

Further Context Dependent Valuations of Time Preference

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Abstract : The common inclination of people to value losses more than otherwise commensurate gains, gives rise to a predictable pattern of different valuations depending on the measure used to assess the change. Evidence is provided that extends the pattern of variations to future gains and losses. The findings indicate that people are very likely to discount the value of future losses at a much lower rate than future gains – a difference likely to influence investment and saving decisions and call for changes in public expenditures.

Keywords: Time preferences; Endowment effect; Differing discount rates

JEL Classification: C91, D01, D61, D91

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1. Introduction

Violations of the traditional assumption of stable preferences, roughly that if A is preferred to B it will be chosen regardless of expressions of the particulars of the choices, have been commonly observed and reported upon. For example, the same people were, on average, willing to trade \$5.60 for a 50 percent chance to win \$20, but demanded \$10.87 to give up the same entitlement (Kachelmeier and Shehata, 1992). Similar disparate valuations that depend on the context of the valuation have been demonstrated over a very wide range of investigations, entitlements, methods of observation, real and hypothetical exchanges, and experimental and non-experimental circumstances.

Such context dependent valuations give rise to often predictable patterns of differing values for otherwise normatively identical entitlements. The purpose of the present study is to provide further evidence, from real exchange experiments and hypothetical survey responses that extends these expectations of disparate valuations to include differing valuations of future gains and future losses. In this study people were found, for example, to value future outcomes in a pattern of differences consistent with expectations, including their discounting future losses at a lower rate than future gains.

2. Disparities between measures and the expected patterns of valuation

The findings that people value a loss from a reference state more, and often much more, than an otherwise fully commensurate gain beyond the reference, are pervasive and well-known. Consistent evidence of this reference, or as it is more frequently known, endowment effect, has come from a wide variety of survey studies, replicated real exchange experiments, and recordings of choices made by individuals in non-experimental decisions (reviewed in, for example, Samuelson and Zeckhauser, 1988; Kahneman, Knetsch, and Thaler, 1991; Rabin, 1998; and Knetsch and Tang, in press). For example, the greater sensitivity of investors to losses in making real portfolio choices is apparent in their observed reluctance to realize a loss by selling. This leads not only to smaller volumes of sales of securities that have declined in price relative to those for which prices have increased (Shefrin and Statman, 1985), but to investors earning substantially lower returns as they replace their winning stocks more often relative to ones with current prices below acquisition prices (Odean, 1998).

As long recognized, an endowment effect is unlikely in cases such as merchants giving up stock in exchange for money – that being the point of such enterprises. And while some studies have shown diminution, or even elimination, of the valuation disparity over repeated trials, these have been based on second price Vickrey auctions which have been shown to be unlikely to give accurate readings of people's valuations of gains and losses (Knetsch, Tang, and Thaler, 2001). While differences in valuations of gains and losses may not be universal, they appear, on current evidence, to be pervasive, and inconsistent with the easy assumption of standard theory that "we shall normally expect the results to be so close together that it would not matter which we choose" (Henderson, 1941, p. 121). People commonly value losses more than gains, and the choice of measure does matter.

An important implication of the valuation disparity is that an entitlement, or a change in entitlement, will usually not have a single or unique value to an individual. The value will instead differ depending on the context of the valuation – it will usually be larger, for example, in the context of a loss than in the context of a gain. Further, an individual's valuations for positive and for negative changes will depend on the reference state relevant to the change, giving rise to a two by two array of gain and loss valuations illustrated in Figure 1. Here, gains and losses to an entitlement are represented on the vertical scale and changes in money, or whatever valuation numeraire is used, are on the horizontal one.

