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On the interaction of risk and time preferences: An experimental study

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On the Interaction of Risk and Time Preferences – An Experimental Study

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Abstract

Experimental studies of risk and time–preference typically focus on one of the two phenomena. The goal of this paper is to investigate the (possible) correlation between subjects' attitude to risk and their time–preference. For this sake we ask 61 subjects to price a simple lottery in 3 different scenarios. At the first, the lottery premium is paid "now". At the second, it is paid "later." At the third, it is paid "even later." By comparing the certainty equivalents offered by the subjects for the three lotteries, we test how time and risk preferences are interrelated. Since the time interval between "now" and "later" is the same as between "later" and "even later", we also test the hypothesis of hyperbolic discounting. The main result is a statistically significant negative correlation between subjects' degrees of risk aversion and their (implicit) discount factors.

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1. Introduction

Most major economic decisions in reality are made under conditions of uncertainty and effect the future as well as the presence (e.g., the classical consumption\ savings allocation problem). The optimal decisions thus typically depend on risk attitudes as well as on time preferences. But how are these two aspects interrelated? Are risk attitudes and time preferences, for instance, independent in the sense that risk attitudes are no reliable indicator of time preferences and vice versa? Or will risk aversion usually coincide with impatience?

One way to answer these questions would be to develop models of indirect evolution and derive the evolutionarily stable constellation of time preferences and risk attitudes (see To, 1999, or Huck, Müller, and Strobel, in press, who focus only on risk attitudes). If impatience, for instance, endangers surviving harsh winters and risk loving behavior also reduces one's life expectation, the stable constellation would rely on patience and risk aversion.

In this paper we approach the problem empirically by performing appropriate (classroom) experiments. In fact, the experimental literature on decision and choice contains many references exploring the risk attitudes (see, for examples, the survey by Camerer, 1995) and time preferences (see, for examples, Loewenstein and Elster, 1992) of human subjects. To the best of our knowledge, however, there have not been yet any direct attempts to investigate the correlation between risk attitudes and time preferences.[1]

Instead of performing new experiments, we could have tried to (re)analyze the data, collected in previous experiments on inter–temporal consumption in a stochastic environment (see the survey by Anderhub and Güth, 1999). Yet, due to the

[1] Prelec and Loewenstein (1991) and Keren and Roelofsma (1995) study the interaction between choice with uncertainty and inter-temporal choice. Prelec and Loewenstein (1991) formulate two general psychological principles that explain the different "anomalies" that have been found in choice with uncertainty and in inter-temporal choice. Keren and Roelofsma (1995) study the interrelations between the certainty effect in choice with uncertainty and the immediacy effect in inter-temporal choice. These references, however, do not deal explicitly with subjects' attitudes to risk.

very complicated design of the environment in these experiments it seems unreasonable to assume that the participating subjects choose the optimal consumption plan given their individual risk attitudes and time preferences. Hey and Dardanoni (1987), for instance, report the results of a large scale optimal consumption experiment where subjects' actual behavior departed significantly from the optimal plan. In such a context, it seems impossible to disentangle the impact of the cognitive limitations from the impact of the various constellations of time and risk preferences. We therefore chose to run a very simple "new" experiment to examine the relationships between individual risk attitude and time preferences.

In our experiments each participant had to evaluate (i.e., state his certainty equivalent to) three lotteries which differed only in the timing of their payments. The premium from the first lottery (L_0) was paid to the subjects immediately after the experiment (date 0). The premium from the second lottery (L_4) was paid 4 weeks after the experiment. The premium from the final lottery (L_8) was paid 8 weeks after the experiment.

Since lotteries are risky prospects, the certainty equivalents should reveal some information on the basic risk attitudes. Time preferences were revealed since each participant had to decide on all three lotteries simultaneously. Since the payments from the three lotteries were fixed at three equidistant points in time, the experiment can also be used to test the hypothesis of **hyperbolic discounting** (see, for instance, Ainslie and Haslam 1992, Loewenstein and Prelec 1992, and Laibson, 1996).

