

An Overview of Decision Making Under Risk and Uncertainty: Lecture II

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1 Introduction

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Economic Decisions

- Economics is the study of choices
 - Consumer demand - the choice of goods and services
 - Production - choices of inputs used to create outputs
- Students of economics realize that many of these choices cannot be explained by simplistic models.
 - Property rights
 - Government barriers
 - Imperfect or incomplete information

Formulating the Risk Problem

- Agreement on terminology
 - A basic assumption is there exists at least two actions a_1 and a_2 .
 - The outcome of these actions will be affected by a random event E .
 - One of the things that makes an event random is that it has more than one possible value A or B .
 - The combination of the action and the random event is an outcome $O[a_1|A]$ is the outcome for using action a_1 under event A .

Graphical Overview of Risky Decision

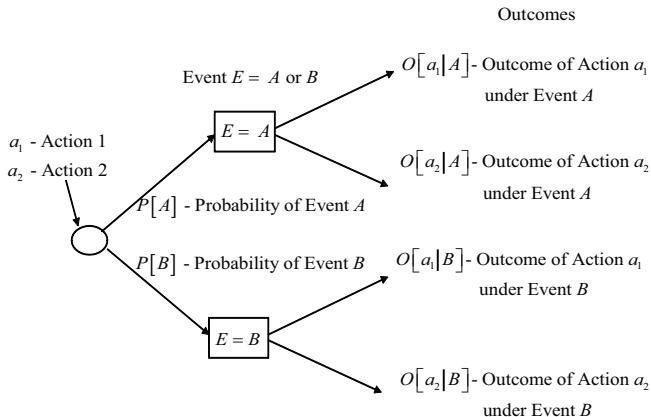


Figure: Fertilizer Decision under Risk

Fertilizer Case

- Taking the scenario where the producer chooses the level of fertilizer to apply to a crop:

$$\max_{x_1} \pi = p_y x_1^\alpha x_2^{1-\alpha} - w_1 x_1 - w_2 x_2 \quad (1)$$

Assume that the results (outcomes) are affected by the state of nature (or the outcome of the random event E).

- Assume that the event has two possible results (A or B).
- For the production scenario this could be A is a high rainfall event and B is a low rainfall event.
- This outcome could have a quantitative measure - A is the number of inches of rainfall during the growing period.
- In a similar concept, the event could be viewed as an uncontrollable input into the production process.
- x_2 in Equation 1 could be the inches of rainfall received in the growing period.
- Probability measures will be more rigorously developed in a subsequent lecture $P[E = A] = 0.60$ and $P[E = B] = 0.40$

Fertilizer Profit per Acre

Table 1. Yield and Profit per Acre for the
Cobb-Douglas Production Function

Nitrogen per Acre	Rainfall (inches per growing season)	
	30	35
<i>Corn Yield (Bushels per Acre)</i>		
90	41.71	46.57
110	44.30	49.35
<i>Profit per Acre (\$ s)</i>		
90	103.95	116.31
110	109.68	122.80

Decision Criteria

- The forgoing discussion outlines the physical description of the economic problem facing the decision maker; however, at this point it is devoid of economic content.
- One that is usually offered is to choose the action that maximizes the expected value of production.

$$\max_{a_i} \begin{cases} E[\pi | a_1] = P[E = A] 116.31 + P[E = B] 103.95 = 111.37 \\ E[\pi | a_2] = P[E = A] 122.80 + P[E = B] 109.68 = 117.55 \end{cases} \quad (2)$$

- Under this decision criteria a_2 is preferred to a_1 since

$$E[\pi | a_1] = 111.37 < E[\pi | a_2] = 117.55 \quad (3)$$

- While this answer students will probably be hard-pressed to give a compelling reason for this criteria.
 - Since microeconomic theory assumes consumers prefer more to less - consumers would choose to maximize income.

Decision Making Under Risk: Fact or Fiction

Two potential misconceptions about our treatment should be immediately dismissed. First, a good risky decision does not guarantee a good outcome; rather, it is one consistent with the decision maker's beliefs about possible outcomes. A good decision is a considered choice based on a rational interpretation of the available information. Whether such a decision turns out right or wrong is partly a matter of luck and in any case can never be determined until after the event, and often not even then. Second, the normative procedures we will present serve to aid decision makers through the complexities of their decision problems. The role of the decision maker is in no way denigrated; as we shall see, his beliefs and preferences are of absolutely paramount importance. (Anderson, Dillon, and Hardaker p.3).