Experimental Design

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1 Experimental Design

1.1 Procedures

Our study consists of choices between 19 pairs of lotteries and a questionnaire. 1/3 of the participants are randomly selected. For these participants, one of the choices is randomly selected and participants are paid based on this choice. Payoffs are displayed in an experimental currency that is converted into Chinese Yuan after the experiment. The experiment was programmed with oTree (Chen et al., 2016).

Our study consists of 3 parts. We will describe each part in turn. For participants in the study, no difference will be drawn between the different parts. Rather, all tasks will be presented as choices between two options. Subjects will be exposed to choices from part I and II in random order. For Part I choices, the randomization is such that subjects never encounter two choices between which only the correlation structure changes (see below) immediately after one another. After completing these tasks, subjects are informed that they will make 5 additional decisions (part III) for which they will receive immediate feedback on the outcome of their decision. These five choices appear in random order. All randomization is done at the subject level.

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.

1.2 The lottery choices

1.2.1 Part I: first-order-stochastic dominance (FOSD)

Subjects choose between the lotteries in table 1 and 2. For each choice task, lottery G dominates lottery B in the sense of FOSD. Note that the choice tasks on the left and right side of the table are the same in terms of the marginal distribution of the lotteries, for a given number of states.

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However, for the lotteries on the left side of the table, the dominant lottery G has negative relative skewness, whereas it has positive relative skewness for choice tasks on the right side of the table.

We employ the following within subject treatment. We present subjects the choice tasks either in the minimal state space (i.e. 3 displayed states for the 3 states and 6 displayed states for the 6 states choice task), or we split each state into two, which results in a presentation with double the number of states as in the minimal state space (i.e. 6 displayed states for the 3 states and 12 displayed states for the 6 states choice task). The states are split such that each initial state is split in the same way. For instance, if state 1 of a 3-states choice task that occurs with probability 1/3 is split into two states that occur with probability 1/9 and 2/9, state 2 and 3 are split in the same way. For an illustration of this for choice task FOSD 1 for set 1, consider table 3.

Half of the subjects receive set 1 non-split, and set 2 split, and the other group receives set 2 non-split and set 1 split.

In part I, subjects complete a total of 8 decision.

Table 1 Decision Tasks: Set 1

1: $FOSD^{-}_{3,1}$

	1/3	1/3	1/3
G^1_3	71	63	22
B^1_3	59	18	67

2: $FOSD^{+}_{3,1}$

	1/3	1/3	1/3
G^1_3	71	63	22
B^1_3	18	67	59

3: $FOSD^{-}_{6,1}$

	1/6	1/6	1/6	1/6	1/6	1/6
G^1_6	97	79	61	43	25	7
B^2_6	75	57	39	21	3	93

4: $FOSD^{+}_{6,1}$

	1/6	1/6	1/6	1/6	1/6	1/6
G^1_6	97	79	61	43	25	7
B^2_6	3	93	75	57	39	21

Table notes: The first row presents different possible states and their probability of occurring. Rows 2 and 3 display the payoffs of option G (FOSD) and B in the different states of the world. All payoffs are in cents. The relative skewness for lottery G on the right is: 3 states: 0.31; 6 states: 1.79.

Table 2 Decision Tasks: Set 2

5: $FOSD^{-}_{3,2}$

	1/3	1/3	1/3
G^1_3	98	49	9
B^1_3	45	5	94

6: $FOSD^{+}_{3,2}$

	1/3	1/3	1/3
G^1_3	98	49	9
B^1_3	5	94	45

7: $FOSD^{-}_{6,2}$

	1/6	1/6	1/6	1/6	1/6	1/6
G^2_6	98	92	87	19	14	8
B^2_6	88	83	15	10	4	94

8: $FOSD^{+}_{6,2}$

	1/6	1/6	1/6	1/6	1/6	1/6
G^2_6	98	92	87	19	14	8
B^2_6	4	94	88	83	15	10

Table notes: The first row presents different possible states and their probability of occurring. Rows 2 and 3 display the payoffs of option G (FOSD) and B in the different states of the world. All payoffs are in cents. The relative skewness of lottery G is $\approx$ 0.696313 for the tasks on the left and -0.696313 for tasks on the right, regardless of the number of the states.