Due to the rather robust evidence for an **endowment** or **status quo** effect (see Samuelson and Zeckhauser 1988, Thaler 1980, and Tietz 1991 for a sample of experimental evidence) it seemed necessary to test how impatience and risk aversion interact with the status quo. For this purpose, we have divided the subjects into two groups. The first group (of 27 subjects) was asked to state the maximal price they are willing to pay for the lottery. The second group (of 34 subjects) was endowed with the lottery and asked to state the minimum price for which they are willing to sell the lottery. We, henceforth, refer to the first treatment as the P–treatment (where the P stands for "willingness to Pay") and to the second treatment as the **A**–treatment (where the A stands for "willingness to Accept").

In section 2 we describe in detail the experimental procedure. The main results are presented in section 3. Section 4 proceeds with the analysis. Section 5 concludes.

2. Experimental procedure

The subjects were 61 students recruited at the University of Haifa, Israel. Participants were seated isolatedly in a large lecture hall to discourage any kind of communication. Appendix A presents the (English translation) of the instructions that were presented to the subjects for each one of the two basic treatments. The self–explanatory instructions start by introducing a risky prospect that pays a "premium" of 25 NIS (New Israeli Shekel) or 125 NIS with equal probabilities.[2] Subjects are told that at the end of the experiment it will be randomly decided whether the realized premium will be paid immediately, after 4 weeks or after 8 weeks, where the probability of each payment–date is 1/3. The subjects are then asked to state the maximal buying price that they are willing to pay for the lottery (in the case of the P–treatment) or the minimal selling price that they require for the lottery (in the case of the A–treatment). Each subject is asked to state three valuations, one value for each possible realization date of the lottery. The actual realization date was randomly determined (for all subjects simultaneously) at the end of the experiment. We henceforth use L_0, L_4, L_8 to denote the values stated by the subjects; $\varnothing L_t$ is used to denote the average value of L_t (across all subjects).

We use the random price mechanism (Becker, Degroot and Marshack, 1964) to determine whether each subject will actually get (in the P–treatment), or sell (in the A–treatment) the lottery and the actual price that he will pay or receive for the lottery. That is, we randomly draw an integer k between 0 and 125 and sell

[2] The conversion rate of the NIS (New Israeli Shekel) with respect to the American dollar at the time of the experiment was approximately 4 Shekel per dollar.

the lottery to the subject at the price k (in the P–treatment) if the highest buying price of the subject for the corresponding realization date is not lower than k; we buy the lottery from the subject at the price k (in the A–treatment), if the lowest selling price of the subject for the corresponding realization date is not higher than k. Since the random mechanism is incentive compatible[3], we assume that L_0, L_4, and L_8 represent the individual certainty equivalents for the lottery with payments today, in 4 weeks, and 8 weeks, respectively.

A special problematic feature of building an incentive scheme for such an experiment is that some of the payments to the subjects should be made "in the future", one or two months after the experiment. Such an incentive scheme might be ineffective if the participants have doubts whether future payments will actually be made as described in the instructions. To avoid the problem, we have exploited a usual practise of Israelian banks which accept "deferred cheques"; i.e., cheques whose monetary transfers are supposed to take place at a pre–specified future date. Thus, subjects were told that they will receive a "deferred cheque" immediately after the experiment, where the payment–time specified on the cheque will be either now, in 4 weeks, or in 8 week, depending on the realized payment date, as explained above.

In particular, in the case of treatment P, we have endowed each subject with 75 NIS.[4] If the subject "won" the lottery for the price k, the buying price k was subtracted from the initial endowment and the subject received a cheque (for date 0) for the difference, $75 - k$. In addition, the subject received a (possibly) deferred cheque for the realized premium payment.[5] If the subject did not win the lottery he simply received an immediate cheque for 75 NIS (his endowment).

[3] That is, stating one's true certainty equivalent as the buying or selling price is the only undominated strategy.

[4] This monetary endowment could have provided an influential anchor for deciding about one's certainty equivalents. Actually the amount 75 was far more prominent in the A–treatment (36% of all L_t^A–choices) than in the P–treatment (only 4% of all L_t^P–choices). A more serious concern is that an endowment of only 75 rules out risk loving in case of the P–treatment (actually $75 \geq L_t^P$ holds universally whereas $L_t^A > 75$ is true for 6 of 102 L_t^A–choices).

