Experimental Validation of Common Patience Survey Measures: Technical Report

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This technical report validates a comprehensive set of survey-based measures of patience, self-control and planning against a real-incentivized experimental measure of time preferences. Results from two experiments are reported: The first experiment covers 26 distinct survey measures administered to a sample of 164 subjects from the general Danish population. The second experiment restricts attention to eight of the 26 survey measures, but is administered to a much larger, representative sample of 14,191 subjects from the broad Danish population. Our results shed light on the informativeness of survey-based measures for predicting behavior in intertemporal allocation tasks.

Keywords: Time preferences, patience, self control, impulsivity, survey measures, experimental validation.

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1 Introduction

The purpose of this report is to validate commonly used survey-based measures of patience, self-control and planning against a real-incentivized preference measure. The experimental preference measure we consider is constructed from a sequence of choices in a graphical variant of the convex-time budget allocation task implemented in a wide range of studies (see e.g. Andreoni and Sprenger (2012) and Carvalho, Meier, and Wang (2016)). Epper et al. (2019) externally validate this and other nonparametric and structural preference measures using a larger sample of mid-aged Danes. They demonstrate that the measures are highly predictive for people's position in the real-life wealth distribution, and that this association between experimentally elicited patience and the wealth position is stable over time, exists through the wealth distribution and remains large after controlling for education, income profile, school grades, initial wealth, parental wealth, credit constriants, demographics, risk preferences and additional behavioral parameters.

To validate a range of survey measures against this experimental preference measure, we draw from two experiments: The first experiment (henceforth referred to as `pilot experiment`) was conducted among a sample of 164 subjects sampled from the general Danish population. It comprised a large set of survey measures on patience and related concepts. The second experiment (henceforth referred to as `broad population experiment`) was conducted among a much larger sample of 14,191 subjects from the general Danish population. This experiment restricted attention to a subset of the survey measures administered in the pilot experiment.

This report is structured as follows: Section 2 outlines the studies and the survey and experimental design. Section 3 investigates correlations between stated (survey) and revealed (experimental) preferences. This report does not intend to discuss the related literature in detail. The reader is advised to consult the literature review sections of the articles cited below.

2 Design

In this section, we briefly outline the two experimental studies (Section 2.1). The experimental setup and preference measure is described shortly in Section 2.2. In this report, we focus on a simple nonparametric index of patience. Epper et al. (2019) consider a similar and alternative measures of time preferences, including structurally estimated discount rates, and find that the different experimental patience measures are all correlated strongly and significantly with rank correlations in the range of 0.84 to 0.97. Lastly, we present the survey mesures on patience and related concepts (Section 2.3).

2.1 Studies

We analyze data collected in two experimenal studies: A `pilot experiment` and a `broad population experiment`. Both studies were conducted by the Center for Economic Behavior and Inequality (CEBI) during Spring and Summer 2018. The basic setup closely follows the one described in Epper et al. (2019) which documents findings from an online study with mid-aged Danes. The present two studies differ from this previous work in several aspects. Most prominently, in contrast to Epper et al. (2019), subjects in the two studies were assigned to two treatment conditions: First, a low-stake condition with monetary outcomes comparable to typical intertemporal choice experiments (among them the Epper et al. (2019) study), and, second, a high-stake condition with substantially (30 times) larger monetary outcomes. In each allocation choice, subjects were initially given an endowment of DKK 250 (USD 39.19 during the time of the experiment) and DKK 7,500 (USD 1,175.64), respectively. They could receive a substantially larger amount by foregoing parts of sooner payouts until a later point in time, however. The two studies differed in terms of how the treatments were implemented: In the pilot experiment, subjects faced both the low- and the high-stake condition, whereas in the broad population experiment, they were randomly assigned to only one of the two conditions. Subjects also took decisions in a series of risky choice tasks in the pilot experiment, and in a series of risky and social choice tasks in the broad population experiment.

A randomly selected choice in one of these tasks was paid out for real shortly after the experiment. In addition, participants had a 1/100 chance of also getting paid out for one of their intertemporal choices. Payments were transferred to participants' phones using a mobile payment service at the respective due date.

For the `pilot experiment`, a total of 1000 individuals were invited for participation in the online experiment. Of those invited, 221 subjects logged into the web-platform, and 164 subjects eventually completed the experiment. Our analyses in this report are based on these 164 subjects.

