APEC 8001 Recitation

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Today's Agenda

1. General Questions and/or Concerns
2. Simple & Compound Lotteries
3. Assumptions on Lottery Preferences
4. Expected Utility Functions & the Expected Utility Theorem
5. More Difficult Topics from Lectures 7 & 8
6. Questions

General Questions and/or Concerns

- APEC 8001 specific concerns
- Upcoming transition to APEC 8002
- Applied Micro sequence questions

Simple & Compound Lotteries

Simple Lottery

A ***simple lottery L*** is a list (***vector***) of the form $L = (p_1, p_2, ..., p_n)$ with $p_n \geq 0$ for all n and $\sum_{n=1}^{N} p_n = 1$

Compound Lottery

Given K simple lotteries, ***each of which is denoted by*** $L_k = (p_1^k, p_2^k, ..., p_N^k)$, $k = 1, 2, ..., K$, and has a probability $\alpha_k \geq 0$, with $\sum_{k=1}^{K} \alpha_k = 1$, the ***compound lottery*** $(L_1, L_2, ..., L_K; \alpha_1, \alpha_2, ..., \alpha_K)$ is the risky object of choice that yields the simple lottery L_k with probability α_k for $k = 1, 2, ..., K$

Simple & Compound Lotteries

You will see that any compound lottery can be expressed as a ***reduced lottery*** by multiplying each probability in the simple lottery by the probability of that simple lottery occurring:

$$
\begin{aligned}
L &= \sum_{k=1}^{K} (\alpha_k p_1^k, \alpha_k p_2^k, ..., \alpha_k p_N^k) \\
&= \sum_{k=1}^{K} \alpha_k (p_1^k, p_2^k, ..., p_N^k) \\
&= \sum_{k=1}^{K} \alpha_k L_k
\end{aligned}
$$

Assumptions on Lottery Preferences

Continuity of Preferences over Lotteries

The preference relation $\succsim$ on the space of simple Lotteries $\mathscr{L}$ is ***continuous*** if, for any $L, L', L'' \in \mathscr{L}$, the following two sets:

$$\alpha \in [0,1] : \alpha L + (1-\alpha)L' \succsim L'' \subset [0,1]$$
$$\alpha \in [0,1] : L'' \succsim \alpha L + (1-\alpha)L' \subset [0,1]$$

are closed sets.

Independence Axiom

The preference relation $\succsim$ on the space of simple lotteries $\mathscr{L}$ satisfies the ***independence axiom*** if, for all $L, L', L'' \in \mathscr{L}$ and all $\alpha \in (0,1)$ the following holds:

$$L \succsim L' \text{ if and only if } \alpha L + (1-\alpha)L'' \succsim \alpha L' + (1-\alpha)L''$$

von Nuemann − Morgenstern (v.N − M) Expected Utility Function

The utility function $U : \mathscr{L} \longrightarrow \mathbb{R}$, has an v.N-M expected utility form if there is an assignment of numbers" $(u_1, u_2, ..., u_N)$ to the N possible outcomes such that for ***every*** lottery $L = (p_1, p_2, ...p_N) \in \mathscr{L}$ we have:

$$U(L) = u_1 p_1 + u_2 p_2 + ... + u_n p_N$$

Expected Utility Theorem

Suppose that the ***rational preference relation*** $\succsim$ on the space of lotteries $\mathscr{L}$ ***satisfies*** the ***continuity and independence*** axioms. Then $\succsim$ can be represented by a utility representation of the expected utility form.

Expected Utility Functions & the Expected Utility Theorem

Implications of this theorem can help to determine preferences over lotteries

- Each outcome of a lottery gives the consumer some utility
- For each lottery, assign a number for that utility to each outcome in the lottery
- Represent each lottery L in expected utility form $U(L)$
- We can then use the relationships between preferences and utility to compare any pair of lotteries, say $L, L' \in \mathscr{L}$:

$$L \succsim L' \textit{ if and only if } U(L) \geq U(L')$$

More Difficult Topics from Lectures 7 & 8

- Deadweight Loss from a Commodity Tax
- Money Metric Utility
- Welfare Analysis with Partial Information

Questions?

Any remaining questions?