Changes in the domain of gains can be valued as either (1) the maximum an individual is willing to pay (WTP) for a gain (Quadrant I), or (2) the minimum amount the individual is willing to accept (WTA) to forego a gain (Quadrant II). Changes in the domain of losses can be valued as either (1) the minimum WTA to accept a loss (Quadrant III), or (2) the maximum WTP to avoid a loss (Quadrant IV).¹ Of the four, the values in Quadrant

¹ The Quadrant I and Quadrant III sums are the compensating variation measures of a gains and a loss respectively, which are appropriate for assessing changes for which the reference is the state without the change. The Quadrant II and Quadrant IV sums are the equivalent variation measures of a gain and a loss respectively, and are appropriate for changes for which the reference is the state after the change

I (the WTP for a gain) can be expected to be the smallest as the value of the gain is discounted for being a gain and the value of loss in the numeraire good (usually money) will be given greater weight for being a loss – people will therefore be willing to give up less of the numeraire good to secure the gain in entitlement. The values in Quadrant III can, for analogous reasons, be expected to be the largest of the four measures as the compensation is a gain and valued less for being so, and the loss is here given greater weight for being a loss from the reference state – people will therefore demand more of the numeraire good to accept the loss. The values in both Quadrant II and Quadrant IV can generally be expected to be intermediate between Quadrant I and Quadrant III, as they involve either tradeoffs between two gains (Quadrant II), or tradeoffs between two losses (Quadrant IV), rather than tradeoffs between a gain and a loss.

The array of commonly differing valuations of gains and losses, illustrated by Figure 1, can fully be expected to apply with equal force to future gains and losses as they do well to present changes. The Quadrant I valuation is then the maximum sum that an individual would pay now (or in the near term) for a future gain; Quadrant II is the gain received now to forego a future gain; Quadrant III is the immediate gain that compensates for a future loss; and Quadrant IV is the present payment to avoid a future loss. The pattern of valuations over the four measures of future gains and losses can be expected to be the same as that of present gains and losses: a smaller WTP for a future gain, a larger WTA for a future loss, and intermediate values for the choice of gains and the choice of losses. The smaller WTP for a future gain represents a smaller present value of a future outcome, and consequently implies use of a higher discount rate to value future gains; a larger WTA for a future loss represents a larger present value of a future loss, implying a lower discount rate to value future losses. Thus, all else equal, people can commonly be expected to trade off present for future consumption at different rates for future gains and future losses.

Further, future values (like present values) and discount rates in each quadrant can be assessed in (at least) two ways – by eliciting the present tradeoff that people make with a future outcome, or by eliciting the future outcome individuals are willing to trade off with a present change. Thus, values in Quadrant I can be measured by either the maximum WTP for a future gain or the future gain necessary to make sacrifice of a present WTP sum acceptable. Values in Quadrant II can be measured by either the present sum equivalent to a future gain, or the future gain necessary to be judged equivalent to a present gain. Values in Quadrant III can be measured by either the minimum WTA to accept a future loss, or the future loss that would be accepted for a particular present gain in the numeraire good. Values in Quadrant IV can be measured by either the sum given up to avoid a future loss, or the future loss judged equivalent to a loss in the numeraire good.

For this study, an experiment was designed to test for the pattern of valuations expected to result from any disparity between people's valuation of future gains and losses.. In addition, the experiment provided tests for both possible differences between alternative measures of each valuation, and between assessments based on responses to hypothetical questions and ones based on revealed preferences motivated by the possibility of real exchanges being carried out.

3. Design of the experiment

This test of time preferences was conducted at the Selten Laboratory of Nankai University, P. R. China, and all the participants were in their first year of courses in the International Business School of the University. The tests were carried out using subjects in two groups, with individuals in both providing their valuations of a gain and a loss to be realized (without risk) three months in the future. Participants in Group 1 responded to hypothetical questions; those in Group 2 selected from real exchange offers.