For the `broad population experiment`, a total of 55200 individuals were invited for participation in the online experiment. Of those invited, 17613 subjects logged into the web-platform, and 14191 subjects eventually completed the experiment. Our analyses in this report are based on these 14191 subjects.

2.2 Experimental elicitation and patience measure

In the two experiments, subjects were asked to allocate money across different payment dates. The principal setup shares similarities with Andreoni and Sprenger (2012).[1] Every subject faced a series of independent budget allocation tasks. These tasks differed in terms of payment dates and interest payments. In the pilot experiment, subjects were first confronted with a random sequence of low-stake allocation tasks. After having completed this block of choices, they were presented a random sequence of high-stake allocation tasks. There were a total of 26 such tasks in each stake condition. In the broad population experiment, subjects were randomly assigned to either the low-stake or high-stake condition. There were 16 tasks in each condition. Tables 1 to 4 list the parameterizations of the allocation tasks for the two experiments and the two stake conditions. x_1 and x_2 denote the value of a sooner (t_1 weeks after the experiment) and later (t_2 weeks after the experiment) allocation token. 1 token corresponded to DKK 1. In each task, there were a total of 100 tokens, and they were initially allocated to the earlier date. Figure 1 depicts the original allocation in task (`choiceId`) 15 of the broad population, high-stake condition (see Table 4). In this task, the subject would receive 1.124 later tokens (in 16 weeks after the experiment) for each sooner token (in 8 weeks) that she saves for later retrieval.

Subjects were then given the possibility to allocate sooner tokens (in 8 weeks) to the later date (in 16 weeks). Tokens were moved between the sooner and later payment date by dragging a horizontal (blue) bar up or down.[2] Figure 2 depicts an example allocation choice where a hypothetical subject chose to save 3000 tokens for later payment. In this example, the subject would receive 4500 tokens in 8 weeks *and* 3372 tokens (the 3000 tokens saved plus interest) in 16 weeks.

Since the interest payment varies across different allocation tasks, whether or not a subjects is willing to save tokens for later retrieval will reveal information on patience. We construct a similar nonparametric index of patience as Epper et al. (2019).[3] Specifically, we consider the allocation choices that involve distributing tokens over the two future payment dates (8 vs. 16 weeks). We take the number of tokens saved for the later point in time, z, as an indicator for patience, normalize the measure, and then aggregate over the different choice situations (indexed by i) using the median. This yields the following patience index:

$$\eta = \text{median}\left(\frac{z_i}{100}\right),$$

where higher values indicate higher patience, $\eta = 1$ denotes maximum patience, and $\eta = 0$ denotes minimum patience.

[1] See also the discussion in Epper et al. (2019).

[2] The bar could also be moved by the keyboard or directly clicking with the mouse to a specific location on the vertical bars.

[3] There are two differences to the index in Epper et al. (2019). First, in the experiment described below, 101 (instead of 11) allocations were possible. Second, here we use a more robust aggregator (median) that also acknowledges the fact that we are working with an ordinal (and not continuous) index. Epper et al. (2019), Appendix B.3 further demonstrates that this nonparametric index and discount rates estimated by a random-utility approach are strongly and significantly rank-correlated (coefficients are between 84 to 97 percent, depending on the exact model specification).

