WORKING PAPERS

Nudges and Impatience: Evidence from a Large Scale Experiment

Eline van der Heijden
Tobias J. Klein
Wieland Müller
Jan Potters

September 2011

Working Paper No: 1110

DEPARTMENT OF ECONOMICS

UNIVERSITY OF VIENNA

Nudges and Impatience: Evidence from a Large Scale Experiment*

Eline van der Heijden†
Tilburg University

Tobias J. Klein‡
Tilburg University

Wieland Müller§
University of Vienna
Tilburg University

Jan Potters¶
Tilburg University

September 28, 2011

Abstract

We elicit time preferences of a representative sample of 1,102 Dutch individuals and also confront them with a series of incentivized investment decisions. There are two treatments which differ by the frequency at which individuals decide about the invested amount. The low frequency treatment provides a nudge by stimulating decision makers to frame a sequence of risky decisions broadly rather than narrowly. We find that impatient individuals are more "nudgeable" than patient ones as the effect of the treatment on investment levels is significantly larger within the group of high discounters than within the group of low discounters. This result is robust to controlling for various economic and demographic variables and cognitive ability. This finding is interesting from a policy perspective because impatient individuals are often the target group of nudges as impatience is associated with problematic behaviors such as low savings, little equity holdings, low investments in human capital, and an unhealthy lifestyle.

Keywords: narrow framing, time preferences, field experiment.

JEL classification numbers: C93, D03, D81.

*We thank Marika de Bruijne of CentERdata (Tilburg University) for her most efficient support in collecting the data. Furthermore, we thank Uri Gneezy, Gijs van de Kuilen, Arthur van Soest, Matthias Sutter, Stefan Trautmann, and participants of seminars at Durham, Tilburg, Mannheim, and Waseda University Tokyo, the 2007 Leaf Conference at UCL, the 2007 ESA World Meeting in Rome, the 2008 Netspar Annual Conference, and the 2010 ESE Conference in Rotterdam for helpful comments. We gratefully acknowledge financial support from CentER and Netspar. The third author acknowledges financial help from the Netherlands Organisation for Scientific Research (NWO) through a VIDI grant.

†CentER and Department of Economics, P.O. Box 90153, 5000 LE Tilburg, the Netherlands, Email: *eline.vanderheijden@uvt.nl*.

‡CentER, Netspar, and Department of Econometrics and Operations Research, P.O. Box 90153, 5000 LE Tilburg, the Netherlands, Email: *T.J.Klein@uvt.nl*.

§CentER and TILEC, Tilburg University, and VCEE and Department of Economics, University of Vienna, Brünnerstrasse 72, 1210 Vienna, Austria, Email: *wieland.mueller@univie.ac.at*.

¶CentER, TIBER, Netspar, and Department of Economics, P.O. Box 90153, 5000 LE Tilburg, the Netherlands, Email: *j.j.m.potters@uvt.nl*.

1 Introduction

People are affected by "nudges" (Thaler and Sunstein, 2008). Variations in presentation and choice architecture are often found to have significant effects on people's decisions, even though they would leave a rational decision maker unaffected.[1] In this paper we investigate which demographic or socio-economic characteristics co-vary with the impact of a nudge and address questions such as: Are women more "nudgeable" than men? Does the sensitivity to nudges fade with age? Is nudgeability related to education? We are particularly interested in the relationship between an individual's rate of time preference and his or her nudgeability. Heavy discounting is associated with problematic behaviors such as undersaving, low investment in human capital, and an unhealthy life style.[2] Benevolent nudges typically aim to remedy such problems. Therefore, it is important to know if nudges are effective for impatient persons, since these are the typical target group of potential interventions.

The CentERpanel, hosted by Tilburg University, provides a unique opportunity to run economic experiments on a broadly representative sample of the adult population. It enables us to measure people's time preferences in an incentivized way. At the same time, a wealth of background information of the individual panel members is available. This allows us to investigate whether the effect of a nudge is related to socio-demographic background variables such as gender, age, occupational status, education, and income.

The specific nudge that we investigate stimulates decision makers to frame a sequence of risky decisions broadly (in combination) rather than narrowly (in isolation), and, thus, not to fall prey to *myopic loss aversion*. The design is based on Gneezy and Potters (1997). Two groups of participants are asked to make a sequence of three risky investment decisions. Participants in the first (high frequency) group can change their investment level from one decision to the next and are supplied with feedback about the outcome after each decision. Participants in the second (low frequency) group are restricted to choose the same investment level for all three rounds before the first lottery is played, and they receive feedback about the outcomes only at the end of the third round. Gneezy and Potters (1997) find that participants in the second group invest higher amounts

[1] Prominent examples include Madrian and Shea (2001) who illustrate that the default option has a major effect on the decision to enroll into a retirement savings plan, Ashraf, Karlan, and Yin (2006) who report that savings increase substantially when people are offered a commitment device, Brown et al. (2008) who find that the decision to annuitize retirement savings is affected by whether the problem is framed in consumption terms or in investment terms, Bertrand et al. (2010) who show that the take-up of loan offers is higher when the offer contains a single rather than mutliple offers.

[2] See, e.g., Eckel, Johnson, and Montmarquette (2005), Chesson et al. (2006), Khwaja, Sloan, and Salm (2006), Chabris et al. (2008), Meier and Sprenger (2007), and Sutter et al. (2010).

on average than participants in the first group.[3] When induced to take a decision once-and-for-all (low frequency), individuals are "nudged" to evaluate the risks in combination, and this pooling of the risks renders them more attractive.[4]

Our main result is that the effect of the treatment (high versus low frequency) on investment levels is significantly larger within the group of high discounters than within the group of low discounters. In other words, impatient individuals are more "nudgeable" than patient ones. This result is robust to controlling for various economic and sociodemographic variables.[5] Moreover, almost none of these background variables co-varies significantly with the treatment effect. For example, the nudge is equally effective for men and women, for younger and older people, and for individuals with a high and a low level of education. From a policy perspective, our finding that nudges may be effective for impatient individuals is reassuring, as they may be exactly the target group of such nudges. At the same time, of course, it also implies that this group may be particularly vulnerable to malicious nudges.

Few studies have examined whether nudges and treatment effects are related to background variables. Ashraf, Karlin, and Yin (2006) report that in their field experiment women with hyperbolic, time-inconsistent preferences were more likely to pick up a commitment savings product than were men or women with time-consistent preferences. Guiso (2009) manipulates the accessibility of background income risk and finds that higher accessibility generally increases risk tolerance, particularly for those individuals who say that they base their decisions mostly on reasoning as compared to those who say they mostly rely on intuition. Interestingly, Steul (2006) reports more or less the opposite result for the impact of the framing of investment portfolios (aggregated vs. segregated) on risk taking. Subjects who said they engaged in explicit calculations of expected values were less affected by the framing manipulation than subjects who said they did not. We contribute to this literature by relating nudgeability to time preference.

[3] For similar results see Thaler et al. (1997), Benartzi and Thaler (1999), Read, Loewenstein, and Rabin (1999), Barron and Erev (2003), Gneezy, Kapteyn, and Potters (2003), Langer and Weber (2003), Haigh and List (2005), Bellemare et al. (2005), Sutter (2007), Hopfensitz and Wranik (2008), and Fellner and Sutter (2009).

[4] Similar manipulations have been applied outside the lab. Gneezy, Kapteyn and Potters (2003) report how an Israeli bank reduced the information that was released about investment performance in order to induce its clients to take a less myopic perspective. Kliger and Levit (2009) show how the Tel Aviv Stock Exchange affected traders' evaluation period by shifting the trading frequency of certain securities from daily to weekly.

[5] In line with recent studies (Benjamin, Brown, and Shapiro, 2006, Burks et al., 2009, Dohmen et al., 2010) we find that patience is positively related to cognitive ability. Interestingly, when we control for cognitive ability we still find a positive effect of impatience on the treatment effect. For this control, we use subjects' answers to the Cognitive Reflection Test by Frederick (2005). We have these answers for about half of the subjects in our sample.