Subjects in the first Group provided eight (hypothetical) valuations -- two for each of the four quadrant measures of the value of future outcomes illustrated in Figure 1. Further, each participant valued the future outcomes in each quadrant in terms of both the amount they would sacrifice for a specified future gain or loss, and the future gain or loss they would weigh against a specific present gain or loss. That is, each participant valued a future gain in terms of both the sum they would be willing to pay now to receive it, and the future gain they felt would be equivalent to a present loss. They valued a future loss in terms of both the sum they would demand to accept it, and the amount they would pay to avoid it. The tradeoffs in Quadrants I, II, and III, were framed in terms of simple money gains and losses now and three months in the future; the tradeoff in Quadrant IV was, as a further exploration, framed in terms of a present or delayed payment of a fine for a driving violation.

English translations of the eight valuations are summarized in Table 1.² In the case of Direction II for Quadrant I, for example, the respondents were asked to complete the form given to them, "in accord with their true valuations", of the sum they would agree to pay now to receive ¥130 three months later. The valuations were recorded as yes or no responses to a range of prices ranging from ¥130 down to ¥90, with a space provided to record any price not given in the range. The prices selected for each valuation, included with each of the question synopses in Table 1, were designed to range over the same interval, minimizing the possibility that any differences between the measures could be attributable to diminishing marginal utility. Twenty respondents were included in the sample, but from 1 to 5 responses over the eight measures were invalid because of inconsistent indications of valuations across the varying levels of price, leaving from 15 to 19 valid responses for the analyses.

Subjects in Group 2, the real exchange experiment, provided only Quadrant I and Quadrant III valuations of future gains and future losses and were divided into two sub-samples for this purpose. Participants in each sub-sample provided two valuations -- one in each direction of eliciting the present tradeoff for a future change, or eliciting the future change to be traded for a present gain or loss -- for either Quadrant I or Quadrant III outcomes, using the same question format and procedures used for the hypothetical valuations.

The incentive of actual exchanges was provided to participants in Group II by announcing that a random price would be selected in each sub-sample after all responses

² Actual instructions in Chinese are available from the Selten Laboratory.

were collected, and that all those who had stated a willingness to pay more than the random price for a future gain or a willingness to accept a lower price for a future loss (or the equivalent alternative measures), were eligible (and required) to be one of two randomly selected individuals who would actually carry out real money exchanges in accord with the random price (thus providing an incentive for all to act in accord with their real preferences lest they suffer in the event they are chosen).

The Quadrant III real exchange sub-sample was repeated a second time using identical procedures, except that the range of prices provided to participants differed. In the first experiment the range was from ¥110 to ¥150 for the one measure and ¥130 to ¥90 for the other; in the second experiment these were changed to ¥90 to ¥150 for the first and ¥150 to ¥110 in the second. As no large or significant difference was found in either of the two valuations of the two sub-samples ($t = 1.65$, $p > 0.11$ for the WTA for the elicited future loss measure, and $t = 0.11$, $p > 0.92$ for the elicited present gain measure; with similar results for the Westenberg-Mood median tests between the median values), the two were pooled into a single sub-sample for all subsequent analyses.

One of twenty participants in the Quadrant I valuations sub-sample provided invalid responses and was eliminated from subsequent analyses. Similarly, 4 responses for one measure of Quadrant III valuations, and 1 for the other, were invalid due to inconsistent responses across the varied prices, leaving 36 and 39 usable valuations.

4. The results

The results of the hypothetical response survey of Group 1 are summarized and reported in Table 2, and the results of the real exchange experiment are reported in Table 3. Each column in each of the two tables represents a one directional measure in each quadrant. The letter h (in Table 2) denotes the hypothetical survey response results, r (in Table 3) the results from the real exchange experiment, the quadrant number follows, with the directional measure given by the last number: 1s are the elicited present tradeoffs with a future outcome, and 2s the elicited future outcome traded for a present change. For example, hq32 represents the maximum future loss accepted for a present gain, Quadrant III, measure of the hypothetical response survey; and rq11 indicates the maximum willingness to pay for a future gain, Quadrant 1, measure of the real exchange experiment.