1.2.2 Part II and III: Same Marginal Lotteries

For each subject, we include 2 blocks of 5 choices between two lotteries with the same marginal distribution, but different relative skewness. Each subject will see one block of 5 such choices mixed

Table 3 Decision Tasks: Set 1

$FOSD^{-}_{3,1}$			
	1/3	1/3	1/3
G^1_3	98	49	9
B^1_3	45	5	94

$FOSD^{-}_{3,1}$						
	1/9	2/9	1/9	2/9	1/9	2/9
G^1_3	98	98	49	49	9	9
B^1_3	45	45	5	5	94	94

Table notes: The first row presents different possible states and their probability of occurring. Rows 2 and 3 display the payoffs of option G (FOSD) and B in the different states of the world. All payoffs are in cents. The relative skewness for lottery G on the right is: 3 states: 0.35; 4 states: 1.15; 6 states: 1.79.

Table 4 Same Marginal lotteries. Block 1.

1	1/3	1/3	1/3
A	20	73	64
B	73	64	20

2	1/3	1/3	1/3
A	0	33	120
B	120	0	33

3	1/3	1/3	1/3
A	0	101	53
B	101	53	0

4	1/4	1/4	1/4	1/4
A	0	16	50	149
B	149	0	16	50

5	1/4	1/4	1/4	1/4
A	0	20	60	120
B	120	0	20	60

into the other decisions. The other block of 5 choices will appear after subjects have completed all other lottery choices. For these choices, subjects will receive immediate feedback on the outcome of their choices. Whether subjects will receive feedback for block 1 or block 2 choices is randomized at the subject level.

For the lotteries, see table 4 and 5. Note that lottery A always has negative and lottery B always has positive relative skewness.

In part III and IV, subjects complete a total of 10 choices.

Table 5 Same Marginal lotteries. Block 2.

1	1/3	1/3	1/3
A	9	33	110
B	110	9	33

2	1/3	1/3	1/3
A	15	41	101
B	101	15	41

3	1/3	1/3	1/3
A	3	50	86
B	86	3	50

4	1/4	1/4	1/4	1/4
A	7	26	32	143
B	143	7	26	32

5	1/4	1/4	1/4	1/4
A	13	37	81	94
B	94	13	37	81

1.2.3 Control task: State-wise domination

We also include one choice between a state-wise dominant and a dominated choice. This serves as a control task. All subjects choosing the dominated lottery will be excluded from the analysis. This task can be found in table 6.

1.3 Questionnaire

Survey on how subjects made decisions: Directly after the last choice task, subjects are prompted to answer a short survey regarding their decision making in the experiment. Subjects are asked to which extent, on a scale from 1-9 they 1) compared payoffs by columns 2) compared

Table 6 Caption

	1/4	1/4	1/4	1/4
G	16	38	69	87
B	12	34	75	83

lotteries by rows 3) considered the probabilities 4) calculated the expected value of each option. Participants can also add any comments or other consideration in free form.

The survey further includes:

- The CRT (Frederick, 2005)
- Standard demographics: These include age, gender, level of education, occupation, income and marriage status.

2 Analysis Plan

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

2.1 Part I: FOSD lotteries

For tasks 1 and 2 (of set 1) and tasks 5 and 6 (of set 2), Loewenfeld (2022) documented the following pattern. Subjects tend to choose lottery G less frequently when it has positive than when it has negative relative skewness. This tendency is much stronger for the 6 states choice task then for the 3 states choice task. These patterns could be driven by the fact that the 6 states choice task is arguably more complicated than the 3 states choice task. It seems plausible that, if the choice task becomes too complex, subjects revert to a simple heuristic according to which they compare the number of "winning states" of the lotteries in the choice set and choose the one that wins most often. An alternative explanation is that the pattern is caused by the increase in the absolute relative skewness when moving from three to six states. The goals of this part of the experiment are the following.

1. Replicate the findings of Loewenfeld (2022).
2. Provide direct evidence on whether an increase in choice complexity can lead to these patterns. To this end, we directly manipulate task complexity by presenting choice either in the minimal state display or in the split display (see table 3).
3. Disentangle the role of increasing number of winning states from increased absolute relative skewness.