2 Experimental design and data collection

2.1 Experimental design

Our experiment had two parts. The first part was a risky investment decision task and the second part consisted of the elicitation of time preferences.

Part 1: Investment decision. In this part we employed the basic design of Gneezy and Potters (1997) involving three rounds of an investment task. In each round, subjects were endowed with €2 and had to decide how much of this amount they wanted to invest in a lottery in which there was a 2/3 chance to lose the invested amount and a 1/3 chance to win 2.5 times the invested amount. Hence, expected earnings in round t when investing an amount x_t (with $0 \leq x_t \leq 2$ and $t = 1, 2, 3$) were equal to $2 - (2/3)x_t + (1/3)2.5x_t = 2 + (1/6)x_t > 2$. The lotteries in each round were independent. Moreover, subjects could not invest money accumulated in previous rounds, that is, the maximum investment in each round was €2.

The central feature of the design was that were two treatments. In the high-frequency treatment (referred to as "HIGH"), subjects made the investment decisions round by round. At the beginning of round 1 they had to choose the amount x_1 of their endowment of €2 to invest in the lottery. Then they were informed of the result of the lottery in round 1. Thereafter, subjects decided on the part x_2 of their new endowment of €2 they wished to invest in round 2. Again, they were informed of the outcome of the round-2 lottery, and were finally asked to make their decision x_3 for round 3, with subsequent feedback about the outcome. In the low-frequency treatment (referred to as "LOW"), subjects made just one decision for all three rounds, which imposes the constraint $x_1 = x_2 = x_3$. Subjects in this treatment only received feedback about the combined result of rounds 1, 2, and 3 at the end of the third round. That is, they were only informed whether they had won in no, one, two or all three rounds, but could not assign a gain or loss to any particular round.[6] In this part of the experiment all subjects were paid according to their decisions.

Part 2: Elicitation of time preferences. For this part of the experiment we followed Coller and Williams (1999) and confronted subjects with a set of 20 payoff alternatives, which we also list in the rows of Table 1. In principle, in each of the 20 rows subjects had to decide between option A and Option B. Option A always paid €300 in one month from the day of the experiment. Option B paid the amount of €300 + €X after seven months from the day of the experiment, where X

[6] There was also a third treatment in which subjects first chose whether they wanted to make their investment decision(s) under the conditions of treatment LOW or treatment HIGH and only then were confronted with the decision task of the chosen treatment. However, we will not report on this treatment in this paper.

varied from €3.80 to €79.70 (corresponding to annual interest rates varying from 2.5% to 50% of return on the amount of €300, compounded quarterly).[7] However, instead of asking the subjects to make a choice for each decision listed in the rows of Table 1, a subject's task was to choose the *minimum* X which would make her prefer Option B (performed by moving a slider on a row in Table 1 that represented a "switch point" from preferring Option A to preferring Option B). So, for instance, if a subject's preference was such that it would take an extra payment of at least €25 to wait seven months from the day of the experiment instead of receiving €300 in one month from the day of the experiment, this subject would select the row of decision alternative 7 in Table 1. By asking subjects to indicate the minimum amount of X to make it worth waiting for seven months, we forced subjects to switch from Option A to Option B at most once. In particular, we explicitly stated that there are, in principle, three choices available: a preference for Option A in all decision rows, a preference for Option B in all decision rows, and a preference for Option A for decision rows with a lower number, and Option B for decision rows with a higher number. The instructions explained what a subject needed to do in each of these cases (see the Appendix with the instructions).[8]

Subjects were informed that there was a 1 in 100 chance to be selected and paid in accordance with the stated preference.[9] We told them that for this purpose the computer would randomly select a number between 1 and 100, independently for each subject. If the number was 100, the subject would receive an additional sum of money in this part of the experiment. The computer would then randomly select one of the decision lines in Table 1 and the subject would be paid according to the choice indicated in this decision line. To make sure that subjects received their money exactly in one or seven months from the day of the experiment, we made use of CentERdata's established and reliable payment system (see also below).

To summarize, our experiment had two parts. Treatments only differed in the first part of the experiment. In treatment High, subjects made three investment decisions in part 1, and in treatment Low they made only one investment decision. In the second part of the experiment we

[7] Note that the reward is always received with a delay. Using the CentERpanel (see below) forced us to have a front-end delay since it was impossible to pay the participants immediately after the experiment. This means that our time preference measure is not affected by present-bias.

[8] In order for a subject to select Option A in all decisions, in the experiment Table 1 contained an additional decision line 21 with the entry "Always €300" in column 2 labeled "Payment Option A," and no entry in all other columns. Hence, time preference choices ranged from 1 to 21. (Note that the experiment was administered in Dutch and that the Appendix with instructions contains a translation of the screens used in the experiment.)

[9] This is common practice in experiments with large samples, see e.g. Andersen et al. (2008) and von Gaudecker, van Soest, and Wengström (2011). Starmer and Sugden (1991) find in a different context that subjects' responses are not affected by this.

Decision	Payment Option A (pays amount below in 1 month)	Payment Option B (pays amount below in 7 months)	Preferred Payment Option
1	€300	€303.80	A B
2	€300	€307.50	A B
3	€300	€311.40	A B
4	€300	€315.20	A B
5	€300	€319.00	A B
6	€300	€322.90	A B
7	€300	€326.80	A B
8	€300	€330.80	A B
9	€300	€334.70	A B
10	€300	€338.70	A B
11	€300	€342.70	A B
12	€300	€346.70	A B
13	€300	€350.70	A B
14	€300	€354.80	A B
15	€300	€358.90	A B
16	€300	€363.00	A B
17	€300	€367.10	A B
18	€300	€371.30	A B
19	€300	€375.50	A B
20	€300	€379.70	A B

Table 1: Table used for the elicitation of time preferences in part 2 of the experiment

elicited subjects' time preferences.

2.2 Data collection

The experiment was conducted by CentERdata, an institute for applied economic and survey research for the social sciences that is affiliated with Tilburg University in the Netherlands. CentERdata carries out its survey research mainly by using its own panel called CentERpanel. This panel is internet-based and consists of about 2,000 households in the Netherlands that form a representative sample of the Dutch population.[10] Panel members use their computers at home to participate in the panel questionnaires, and they complete a questionnaire on the internet every week.[11] A particular advantage of the CentERpanel is that for each panel member, researchers have access to regularly collected background information such as demographic and financial data.

[10] For more information about the CentERpanel and the way it is administered see http://www.centerdata.nl/en/.

[11] Panel members without a computer answer questionnaires using a special device connected to their TV sets.

After logging on to our experiment, panel members were randomly assigned to one of the treatments and were informed about the nature of the experiment. Then, subjects decided whether or not to participate—as is common with all modules of the panel. For participating subjects, the next screen then described the investment decision task. After making their decision (treatment Low) or their decisions (treatment High) in the first part of the experiment, time preferences were elicited. Subjects received their earnings by means of the payment and reimbursement system used by CentERdata. CentERdata reimburses the costs for internet access to panel members' private bank accounts four times a year. Whereas payments for earnings in Part 1 were made at the earliest scheduled normal date of payments, it was absolutely crucial for the payments in Part 2 of the experiment that subjects would receive their money either exactly one month or exactly seven months from the day of the experiment. Hence, subjects were told that they would, conditional on receiving a payment at all, receive it for the second part of the experiment also by means of CentERdata's reimbursement system, in accordance with their stated preference in the selected line. Since CentERdata makes reimbursement and other payments regularly and reliably, we can assume that subjects believed that payments for the time elicitation task would be paid according to the rules specified.

Prior to the panel experiment, we conducted a pilot experiment in the lab of Tilburg University with 92 student subjects in order to test whether instructions were clear and whether the procedures we designed to use in the main panel study actually worked. The lab experiment was conducted in exactly the same way as later in the CentERpanel. That is, student subjects completed the experiment using a web browser (in the lab) and using the same screens as later the subjects in the panel (at home). As there were no problems with the lab pilot, we used the same procedures and programs later in the main panel study.

