Experimental Design

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1 Experimental design

1.1 Procedures

Our study consists of 29 binary choices and a short questionnaire. All participants receive a fixed participation fee of 8 RMB. On top of that, 1/3 of the participants are randomly selected and one of their choices is randomly selected for real payment. Payoffs are displayed in an experimental currency (ECU) that is converted into Chinese Yuan after the experiment (1 RMB=2.5ECU). The experiment is programmed with oTree (Chen et al., 2016).

We implement three between-subject treatments, described below. Participants are recruited via Credamo, a Chinese survey company. They receive a link to the experiment and complete it on their personal computer. We are aiming for 150 participants per treatment.

1.2 Main lottery choices

Subjects make a choice between two risky lotteries. The payoffs of these lotteries depend on the turn of a wheel of fortune. Risk is thus described by states of nature à la Savage (1954). There are in total S states of nature denoted by $s = 1, ..., S$, each with an associated probability given by $p_s = 1/S$. A lottery $\theta \in \{A, B\}$ is defined as a function that assigns a real valued payoff x_s^θ to each possible state of nature. The state-space defines which payoffs occur in the same state of the world.

We consider lotteries with 3, 4, or 6 distinct payoffs, that all occur with equal probability. For the three-payoff case, subjects choose a lottery θ with the marginal distribution $(a + \epsilon_\theta, 1/3; b + \epsilon_\theta, 1/3; c + \epsilon_\theta, 1/3)$, with $a > b > c$, and similar for the four and six payoff case.[1]

Lotteries are displayed to subjects in tables. There are two rows $R \in \{A, B\}$ that display the payoffs of lottery A and B. Naturally, $\theta = R$. There are in total C columns denoted by $c = 1, ..., C$.

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[1] For four-payoff case: $(a + \epsilon_\theta, 1/4; b + \epsilon_\theta, 1/4; c + \epsilon_\theta, 1/4; d + \epsilon_\theta, 1/4)$, with $a > b > c > d$. For six-payoff case: $(a + \epsilon_\theta, 1/6; b + \epsilon_\theta, 1/6; c + \epsilon_\theta, 1/6; d + \epsilon_\theta, 1/6; e + \epsilon_\theta, 1/6; f + \epsilon_\theta, 1/6)$, with $a > b > c > d > e > f$.

In our experiment, $C = S$. A cell of the table in row θ and column c displays the payoff $x^{\theta}_{s,c}$. The column-space thus defines which payoffs are displayed together, in the same column.

Treatments 1-3 systematically vary how payoffs occur together in the state-space and in the column-space. Consider tables 1-3. The left-hand side of the tables indicates the state-space, that is which payoffs occur together in the same state. The right-hand side displays the column space, that is which payoffs are displayed together in the same column. Taking the left- and the right-hand side together describes the state- and column space for a given column. Figure 2, provides an illustration of the resulting display in the different treatments.

In treatment 1, the state-space and the column-space are identical ($s = c$) and are displayed in table 1. In treatment 2, payoffs are perfectly correlated across states, but the column-space is equivalent to treatment 1. See table 2. In treatment 3, the state-space is as in treatment 1, but payoffs are now perfectly correlated across columns. See table 3.[2]

Table 1 Column- and state-space in treatment 1

State-space					Column-space			
	s_1	s_2	s_3			c_1	c_2	c_3
Lottery A	$a+\epsilon_A$	$b+\epsilon_A$	$c+\epsilon_A$	+	Lottery A	$a+\epsilon_A$	$b+\epsilon_A$	$c+\epsilon_A$
Lottery B	$c+\epsilon_B$	$a+\epsilon_B$	$b+\epsilon_B$		Lottery B	$c+\epsilon_B$	$a+\epsilon_B$	$b+\epsilon_B$

Table notes: All states are equally likely.

Table 2 Column- and state-space in treatment 2

State-space					Column-space			
	s_1	s_2	s_3			c_1	c_2	c_3
Lottery A	$a+\epsilon_A$	$b+\epsilon_A$	$c+\epsilon_A$	+	Lottery A	$a+\epsilon_A$	$b+\epsilon_A$	$c+\epsilon_A$
Lottery B	$a+\epsilon_B$	$b+\epsilon_B$	$c+\epsilon_B$		Lottery B	$c+\epsilon_B$	$a+\epsilon_B$	$b+\epsilon_B$

Table notes: All states are equally likely.

