Ambiguity Aversion

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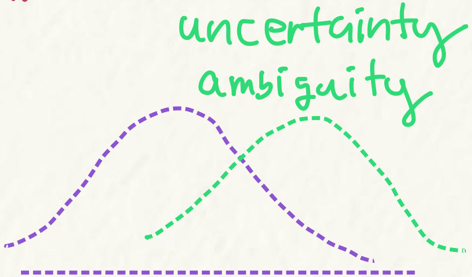
Prospect $(\overset{?}{x}, \overset{?}{p}\,;\ 0, 1-p)$

Our discussion so far has centered on understanding how people act when the outcomes of gambles have known objective probabilities.

In reality, probabilities are rarely objectively known.

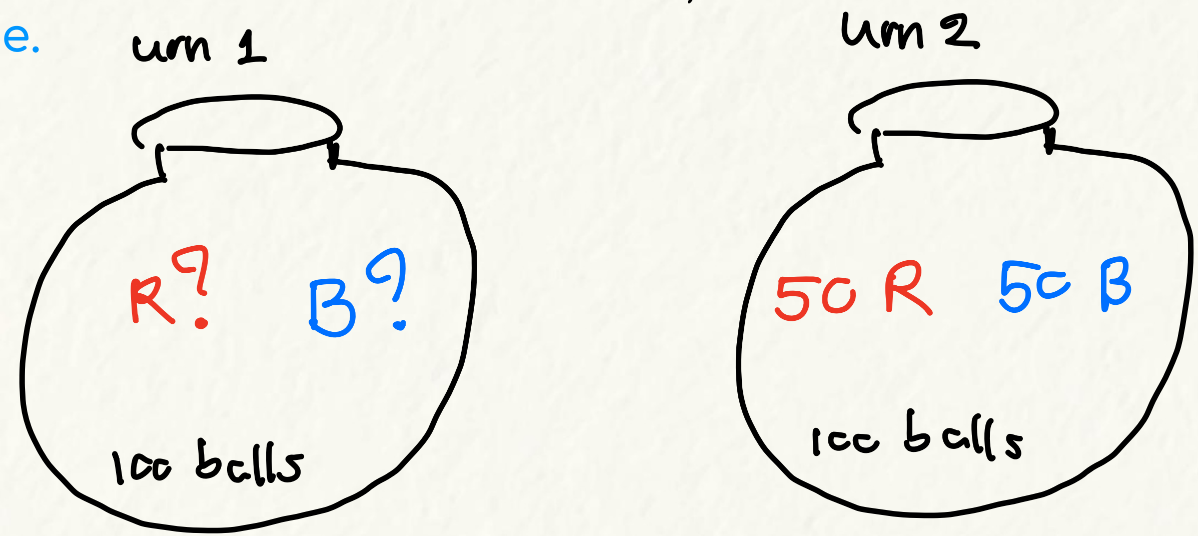


Classic experiment by Ellsberg (1961)

Suppose that there are two urns, 1 and 2.

Urn 1 contains a total of 100 balls, a mix of red and blue, the subject does not know the proportion of each.

Urn 2 contains a total of 100 balls , a mix of red and blue, 50 red and 50 blue.



$Prob(R) = 1/2$
$Prob(B) = 1/2$

Classic experiment by Ellsberg (1961)

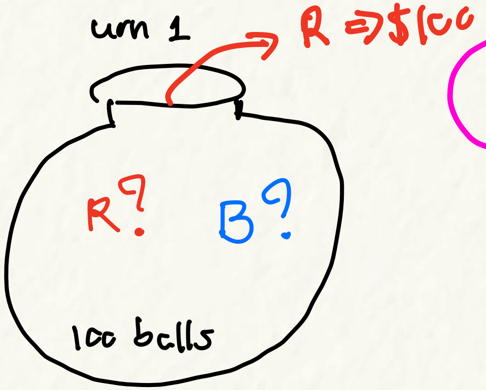
Subjects are asked to choose one of the following two gambles, each of which involves a possible payment of $ 100, depending on the color of a ball drawn at random from the relevant urn:

a_1: one ball is drawn from Urn 1, $\boxed{\text{\$100 if red,}}$ \$0 if blue.

