The effects of attitudes towards risk and ambiguity on educational investment: Preliminary results

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June 26, 2023

1 Data & methodology

I use data from the Longitudinal Internet Studies for the Social Sciences (LISS panel), which is representative of the Dutch population, and the American Life Panel (ALP), which is representative of the American population. Both datasets contain administrative data as well as survey questions designed for the elicitation of risk and ambiguity attitudes.[1]

1.1 Survey questions on risk and ambiguity

To elicit ambiguity aversion, Dimmock et al. (2016a,b) designed special surveys as part of ALP and LISS panel respectively. Specifically, each individual are asked whether they prefer the risky box, the ambiguous box or either (meaning indifferent) as in Figure 1.

The question will be asked repeatedly until the respondent chooses "Indifferent" or until the 6th iteration whichever occurs first. Figure 1 shows the first question in the sequence. If the respondent chooses "Choice U" in this question, she is then presented with a similar question wherein Choice U stays the same while the number of the winning balls in Choice K increases using a bisection method.[2] If, on the other hand, "Choice K" is chosen in the first question, in the following question, the number of winning balls in Choice K is reduced. If "Indifferent" is chosen at any stage of the sequence, the sequence stops and the proportion of winning balls in the last stage indicates probability of winning a risky 'lottery' that makes the risky choice and ambiguous choice equally attractive. Finally, if "Indifferent" is never chosen, the sequence stops after the 6th iteration of the question and the final probability of winning a risky 'lottery' is adjusted via the bisection method. In total, three sequences of questions on ambiguity with varying initial degree of risk are asked in both the LISS panel and ALP.

In a similar manner, to elicit risk attitudes, two sequence of questions about two choices involving sure gain on one side and a risky lottery on the other are presented to respondents. Figure 2 shows the first question in this sequence of questions on risk for the ALP. Depending on the choices of the respondent, the prize of

[1] For LISS panel, survey number 44 contains said questions on risk and ambiguity. The ALP counterpart is survey number 243.

[2] After each question that the respondent chooses either "Choice K" or "Choice U", the proportion of the winning balls in the risky choice is adjusted as follows. In the first question, if "Choice K" is chosen, the proportion of winning ball in the next question is then $(0\% + 50\%)/2 = 25\%$ and 50% becomes the new ceiling instead of 100%. If "Choice U" is chosen, the proportion of winning ball in the next question is $(50\% + 100\%)/2 = 75\%$ and 50% becomes the new floor. The new floor and ceiling are carried to the next question and get updated again depending on the subsequent choices of the respondent.