Table 3 Column- and state-space in treatment 3

State-space					Column-space			
	s_1	s_2	s_3			c_1	c_2	c_3
Lottery A	$a+\epsilon_A$	$b+\epsilon_A$	$c+\epsilon_A$	+	Lottery A	$a+\epsilon_A$	$b+\epsilon_A$	$c+\epsilon_A$
Lottery B	$c+\epsilon_B$	$a+\epsilon_B$	$b+\epsilon_B$		Lottery B	$a+\epsilon_B$	$b+\epsilon_B$	$c+\epsilon_B$

Table notes: All states are equally likely.

We employ the 9 parameter sets in table 4 and systematically vary ϵ_A and ϵ_B. Each subject encounters each of the lotteries with $\epsilon_A = 0$ and $\epsilon_B = 0$. Each subject further encounters each of the lotteries with $\epsilon_A = \mathit{premium}$ and $\epsilon_B = 0$ and with $\epsilon_A = 0$ and $\epsilon_B = \mathit{premium}$, where $\mathit{premium} \in \{1, 3, 9\}$ and the premium is fixed for each of the 9 parameter sets for a given subject. Each subject encounters three lotteries with a premium of 1, 3, and 9 respectively.[3] Premiums

[2] The tables below display the case of three-payoff lotteries. The state- and column-space are chosen analogously for the four- and six-payoff lotteries. That is, for $\epsilon_A = 0$ and $\epsilon_B = 0$, lottery B yields a higher payoff in all but one state/column, or payoffs are perfectly correlated across states/columns.

[3] The premium of 1 is chosen because it is the smallest possible premium while sticking to integer values. We then increases the premiums by a factor of three.

○ Option A	a if Red	b if Blue	c if Green
○ Option B	c if Red	a if Blue	b if Green

(a) Treatment 1

○ Option A	a if Red	b if Blue	c if Green
○ Option B	c if Green	a if Red	b if Blue

(b) Treatment 2

○ Option A	a if Red	b if Blue	c if Green
○ Option B	a if Blue	b if Green	c if Red

(c) Treatment 3

Figure 1 Illustration of state and column space in the different treatments. Colors describe the states of the world, induced, for instance, by the turn of a wheel of fortune or the draw of a marble from an urn.

Table 4 Parameters for the same-marginal lottery tasks

Task	a	b	c	d	f	g
1	73	64	20	-	-	-
2	101	53	0	-	-	-
3	110	22	9	-	-	-
4	149	50	16	0	-	-
5	120	60	20	0	-	-
6	94	81	37	13	-	-
7	93	75	57	39	21	3
8	135	72	50	37	24	8
9	115	75	61	39	27	14

Table notes: The parameters of the lotteries are partially chosen to ensure comparability with previous experiment. We include 6-state lotteries to address the concern that salience effects Bordalo et al. (2012) might not be present if choice tasks are too simple.

are varied between subjects such that the same number of subjects (safe for dropouts) encounter a given parameter set for a given premium.

1.3 State- and column dominant lotteries

As an attention check, we further include two choices between a state- and column-wise dominant lottery and a dominated alternative. Any subject failing to choose one or two of the dominant lotteries will be excluded from the analysis.

Table 5 Parameters for the same-marginal lottery tasks

Task	a	b	c	d	f	g
State-wise 1	83	65	38	12	-	-
State-wise 2	91	77	54	37	25	11

Table notes: the dominant lottery is obtained by adding a payoff premium of 5 to each possible payoff.

1.4 Questionnaire

We further include the following survey items:

- Subjects are asked to which extent, on a scale from 1-9, they 1) compared payoffs by columns, 2) compared payoffs by states, 3) compared lotteries by rows, and 4) calculated the expected value of each option. Participants can also add any comments or other consideration in free form.

2 Analysis plan

2.1 Framework

Consider a decision maker who has to choose between two different lotteries. A decision maker acting in accordance with generalized regret theory (Loomes and Sugden, 1987) will choose lottery A if and only if[4]

$$A \succcurlyeq B \Longleftrightarrow \sum_{s=1}^{S} \phi_{state}(x^A_{s,c}, x^B_{s,c}) \geq 0 \quad (1)$$

A decision maker acting in accordance with salience theory (Bordalo et al., 2012) will choose lottery A if and only if

$$A \succcurlyeq B \Longleftrightarrow \sum_{c=1}^{C} \phi_{column}(x^A_{s,c}, x^B_{s,c}) \geq 0 \quad (2)$$

For $space \in \{state, column\}$, the function $\phi_{space} : \mathbb{R} \times \mathbb{R} \rightarrow \mathbb{R}$ is skew-symmetric (i.e., for any a and b, $\phi_{space}(a, b) = -\phi_{space}(b, a)$) and increasing in its first argument (i.e., for any outcome c, if $a > b$, then $\phi_{space}(a, c) > \phi_{space}(b, c)$). Consider any $a, b, c \in \mathbb{R}$, with $a > b > c$. We will say that $\phi_{space}()$ is