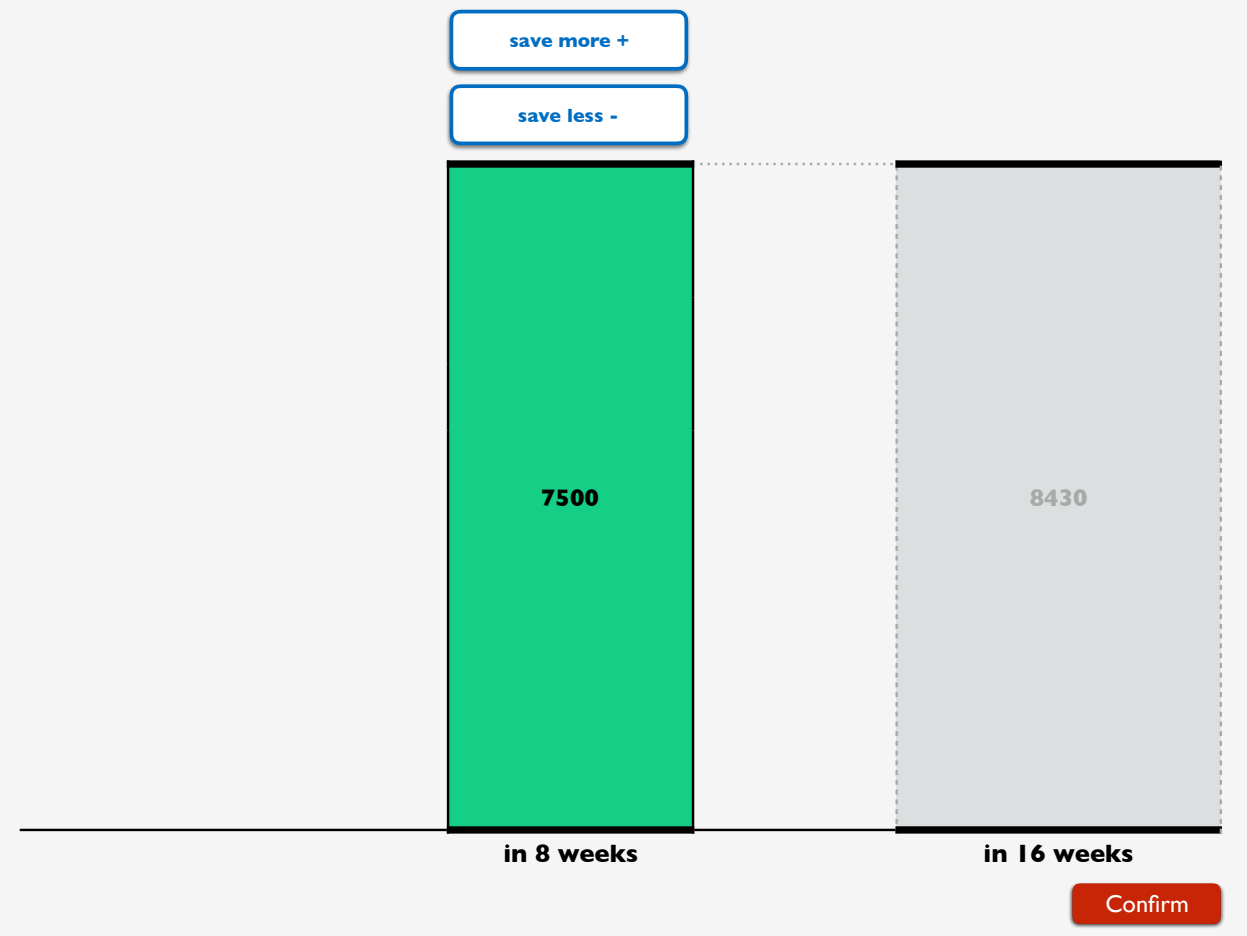

Figure 1: Choice Screen | High Stakes | Default

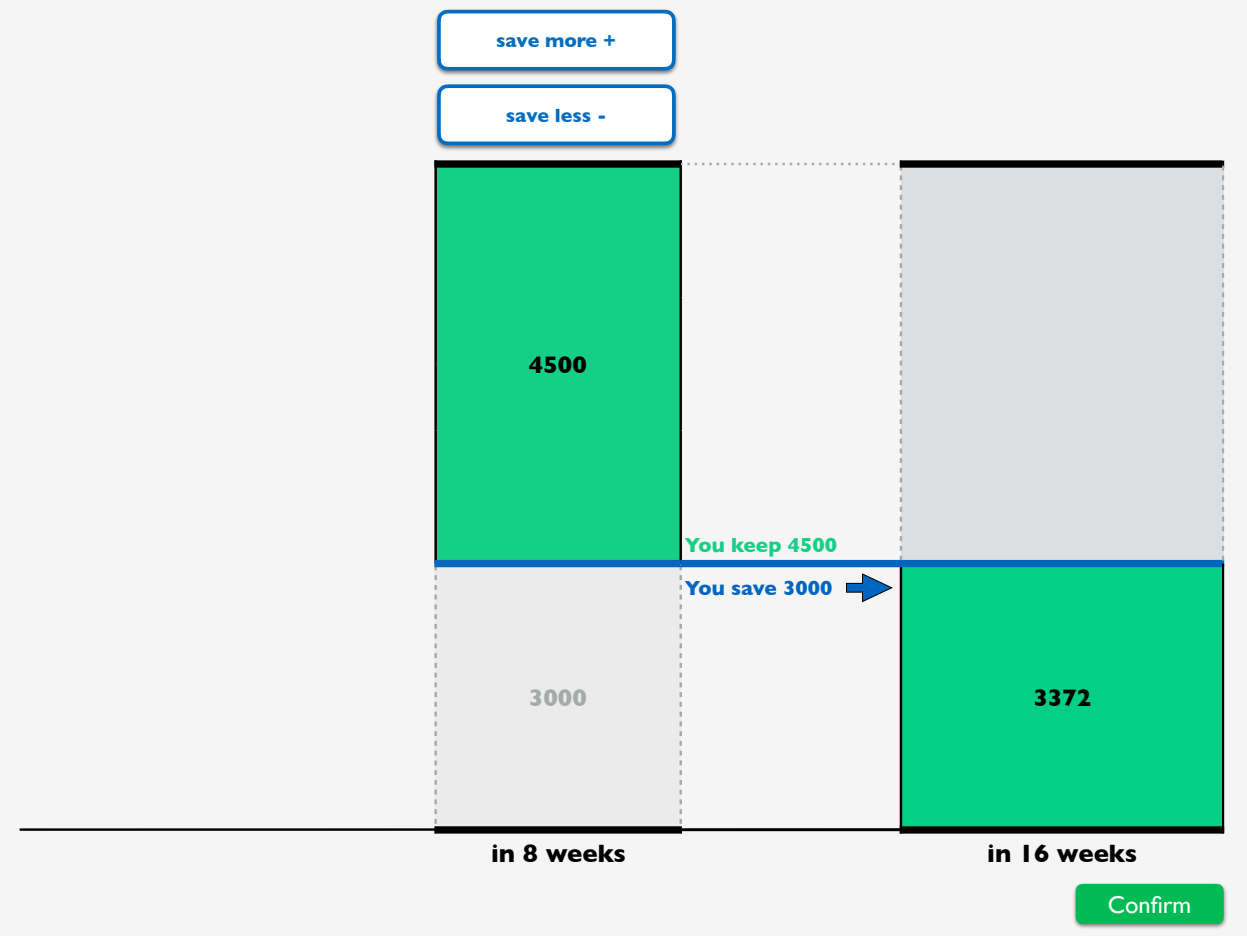

Figure 2: Choice Screen | High Stakes | Chosen Allocation

Table 1: Pilot Experiment | Low Stakes

choiceId	x1	x2	t1	t2
1	2.50	2.52	0	8
2	2.50	2.58	0	8
3	2.50	2.62	0	8
4	2.50	2.67	0	8
5	2.50	2.73	0	8
6	2.50	2.77	0	8
7	2.50	2.83	0	8
8	2.50	2.88	0	8
9	2.50	2.92	0	8
10	2.50	2.98	0	8
11	2.50	2.52	8	16
12	2.50	2.58	8	16
13	2.50	2.62	8	16
14	2.50	2.67	8	16
15	2.50	2.73	8	16
16	2.50	2.77	8	16
17	2.50	2.83	8	16
18	2.50	2.88	8	16
19	2.50	2.92	8	16
20	2.50	2.98	8	16
21	2.50	2.55	0	16
22	2.50	2.65	0	16
23	2.50	2.75	0	16
24	2.50	2.85	0	16
25	2.50	2.95	0	16
26	2.50	3.05	0	16

Table 2: Pilot Experiment | High Stakes

choiceId	x1	x2	t1	t2
1	75.00	75.75	0	8
2	75.00	77.25	0	8
3	75.00	78.75	0	8
4	75.00	80.25	0	8
5	75.00	81.75	0	8
6	75.00	83.25	0	8
7	75.00	84.75	0	8
8	75.00	86.25	0	8
9	75.00	87.75	0	8
10	75.00	89.25	0	8
11	75.00	75.75	8	16
12	75.00	77.25	8	16
13	75.00	78.75	8	16
14	75.00	80.25	8	16
15	75.00	81.75	8	16
16	75.00	83.25	8	16
17	75.00	84.75	8	16
18	75.00	86.25	8	16
19	75.00	87.75	8	16
20	75.00	89.25	8	16
21	75.00	76.50	0	16
22	75.00	79.50	0	16
23	75.00	82.50	0	16
24	75.00	85.50	0	16
25	75.00	88.50	0	16
26	75.00	91.50	0	16

