteriorating ones. Loewenstein and Prelec (1993) discuss a number of explanations of this phenomenon, which all invoke *within-option* operations. One explanation is adaptation and loss aversion. People adapt to ongoing stimuli over time, and evaluate ensuing stimuli relative to their adaptation level. An improving sequence becomes a series of positive departures (gains) from the adaptation level, while a deteriorating sequence become a series of negative departures (losses) from the adaptation level. Preference for improving sequences over deteriorating ones then follows from loss aversion (Kahneman & Tversky, 1979).

Our explanation, in contrast, invokes *between-option* operations. When people focus on the improving sequence and compare it with the deteriorating one, they experience an increasing series of comparative losses and gains. Attraction to relative virtues increases the attractiveness of this option, making choice of improvement more likely. Alternatively, when people focus on the deteriorating sequence and compare it with the improving one, they experience a decreasing series of comparative gains and losses. Aversion to relative vices decreases the attractiveness of this option, making choice of deterioration less likely. According to our explanation, preference for improvement over deterioration is fundamentally a *choice*-related phenomenon, because, without direct comparisons between options, there would be no mental construction of relative virtues and vices. Indeed, it has been shown that preference for improvement over deterioration evaporates in elicitation tasks other than choice, in which other motives and mental operations come to the fore (Frederick & Loewenstein, 2008).

Another puzzle is the hidden-zero effect (Magen, Dweck, & Gross, 2008), which is that the preference for B over W increases when two single dated receipts are changed into sequences by explicating the zero receipt. Thus, for instance, choice of '$0 today and $400 in 1 year' over '$300 today and $0 in 1 year' is more likely than choice of '$400 in 1 year' and '$300 today.' The comparative mental accounting model explains the

hidden-zero effect as follows. Both sequences, each with duration of 1 year, can become the target option. When B is the referent option, W becomes a relative vice, and, by aversion to relative vices, the preference for B over W increases. When W is the referent option, B becomes a relative virtue, and, by attraction to relative virtues, the preference for B over W increases.

Yet another puzzle is the mere token effect (Urminsky & Kivetz, 2011), which is a violation of independence in which the preference for B over W increases when two single dated receipts are changed into sequences by adding a common consequence before both receipts. For instance, choice of '€50 tomorrow and €400 in 1 year' over '€50 tomorrow and €200 in 1 week' is more likely than choice of '€400 in 1 year' over €200 in 1 week.' The comparative mental accounting model can explain the mere token effect as well. With the introduction of the token, the sequence of longer duration, B, becomes the target option, whereas the sequence of shorter duration, W, becomes the referent option. As a result of the comparison process, the choice between B and W is framed as a decision of whether to accept the relative virtue '€200 less in 1 week and €400 in 1 year.' By attraction to relative virtues, the tendency will be to accept this prospect.

In our article, we provide a much more exhaustive analysis of recently discovered anomalies in choices involving sequences. The comparative mental accounting accommodates most.

## Conclusion

Our results show an interesting pattern: People are extremely impatient in gains, with many declining to receive a 33% interest rate, much and much higher than riskless market rates, but they become more farsighted when faced with other intertemporal arrangements. First, their impatience in gains decreases when future benefits are preceded by immediate costs (attraction to virtues). Furthermore, they are averse to procrastination in losses (debt aversion), and become even more farsighted when future costs are preceded by immediate benefits (aversion to vices).

Our theoretical reconstruction suggests that, people make direct comparisons between options. Specifically, the outcomes of the option with the longest duration are compared, period by period, with the outcomes of the options with the shortest duration. The result is that even sequences are cognitively represented as relative virtues, relative vices, or, more generally, mixed prospects. This proposal of comparative framing greatly increases the scope of a mental accounting approach to intertemporal choice.

It also opens avenues toward a better understanding of real-life decisions. The paradigmatic example of intertemporal choice is whether to get a job and earn a living now or go to college and earn a better living later. How is such a complex decision made? Plausibly, people would make direct comparisons between the features of the options under consideration. In this case, comparisons between studying (or partying) and working, between the jobs available with and without a college degree, between prospective earnings, and between incurring and foregoing tuition debt. Current models of intertemporal choice are notably ignorant of such comparisons in decision making: Each option receives its discounted value, regardless of how it compares to other options, and the option with the highest value is chosen. Our analysis suggests that intertemporal choice is comparative in a carefully crafted choice environment, and we would be surprised if people suddenly ceased to make comparisons in the wild.

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