- Convex if $\phi_{space}(a, c) > \phi_{space}(a, b) + \phi_{space}(b, c)$
- Concave if $\phi_{space}(a, c) < \phi_{space}(a, b) + \phi_{space}(b, c)$
- Linear if $\phi_{space}(a, c) = \phi_{space}(a, b) + \phi_{space}(b, c)$

We first consider the case in which $\epsilon_A = \epsilon_B = 0$. Linearity of function ϕ_{space} implies indifference in all treatments between lottery A and B in all treatments. Convexity of the ϕ_{space} function implies a strict preference for lottery A ("the convexity lottery"), and concavity implies a strict preference for lottery B ("the concavity lottery") in treatment 1. In treatment 2, the decision maker is indifferent for any function ϕ_{state}, but for the function ϕ_{column}, the preference relation is as in treatment 1. In treatment 3, the decision maker is indifferent for any function ϕ_{column}, but for function ϕ_{state}, the preference relation is as in treatment 1. Our setting thus allows for testing the shape of ϕ_{state} (convex, concave, linear). The distinction between state and column space allow disentangling regret and salience theory. In Regret Theory (Loomes and Sugden, 1982, 1987) ϕ_{state} is convex, whereas in Salience Theory ϕ_{state} is convex.

We also include tasks with ($\epsilon_A > 0$, $\epsilon_B = 0$) and ($\epsilon_A = 0$, $\epsilon_B > 0$) to gauge the strength of the preferences observed for ($\epsilon_A = 0$, $\epsilon_B = 0$).

2.2 Hypothesis

Unless otherwise noted, we test our hypotheses using two sided tests and refer to results as statistically significant if $p < 0.05$.

[4] Note that all states are equiprobable so that the p_s can be omitted.

We test, for each treatment, whether the fraction of choices for the convexity lottery is statistically different from 0.5, the random choice benchmark that obtains under linearity of function ϕ_{state}. We do so by running the following logit regression, including all choice tasks.

$$convexity_{i,t} = c + \epsilon_{i,t} \tag{3}$$

where the dummy $convexity_{i,t}$ is equal to one if subject i chose the convexity lottery for choice t and zero otherwise. We test the null hypothesis that $c = 0$, using a Wald Chi-Square test, with standard errors clustered at the subject level.

Predictions: Based on previous experiments, we suspect ϕ_{column} to be concave ϕ_{state} to be linear in the aggregate. We thus expect to find evidence for ϕ_{column} to be concave, and not to be able to reject that ϕ_{state} is linear. That is, we expect $c < 0$ and significant for treatments 1 and 2, but not to be able to reject that $c = 0$ in treatment 3.

Finally, we test for treatment differences (all three possible differences). To this end, we compute, for each subject, the fraction of choices of the convexity lottery, irrespective of the level *premium*. We then test for treatment differences using the Wilcoxon rank-sum test.

Predictions: We expect the fraction of choices of the convexity lottery to be larger in treatment 3 than in treatment 1 and 2. We expect no significant difference between treatments 1 and 2.

Finally, we will gauge the robustness of observed correlation preferences. Theoretically, any effects found thus far should be decreasing in the level of *premium*. We run the following regression

$$convexity_{i,t} = c + \beta_1 p1_{i,t} + \beta_2 p2_{i,t} + \beta_3 p3_{i,t} + \epsilon_{i,t} \tag{4}$$

, where $p1$, $p2$, and $p3$ are dummies that indicate the levels of premium (1, 3, and 9 respectively), with $premium = 0$ as the omitted category. We will test, for the different treatments, the null hypotheses that $\beta_1 = 0$, $\beta_2 = 0$, and $\beta_3 = 0$, using Wald Chi-Square tests, with standard errors clustered at the subject level.

Predictions: Since we expect $c < 0$ in treatments 1 and 2, we expect $0 \leq \beta_1 \leq \beta_2 \leq \beta_3$. Since we expect $c = 0$ in treatment 3, we expect neither of the coefficients to differ significantly from 0 for treatment 3.

Further, we will test whether correlation preferences are still significant for the different levels of premiums. This is rather exploratory, as we have no theory or prior observations to make predictions about the strength of correlation preferences. We will further gauge the informativeness of null findings using 95% confidence intervals (calculated from Wald Chi-Square tests) and Bayes factors. We further explore heterogeneity in correlation sensitivity, and how the number of states, demographics and survey answers correlate with correlation sensitivity.

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