Managerial Economics & Business Strategy

Chapter 12
The Economics of Information

Modified by DF 3/12

Overview

I. Mean, Variance, etc.

II. Uncertainty and Consumer Behavior
   Utility function
   Consumer search

III. Uncertainty and the Firm

IV. Uncertainty and the Market
   Adverse selection, moral hazard
   Possible solutions

V. Auctions

The Mean

- The expected value or average of a random variable
- Computed as the sum of the probabilities that different outcomes will occur multiplied by the resulting payoffs:

$$\mu = E[x] = q_1 x_1 + q_2 x_2 + \ldots + q_n x_n,$$

  where x_i is payoff i, q_i is the probability that payoff i occurs, and $q_1 + q_2 + \ldots + q_n = 1$.
- Note that the probabilities (weights) on the possible outcomes need not be identical. For example, if outcome i has very high q_i, then $E[x]$ is close to x_i.
- The mean provides information about the average value of a random variable but yields *no* information about the degree of risk associated with the random variable.

Variance & Standard Deviation

Variance is:

- A measure of *risk*.
- The sum of the probabilities that different outcomes will occur multiplied by the squared deviations from the mean of the random variable. Var[x]=

$$\sigma^2 = q_1 (x_1 - E[x])^2 + q_2 (x_2 - E[x])^2 + \ldots + q_n (x_n - E[x])^2$$

- Again, weights may not be equal…

Standard Deviation is:

- The square root of the variance.
- Interpreted as average (Euclidean) distance from the mean.

Uncertainty and Risk Aversion

- Handy utility function representation:

$$U_i = CE_i = E[x] - \tfrac{1}{2} r_i Var[x]$$

- CE is the **certainty equivalent**, the person's WTP for the bet.
- $\tfrac{1}{2} r_i Var[x]$ is the **risk premium**, $E[x] - CE$.
- For a bet $E[x]=\$5$ and $Var[x]=25$, most students in class indicated a CE between \$4 and \$5, or a RP between 1 and 0.
- This implies that most students have **risk aversion** parameter r_i between 0.08 and 0.00.
- **Risk averse**: $CE_i < E[x]$ or (equivalently) $r_i > 0$. The majority.
- **Risk neutral**: $CE_i = E[x]$ or $r_i = 0$. This is fairly common too.
- **Risk seeking**: $CE_i > E[x]$ or $r_i < 0$. Las Vegas needs you!

Diversification

- **Diversification** can actually reduce risk.
- Suppose that 100 people face independent risks:
  - $x_i = 0$ or 10, $p_i = 0.5$, so E[x]=5 and Var[x] = 25 each.
- Pooling, the total is E[T]=500 and Var[T] = 2500.
  - (Var[T] would be higher if the risks were positively correlated.)
- For an equal share s = T/100 in the pool:
  - E[s] = E[T]/100 = \$5…no magic there, but
  - Var[s]=Var[T/100]=Var[T]/100^2 = 25/100 !
  - and σ_s is 0.5 instead of 5.0!
- Intuition: T is usually near 500, since independent risks often offset. So a share of the pool is much less risky.
- The magic works better the wider the pool and the lower the correlation.
  - cor mismeasured in subprime loans…

1

Risk Sharing

- The other way to reduce the cost of risk is for more risk averse people to sell the risk to less risk averse people.
- E.g., in the bet discussed in class, those whose CE was $4.00 could sell the gamble to classmates whose CE was $5.00. At a price of $4.50, both would be better off. The sum of risk premiums would decrease, and consumer surplus would increase.
- The insurance industry diversifies away a lot of risk, and shares the rest (with re-insurers and shareholders).
  - Fire insurance and national tornado insurance diversify well.
  - Earthquake insurance less well due to high correlation among losses. But risk sharing still helps.

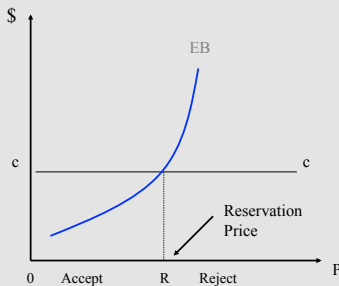## How Risk Aversion Influences Consumer Decisions

- Customers perceive new products as risky-- unknown quality.
- Devices to overcome the problem either raise the expected value or decrease perceived variance.
  - Informative advertising
  - Free samples
  - Guarantees
- Brand names exist mainly to ease the problem.

Searching for a good price

The Optimal Search Strategy.

Consumer Search

An increase in search costs raises the reservation price.
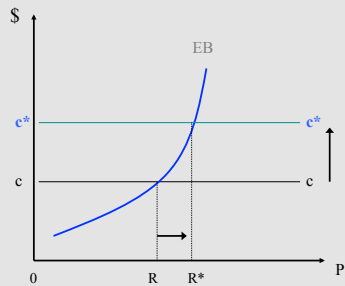
Uncertainty and the Firm

- Risk Aversion
  - Are managers risk averse or risk neutral or …?
  - What *should* they be for the sake of:
    - Shareholders
    - Managers
    - Taxpayers
    - ?

Profit Maximization in an uncertain world

- When demand is uncertain, expected profits are maximized at the point where expected marginal revenue equals marginal cost: $E[MR] = MC$
- Practice problem: suppose demand
  - high with probability 1/3 and low with probability 2/3.
  - Pick high and low demand functions…
  - Compute MR in each case
  - Compute $E[MR]$ and solve $E[MR] = MC$
  - The biotech industry
- What if costs are uncertain?

Asymmetric Information

- Situation that exists when some people have better information than others.
- First example: Insider trading, the accusation against Martha Stewart

Two Types of Asymmetric Information

- **Hidden characteristics→Adverse selection**
  - Things one party to a transaction knows about itself, but which are unknown by the other party.
- **Hidden actions → Moral hazard**
  - Actions taken by one party in a relationship that cannot be observed by the other party.

Adverse Selection

- Situation where individuals have hidden characteristics, and they self-select to the detriment of the less informed party.
- Examples
  - Choice of medical plans
  - High-interest loans
  - Auto insurance for drivers with bad records

Moral Hazard

- Situation where one party to a contract takes a hidden action that benefits him or her at the expense of another party.
- Examples
  - The principal-agent problem
  - Care taken with rental cars

Possible Solutions

1. Signaling
   - Attempt by an informed party to send an observable indicator of his or her hidden characteristics to an uninformed party.
   - To work, the signal must not be easily mimicked by other types.
   - Example: Education

Possible Solutions

2. Screening
   - Attempt by an uninformed party to sort individuals according to their characteristics.
   - Often accomplished through a *self-selection device*
     - A mechanism in which informed parties are presented with a set of options, and the options they choose reveals their hidden characteristics to an uninformed party.
   - Examples include price discrimination via
     - quantity discounts and
     - quality increments in a product line, eg. bicycles