In total, $1,872$ members of the CentERpanel logged on to our experiment. Of these subjects, 1,637 (87.4%) subjects decided to participate in our experiment, while 235 (12.6%) subjects decided not to participate. Of the 1,637 subjects participating, 1,102 subjects participated in the two randomly assigned treatments reported in this paper (while the remaining 535 subjects participated in another treatment referred to in footnote 6).

The column labeled "Participation" in Table 2 shows descriptive statistics for participating subjects in each of the two treatments, as well as statistics of subjects who chose not to participate in the experiment. The columns labeled "Investment (in %)" show statistics of investment decisions for participating subjects, which we analyze in Section 3.1.

		Participation			Investment (in %)		
		YES		NO			
		Low	High		Low	High	Difference
Gender	Female	47.2	46.1	50.2	51.7	43.1	8.6***
	Male	52.8	53.9	49.8	52.5	43.7	8.8***
Age	Age 18-24	5.08	3.81	5.11	50.5	44.8	5.7
	Age 25-34	19.4	20.3	7.2	58.1	43.5	14.6***
	Age 35-44	19.8	17.4	16.2	53.2	42.3	10.8***
	Age 45-54	19.8	27.0	18.3	48.6	44.1	4.5
	Age 55-64	18.0	16.9	24.3	47.8	41.1	6.7**
	Age 65+	18.0	14.5	28.9	53.0	45.8	7.2**
Education	Low	30.49	29.95	36.60	52.6	46.0	6.6**
	Middle	35.03	33.58	28.09	52.9	43.2	9.7***
	High	34.48	36.48	35.32	50.8	41.5	9.3***
Location	Rural	57.4	61.9	53.2	53.1	43.9	9.2***
	Urban	42.6	38.1	46.8	50.6	42.6	8.0***
Partner	No	23.1	23.6	26.0	50.3	39.8	10.5***
	Yes	76.9	76.4	74.0	52.6	44.5	8.1***
Position in HH	Head	61.7	63.7	59.2	51.8	41.7	10.1***
	Other	38.3	36.3	40.8	52.6	46.5	6.1**
Children	No	59.5	53.4	66.8	52.2	41.8	10.4***
	Yes	40.5	46.6	33.2	51.9	45.3	6.6**
Occupation	Employed (contract)	50.5	54.1	42.1	51.5	42.7	8.8***
	Retired	18.2	15.3	28.5	55.5	42.5	13.0***
	Works in own household	12.3	14.0	13.2	49.7	45.3	4.4
	Student	5.4	2.9	4.7	53.9	37.6	16.3
	Freelance or self-employed	4.2	3.1	2.1	51.0	50.4	0.6
	Unemployed	2.0	1.8	0.9	39.1	39.7	−0.6
	Other	7.4	8.9	8.5	54.2	47.0	7.2
Household (HH) income	HH gr. income ≤ €2,250	25.2	23.1	30.6	54.0	42.5	11.5***
	HH gr. income €2,251−€3,130	22.9	26.7	25.5	49.6	41.9	7.7***
	HH gr. income €3,131−€4,350	27.2	27.4	23.8	53.3	46.2	7.1**
	HH gr. income ≥ €4,351	24.7	22.9	20.0	51.1	42.8	8.3**
Equity	No	76.6	74.6	-	52.2	43.7	8.5***
	Yes	23.4	25.4	-	51.8	42.6	8.2***
Plays lottery	Never	32.8	29.6	-	51.4	44.5	6.9**
	At least once a year	67.2	70.4	-	52.4	43.0	9.4***
Has savings account	No	12.9	11.6	-	50.4	50.4	0
	Yes	87.1	88.4	-	52.3	42.5	9.8***
	Number of observations	551	551	235	551	551	551

Notes: Numbers indicate column percentages within each main category listed in the first column. For treatment High, the table shows the average relative investment over the three rounds. *,**, *** indicate significance at the 10%, 5%, 1% level of Mann-Whitney U tests for differences of the distributions of the percentages invested across treatments for subjects in the category listed in column 1. The last three variables are not available for non-participants as these questions were only presented to participants.

Table 2: Descriptive statistics

The table is grouped according to a selection of various sociodemographic and socioeconomic characteristics. Concentrating on descriptive statistics for participating subjects, we note that by and large the distribution of the covariates is balanced across the two treatments. We show below that our results are robust to controlling for all those covariates. A comparison of the descriptive statistics in the columns for participants with those of non-participants reveals no significant differences except for some of the age and children categories as well as for the occupation category, with retired and older individuals and those with no children being more reluctant to participate. To address this potential sample selection problems, for regressions reported below we ran Heckman (1976) selection models using the variable "Ratio" as one of the exclusion variables. The variable "Ratio" measures the proportion of questionnaires completed by panel members in the three months proceeding our experiment. This variable can be assumed to affect the participation decision but not the decisions taken in the experiment. For none of the regressions we found evidence for a selection bias.

3 Results

3.1 A first look at the data

We first look at Part 1 of the experiment and compare the average percentage of the endowment invested between the two treatments. Table 3 shows that, on average, subjects invested 43.4% of their endowment in treatment HIGH and 52.1% in treatment LOW—a 8.7 percentage point difference.[12] A Mann-Whitney U test confirms that the distributions of percentages invested differ significantly across treatments ($p < 0.0001$). This finding is in line with the treatment effect found in many studies that have used the Gneezy and Potters (1997) design.[13] Although in our heterogeneous sample the difference between the treatments is somewhat lower than in studies using a more homogeneous group of subjects, our result implies that the main treatment effect carries over to the population at large.

With our heterogenous subject pool, we can analyze whether the treatment effect is present for subsamples of the population. The last three columns of Table 2 show the average percentage

[12] For treatment HIGH, the table shows the average percentages invested in the three individual rounds, which are fairly stable: 42.6%, 42.3%, and 45.4%, respectively.

[13] See footnote 3 for references. The differences observed in these earlier studies range from 11.6 percentage points (student sample in Haigh and List, 2005) to 31.5 percentage points (Fellner and Sutter, 2009). In our pilot lab experiment with students subjects we obtained a difference of 14.1 percentage points. For a non-standard subject pool of professional traders Haigh and List found a difference of 28.7 percentage points.

Treatment	Mean	SD	#Obs
Low	52.1	27.5	551
High	43.4	24.5	551
H_0: Treatment has no effect on investment			
$p < 0.0001$ (two-tailed Mann-Whitney U test)			

Note: For treatment High, the table shows the average investment over three rounds.

Table 3: Percentage of per-period endowment invested

invested in the two treatments for subjects with various characteristics listed in the first column of the table, the difference between these two percentages, and the results of Mann-Whitney U tests of treatment differences. Reading Table 2 row-wise, we note that a substantial and significant treatment effect is present in the majority of the subsamples displayed in the table. Considering subgroups that have a substantial number of participants, we find that regarding socio-demographic characteristics only the difference in the group of people aged 45-54 is not statistically significant. In the regressions presented in the next section we control for the effect of background variables.

Before turning to the relationship between the treatment effect and time preference, we first briefly look at the results of Part 2 of the experiment in which we elicited subjects' time preferences. We find a mean choice of 14.31 (standard deviation 6.52) and a median choice of 15.[14] The latter corresponds to an annual interest rate of between 32.5 and 35 percent, which is similar to the range of 27.5 to 30 percent found by Dohmen et al. 2010 for the German population, and the 28 percent reported by Harrison, Lau, and Williams (2002) for their Danish sample.[15]

Now we combine the data from the two parts of the experiment and relate investment behavior to time preferences. Figure 1 shows local linear regression estimates of mean investment in the two treatments (vertical axis) plotted against the time preference (horizontal axis), along with corresponding 95% confidence intervals.[16] As the line indicating investment behavior in treatment Low is consistently above the line indicating investment behavior in treatment High, this figure replicates the finding that subjects in treatment Low invest on average more than subjects in treatment High. Interestingly, investment behavior in treatment High hardly varies with subjects' time preferences, while in treatment Low it does. Importantly, the difference in investment levels

[14] Means of elicited time-preference choices are virtually the same across the two treatments (treatment Low: 14.30, standard deviation 6.62; treatment High: 14.32, standard deviation 6.44).