We construct a dummy $G^{rs}_{i,S,set,d}$ that is equal to one if subject i chose the FOSD lottery with relative skewness $rs \in \{+,-\}$, with $S \in \{3,6\}$ states, in set $set \in \{1,2\}$ and display $d \in \{minimal, split\}$.

In a first step, we pool choices from the two different sets of choice tasks. We test the hypothesis that the choice frequency of G is higher when it has negative than when it has positive relative skewness, using a McNemar's test of proportions. We perform the tests separately for the three and six states choice tasks, and the minimal state display and the split display.

Next, we test whether the complexity manipulation increases correlation effects, again pooling the choice tasks from the different sets. To this end, we construct a variable $shift_{i,S,d}$ that is equal to 1 if, for a given number of states $S \in \{3, 6\}$ in display $d \in \{minimal, split\}$, a subject chose lottery G when it has positive but not when it has negative relative skewness. For the reverse choice pattern, $shift_{i,S,d} = -1$. If a subject's chose the same lottery regardless of the relative skewness of lottery G, $shift_{i,t} = 0$. For each subject, we sum $shift_{i,S,d}$ for the three and the six states choice task, separately for the minimal-state display and the split display, i.e., we take $\sum_S shift_{i,S,d} \in \{-2, -1, 0, 1, 2\}$. We then test, using a Wilcoxon signed-rank test, the hypothesis that the effects of changing the relative skewness are larger when choice tasks are presented in the split-display, i.e., we expect $\sum_S shift_{i,S,minimal} < \sum_S shift_{i,S,split}$.

Finally, we can shed some light on whether the stronger correlation effects observed in Loewenfeld (2022) for different numbers of states are caused by larger differences in the relative skewness or by larger differences in the number of winning states. Note that for set 2, the relative skewness of lottery G is fixed (to approximately 0.696313), whereas the number of states increases from three to six. Moreover, between sets, we vary the relative skewness of lotteries while keeping the number of the winning states constant. We aim to disentangle the role of relative skewness and winning states by running the following logistic regression.

$$G_{i,t} = c + \beta_1 RS + \beta_2 WS + \epsilon_{i,t} \tag{1}$$

where RS denotes the relative skewness of a lottery, and WS denotes the fraction of states in which a lottery yields a higher payoff than the alternative. We will test the hypotheses that $\beta_1 = 0$ and $\beta_2 = 0$, using a Wald Chi-Square test, with standard errors clustered at the subject level. We will pool observations from the minimal state and split display treatment. We expect $\beta_2 > 0$ and significantly different from 0 and β_1 not to be significantly different from 0.

2.2 Part II and III: Same Marginal Lotteries

We construct a dummy $skew_{i,t}$ that is equal to one if subject i chose the lottery with the higher relative skewness for choice t. We also construct a dummy that is equal to 1 if subjects received immediate feedback on a given choice. We then run the following logistic regression

$$skew_{i,t} = c + \beta feedback_{i,t} + \epsilon_{i,t} \tag{2}$$

By testing whether c is equal to 0, we test whether the frequency of lottery B choices is significantly different from 0.5 (the random choice benchmark). Namely, we test for preferences for positive relative skewness when subjects do not receive immediate feedback. We also test if β is different from zero. If it is positive and significant, this will be interpreted as evidence in favor of regret theory. We test these hypotheses using a Wald Chi-Square test, with standard errors clustered at the subject level.

To further test for differences in relative skewness seeking due to feedback, we calculate, for each subject i, the average of the variable $skew_{i,t}$. We call this the relative skewness seeking score (RSSS). We compute the RSSS both for choices with and without immediate feedback. The score ranges from 0 to 1. We then test for differences in the distribution of relative skewness seeking scores with and without feedback. To this end, we perform a Wilcoxon signed-rank test.

If no statistically significant difference due to immediate feedback is found, we then pool the observations with and without immediate feedback. We then run the following logistic regression

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

where c is a constant. We again test whether c is equal to 0, i.e., whether the frequency of lottery B choices is significantly different from 0.5 (the random choice benchmark).

We expect no significant feedback effects. We expect choice frequencies of lottery B not to be significantly different from 0.5.

References

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