Table 3: Broad Population Experiment | Low Stakes

choiceId	x1	x2	t1	t2
1	2.50	2.51	0	8
2	2.50	2.56	0	8
3	2.50	2.61	0	8
4	2.50	2.66	0	8
5	2.50	2.71	0	8
6	2.50	2.76	0	8
7	2.50	2.81	0	8
8	2.50	2.86	0	8
9	2.50	2.51	8	16
10	2.50	2.56	8	16
11	2.50	2.61	8	16
12	2.50	2.66	8	16
13	2.50	2.71	8	16
14	2.50	2.76	8	16
15	2.50	2.81	8	16
16	2.50	2.86	8	16

Table 4: Broad Population Experiment | High Stakes

choiceId	x1	x2	t1	t2
1	75.00	75.30	0	8
2	75.00	76.80	0	8
3	75.00	78.30	0	8
4	75.00	79.80	0	8
5	75.00	81.30	0	8
6	75.00	82.80	0	8
7	75.00	84.30	0	8
8	75.00	85.80	0	8
9	75.00	75.30	8	16
10	75.00	76.80	8	16
11	75.00	78.30	8	16
12	75.00	79.80	8	16
13	75.00	81.30	8	16
14	75.00	82.80	8	16
15	75.00	84.30	8	16
16	75.00	85.80	8	16

2.3 Survey measures

We consider a total of 26 survey measures recoded such that higher values always indicate higher patience, higher self-control or less impulsivity.[4] The survey measures are listed below. The pilot experiment contains all 26 survey questions. The eight questions included in the broad population experiment are marked with an asterisk (∗).

1. `impatience1`:

- Question: *Imagine that you won 100,000 DKK that would be paid out in 12 months. How much of the 100,000 DKK would you be willing to waive to receive the money today instead?*
- Answer type: Text field taking integer values between 0 and 100,000.
- Remarks: Reverse coding.

2. (∗) `impatience2`:

- Question: *Imagine that you won 100,000 DKK today that you could use to increase your spending. You could for example spend the money on food and beverages, travels, clothing and footwear, electronic equipment, transport, restaurants and hotels, household equipment, and maintenance of the home. You could spend the money within the next 12 months or later on. How much of the 100,000 DKK would you use to increase your spending within the next 12 months?*
- Answer type: Text field taking integer values between 0 and 100,000.
- Remarks: Reverse coding.

3. `postpone`:

- Question: *To what extent do you agree with the following statements? I spend less money today such that I can afford more in the future.*
- Answer type: 'strongly disagree, . . . , 'strongly agree' (7-point Likert scale)

4. (∗) `selfcontrol`:

- Question: *I am good at exercising self-control in my actions and decisions.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)

5. `procrastination`:

- Question: *I have a tendency to postpone the completion of necessary tasks although it would be better to complete them now.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Reverse coding.

6. `literacyGoals`:

- Question: *I cannot motivate myself to accomplish long-term goals.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Fernandes, Lynch Jr, and Netemeyer (2014). Reverse coding.

7. `literacySpendings`:

- Question: *I try to spend my money wisely.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Fernandes, Lynch Jr, and Netemeyer (2014).

[4]For consistency, the ordinal survey response categories were homogenized to a 7-point Likert scale. The exceptions are the DLSY questions (24-26), where the original scale was used.

8. `brockhoff1`:

- Question: *It is difficult for me to listen to private conversations on topics, which do not immediately concern me.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015). Reverse coding.

9. `brockhoff2`:

- Question: *Waiting for restaurant services is difficult for me.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015). Reverse coding.

10. `brockhoff3`:

- Question: *Waiting causes physical reactions for me.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015). Reverse coding.

11. `brockhoff4`:

- Question: *Even without further appointments I get angry to encounter transfer times when changing planes.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015). Reverse coding.

12. `brockhoff5`:

- Question: *Frequently, I switch waiting-lines in front of counters.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015). Reverse coding.

13. `brockhoff6`:

- Question: *I like to decide spontaneously.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015). Reverse coding.

14. `brockhoff7`:

- Question: *I like to be meticulous.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015).

15. `brockhoff8`:

- Question: *I dislike long-winding arguments.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Brockhoff, Margolin, and Weber (2015). Reverse coding.

16. `schnitker1`:

- Question: *When someone is having difficulty learning something new, I will be able to help them without getting frustrated or annoyed.*
- Answer type: 'strongly disagree', . . . , 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Schnitker (2012).