[15] A substantial fraction of subjects switched from Option A to Option B at 20 or chose Option A throughout (i.e., chose 21, see footnote 8). Whereas a choice of 20 means that a subject has a discount rate in the interval from 47.5 to 50 percent, a choice of 21 means that a subject has a discount rate of 50 percent or higher.

[16] For this and also for the results presented below we used only the first period's choice of treatment High. Results are not sensitive to the choice of the bandwidth. For the figure, we used a rule-of-thumb bandwidth.

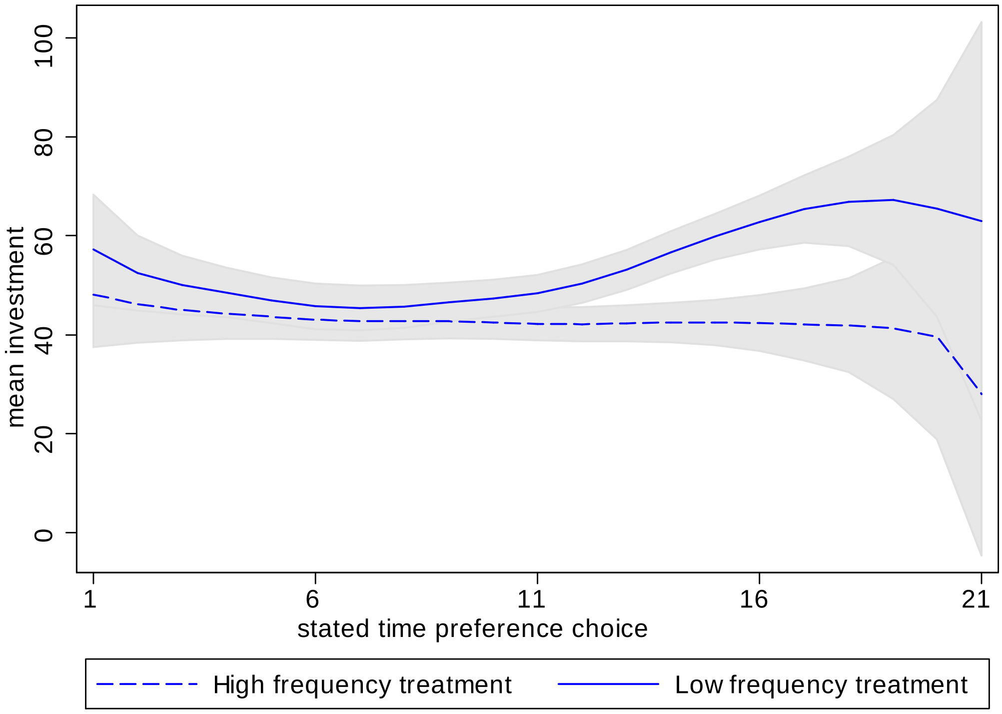


Figure 1: Relationship between investment in each treatment and the time preference

across the two treatments increases with impatience. This means that impatient subjects are on average more affected by our treatment manipulation than patient subjects.

3.2 Regression analysis

The evidence presented in the previous section suggests that there is a relationship between the invested amounts and time preferences. In this section, we examine whether this relationship is robust to the inclusion of various covariates.[17] It is important to do so because these covariates may be related to investment levels and the treatment effect on the one hand, and time preferences on the other hand. For example, less educated individuals are more impatient. So, finding that more impatient individuals react more strongly to the treatment manipulation may simply reflect the fact that less educated individuals react more strongly to the treatment. We rule this out by controlling for education and its interaction with the treatment indicator (as well as other covariates and their interaction with the treatment indicator) and still finding a significant coefficient on the interaction

[17] Regressing the stated time-preference choice on background variables as listed in Table 2, we find that individuals who have a high education, have invested in equity, or have a savings account are significantly more patient than individuals who have, respectively, low education, no equity, or no savings account.

term between the treatment indicator and impatience. This is done by means of regressions of the percentages invested on a treatment dummy "Low", an indicator for a stated time preference choice above 10, "Time01", and the interaction between the two, controlling for sociodemographic characteristics. We use data for the only choice made in treatment Low and the round-1 choice made in treatment High. The coding of "Time01" is based on Figure 1, which suggests that the effect of "Low"is higher for stated time preference choices above 10.[18] According to this measure, 70.3 percent of the individuals are impatient. The estimation results are presented in Table 4. All explanatory variables other than "Low" are de-meaned when they are not interacted. Hence, the constant term is always the mean investment in the high-frequency treatment. For the interaction terms the mean was calculated for all observations with Low=1 and then subtracted. This de-meaned value was then interacted with "Low". Hence, the coefficient on "Low" is always the average effect of "Low" for those in treatment "Low" and across all covariates.[19] Our baseline specification, (1), has no covariates, whereas in specifications (2) to (5) we control for groups of covariates.

The estimated coefficients on the treatment variable "Low", the time preference variable "Time01" and the interaction term between these two variables, "Time01×Low", are similar across all 5 specifications. The treatment effect is consistently estimated to be a 9.5 percentage point increase in the percentage of the endowment that was invested, and is always highly significant. This means that the treatment effect (according to which subjects invest more if encouraged to take a broader frame) remains if we control for socioeconomic variables and the stated time preference. The coefficient of the variable "Time01" is estimated to be negative, but insignificant in all specifications. Hence, subjects' time preferences are not related to their investment behavior in treatment High. However, the coefficient on the interaction term "Time01×Low" is consistently estimated to be around 8.5, and is significantly different from zero in all specifications, which means that the treatment effect depends on the time preference. Subjects with a higher discount rate are affected more by our treatment manipulation, or, put differently, more impatient subjects invest more when placed in an environment that, arguably, encourages them to take a broader perspective.

[18] Defining "Time01" by means of a median split and running the same regressions yielded very similar results. We also carried out a specification check based on regression specification (1) in Table 4. If, in addition to Low and Time×Low, we include a full set of dummies for stated time-preference choices, and interactions of those with Low, then we cannot reject the null hypothesis that the coefficients on these dummies are jointly zero. Likewise, if we include a second order polynomial in the time preference, interacted with Low, in addition to Low, Time01 and Time01×Low, we cannot reject the null that the additional 4 coefficients are jointly zero. This suggests that our definition of "Time01" is appropriate.

[19] This is the treatment effect on the treated. It differs only slightly from the average treatment effect, as treatment assignment was random and the distributions of covariates are almost identical in the treatment and the control group.