[5] The two sums where combined and paid in one check when the realization date of the lottery was zero.

In the case of treatment A, if the realized selling price k was higher than the one stated by the subject for the corresponding realized date, the subject got an immediate cheque for the realized selling price k. Otherwise, he got a (possibly) deferred cheque for the realized lottery premium.

The chance moves deciding whether the premium is high or low and whether it will be paid now, in 4 weeks, or in 8 weeks were publicly performed immediately after the experiment by throwing a die to decide whether the premium is high or low and throwing the die once more to determine the payment–timing. We have then used the results to fill out the individual cheques for the subjects.

3. Major Results

The experimental data for the two treatments are presented in Appendix B. The first three columns of the table represent the ordered decision vectors L_0, L_4, L_8 for each treatment. The next column represents the quotient

$$\delta_1 = \frac{L_4}{L_0}$$

which we take as a measure of the discount factor from date 4 to date 0. The fifth column represents the corresponding measure of the discount factor from date 8 to date 4,

$$\delta_2 = \frac{L_8}{L_4}.$$

The last column presents an estimate of the degree of risk–aversion of the corresponding subject:

$$r_0 = \frac{75 - L_0}{75}$$

Note that since the expected value of our basic lottery is 75, risk–averse subjects should evaluate the lottery at a price lower than 75 when the payment–date is 0, i.e. r_0 should be positive. Risk seeking subjects on the other hand should be willing to pay more than 75 for the same risky prospect, i.e. r_0 should be negative.

