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Abstract

Subjects are asked to report their confidence in their own decisions regarding the Ellsberg three color urn. Subjective confidence is measured via a 5 point Likert scale. Surprisingly, subjects are more confident in their answer for the more complicated two color question, compared to the simple one color question. This is robust across a wide range of experimental contexts.

Keywords: Ellsberg experiment, Confidence

JEL-Codes: C91, D81

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Ellsberg (1961) pointed out that human behavior can be at odds with the assumptions of subjective expected utility. Following his observation, a large literature has worked on theoretically relaxing the crucial sure-thing principle. Ellsberg urn experiments are often used as an empirical justification of these models.¹ In the Ellsberg three color experiment, subjects are asked to take two decisions with regard to an urn filled to $\frac{1}{3}$ with balls of color A, and filled to $\frac{2}{3}$ with balls of colors B and C. It is unknown to the subjects how many balls of color B and C are exactly in the urn, they only know that the total of balls of color B and C adds up to $\frac{2}{3}$ of all balls in the urn. Subjects then have to take two bets on the outcome of two separate draws, with replacement, from the urn (compare table 1). In the first, which I will call *one color question*, subjects can chose to win the price if the drawn ball is of color A, or to win the price if the ball is of color B. In the second, which I will call *two color question*, subjects can chose to win a price if the balls is of [color A or color C], or to win a price if the ball is of [color B or color C]. Subjects who bet on the “risky” color(s) with known proportions twice are labeled ambiguity averse, subjects who bet on the “ambiguous” color(s) twice are labeled ambiguity loving. Otherwise, subjects are called ambiguity neutral. Typically, subjects are forced to take one bet for each question and their preferences are assumed to be strict.

This is problematic. Subjects may be indifferent and answer randomly. Their pref-

Table 1: Bets in the Ellsberg three color experiment

		10 balls	20 balls	
		Color A	Color B	Color C
one color question	Risky	<i>win</i>	<i>lose</i>	<i>lose</i>
	Ambiguous	<i>lose</i>	<i>win</i>	<i>lose</i>
two color question	Ambiguous	<i>win</i>	<i>lose</i>	<i>win</i>
	Risky	<i>lose</i>	<i>win</i>	<i>win</i>

¹See Trautmann and van de Kuilen (2014) for a recent survey of Ellsberg experiments.

erences may be stronger in some cases than in others. To shed light on this, subjects are asked for their subjective confidence in their own decision.

In the following experiments, subjects report their confidence in their own choice via a five point Likert scale, ranging from “not confident at all” (0) to “very confident” (4). The data is taken from three experiments run by Dominiak and Duersch (2015), henceforth DD, Dominiak, Duersch, and Lefort (2012), henceforth DDL, and Duersch, Roemer, and Roth (2013), henceforth DRR. Previously, DDL found that confidence is higher when adhering to the axioms of consequentialism and dynamic consistency and when acting ambiguity averse, while DRR report that subjects who are more consistent in their choices across urns are also more confident.

In all treatments, subjects are more confident in their choices in the two color question. For all treatments but one, the difference is significant at 1% level when tested with a two-sided sign rank test (compare table 2).

Note that the treatments take place under very different conditions²: Treatment *S*

Table 2: Confidence

Paper	Treatment	Confidence	Confidence	Obs.	sign rank
		1 color question	2 color question		test p-value
DD	S	2.35	3.02	40	.000
DD	M	2.45	3.03	33	.008
DD	B	2.58	2.77	31	.153
DDL	-	2.40	3.11	90	.000
DRR	short	2.01	3.03	34	.000
-	short'	2.30	2.99	38	.000
DRR	long(normal)	2.12	2.79	105	.000
DRR	long(delayed)	2.13	2.81	108	.000
DRR	long(experienced)	2.16	2.80	102	.000

²For more details and instructions, see the original papers.

in DD corresponds to the standard way the Ellsberg task is administered. The urn was filled by the experimenters and nothing was mentioned in the instructions about how it was filled. In treatments M and B the urn was filled by another subject with either malevolent or benevolent incentives towards the decision maker. In the experiment by DDL, the urn was filled by the experimenters, but subjects had to answer two additional questions with respect to the urn. Importantly, the order of the one color and two color question was reversed in DDL, such that this experiment serves as a control for a possible order effect. In the experiment by DRR, subjects had to decide for multiple urns, four in treatment $short/short'$ and six in treatment $long$.³ Treatment $long$ itself is divided into two urns with immediate payment ($normal$), two urns where payment was delayed by two months ($delayed$), and two urns which were administered with a two months delay and where subjects had previous experience with the task via the other treatments ($experienced$). In each case, the average confidence is reported. The finding is robust across these different setups.

While there is never a significant correlation between confidence and choice in the one color question, there is a significant positive pairwise correlation between confidence and choosing the non-ambiguous bet in four cases for the two color question. For treatments S , $long(experienced)$, and $short$, the correlation is significant at 1% level. However, it is only significant at 10% level for treatment M and insignificant for all other treatments.

Why are subjects showing a higher confidence in their choices in the two color question, despite this being the more “complicated” one, using two colors for payoff? Perhaps, due to the simplicity of the one color question, subjects deliberate less on this question compared to the more complex two color question, and subjects use length of deliberation as a metric to judge their own confidence. It is also possible that subjects confuse ‘confidence in their own choices’ with ‘probability of winning the price’. Further research is needed to explain the cause of this empirical regularity.

³Treatment $short'$ uses a dataset that is not used in DRR. The design is identical to $short$, with the exception of payment. In $short'$ all urns are paid. In $short$ a randomly chosen urn out of each pair of urns is paid.

References

- DOMINIAK, A., AND P. DUERSCH (2015): “Benevolent and Malevolent Ellsberg Games,” *AWI Discussion Paper Series*, 592.
- DOMINIAK, A., P. DUERSCH, AND J.-P. LEFORT (2012): “A Dynamic Ellsberg Urn Experiment,” *Games and Economic Behavior*, 75, 625–638.
- DUERSCH, P., D. ROEMER, AND B. ROTH (2013): “Intertemporal stability of ambiguity preferences,” *AWI Discussion Paper Series*, 548.
- ELLSBERG, D. (1961): “Risk, Ambiguity, and the Savage Axioms,” *Quarterly Journal of Economics*, 75, 643–669.
- TRAUTMANN, S., AND G. VAN DE KUILEN (2014): “Ambiguity Attitudes,” in *Blackwell Handbook of Judgment and Decision Making*, ed. by G. Keren, and G. Wu. Blackwell.