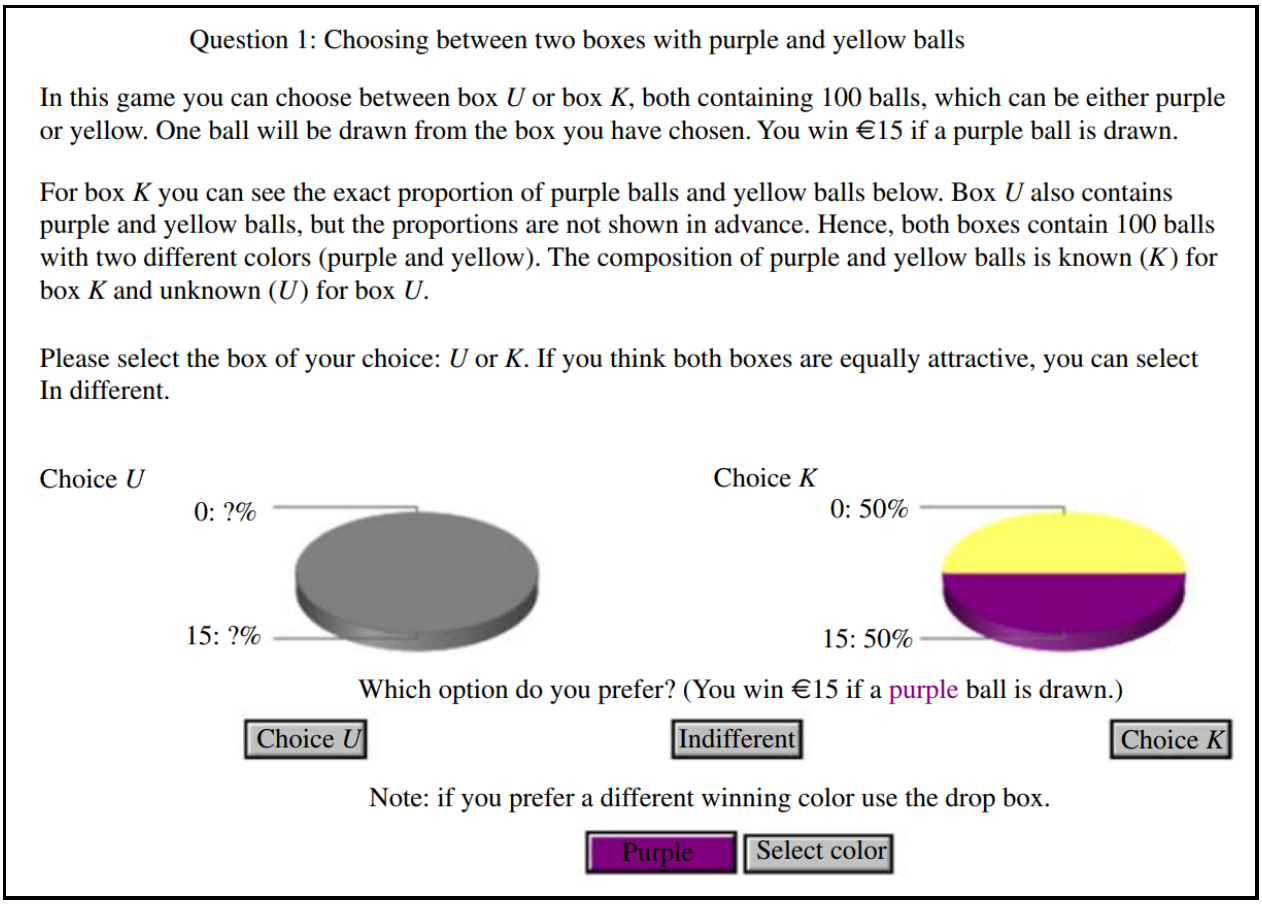

Figure 1: Question 1 in the ambiguity sequence of the LISS panel.

the sure-gain Box A is updated via a bisection method while the risky Box B remains the same. The question is repeated until "Indifferent" is chosen or until the 4th iteration is reached.

1.2 Elicitation of attitudes towards ambiguity

The elicitation procedure in both panels follow the source method of Abdellaoui et al. (2011) which subsume a variety of models of ambiguity, including prospect theory (Tversky and Kahneman, 1992), Choquet expected utility (Schmeidler, 1989), and multiple priors (Gilboa and Schmeidler, 1989). The source method measures ambiguity attitudes via *matching probabilities*, that is, in the context of ALP and LISS ambiguity sequence, the proportion of winning balls in the final iteration. Matching probability can be denoted as follows,

$$m(p) = X/100,$$

where p is the proportion of winning balls when the number of balls of any one colour is the same, X the number of winning balls after the final iteration is reached, and $m(p)$ the *matching probability* of the ambiguity-neutral probability of p. If $m(p) < p$, the respondent is ambiguity-averse as she underweigh the ambiguity-neutral probability of the risky choice due to the ambiguous box. By contrast, under ambiguity-seeking, $m(p) > p$. For instsance, in an urn with 100 balls of 2 colours, $m(0.5) = 0.45$ means that the respondent is indifferent between gambling on one colour from the known urn with 45 of the 100 balls in the