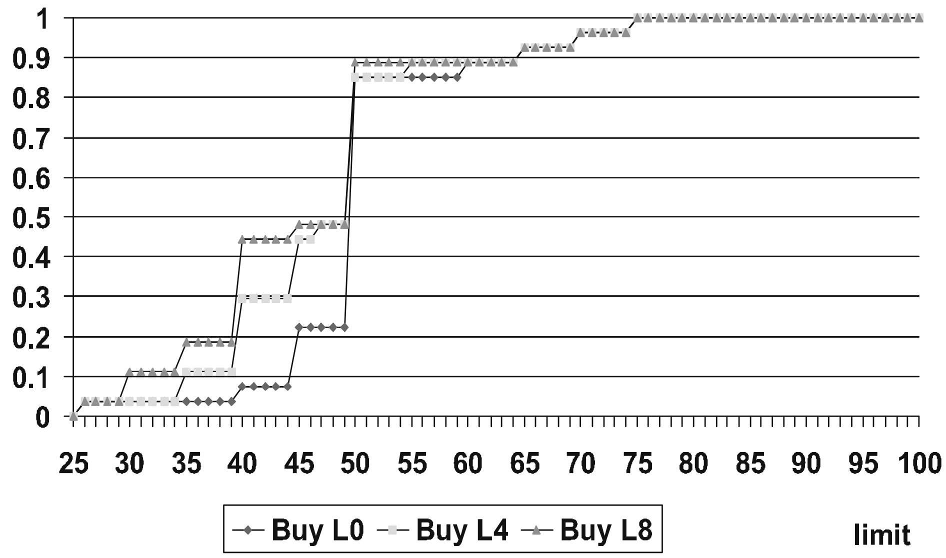

Figure 3.1: Distribution of prices in the P–treatment

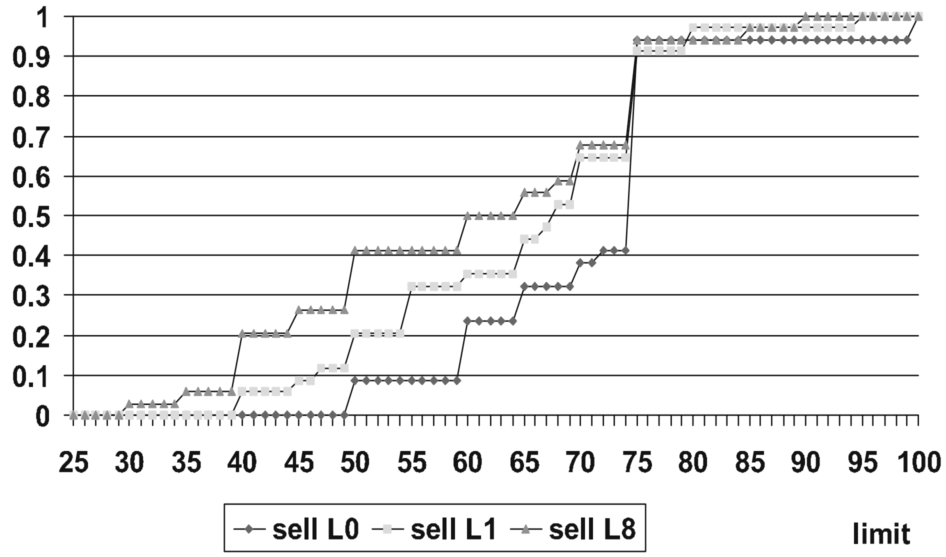

Figure 3.2: Distribution of prices in the A–treatment

Figures 3.1 and **3.2** represent the distribution of bids (L_0, L_4, L_8) for each treatment and every realization date. From the figures one immediately recognizes the endowment effect:

Observation 1: The distributions of L_0, L_4 and L_8 for the A–treatment stochastically dominate the corresponding distributions for the P–treatment; i.e. for every number L, $\text{Prob}\left\{L_t^A \leq L\right\} \leq \text{Prob}\left\{\text{L}_t^P \leq \text{L}\right\}$, for $t = 0, 4$ and 8, where L_t^P denotes the distribution of L_t in the P–treatment, L_t^A denotes the distribution of L_t in the A–treatment, and the inequality is strict in the overlapping range of L_t^P and L_t^A.

To check the statistical significance of the stochastic dominance effect, we have applied the Kolmogorov–Smirnov–test (Z = 2.962, 2.506, and 1.851; p = .000, .000, and .002 for t = 0, 4, and 8, respectively) and the Mann–Whitney–test ($Z = -5.765$, -4.621, and -3.274, p = .000, .000, and .001 for t = 0, 4, and 8, respectively). Since all tests clearly support the status quo–effect, we can safely state

Conclusion 2: Even when the object under consideration is a lottery, and the date at which the lottery's payoff will be realized is uncertain, subjects' willingness to accept is on average significantly higher than their willingness to pay, for each possible realization date.

The hyperbolic discounting conjecture (see the references mentioned in the introduction) basically says that the discount factor applied to payoffs that are expected at date t, $\delta(t)$, is decreasing hyperbolically in t, so that $\delta(t) - \delta(0) > \delta(t + K) - \delta(K)$ for every positive t and K. Hyperbolic discounting is considered one of the "anomalies" (see, Loewenstein and Prelec, 1992) that characterize human behavior in inter–temporal choice and contradict Samuelson's discounted utility model. Thaler (1981), for instance, shows that decision makers might prefer one apple today to two apples tomorrow and at the same time prefer two apples in 51 days to one apple in 50 days.

In the context of our experiments hyperbolic discounting implies that $\delta_2 > \delta_1$. On average, $\delta_2 = 0.9587$ and $\delta_1 = 0.9398$ in the P–treatment while $\delta_2 = 0.9185$

and $\delta_1 = 0.9110$ in the A–treatment. The average implicit discount rates thus satisfy the hyperbolic discounting conjecture. The difference between δ_1 and δ_2, however, are statistically insignificant (see the test results in **Table 3.1** for each treatment separately and for both treatments combined).

	P–treatment	A–treatment	both treatments
Kolmogorov–Smirnov	$Z = .544$	$Z = .606$	$Z = .815$
	$p = .928$	$p = .856$	$p = .520$
Mann–Whitney	$Z = -.664$	$Z = -.413$	$Z = -.818$
	$p = .507$	$p = .680$	$p = .414$

Table 3.1: Test results for the difference between δ_1 and δ_2

Table 3.2 indeed shows that only 23% of the subjects conformed with the hyperbolic discounting hypothesis in our experiments:

	P–treatment	A–treatment	Total
$\delta_1 = \delta_2 = 1$	14	10	24
$\delta_1 > \delta_2$	7	16	23
$\delta_2 > \delta_1$	6	8	14
Total	27	34	61