The results of the four main tests of interest are presented in the following: (1) differences between hypothetical and real exchange offers, (2) differences between the valuation of future gains and future losses, (3) differences among the four quadrant measures, and (4) differences between the alternative (directional) measures within each quadrant.

4.1 Comparison of real exchange experiment and hypothetical survey

The means and medians of the Quadrants I and III results of the real exchange experiment and the hypothetical response surveys are compared in Table 4, together with the annual discount rates implied by these valuations. While there are differences

between the hypothetical and real exchange valuations, they are for the most part not large and are, somewhat curiously, significantly so only in the case of Quadrant III valuations ($t=2.20$, $p<0.03$, and $t=-2.64$, $p<0.01$ for the means test for the two measures, $\chi^2 = 3.25$, $p<.07$ and $\chi^2 = 4.45$, $p<.04$, for the Westenberg-Mood median test). Also somewhat curiously, the hypothetical values were not consistently larger than those from the real exchange valuations, as is often the case. As the future outcomes were for only three month periods, the annual discount rates calculated from these valuations are sensitive to even fairly small differences in the valuations and consequently appear to vary more widely between the measures.

The somewhat smaller standard deviations of the real exchange valuations (Tables 2 and 3) provide some modest support for the common suggestion that participants' decisions in the hypothetical surveys may be more random and imprecise than those enforced by the consequences of real exchanges –even when the real consequence is only a possibility rather than a certainty, as was the case in this experiment where only two participants in each sub-sample played out the exchanges for real. While these results provide some further support for the view that less confidence can be placed in hypothetical measures as cardinal measures, these and other hypothetical responses may still have considerable validity as indicators of ordinal ones.

4.2 Comparisons between valuations of future gains and future losses

Perhaps the most important finding of the present study is the strong evidence of a large disparity between the valuation of future gains and the valuation of future losses, and the implication that people commonly use a higher rate to discount future gains than they do future losses. The evidence is apparent in both the results of the real exchange experiment and the responses to the hypothetical survey.

The discount rates for Quadrant I measures of a future gain are large – 97 and 91 percent for the means of the two real exchange measures (Table 4), and 109 and 91 percent for the medians; and 84 and 94 percent for the means of the hypothetical responses and 46 and 120 percent for the medians. In contrast, the rates for Quadrant III measures of the value of a future loss are in most cases very small: 22 and 2 percent for the means of the real exchange measures, and 18 and 0 percent for the medians; and –8 and –39 for the means of the hypothetical responses and 0 and 0 percent for the median responses. The tests confirm the statistical significance of these differences, with means and medians different: probabilities are below 1 percent for the tests of means for both the hypothetical response and real exchange measures, and below 2 percent for all of Westenberg-Mood tests of medians.

Clearly, here again people expressed widely disparate valuations between the prospect of a future gain and a future loss. Future losses, like present losses, are aversive and people demand large sums to compensate for their acceptance. Similarly, just as they are willing to sacrifice relatively little to secure a present gain, they are willing to pay relatively small amounts for a future gain. The present findings add further to the accumulating evidence of this disparity – a difference unanticipated by the dictates of standard theory, but readily apparent in observations of people's actual behavior.

4.3. The pattern of time preferences

People's common inclination to value losses more than gains – the endowment effect – give rise, as noted earlier, to four alternative measures of the value of gaining or losing an entitlement (as illustrated in Figure 1). The expected pattern of relative values among the four, are that people would value a gain, in terms of their willingness to pay to obtain it (Quadrant I), by the smallest sum; a loss, in terms of their demand for compensation to accept it (Quadrant III), the most; and both the compensation to forego a gain (Quadrant II) and the payment to avoid a loss (Quadrant IV), somewhere between them.

The results of the hypothetical survey responses, in which valuations in all four quadrants were obtained fall entirely within the expected pattern (Table 5). The Quadrant I discount rates are very large (reflecting a reluctance to pay much for a future gain), those of Quadrant III are very low (owing to a reluctance to accept a future loss), and those of the Quadrants II and IV fall in between. The Quadrant I and III valuations from the real exchange experiment (Table 4) are also consistent with the expected pattern and with the hypothetical survey results.