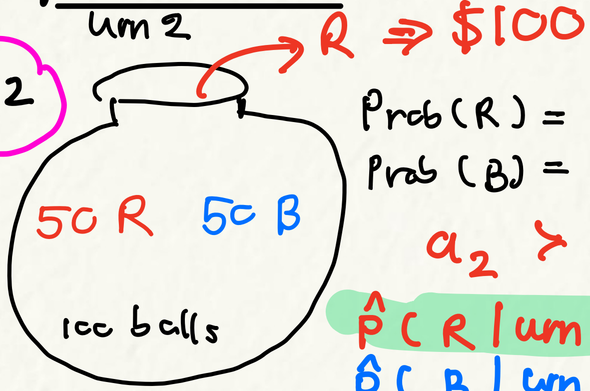
a_2: one ball is drawn from Urn 2, $\boxed{\text{\$100 if red}}$, \$0 if blue.

a_1

R	B
99	1
60	40
50	50
40	60
0	100



a_2



Prob(R) = 1/2

Prob(B) = 1/2

$a_2 \succ a_1$

$\hat{p}(R \mid \text{urn } 1) < 50\%$

$\hat{p}(B \mid \text{urn } 1) > 50\%$

Classic experiment by Ellsberg (1961)

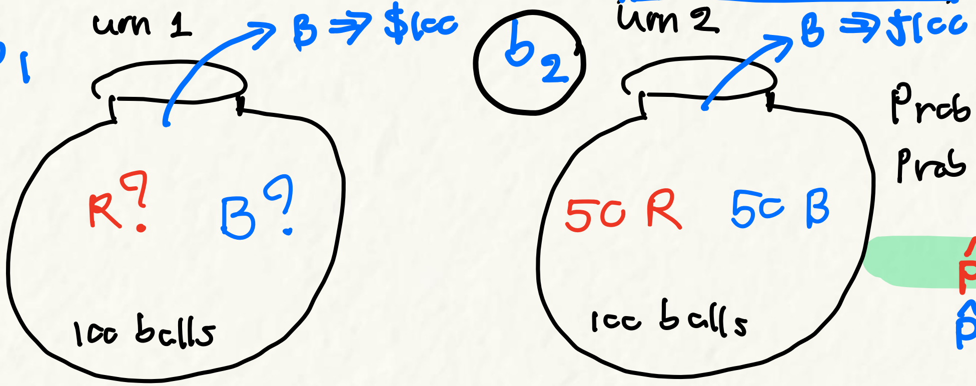
Subjects are also asked to choose one of the following two gambles, each of which involves a possible payment of $ 100, depending on the color of a ball drawn at random from the relevant urn:

b_1: one ball is drawn from Urn 1, $\boxed{\text{\$100 if blue,}}$ \$0 if red.

b_2: one ball is drawn from Urn 2, $\boxed{\text{\$100 if blue,}}$ \$0 if red.

b_1

R	B
99	1
60	40
50	50
40	60
0	100



Prob(R) = 1/2

Prob(B) = 1/2

$\hat{p}(R \mid \text{urn } 1) > 50\%$

$\hat{p}(B \mid \text{urn } 1) < 50\%$

Classic experiment by Ellsberg (1961)

a_2 is typically preferred to a_1.

This implies a subjective probability that fewer than 50% of the balls in Urn 1 are red.

b_2 is typically preferred to b_1.

This implies a subjective probability that fewer than 50% of the balls in Urn 1 are blue.

Ambiguity aversion

- The experiment suggests that people do not like situations where they are uncertain about the probability distribution of a gamble.

- Such situations are known as situations of ambiguity, and the general dislike for them, as ambiguity aversion.

An early discussion of this aversion can be found in Knight (1921), who defines:

risk as a gamble with known distribution and

uncertainty as a gamble with unknown distribution, and

suggests that people dislike uncertainty more than risk.