Table 3.2: Number of subjects with ($\delta_2 > \delta_1$) or without ($\delta_1 \geq \delta_2$) hyperbolic discounting

Observation 3: Only 14 of our 61 participants satisfy hyperbolic discounting in the sense of $\delta_2 > \delta_1$. There is no significant treatment effect with respect to the percentage of subjects conforming with hyperbolic discounting (22.2% for the P–treatment and 23.5% for the A–treatment). Note, however, that the implicit discount rates (δ_1^A, δ_1^P and δ_2^A, δ_2^P) are also not significantly different at the P–treatment than they are in the A–treatment (Kolmogorov–Smirnov–test $Z = .824$, $p = .506$, and Mann–Whitney–test $Z = -1.043$, $p = .297$ for δ_1^A, δ_1^P; Kolmogorov–Smirnov–test $Z = .913$, $p = .375$, and Mann–Whitney–test $Z = -1.625$, $p = .104$ for δ_2^A, δ_2^P). Indeed, the data shows that

$$\frac{\varnothing L_0^P}{\varnothing L_0^A} = .71 < \frac{\varnothing L_4^P}{\varnothing L_4^A} = .73 < \frac{\varnothing L_8^P}{\varnothing L_8^A} = .76$$

so that the relative size of the endowment effect decreases slightly the longer the delay. This is summarized by the next observation:

Observation 4: The status–quo has a significant effect on the average implicit discount rates. In particular, the implicit discount rates in the P–treatment are significantly higher than the implicit discount rates at the A–treatment. As a result, the relative size of the endowment effect slightly decreases with the delay of the payment realization–date.

Does the pattern of time–preferences revealed by the ratio δ_1/δ_2 depend on whether the subject is asked to sell or to buy the lottery? We can check this by comparing the δ_1^A/δ_2^A–distribution with the δ_1^P/δ_2^P–distribution where δ_τ^A, is the discount factor for $\tau = 1, 2$ in the A–treatment and δ_τ^P is the discount factor for $\tau = 1, 2$ in the P–treatment. The results summarized in **Figure 3.3** demonstrate that the quotient δ_1/δ_2 takes higher values more often in the P–treatment than it does in the A–treatment. The difference between the two distributions, however, is insignificant (Kolmogorov–Smirnov–test $Z = .913$, $p = .375$ and Mann–Whitney–test $Z = -1.274$, $p = .203$).

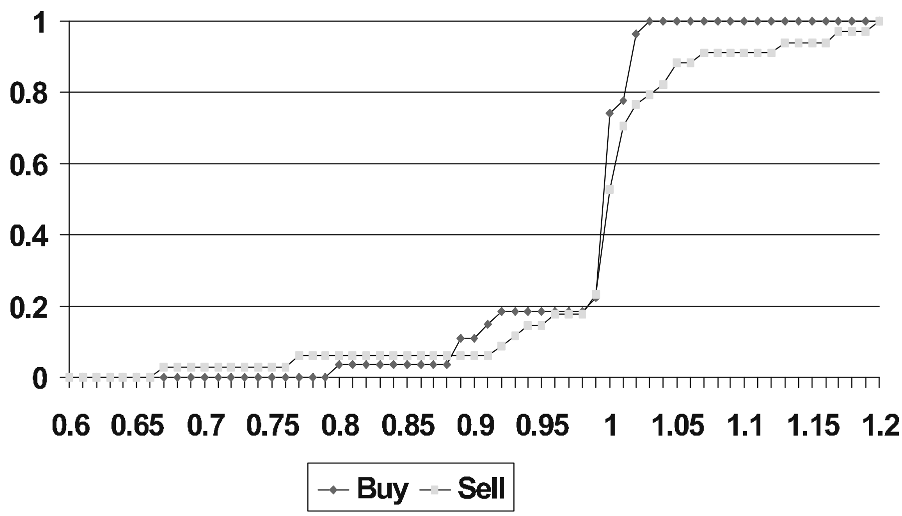

Figure 3.3: Distribution of δ_1/δ_2

4. Risk and Time–Preferences

As explained above, we measure the individual degree of risk aversion by the ratio

$$r_0 = \frac{75 - L_0}{75}.$$

The data in appendix B demonstrates that the distribution of r_0^P stochastically dominates the distribution of r_0^A. Formally, however, this follows directly from the fact that the distribution of L_0^A stochastically dominates the distribution of L_0^P. The difference between the two distributions is significant (Kolmogorov–Smirnov–test $Z = 2.962$, $p = .000$ and Mann–Whitney–test $Z = -5.765$, $p = .000$). We summarize these findings as follows :

Observation 6: The status–quo has a significant effect on the revealed risk preferences. In particular, the individual risk–aversion measures generated from the P–treatment are significantly higher (in the sense of first order stochastic dominance) than the ones derived from the A–treatment.