	(1)	(2)	(3)		(4)	(5)
	Dependent variable: percentage of the per-period endowment invested					
Constant	42.551***	42.553***	42.544***	Constant	42.576***	42.636***
	(1.12)	(1.12)	(1.12)		(1.12)	(1.12)
Low	9.531***	9.528***	9.546***	Low	9.565***	9.361***
	(1.58)	(1.58)	(1.60)		(1.58)	(1.58)
Time01	−1.648	−1.679	−1.723	Time01	−1.405	−2.218
	(2.44)	(2.45)	(2.47)		(2.47)	(2.46)
Time01×Low	8.554**	8.947**	8.839**	Time01×Low	8.045**	9.351***
	(3.46)	(3.47)	(3.50)		(3.53)	(3.49)
Female		−0.004		Education Low	−0.630	
		(2.26)			(2.81)	
Female×Low		−1.550		Education High	−3.517	
		(3.21)			(2.73)	
Age		1.210		[Education Low]×Low	−0.394	
		(7.69)			(3.96)	
Age×Low		−12.340		[Education high]×Low	2.785	
		(10.46)			(3.91)	
Employed			8.471	HH gross income €2251−€3130	−3.854	
			(6.06)		(4.42)	
Freelance			1.930	HH gross income €3131−€4350	−1.162	
			(8.45)		(4.24)	
Unemployed			−3.591	HH gross income ≥ €4351	3.924	
			(6.74)		(4.26)	
Student			0.666	[HH gross income €2251−€3130]×Low	−3.853	
			(3.37)		(6.44)	
Works in own household			0.378	[HH gross income €3131−€4350]×Low	−5.003	
			(3.26)		(6.22)	
Retired			2.096	[HH gross income ≥ €4351]×Low	−9.224	
			(4.16)		(6.30)	
Employed×Low			−9.601	Lottery01		−2.465
			(8.05)			(2.44)
Freelance×Low			−16.794	Lottery01×Low		3.200
			(11.72)			(3.43)
Unemployed×Low			5.450	Equity01		2.279
			(8.42)			(2.58)
Student×Low			−3.107	Equity01×Low		−1.778
			(4.90)			(3.71)
Works in own household×Low			2.784	Has savings account		−10.721***
			(4.48)			(3.50)
Retired×Low			1.017	[Has savings account]×Low		13.212***
			(6.21)			(4.88)
R^2	0.039	0.042	0.047		0.049	0.049

Note: ** and *** indicate significance at the 5% and 1% level, respectively. Standard errors are in parentheses. Categories left out: "Other" in occupation, "Middle" in education, "≤ €2,250" in HH gross income.

Table 4: Regression results

This result formally corroborates the visual insights gained from Figure 1.

In regressions (2) to (5) we include covariates to assess whether there is a relationship between investment behavior and observed differences in gender, age, occupation, education, income, and variables that proxy for risk preferences such as whether the individual plays in a lottery, holds equity, or has a savings account. Except for having a savings account, these variables are not significantly (at the 5 percent level) related to investment behavior and the treatment effect.[20]

Finally, we address the possibility that impatience is related to cognitive ability, and that therefore, the treatment effect may also depend on cognitive ability. To shed light on the role of cognitive ability we matched our data with data on the Frederick (2005) three-item "Cognitive Reflection Test" (CRT) measure that was collected in a different experiment. It is a simple measure of intelligence that is given by the number of correct answers to three questions. Despite its simplicity, Frederick (2005) provides evidence that it has equal or sometimes even better predictive power, e.g. for predicting impatience, than other measures that are substantially more difficult to elicit. In our data, the CRT measure is negatively correlated to our measure of impatience, i.e. more impatient individuals answer less of the CRT questions correctly.

The CRT score is available for 563 out of the 1,102 individuals who participated in our experiment. In order to assess whether this is a selected sample, as before, but now for those individuals for whom this information is available, we regressed the invested amount on an indicator for treatment LOW, our measure "Time01" for impatience, and the interaction of the two. The results are presented in column (1) of Table 5. They are very similar to our main results that are presented in column (1) of Table 4. We conclude from this that the subsample of individuals for whom the CRT measure is available is not a selected sample. This is confirmed by comparing means of the observable characteristics for this subsample to the ones reported for the main sample in Table 2 (results not reported).

In order to relate the invested amount and the treatment effect to both impatience and cognitive ability by means of a regression, we create a dummy for a CRT measure of at least 2

[20] We also tested for a relationship between the invested amount and the covariates using the following two kinds of tests. For each main category listed in column 1 of Table 2, we tested whether the investment in treatment HIGH is the same across all subcategories listed in column 2 of Table 2 (Test 1), and whether the treatment effect (that is, the effect of LOW) is the same across all subcategories listed in column 2 of Table 2 (Test 2). For example, to conduct these tests for the main category Gender, we first estimated the regression equation $x_p = \alpha_0 + \alpha_1 \times Low + \alpha_2 \times Female + \alpha_3 \times Female \times Low + \varepsilon_i$, where x_p is the percentage of the per-period endowment invested, and "Low" and "Female" are dummy variables coding treatment and gender. Then we tested H_0: $\alpha_2 = 0$ (Test 1) and H_0: $\alpha_3 = 0$ (Test 2). These two hypotheses were not rejected for any of the main categories (at the 5% level), except for having a savings account. This means that both the average relative investment in treatment HIGH and the difference in average relative investments in treatments HIGH and LOW are statistically the same across the subcategories listed in Table 2.

	(1)	(2)
Constant	40.814***	40.836***
	(1.53)	(1.52)
Low	12.027***	11.985***
	(2.21)	(2.21)
Time01	−1.470	−2.511
	(3.33)	(3.99)
Time01×Low	11.409**	12.881***
	(4.78)	(4.82)
CRT		−4.058
		(4.56)
CRT×Low		10.720**
		(4.60)
Time01×CRT		1.147
		(4.87)
N	563	563
R^2	0.062	0.085

Note: ** and *** indicate significance at the 5% and 1% level, respectively. Standard errors are in parentheses.

Table 5: Regression results controlling for cognitive ability

and regress the invested amount on the treatment dummy, the interaction thereof with a dummy for impatience, a dummy for a high CRT score, and the interaction thereof with the treatment dummy. Results are presented in column (2) of Table 5. They show that our main result remains to hold: The treatment effect is higher by about 13 for impatient individuals. At the same time, we find that it is higher by about 11 for individuals with a CRT score of at least 2. This means that both impatient individuals and individuals with higher cognitive ability react more strongly to the treatment manipulation.[21]

4 Summary and conclusions

Using a large sample of the Dutch population, we analyze whether individuals' decision framing can be influenced by a simple treatment manipulation—a 'nudge'—and if so, whether the effect of the nudge is correlated with individuals' time preferences and demographic and socioeconomic characteristics. The nudge reduces people's decisions flexibility and encourages them to frame a

[21] The specification here could still be too restrictive, as it does not allow the dependence of the treatment effect on impatience to depend on the CRT score. When we additionally allow for such a dependence we find that the treatment effect for individuals who are both impatient and smart is higher by 25.706, as compared to individuals who are neither smart nor impatient. It is by 23.097 higher if they are only impatient, and by 26.781 if they are only smart.

sequence of risky choices broadly rather than narrowly and, as a consequence, not to fall prey to myopic loss aversion.

We find that the effect of the treatment manipulation that was previously found in student samples is not specific to those samples. We provide evidence that the (average) treatment effect is present in subsamples with diverse socioeconomic characteristics in terms of, for instance, gender, age, occupation, education, and, income. The effect first found in the lab turns out to be a robust behavioral pattern in all strata of the population.

This finding squares well with Rabin and Weiszacker (2009) who show that the tendency to bracket narrowly is rather uniform across the population, and does not vary much with observable background characteristics. The fact that relatively simple nudges can induce people to frame more broadly is important, since narrow framing, and related phenomena such as narrow bracketing and myopic mental accounting, have been associated with somewhat distressing phenomena such as the disposition effect (Kumar and Lim, 2008), the stock market participation puzzle (Barberis, Huang, Thaler, 2006), the equity premium puzzle (Benartzi and Thaler, 1995), the willingness to pay large premiums to insure against small risks (Rabin, 2000), and 'adding-up effects' which cause small, seemingly innocent, indulgences to accumulate into a serious (health) hazard (Read, Loewenstein, and Rabin, 1999). Our results suggest that for most of the population variations in presentation and choice structure may have a significant impact on such behavioral patterns.

The result we wish to emphasize is that the effect of our treatment manipulation on risk taking behavior is significantly larger among individuals with high as opposed to those with low discount factors. In other words, the decision frames of impatient people are affected more easily than those of impatient people. This is interesting from a policy perspective, as nudges are typically proposed for individuals with "problematic" behaviors such as low savings, overspending on credit cards, obesity, which have all been associated to a high rate of discounting.