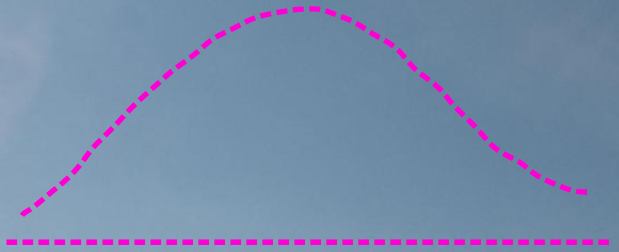
—ambiguity aversion

Ellsberg paradox

Ellsberg paradox shows behavior that is inconsistent with subjective expected utility (SEU).

SEU does not allow agents to express their degree of confidence about a probability distribution and therefore cannot capture ambiguity aversion.

Investors are often uncertain about the distribution of a stock's return.



How do people react to ambiguity?

- One of the popular approaches is to suppose that when faced with ambiguity, people entertain a range of possible probability distributions and act to maximize the minimum expected utility under any candidate distribution.

- In effect, people behave as if playing a game against a malevolent opponent who picks the actual distribution of the gamble so as to leave them as worse off as possible.

How do people react to ambiguity?

- That is, among the set of minimum outcomes achieved through all actions, the decision makers choose the action with the maximum outcome.
- This is an insight from the maximin model which is regarded as one of the neoclassical models of ambiguity.
- Behavioral model of ambiguity is such as “Support theory” (Tversky and Koehler, 1994)

How do people react to ambiguity?

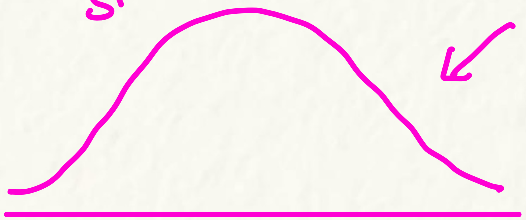
- Some empirical evidences show that ambiguity aversion and attitudes to risk are not correlated (Camerer, 1995).
- For instance, someone who is more risk averse is not necessarily more ambiguity averse.

Camerer, C. F. (1995). Individual decision making. In J. Kagel and A. E. Roth (eds.), The Handbook of Experimental Economics. Princeton, NJ: Princeton University Press.

How do investors react to ambiguity?

- Maenhout (2004) shows that if investors are concerned that their model of stock returns is misspecified, they will charge a substantially higher equity premium as compensation for the perceived ambiguity in the probability distribution.

stock return



misspecified ?

equity premium puzzle

one possible explanation is:

>: high excess return to compensate with ambiguity avesion

Maenhout, P. J. (2004). Robust Portfolio Rules and Asset Pricing. *The Review of Financial Studies*, *17*(4), 951–983. http://www.jstor.org/stable/3598055

How do investors react to ambiguity?

- Investors have a home country bias, investing far more in home country securities relative to diversifying by using international securities (French and Poterba, 1991)

French, K. R. and Poterba, J. M. (1991). Investor diversification and international equity markets. American Economic Review 81(2): 222–6.

Further readings

- Alon, Shiri & Schmeidler, David. 2014. "Purely subjective Maxmin Expected Utility." Journal of Economic Theory. Volume 152.
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- Ellsberg, Daniel. "Risk, Ambiguity, and the Savage Axioms." *The Quarterly Journal of Economics*, vol. 75, no. 4, Oxford University Press, 1961, pp. 643–69, https://doi.org/10.2307/1884324.
- French, K. R. and Poterba, J. M. (1991). Investor diversification and international equity markets. American Economic Review 81(2): 222–6.
- Machina & Siniscalchi. 2014. "Chapter 13 - Ambiguity and Ambiguity Aversion," Handbook of the Economics of Risk and Uncertainty, Vol 1.
- Maenhout, Pascal J. "Robust Portfolio Rules and Asset Pricing." *The Review of Financial Studies*, vol. 17, no. 4, [Oxford University Press, Society for Financial Studies], 2004, pp. 951–83, http://www.jstor.org/stable/3598055.
- Tversky, A. and Koehler, D. J. (1994). Support theory: a nonextensional representation of subjective probability. Psychological Review 101(4): 547–67.

Thanks!