How are the risk attitudes and time preferences interrelated? **Table 4.1** gives the coefficients of correlation between r_0 and δ_1 and between r_0 and δ_2 for each of the treatments and for the aggregated data. The Spearman coefficients for each treatment separately turn out to be negative and significantly different from zero (one–sided). However, when we pool the data together the negative significant correlation disappears: The difference between the results for both treatments are not statistically significant.

These results are summarized by the next observation:

Observation 7: The data reveal a statistically significant negative correlation between the degree of risk aversion and the intensity of discounting. That is, subjects that exhibit a relatively high degree of risk aversion tend to discount the future more heavily than subjects that are less risk averse.

To check whether risk attitudes are somehow correlated with the (in)consistency of time preferences, we have also calculated the correlation between r_0 and $\frac{\delta_2}{\delta_1}$ (see **Table 4.1**). The results here, however, were not significantly different from zero.

	δ_1	δ_2	δ_2/δ_1
A–treatment	$-.476^{***}$	$-.285^{*}$	.080
P–treatment	$-.316^{**}$	$-.364^{**}$	$-.252^{*}$
Both treatments	$-.140$	$-.064$	.046

Table 4.1: Correlations with respect to r_0
(* $p = 0.1$;** $p = 0.05$, *** $p = 0.01$)

Finally note that the measures of r_0, δ_1 and δ_2 defined above are "arbitrary" in the sense that they have not been derived from any formal theory of choice and decision. To take a more rigorous (but still very arbitrary) approach, one may assume that the individual utility functions come from some parametric family of utility functions; e.g. $u(x) = x^\alpha$ and use the individual L_0's to derive the individual utility functions; e.g., solve for the individual α's. One may then use the individual L_4 and L_8 to derive the implicit discount factors δ_1 and δ_2. We have made a few attempts to analyze the data in this alternative approach but the results were uninformative.

5. Discussion

The main result of the paper suggests that risk averse agents tend to discount the future more heavily (than agents that are less risk averse or risk seeking). This observation is in agreement with previous research (Keren, 1995) suggesting that discounting is (partially) due to the uncertainty encapsulated in future payoffs. In particular, Keren (1995) finds out that introducing external uncertainty (i.e., probabilistic outcomes) has a similar effect on subjects' behavior as the expansion of time delays. For example, Keren reports that in choosing between (A) Fl. 100

now or (B) Fl. 110 in 4 weeks, 82% chose A. When the probability of getting the positive prospect (in each alternative) was decreased to 50%, the proportion of subjects choosing A has decreased to 39%. The effect of postponing the payment date in 26 weeks was similar: Only 37% of the subjects chose "Fl. 100 in 26 weeks" over "Fl. 110 in 30 weeks".This suggests that risk averse agents might indeed discount future payoffs more heavily to compensate for the uncertainties associated with the postponed payoffs. In particular, risk averse agents might be more inclined towards myopic behavior.[6]

Somewhat surprisingly, we found out that only 22.8% of our subjects comply with the hyperbolic discounting conjecture. A possible explanation lies in the framing of the experiment. In our experiment, the subjects were asked to state the three conditional prices L_0, L_4, and L_8 concurrently. The typical experimental evidence on hyperbolic discounting is composed of two separate binary choice problems (as demonstrated by Thaler's example in the introduction) where the subjects inconsistently prefer the smaller and closer outcome when both outcomes are close but switch to preferring the larger and remote outcome when both outcomes are remote. We speculate that this inconsistency will become weaker if subjects are asked to make both choices at the same time; e.g., if we ask the subjects to choose whether they want to consume 1 apple today or 2 apples tomorrow and (at the same time) decide whether they prefer 1 apple in 50 days or 2 apples in 51 days. We also guess that in the framework of our experiments the evidence in favor of hyperbolic discounting might have been stronger if the subjects were asked to state the price they will be willing to pay (or willing to accept) in 4 weeks for a lottery that is paid in 8 weeks (and the corresponding number will be divided by L_4 to approximate δ_2).[7]