Why is nudgeability related to time preference? Our results indicate that the effect is not mediated by cognitive abilities. We speculate that 'accessibility' provides the link between the two. The impact of nudges derives from the fact that many decisions are made intuitively rather than cognitively (Thaler and Sunstein, 2008). Intuitive thoughts come to mind spontaneously, and they are primarily based on the way in which a problem presents itself to the decision maker. A key aspect is accessibility, that is, the ease with which certain characteristics of a problem come to mind (Kahneman 2003). A nudge affects the accessibility of different elements, and its impact derives from decision makers' inability to see beyond the most accessible elements. In a similar vein, accessibility is relevant for decisions that involve a trade-off between the present and the future. The immediate consequences of a decision will come to mind more readily and concretely than consequences in the future (Trope and Liberman, 2003). As a result, the former are likely to attain more weight in the evaluation than the latter. Taking these two lines of argument together suggests a link between nudgeability and time preference. Intuitive decision makers tend to be affected more by accessibility. This will render them more sensitive to nudges as well as induce them to weigh proximate consequences more heavily than distant ones. In sum, we argue that 'accessibility' can be a factor that drives both nudgeability and impatience, but more research is needed to investigate the validity of this argument.

In this paper we have only studied one specific nudge that stimulates people to frame decisions more broadly by reducing the decision frequency and information provision. Future work should examine whether the effect of other nudges varies with individuals' time preferences in similar ways. For instance, it would be interesting to see whether default effects or the impact of commitment devices are stronger for impatient than for patient individuals.

References

[1] Andersen, S., G.W. Harrison, M. I. Lau, and E. E. Rutström (2008): Eliciting Risk and Time Preference, *Econometrica* 76, 583-618.

[2] Ashraf, N., D. Karlan, and W. Yin. (2006): Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines. *Quarterly Journal of Economics* 121, 635–72.

[3] Barberis, N., M. Huang, and R.H. Thaler (2006): Individual Preferences, Monetary Gambles, and Stock Market Participation: A Case of Narrow Framing, *American Economic Review* 96, 1069-1090.

[4] Bar-Gill (2004)

[5] Barron, G. and I. Erev (2003): Small Feedback Based Decisions and their Limited Correspondence to Description Based Decisions, *Journal of Behavioral Decision Making* 16, 215-233.

[6] Bellemare, C., M. Krause, S. Kröger, and C. Zhang (2005): Myopic Loss Aversion: Information Feedback vs. Investment Flexibility, *Economics Letters* 87, 319–324.

[7] Benartzi, S. and R. Thaler (1995): Myopic Loss Aversion and the Equity Premium Puzzle, *Quarterly Journal of Economics* CX, 73-92.

[8] Benartzi, S., and R. Thaler (1999), Risk Aversion or Myopia? Choices in Repeated Gambles and Retirement Decisions, *Management Science 45*, 364-381.

[9] Benjamin, D., S. Brown, and J. Shapiro (2006): Who is Behavioral? Cognitive Ability and Anomalous Preferences, Working paper, Harvard University.

[10] Bertrand, M., D. Karlan, S. Mullainathan, and E. Shafir (2010): What's Advertising Content Worth? Evidence from a Consumer Credit Marketing Field Experiment, *Quarterly Journal of Economics* 125, 263-306.

[11] Brown, J., J. Kling, S. Mullainathan, and M. Wrobel (2008): Why Don't People Insure Late-Life Consumption? A Framing Explanation of the under-Annuitization Puzzle, *American Economic Review 98*, 304-309.

[12] Burks, S. V., J.P. Carpenter, L. Goette, and A. Rustichini (2009): Cognitive Skills Affect Economic Preferences, Strategic Behavior, and Job Attachment, *Proceedings of the National Academy of Sciences*, V.6, No. 109, 7745-7750.

[13] Chabris, C.F., D. Laibson, C.L. Morris, J.P. Schuldt, and D. Taubinsky (2008): Measuring Intertemporal Preferences Using Response Times. National Bureau of Economic Research Working Paper 14353.

[14] Chesson, H., J. Leichliter, G. Zimet, S. Rosenthal, D. Bernstein and K. Fife (2006): Discount rates and risky sexual behaviors among teenagers and young adults, *Journal of Risk and Uncertainty 32*, 217-230.

[15] Coller, M. and M.B. Williams (1999): Eliciting Individual Discount Rates, *Experimental Economics* 2, 107-127.

[16] Dohmen, T., A. Falk, D. Huffman, and U. Sunde, (2010): Are Risk Aversion and Impatience Related to Cognitive Ability?, *American Economic Review* 100, 1238-1260.

[17] Eckel, C., C. Johnson, and C. Montmarquette (2005): Savings Decisions of the Working Poor: Short- and Long-Term Horizons, in: *Field Experiments in Economics*, Research in Experimen-

tal Economics, Vol. 10, ed. by J. Carpenter, G.W. Harrison, and J.A. List. Greenwich, CT: JAI Press, 219-260.

[18] Fellner, G. and M. Sutter (2009): Causes, Consequences, and Cures of Myopic Loss Aversion - An Experimental Investigation, *Economic Journal* 119, 900-916.

[19] Frederick, S. (2005): Cognitive Reflection and Decision Making, *Journal of Economic Perspectives* 19, 25-42.

[20] Gneezy, U., A. Kapteyn, and J. Potters (2003): Evaluation Periods and Asset Prices in a Market Experiment, *Journal of Finance* 58, 821-838.

[21] Gneezy, U. and J. Potters (1997): An Experiment on Risk Taking and Evaluation Periods, *Quarterly Journal of Economics* 112, 631-645.

[22] Guiso, L. (2009): A Test of Narrow Framing and its Origin, CEPR Discussion Paper No. DP7112.

[23] Haigh, M.S. and J.A. List (2005): Do Professional Traders Exhibit Myopic Loss Aversion? An Experimental Analysis, *Journal of Finance* 60, 523-534.

[24] Harrison, G.W., M. Lau, and M.B. Williams (2002): Estimating Individual Discount Rates for Denmark: A Field Experiment, *American Economic Review* 92, 1606-1617.

[25] Heckman, J. (1976): The common structure of statistical models of truncation, sample selection, and limited dependent variables and a simple estimator for such models, *Annals of Economic and Social Measurement* 5, 475-492.

[26] Hopfensitz, A. and T. Wranik (2008): Psychological and Environmental Determinants of Myopic Loss Aversion, NETSPAR discussion paper. nr. 2008-2013.

[27] Kahneman, D. (2003): Maps of Bounded Rationality: Psychology for Behavioral Economics, *American Economic Review* 93 , 1449-1475.

[28] Kliger, D. and B. Levit (2009): Evaluation Periods and Asset prices: Myopic Loss Aversion at the Financial Marketplace, *Journal of Economic Behavior & Organization* 71, 361-371. August

[29] Kumar, A. and S.S. Lim (2008): How Do Decision Frames Influence the Stock Investment Choices of Individual Investors?, *Management Science* 54, 1052-1064.

[30] Khwaja, A, F. Sloan, and M. Salm (2006): Evidence on Preferences and Subjective Beliefs of Risk Takers: The Case of Smokers, *International Journal of Industrial Organization* 24, 667-682.

[31] Langer, T. and M. Weber (2003): Does Binding or Feedback Influence Myopic Loss Aversion? An Experimental Analysis, Working Paper, University of Mannheim.

[32] Madrian, B.C. and D.F. Shea (2001): The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior, *Quarterly Journal of Economics* 116, 1149–1187.

[33] Meier, S., and C. Sprenger (2007): Impatience and Credit Behavior: Evidence from a Field Experiment, Federal Reserve Bank of Boston, Working Paper 07-3.

[34] Rabin, M. (2000): Risk Aversion and Expected-Utility Theory: A Calibration Theorem, *Econometrica* 68, 1281-1292.

[35] Rabin, M. and G. Weizsäcker (2009): Narrow Bracketing and Dominated Choices, *American Economic Review* 99, 1508–1543.

[36] Read, D., G. Loewenstein, and M. Rabin (1999): Choice Bracketing, *Journal of Risk and Uncertainty* 19, 171-197.