17. `schnitker2`:

- Question: *I am very annoyed by delays in traffic.*
- Answer type: 'strongly disagree', ..., 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Schnitker (2012). Reverse coding.

18. `ameriksPlanning`:

- Question: *I have spent a great deal of time developing a financial plan.*
- Answer type: 'strongly disagree', ..., 'strongly agree' (7-point Likert scale)
- Remarks: Taken from Ameriks, Caplin, and Leahy (2003).

19. (∗) `hhplanning`:

- Question: *Have you personally gathered together your household's financial information, reviewed it in detail, and formulated a specific financial plan for your household's long-term future?*
- Answer type: no/yes
- Remarks: 'no' (0), 'yes' (1)

20. `impatienceSOEP`:

- Question: *Are you generally an impatient person or someone who shows great patience?*
- Answer type: 'very patient', ..., 'very impatient' (7-point Likert scale)
- Remarks: Taken from Falk et al. (2016). Reverse coding.

21. (∗) `abstainSOEP`:

- Question: *Are you a person who is generally willing to give up something today in order to benefit from that in the future, or are you not willing to do so?*
- Answer type: 'completely unwilling to give up something today', ..., 'very willing to give up something today' (7-point Likert scale)
- Remarks: Taken from Falk et al. (2016). See also Falk et al. (2018).

22. (∗) `impulsivity`:

- Question: *Are you generally an impulsive person or are you not at all impulsive?*
- Answer type: 'not at all impulsive', ..., 'very impulsive' (7-point Likert scale)
- Remarks: Reverse coding.

23. `vacationPlanning`:

- Question: *How many months in advance do you typically start planning your summer vacation?*
- Answer type: Text field taking non-negative integers.

24. (∗) `dlsyProfile`:

- Question: *If given the offer between the three following jobs, which one would you choose?*
- Answer type:

    1. A job with an average salary from the start.
    2. A job with low salary the first two years but high salary later.
    3. A job with very low salary the first four years but later very high salary.

- Remarks: Taken from the Danish Longitudinal Survey of Youth (DLSY). See Section 3.1 in Brenøe and Epper (2019).

25. (∗) `dlsySavings`:

- Question: It is better to save up money for one's future than to spend it on a car, the newest smartphone etc.
- Answer type:

    1. 'totally wrong'
    2. 'a little wrong'
    3. 'almost right'
    4. 'just right'

- Remarks: Taken from Danish Longitudinal Survey of Youth (DLSY) 1968 and 1976 with one minor edit ("a moped, a tape recorder etc." has been replaced by "a car, a smartphone etc").

26. (∗) `dlsySpendings`:

- Question: It is better to spend your money while you have them than to save up for expensive things.
- Answer type:

    1. 'totally wrong'
    2. 'a little wrong'
    3. 'almost right'
    4. 'just right'

- Remarks: Danish Longitudinal Survey of Youth (DLSY) 1968 and 1976. Reverse coding.

For the validation exercise, we also include the binarized version of the `dlsyProfile` question, referred to as `dlsyProfileBin`. Responses to this question are used in Brenøe and Epper (2019) for establishing a strong and robust association between parental and offspring time preferences.

3 Results

We study rank correlations between the experimental patience index η and the 26 (8) survey measures as well as the binarized version of the DLSY income profile measure. For the sake of this exercise, we consider the survey measures separately and abstain from generating summary indices.[5]

Tables 5 and 6 depict the results of Spearman rank correlation tests for the two stake conditions of the pilot experiments. The variables are ordered by the size of the correlation coefficient (Spearman's ρ). The tables indicate that most coefficients have the expected positive sign, except of a few statistically insignificant measures (namely, some of the Brockhoff questions). Consistently good predictors for experimentally elicited time preferences are the DLSY savings measure (`dlsySavings`), the "willingness to give up something today" measure (`abstainSOEP`), the first impatience measure (`impatience1`), the household planning measure (`hhplanning`), the original DLSY income profile measure (`dlsyProfile`), and the DLSY spendings measure (`dlsySpendings`). The binarized version of the DLSY income profile measure (`dlsyProfileBin`) and the SOEP impatience question (`impatienceSOEP`) are strongly associated with the experimental measure in the high stakes domain only.