This pattern of differing valuations among the four quadrants is further illustrated by the different slopes of representative indifference curves in each of the quadrants in Figure 2, which are based on the median valuations of the hypothetical survey results. If the rates were invariant by quadrant, as asserted by most applications of standard theory, the slopes would be equal in all – reflecting the assertion of equal tradeoffs if present and future outcomes regardless of context. This is clearly not the case with the present findings.

4.4. Comparisons of different valuations in same quadrants

The final test included in the present study concerned an alternative framing of the valuations in each of the four quadrants – asking for essentially the same valuation, but doing it in terms of a different framing of the gains and losses. The discount rates, based on median values, of the two measures of each of the two different quadrants used in the real exchange experiment and for each of four different quadrants used in the hypothetical survey, are summarized in Table 5

While differences between the two alternative measures are evident in some cases, these occur for the most part with responses to hypothetical questions. This is perhaps a further indication, consistent with the differences in standard deviations of the valuations, that hypothetical survey responses may be less reliable than results from real exchange experiments. Further, there seems to be some evidence here that Quadrant III valuations tend to be more consistent, or clustered, than those of other quadrants. Beyond this, there seems to be little that can be suggested in terms of implications or recommendations – save for the obvious that further investigation may be warranted and that an additional element of caution is introduced by these results.

5. Conclusions and discussion

The findings of the studies reported here are ones of differences in the measures of time preferences, rather than ones of invariant rates as assumed by standard economic theory and adhered to in economic practice. Further, in most of the findings the differences fall into a pattern predicted by extensions of well-known implications of the

widely observed endowment effect.

In particular, the common inclination of people to value losses more than commensurate gains strongly suggests that they will also value future losses more than future gains, thereby implying that they will use a lower rate to discount the value of future losses than they will use to value future gains. This expectation was strongly borne out in the results of the present study. The discount rates, by whatever specific measure or by hypothetical response or real exchange choice, were far larger for valuing future gains than future losses. Further, these findings are consistent with the vast array of valuation disparity evidence, and also with the few other instances in which the presence of such specific patterns of differences has been investigated (for example, Donkers, Gregory, and Knetsch, in preparation). Current practice, and the standard assumptions used to justify such procedures, is completely at variance with these findings.

To the, apparently wide, extent for which the compensating variation measures of WTP for gains (Quadrant I) and WTA losses (Quadrant III), are appropriate for assessing values in specific cases, the casual substitution of the equivalent variation measures of equivalent gain (Quadrant II) or equivalent loss (Quadrant IV), is likely to produce a great deal of distortion and mischief to analyses of private investment and expenditure decisions as well as social accountings and justifications for public actions. This further evidence of differences increases the need to choose the appropriate measure of the value at issue, rather than follow customary practice of indifference and convenience based on the now increasingly questionable common assertion of equivalence among the measures.

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Table 1. Valuation Questions: Four Quadrants, Two Ways for Each and Range of Response Options Provided.

	Direction I (Elicit future for present change)	Direction II (Elicit present for future change)
Quadrant I	What is the minimum you would demand from the Lab 3 months later if you give the Lab ¥110 now ? (¥110 - 150)	What is the maximum you would pay the Lab now to get the Lab to give you ¥130 3 months later ? (¥130 - 90)
Quadrant II	What is the maximum amount received 3 months later you think is equivalent to getting ¥85 now? (¥85 - 125)	What is the minimum amount received now you think is equivalent to getting ¥115 paid 3 months later? (¥115 - 75)
Quadrant III	What is the maximum you would pay 3 months from now if the Lab gives you ¥110 now? (¥130 - 90)	What is the minimum you demand now if you pay the Lab ¥130 3 months later? (¥110 - 150)
Quadrant IV	How much would you pay in 3 months rather than pay ¥90 now for a driving violation fine?(¥90 - 120)	How much would you pay now rather than pay ¥120 in 3 months for a driving violation fine? (¥120 - 90)