Note also that previous experimental investigations of hyperbolic discounting did not use deferred cheques to guarantee future payoffs. Thus, the effect might have

[6] Sonsino (1998) demonstrates that increased uncertainty might push risk–averse agents very close to myopic behavior.

[7] However, an experimental investigation of this conjecture seems difficult since the corresponding experiment requires that the subject pays (in the P–treatment) for the lottery 4 weeks before he receives the payoffs.

been more pronounced in the previous investigations since the subjects mistrust that the future money transfers will actually occur.

Finally, our experiment also demonstrates that subjects' degree of risk aversion might be highly sensitive to the experimental procedure that is used to elicit the risk preferences. In particular, the endowment effect carries over to the case of lotteries' evaluation so that subjects exhibit a significantly higher degree of risk aversion in the P–treatment (than in the A–treatment).

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Appendix A: Instructions

Introduction (General)

In the experiment you essentially have to decide whether you want to engage in a risky prospect or not. We start by describing this risky prospect. Afterwards you will be informed how you decide whether or not to engage in it.

The **risky prospect** pays you the high premium of NIS 125 when a toss of a die yields the numbers 1,2 or 3, otherwise, i.e. in a case of the numbers 4, 5 or 6, it yields the low premium of NIS 25.

The **timing of the premium payments** is not yet decided. The three possibilities are that the premium will be paid today, in 4 weeks time, or in 8 weeks time. When you decide whether or not to engage in the risky prospect, you can, however, condition your decision on the timing of the premium payment. In other words: you decide whether or not to engage in the risky prospect today, in 4 weeks time, and you decide whether or not to engage in the 8 weeks risky prospect whose premium will be paid in 8 weeks time.

How will we decide **which timing applies** in your case? After your decisions we will role a die: In case of 1 or 2 all participants will be paid today, in the case of 3 or 4 all participants will be paid in 4 weeks time, and in case of 5 and 6 all participants will be paid in 8 weeks.

We now describe how you decide whether or not you engage in the 4 week–prospect or the 8 week–prospect:

Instructions (P–treatment)

You will receive a monetary endowment of NIS 75 which you can either keep or invest in the risky prospect. For example, the price p for the 4 weeks–prospect will be randomly chosen from the interval $0 \leq p \leq 125$. The urn in front of you contains many such prices p of which one will be randomly selected.

What you have to choose is your limit price L in the sense that you buy the risky prospect at all prices p not exceeding L, i.e. at prices $p \leq L$, whereas you do not buy it at all prices exceeding L, i.e. at prices $p > L$. Notice that your limit price L does not determine the price p which you pay in case of buying the risky prospect. It only determines at which prices p you are willing to buy, namely at all prices p not exceeding L, i.e. at prices $p \leq L$.

Remember that you can choose a limit price L_0 for today–prospect, L_4 for the 4–weeks prospect, and a possibly different limit L_8 for the 8 weeks–prospect. These will be the only choices which you have to make.

If you do not buy, you simply keep your monetary endowment of NIS 75 which is due immediately. If you buy the risky prospect at price p, you only keep your monetary amount of NIS 75 minus p; this amount is due immediately as well. The premium payment of the risky prospect will be due today, or in 4 weeks in case of the 4 weeks–prospect and in 8 weeks in case of the 8 weeks–prospect. Whether or not the high premium of NIS 125 or the low premium of NIS 25 is then due will be decided at the end of the experiment.

Instructions (A–treatment)

You will receive the risky prospect as an endowment which you can either keep or sell for money. More specifically, the price p for the 4 week–prospect will be randomly chosen from the interval $0 \leq p \leq 125$. The urn in front of you contains many such prices p of which one will be randomly selected.