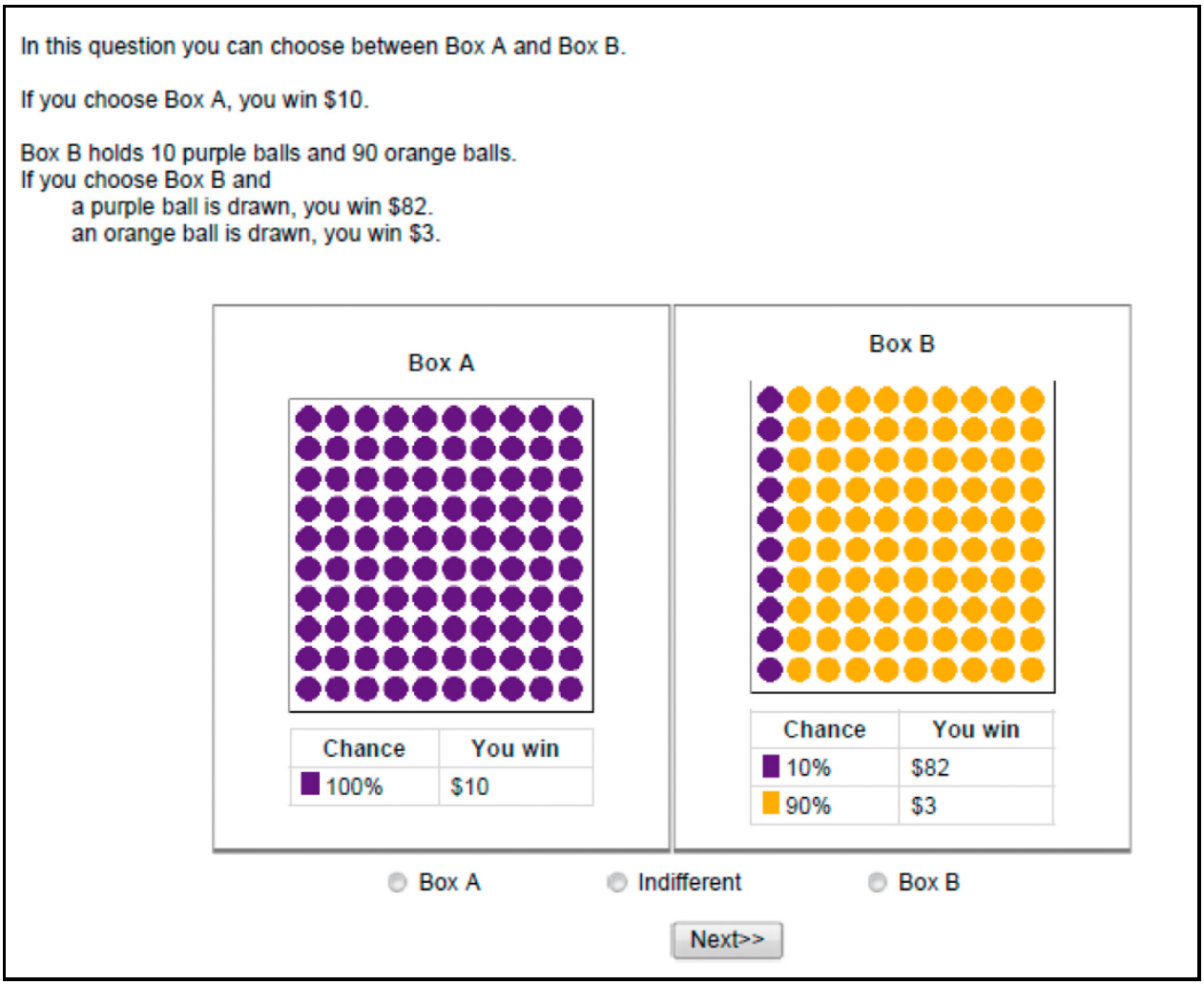

Figure 2: A randomized question in the risk sequence of ALP.

known urn of that colour versus an unknown urn containing 100 balls of 2 colours in unknown proportions.

As shown in Dimmock et al. (2016b), with the matching probabilities $m(p)$ and p, the global ambiguity attitude indices of Abdellaoui et al. (2011) can be measured. First, perform a recoding to find the best fitting line between $m(p)$ and p, say

$$p \mapsto c + sp$$

with c the intercept and s the slope. The ambiguity indices are defined

$$a = 1 - s \quad \text{(index of ambiguity-generated likelihood insensitivity)} \tag{1}$$

and

$$b = 1 - s - 2c \quad \text{(index of ambiguity aversion or pessimism)}. \tag{2}$$

Index a captures *likelihood insensitivity*, defined as the lack of influence of the updating of probabilities following the arrival of new information. Index b captures the degree of *pessimism*, that is, good outcomes are assigned lower weights due to the presence of ambiguity.

1.3 Elicitation of attitudes towards risk

Following method described in Tanaka et al. (2010); Abdellaoui et al. (2011), attitudes towards risk is elicited using expected utility theory (EU) assuming a power utility function, i.e., $u(x) = x^{\sigma}$.[3] Using two sequences of risk question, the coefficient of relative risk aversion (CRRA) can be estimated by fitting the data to the reduced-form regression:

$$\log(CE) = \frac{1}{\sigma}\log(p) + \beta \times \log(stake). \tag{3}$$

and $\rho = 1 - \sigma$ is the estimated CRRA coefficient.

2 Preliminary results

2.1 LISS panel

Table 1: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Monthly school fees ()	161	105.484	317.641	0	3,200
Financial responsibility	161	0.522	0.501	0	1
Education	148	2,986.588	1,156.707	500	7,000
Household income	161	2.513	8.948	−4.836	38.579
Risk aversion (ρ)	161	−0.101	0.219	−0.872	0.075
$AA_{0.1}$	161	0.091	0.218	−0.469	0.469
$AA_{0.5}$	161	0.606	0.304	−0.072	0.875
$AA_{0.9}$	161	−0.005	0.523	−1.184	1.184
Index a	161	0.617	0.292	0.096	1.942

[3] An alternative to EU theory is prospect theory (Tversky and Kahneman, 1992) with Prelec's (1998) probability weighting function. Prospect theory is adopted in both Tanaka et al. (2010); Abdellaoui et al. (2011) instead of standard EU theory. Due to complications in the calculation of involved parameters, I have not adopted this approach in the following results.

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