[37] Starmer, C. and R. Sugden, (1991): Does the Random-Lottery Incentive System Elicit True Preferences?, *American Economic Review* 81, 971-79.

[38] Steul, M. (2006): Does the Framing of Investment Portfolios Influence Risk-Taking Behavior? Some Experimental Results, *Journal of Economic Psychology* 27, 557-570.

[39] Sutter, M. (2007): Are Teams Prone to Myopic Loss Aversion? An Experimental Study on Individual versus Team Investment Behavior, *Economics Letters* 97, 128-132.

[40] Sutter, M., M., Kocher, D. Rutzler, and S. Trautmann (2010): Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior, IZA Discussion Paper 5404.

[41] Thaler, R.H. and C.R. Sunstein (2008): *Nudge: Improving Decisions about Health, Wealth, and Happiness*, New Haven, CT: Yale University Press.

[42] Thaler, R.H., A. Tversky, D. Kahneman, and A. Schwartz (1997): The Effect of Myopia and Loss Aversion on Risk Taking: An Experimental Test, *Quarterly Journal of Economics* 112, 647–661.

[43] Trope, Y. and N. Liberman (2003): Temporal Construal, *Psychological Review* 110, 403-421.

[44] von Gaudecker, H.-M., A. van Soest, and E. Wengström (2011): Heterogeneity in Risky Choice Behaviour in a Broad Population, *American Economic Review*, 101, 664-694.

Appendix

Instructions (translations of the screens used in the experiment)

Screen 1

This study is about individual decision making, and it is conducted by researchers from Tilburg University.

In the questionnaire you will be presented a number of decision problems. The questions are not meant to test you. We are only interested in the choices you make. The only correct choice is the choice that you prefer.

The questionnaire consists of two parts. First you will see the explanation of the first part. After completing the first part, the explanation of the second part will follow. Some general questions will follow at the end of the questionnaire.

In this experiment, you stand to win a sum of money. Your earnings also depend on the decisions that you take in the experiment, and they will be paid in the form of CentERpoints. If you do not want to participate as a matter of principle, you can indicate this below. You will then go directly to the end of the questionnaire.

- I wish to continue with this questionnaire
- No, I don't want to participate in this questionnaire.

Continue Previous

Treatment HIGH

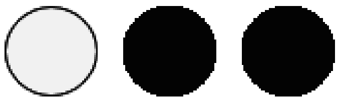
Screen 2

Instructions, part 1

The first part of the study consists of three successive rounds. In each round you start with an amount of 2 euros (200 eurocents). You have to decide which part of this amount (between 0 and 200 eurocents) you want to invest in the following choice situation:

You have a 1 in 3 chance (33%) to win 2.5 times the invested amount and a 2 in 3 chance (67%) to lose the invested amount.

Whether you win or lose depends on the color of the ball that is drawn by the computer. Below you see one white ball and two black balls. The computer randomly draws one of these three balls. Each ball has equal probability to be drawn. If the computer draws the white ball (which happens with a 1 in 3 chance), then you win 2.5 times the amount invested extra in the choice situation; if the computer draws one of the black balls (which happens with a 2 in 3 chance), then you lose the amount invested in the choice situation.



Continue

Screen 3

Your earnings in a round are determined as follows. In each round you start with an amount of 200 eurocents and your earnings in the choice situation are added to that. Thus, if you decide to invest an amount of Y eurocents in the choice situation, then your earnings in a round are equal to 200 + 2.5 times Y if a white ball is drawn and 200 - Y if a black ball is drawn.
After you have decided how much you want to invest in the first round, you are informed of the color of the ball the computer has drawn, what your earnings are in the choice situation, and what your total earnings are for the round.

After that you have to decide how much you want to invest in the choice situation of the second round. You start again with an amount of 200 eurocents, part of which you can invest. Your earnings in this round are determined in the same way as in the previous round. The computer again draws a ball, and the color determines whether you win or lose. Also the third and last round proceeds in the same way.

Please note: the computer draws a new ball for each round and these draws do not influence each other; they are independent. Therefore there is always a 1 in 3 chance to win in the choice situation (a white ball) and a 2 in 3 chance to lose (a black ball). Once you are ready to start, click on the CONTINUE button below.

Continue

Previous

Screen 4a

First round
You start with an amount of 200 eurocents. How many cents do you want to invest in the choice situation in round 1?

You have a 1 in 3 chance (33%) to win 2.5 times the invested amount extra and a 2 in 3 chance (67%) to lose the invested amount.

Below, please enter an amount between 0 and 200 eurocents.

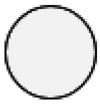
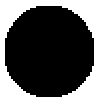
[ ] cents

[Continue] [Previous]

Screen 5a

You have chosen to invest [X1] eurocents in round 1. The computer has drawn the following ball:

[ball 1:

 or ]

This means that you win 2.5 times the invested amount X1 / This means that you lose the invested amount X1. Your earnings for this round are: 200 + 2.5 times X1 = [total1] eurocents./ Your earnings for this round are: 200 – X1 = [total1] eurocents. Click the CONTINUE button when you are ready to choose your investment for the second round.

Continue

Screen 4b

Second round
You start with an amount of 200 eurocents. How many cents do you want to invest in the choice situation in round 2?

You have a 1 in 3 chance (33%) to win 2.5 times the invested amount extra and a 2 in 3 chance (67%) to lose the invested amount.

Below, please enter an amount between 0 and 200 eurocents.

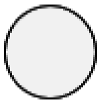
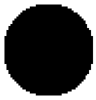
[ ] cents

[Continue] [Previous]

Screen 5b

You have chosen to invest [X2] eurocents in round 2. The computer has drawn the following ball:

[ball 2:

 or ]

This means that you win 2.5 times the invested amount X2 / This means that you lose the invested amount X2. Your earnings for this round are: 200 + 2.5 times X2 = [total2] eurocents./ Your earnings for this round are: 200 - X2 = [total2] eurocents. Click the CONTINUE button when you are ready to choose your investment for the third round.

Continue

Screen 4c

Third round
You start with an amount of 200 eurocents. How many cents do you want to invest in the choice situation in round 3?

You have a 1 in 3 chance (33%) to win 2.5 times the invested amount extra and a 2 in 3 chance (67%) to lose the invested amount.

Below, please enter an amount between 0 and 200 eurocents.

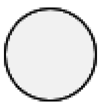
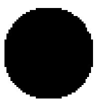
[ ] cents

Continue Previous

Screen 5c

You have chosen to invest [X3] eurocents in round 3. The computer has drawn the following ball:

[ball 3:

 or ]

This means that you win 2.5 times the invested amount X3 / This means that you lose the invested amount X3. Your earnings for this round are: 200 + 2.5 times X3 = [total3] eurocents. / Your earnings for this round are: 200 - X3 = [total3] eurocents.

This is the end of the first part of the study. In total you have earned [total1] + [total2] + [total3] = [total4] eurocents in this part.
This amount will be added to your number of CentERpoints in a few weeks.

Click the CONTINUE button for the instructions to the second part.

Continue

Treatment LOW

Screen 2

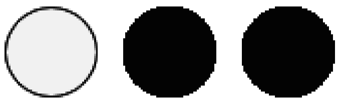
Instructions, part 1

The first part of the study consists of three successive rounds. In each round you start with an amount of 2 euros (200 eurocents). You have to decide which part of this amount (between 0 and 200 eurocents) you want to invest in the following choice situation:

You have a 1 in 3 chance (33%) to win 2.5 times the invested amount and a 2 in 3 chance (67%) to lose the invested amount.

The amount that you invest will stay the same for all three rounds. Therefore, if you invest a certain amount for round 1, then you will invest the same amount for round 2 and round 3.

Whether you win or lose depends on the color of three balls that are drawn by the computer. Below you see one white ball and two black balls. For each round separately, the computer randomly draws one of these three balls. Each ball has an equal probability to be drawn. If the computer draws the white ball (which happens with a 1 in 3 chance), then you win 2.5 times the amount invested extra in the choice situation of that round; if the computer draws one of the black balls (which happens with a 2 in 3 chance), then you lose the amount invested in the choice situation for that round.