Table 2. The Results of the Hypothetical Survey

		hq11	hq12	hq21	hq22	hq31	hq32	hq41	hq42
N	Valid Obs.	16	15	18	17	16	19	17	19
Mean		133.1	105.3	95.1	101.8	107.8	144.2	99	110.7
Median		122.5	100	90	108	110	130	92	107.5
Std. Deviation		26.6	15.8	12.1	13.5	11.1	33.5	23	24.7

Table 3. The Results of the Real Exchange Experiment

		rq11	rq12	rq31	rq32
N	Valid Obs.	19	19	36	39
Mean		136.6	105.8	116.0	129.2
Median		140	106	115	130
Std. Deviation		18.7	12.7	12.9	8.8

Table 4. Comparison of the Results of Real Exchange Experiment and Hypothetical Response Survey (with Implied Annual Discount Rates)

		Real exchange experiments		Hypothetical Surveys	
		Direction I	Direction II	Direction I	Direction II
Quadrant I	Mean	136.6 (97%)	105.8 (91%)	133.1 (84%)	105.3 (94%)
	Median	140 (109%)	106 (91%)	122.5 (46%)	100 (120%)
Quadrant III	Mean	116 (22%)	129.2 (2%)	107.8 (-8%)	144.2 (-39%)
	Median	115 (18%)	130 (0%)	110 (0%)	130 (0%)

Table 5. Annual Discount Rates for Hypothetical Survey and Real Exchange Experiments, Based on Medians of Each Valuation

	Quadrant	Quadrant	Quadrant	Quadrant
Hypothetical Group I				
Elicited Present Value	46%	24%	0%	9%
Elicited Future Value	120%	26%	0%	46%
Real Group II				
Elicited Present Value	109%		18%	
Elicited Future Value	91%		0%	

Figure 1. Alternative Measures of the Tradeoff between Gains and Losses

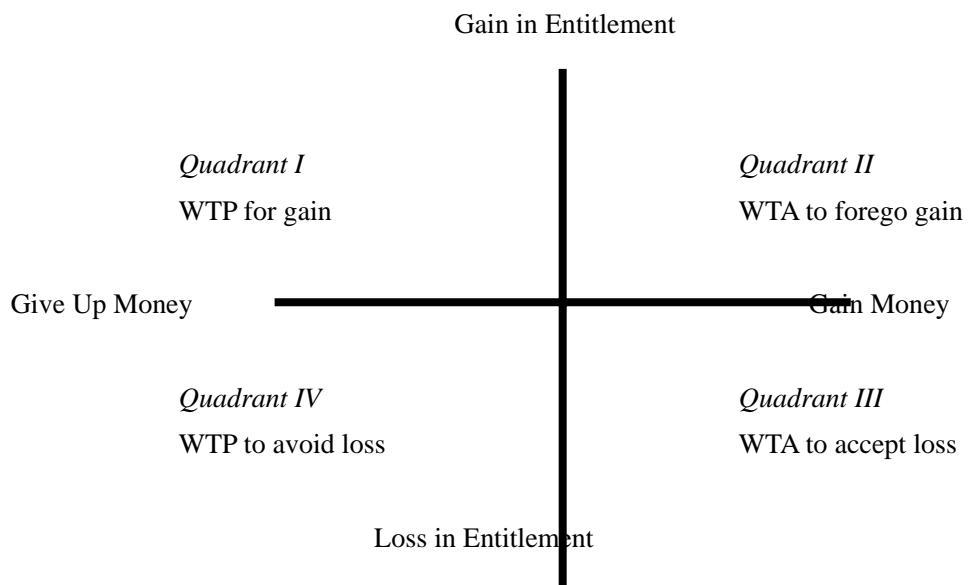


Figure 2. Time preference tradeoffs, based on hypothetical responses.