What you have to choose is your limit price L in the sense that you keep the risky prospect at all prices p below L, i.e. at prices $p < L$, whereas you sell it at all prices p not below L, i.e. at prices $p \geq L$. Notice that your limit L does not determine the price p which you receive in case of selling the risky prospect. It only determines at which prices p you are willing to sell, namely at all prices p not below L, i.e. at prices $p \geq L$.

Remember that you can choose a limit price L_0 for today–prospect, L_4 for the 4–weeks prospect, and a possibly different limit L_8 for the 8 weeks–prospect. These will be the only choices which you have to make.

If you sell the risky prospect, you simply earn the price p which is due immediately. If you keep the risky prospect, you only earn its premium. The premium payment of the risky prospect will be due today or in 4 weeks in case of the 4 weeks–prospect and in 8 weeks in case of the 8 weeks–prospect. Whether or not the high premium of NIS 125 or the low premium of NIS 25 is then due will be decided at the end of the experiment.

Decision form (General)

For the **today–prospect** whose premium is due today I choose the limit

$L_0 =$ .... (you can choose any non–negative limit)

For the **4 weeks–prospect** whose premium is due in 4 weeks from now I choose the limit

$L_4 =$ .... (you can choose any non–negative limit)

For the **8 weeks–prospect** whose premium is due in 8 weeks from now I choose the limit

$L_8 =$ .... (you can choose any non–negativelimit)

Appendix B: Results

P–treatment	L_0	L_4	L_8	δ_1	δ_2	r_0
1	26	26	26	1	1	0.653
2	40	35	30	0.875	0.857	0.467
3	45	35	30	0.778	0.857	0.4
4	45	40	35	0.888	0.875	0.4
5	45	40	40	0.888	1	0.4
6	45	40	40	0.888	1	0.333
7	50	40	35	0.8	0.875	0.333
8	50	40	40	0.8	1	0.333
9	50	45	40	0.9	0.889	0.333
10	50	45	40	0.9	0.889	0.333
11	50	45	40	0.9	0.889	0.333
12	50	45	40	0.9	0.889	0.333
13	50	47	45	0.94	0.957	0.333
14	50	50	50	1	1	0.333
15	50	50	50	1	1	0.333
16	50	50	50	1	1	0.333
17	50	50	50	1	1	0.333
18	50	50	50	1	1	0.333
19	50	50	50	1	1	0.333
20	50	50	50	1	1	0.333
21	50	50	50	1	1	0.333
22	50	50	50	1	1	0.333
23	50	50	50	1	1	0.333
24	60	50	50	0.917	0.909	0.2
25	65	65	65	1	1	0.133
26	70	70	70	1	1	0.067
27	75	75	75	1	1	0

A–treatment	L_0	L_4	L_8	δ_1	δ_2	r_0
1	50	40	30	0.8	0.75	0.333
2	50	45	40	0.9	0.888	0.333
3	50	47	45	0.94	0.957	0.333
4	60	40	35	0.666	0.875	0.2
5	60	50	40	0.833	0.8	0.2
6	60	50	40	0.833	0.8	0.2
7	60	55	50	0.916	0.909	0.2
8	60	55	50	0.916	0.909	0.2
9	65	55	40	0.846	0.727	0.133
10	65	55	45	0.846	0.818	0.133
11	70	60	60	0.923	1	0.133
12	70	67	65	0.957	0.97	0.067
13	72	70	70	1	1	0.067
14	75	70	68	0.972	0.971	0.04
15	75	50	50	0.667	1	0
16	75	60	40	0.8	0.667	0
17	75	60	50	0.8	0.833	0
18	75	65	50	0.867	0.769	0
19	75	67.5	60	0.9	0.889	0
20	75	68	60	0.906	0.882	0
21	75	70	65	0.933	0.928	0
22	75	70	70	0.933	1	0
23	75	75	75	1	1	0
24	75	75	75	1	1	0
25	75	75	75	1	1	0
26	75	75	75	1	1	0
27	75	75	75	1	1	0
28	75	75	75	1	1	0
29	75	75	75	1	1	0
30	75	75	75	1	1	0
31	75	75	75	1	1	0
32	75	80	85	1.066	1.062	0
33	100	80	70	0.8	0.875	-0.33
34	100	95	90	0.95	0.947	-0.33