Continue

Screen 3

Your total earnings are determined as follows. In each round you start with an amount of 200 eurocents and your earnings in the three choice situations are added to that. Thus, if you decide to invest an amount of Y eurocents in the choice situation, then your total earnings are equal to 600 (three times the starting amount of 200) + 2.5 times Y for each white ball that is drawn - Y for each black ball that is drawn.

After you have decided how much you want to invest in the three rounds, you are informed of the colors of the three balls the computer has drawn, about your combined earnings in the three choice situations, and about your total earnings for the three rounds.

Once you are ready to start, click on the CONTINUE button below.

Continue | Previous

Screen 4

You start with an amount of 200 eurocents. How many cents do you want to invest in the choice situation?

You have a 1 in 3 chance (33%) to win 2.5 times the invested amount extra and a 2 in 3 chance (67%) to lose the invested amount.

Please note: the amount you invest stays the same in all three rounds. Therefore, when you invest a certain amount in round 1, then you invest the same amount in round 2 and in round 3.

Below, please enter an amount between 0 and 200 eurocents.

[ ] cents

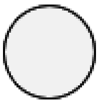
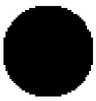
Continue

Previous

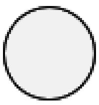
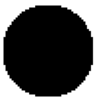
Screen 5

You have chosen to invest [Z] eurocents in each round. The computer has drawn the following three balls:

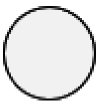
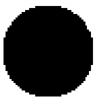
FIRST ROUND: [ball1:

 or ]

SECOND ROUND: [ball2:

 or ]

THIRD ROUND: [ball3:

 or ]

This means that in [count number of white balls] round(s) you win 2.5 times the invested amount and that in [count number of black balls] round(s) you lose the invested amount.

Your total earnings are therefore: 600 + ([count number of white balls] times 2.5 times [Z] eurocents) - ([count number of black balls] times [Z] eurocents) = [total4] eurocents.
This amount will be added to your number of CentERpoints in a few weeks.

Click the CONTINUE button for the instructions to the second part.

Continue

Screen 6

Instructions, part 2 (after Treatment HIGH as well as after Treatment LOW)

Each participant in this part of the study has a chance to earn an additional sum of money. You have a 1 in 100 chance to be selected for this. Whether you actually receive an additional amount of money depends on a number between 1 and 100 that is drawn by the computer. If the number is equal to 100 you are selected for payment.

Continue   Previous

Screen 7

Instructions, part 2
In this part you have to choose between two payment options: option A and option B. Option A will pay 300 euros in 1 month and option B will pay 300 + X euros in 7 months, where X is different in each situation. In the table below you see 20 different amounts for option B. You will be asked later as of which amount you would start choosing option B.

If you are selected for payment (i.e. if the computer has drawn the number 100 for you out of the numbers 1 to 100), then the computer will draw another random number between 1 and 20 which corresponds to one of the 20 choice options you see below. The payment you receive is then in accordance with the preference you have indicated for the choice situation concerned. If for example number 10 is drawn, then you will receive 300 euros in 1 month if you chose option A, and 338.70 euros in 7 months if you chose option B.

	option A in 1 month		**option B in 7 months**		**option A in 1 month**		**option B in 7 months**
1:	300 euros	or	303.80 euros	11:	300 euros	or	342.70 euros
2:	300 euros	or	307.50 euros	12:	300 euros	or	346.70 euros
3:	300 euros	or	311.40 euros	13:	300 euros	or	350.70 euros
4:	300 euros	or	315.20 euros	14:	300 euros	or	354.80 euros
5:	300 euros	or	319.00 euros	15:	300 euros	or	358.90 euros
6:	300 euros	or	322.90 euros	16:	300 euros	or	363.70 euros
7:	300 euros	or	326.80 euros	17:	300 euros	or	367.10 euros
8:	300 euros	or	330.80 euros	18:	300 euros	or	371.30 euros
9:	300 euros	or	334.70 euros	19:	300 euros	or	375.50 euros
10:	300 euros	or	338.70 euros	20:	300 euros	or	379.70 euros

Continue   Previous

Screen 8

In the table below the amounts for option B are indicated once again. In option A you can receive 300 euros in 1 month. In option B you can receive a higher amount in 7 months. We would like to ask you to choose option A or option B for all 20 situations. This you can do by clicking on a box in the table below. The chosen box indicates that you prefer option B (payment in 7 months) as of that amount, and that you prefer option A (payment in 1 month) until that amount.

O 303.80 euros	O 342.70 euros
O 307.50 euros	O 346.70 euros
O 311.40 euros	O 350.70 euros
O 315.20 euros	O 354.80 euros
O 319.00 euros	O 358.90 euros
O 322.90 euros	O 363.00 euros
O 326.80 euros	O 367.10 euros
O 330.80 euros	O 371.30 euros
O 334.70 euros	O 375.50 euros
O 338.70 euros	O 379.70 euros

O I would always choose for 300 euros in 1 month

Continue

Previous

Screen 9

[You have chosen [choice]. This means that you would rather receive 300 + [choice-300] = [choice] in 7 months than 300 euros in 1 month. If the amount you can receive in 7 months is smaller than [choice], then you would rather receive 300 euros in 1 month. /
You have chosen for "always 300 euros". This means that you would rather receive 300 euros in 1 month than a higher amount in 7 months (if this higher amount is not higher than 379.70 euros).]
Below you see the 20 choice situations in which your preferences are underlined. If you want to change your answer, you can click PREVIOUS and fill in the answer again on the previous screen. If the preferences below are correct, click CONTINUE to see whether you will be selected to win one of the amounts chosen.

If you are selected for payment, the computer will draw a random number between 1 and 20 which corresponds to one of the 20 choice situations that you see below. The payment you receive then corresponds to the preference you have indicated for the choice situation concerned. This payment will be paid to you in CentERpoints in exactly one month if you choose for option A and exactly in 7 months if you choose for option B.

[example:]

	option A in 1 month		**option B in 7 months**		**option A in 1 month**		**option B in 7 months**
1:	<u>300 euros</u>	or	303.80 euros	11:	300 euros	or	<u>342.70 euros</u>
2:	<u>300 euros</u>	or	307.50 euros	12:	300 euros	or	<u>346.70 euros</u>
3:	<u>300 euros</u>	or	311.40 euros	13:	300 euros	or	<u>350.70 euros</u>
4:	<u>300 euros</u>	or	315.20 euros	14:	300 euros	or	<u>354.80 euros</u>
5:	<u>300 euros</u>	or	319.00 euros	15:	300 euros	or	<u>358.90 euros</u>
6:	300 euros	or	<u>322.90 euros</u>	16:	300 euros	or	<u>363.70 euros</u>

7:	300 euros	or	326.80 euros	17:	300 euros	or	367.10 euros
8:	300 euros	or	330.80 euros	18:	300 euros	or	371.30 euros
9:	300 euros	or	334.70 euros	19:	300 euros	or	375.50 euros
10:	300 euros	or	338.70 euros	20:	300 euros	or	379.70 euros

Continue

Previous

Screen 10a ***(screen if selected)***

The computer has drawn the number 100 out of the numbers 1 to 100. This means that you have been selected to receive money for this part of the study.

The computer has drawn the number [ERandom] out of the numbers 1 to 20. This means that the next choice situations will be paid:

Option A **Option B**
in 1 month **In 7 month**
[choice situation 1..20 drawn based on ERandom]

Here you had chosen for option [A/B]. This option will pay [Q] euros in 1 month/7months. This amount will be added to your number of CentERpoints in 1 month/7months.

Continue

Screen 10b ***(screen if not selected)***

The computer has drawn the number [draw20] out of the numbers 1 to 100. This means that you have not been selected to receive money for this part of the study.

Continue