The results of the broad population experiment are broadly consistent with those of the pilot experiment (see Tables 7 and 8 below). The best predictors of our experimental measure in the pilot experiment can also be found among the top measures in the broad population data set: The `impatience2` measure, the DLSY spendings measure (`dlsySpendings`), the "willingness to give up something today" measure (`abstainSOEP`), the household planning measure (`hhplanning`) and the DLSY savings measure

[5]This would be possible for the measures in Brockhoff, Margolin, and Weber (2015) or (more or less) arbitrary combinations of other measures.

(`dlsySavings`) all perform very well in the larger data set. Moreover, it appears that both impulsivity and self control are strongly associated with experimentally measured patience.[6] The DLSY income profile measures, both the original and the binarized one, are significantly and positively correlated with the experimental patience measure, but this result only sustains for high stakes. This is not surprising: In the DLSY income profile question subjects face the choice of different (hypothetical) labor income paths. The choice therefore involves outcomes with substantial economic consequences. We may thus expect that responses to this survey question are more strongly associated with large stake (rather than small stake) allocation behavior in experiments.

Table 5: Pilot Experiment | Low Stakes | Spearman Rank Correlations

Measure	ρ	p-value
dlsySavings	0.256	0.001
impatience1	0.254	0.001
ameriksPlanning	0.233	0.003
abstainSOEP	0.218	0.005
hhplanning	0.218	0.005
dlsyProfile	0.194	0.013
literacySpendings	0.185	0.018
brockhoff1	0.170	0.030
dlsySpendings	0.169	0.030
impatience2	0.150	0.055
dlsyProfileBin	0.147	0.060
schnitker1	0.141	0.072
literacyGoals	0.126	0.108
brockhoff2	0.119	0.129
procrastination	0.110	0.162
impatienceSOEP	0.107	0.174
vacationPlanning	0.106	0.176
brockhoff4	0.096	0.219
postpone	0.095	0.227
brockhoff8	0.089	0.257
schnitker2	0.088	0.261
brockhoff7	0.082	0.298
selfcontrol	0.072	0.362
brockhoff3	0.055	0.484
impulsivity	0.049	0.531
brockhoff5	-0.014	0.861
brockhoff6	0.008	0.915

[6] Brenøe and Epper (2019) use an impulsivity measure as a secondary measure to validate their intergenerational transmission results.

Table 6: Pilot Experiment | High Stakes | Spearman Rank Correlations

Measure	ρ	p-value
abstainSOEP	0.333	0.000
dlsyProfile	0.252	0.001
schnitker2	0.230	0.003
dlsySavings	0.221	0.004
impatience1	0.216	0.006
brockhoff1	0.196	0.012
brockhoff3	0.188	0.016
dlsyProfileBin	0.187	0.016
brockhoff4	0.186	0.017
hhplanning	0.182	0.019
impatienceSOEP	0.169	0.031
schnitker1	0.166	0.034
dlsySpendings	0.165	0.034
literacyGoals	0.149	0.057
brockhoff2	0.134	0.087
ameriksPlanning	0.125	0.109
impatience2	0.119	0.128
brockhoff8	0.112	0.154
impulsivity	0.104	0.183
literacySpendings	0.085	0.277
vacationPlanning	0.061	0.435
postpone	0.038	0.626
procrastination	0.035	0.660
brockhoff6	0.031	0.696
brockhoff7	-0.028	0.720
brockhoff5	-0.014	0.859
selfcontrol	-0.003	0.972

Table 7: Broad Population Experiment | Low Stakes | Spearman Rank Correlations with Experimental Measure

Measure	ρ	p-value
dlsySpendings	0.149	0.000
selfcontrol	0.139	0.000
hhplanning	0.135	0.000
abstainSOEP	0.131	0.000
impulsivity	0.117	0.000
dlsySavings	0.112	0.000
impatience2	0.107	0.000
dlsyProfileBin	-0.015	0.218
dlsyProfile	-0.011	0.336

Table 8: Main | High Stakes | Spearman Rank Correlations with Experimental Measure

Measure	ρ	p-value
impatience2	0.154	0.000
dlsySpendings	0.150	0.000
abstainSOEP	0.137	0.000
impulsivity	0.134	0.000
selfcontrol	0.126	0.000
hhplanning	0.111	0.000
dlsySavings	0.110	0.000
dlsyProfile	0.061	0.000
dlsyProfileBin	0.044	0.000

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