Chapter 12
The Economics of Information
Overview

I. The Mean and the Variance
II. Uncertainty and Consumer Behavior
III. Uncertainty and the Firm
IV. Uncertainty and the Market
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:

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

where \( x_i \) is payoff \( i \), \( q_i \) is the probability that payoff \( i \) occurs, and \( q_1 + q_2 + \ldots + q_n = 1 \).

- 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.
The Variance & Standard Deviation

- Variance
  - 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:
    \[ s^2 = q_1 (x_1 - E[x])^2 + q_2 (x_2 - E[x])^2 + \ldots + q_n (x_n - E[x])^2 \]

- Standard Deviation
  - The square root of the variance.

- High variances (standard deviations) are associated with higher degrees of risk
Uncertainty and Consumer Behavior

- Risk Aversion
  - Risk Averse: An individual who prefers a sure amount of $M to a risky prospect with an expected value, $E[x]$, of $M$.
  - Risk Loving: An individual who prefers a risky prospect with an expected value, $E[x]$, of $M$ to a sure amount of $M$.
  - Risk Neutral: An individual who is indifferent between a risky prospect where $E[x] = M$ and a sure amount of $M$. 
Examples of How Risk Aversion Influences Decisions

- Product quality
  - Informative advertising
  - Free samples
  - Guarantees
- Chain stores
- Insurance
Price Uncertainty and Consumer Search

- Suppose consumers face numerous stores selling identical products, but charge different prices.
- The consumer wants to purchase the product at the lowest possible price, but also incurs a cost, \( c \), to acquire price information.
- There is free recall and with replacement.
  - Free recall means a consumer can return to any previously visited store.
- The consumer’s reservation price, the at which the consumer is indifferent between purchasing and continue to search, is \( R \).
- When should a consumer cease searching for price information?
Consumer Search Rule

- Consumer will search until

\[ EB(R) = c. \]

- Therefore, a consumer will continue to search for a lower price when the observed price is greater than \( R \) and stop searching when the observed price is less than \( R \).
Consumer Search

The Optimal Search Strategy.

$\$\leftarrow$ 0  Accept  $R$  Reject  $\rightarrow$  $P$

EB

Reservation Price

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

- **Risk Aversion**
  - Are managers risk averse or risk neutral?

- **Diversification**
  - “Don’t put all your eggs in one basket.”

- **Profit Maximization**
  - When demand is uncertain, expected profits are maximized at the point where expected marginal revenue equals marginal cost: $E[MR] = MC$. 
Example: Profit-Maximization in Uncertain Environments

- Suppose that economists predict that there is a 20 percent chance that the price in a competitive wheat market will be $5.62 per bushel and an 80 percent chance that the competitive price of wheat will be $2.98 per bushel. If a farmer can produce wheat at cost \( C(Q) = 20 + 0.01Q \), how many bushels of wheat should he produce? What are his expected profits?

- Answer:
  - \( E[P] = 0.2 \times 5.62 + 0.8 \times 2.98 = 3.508 \)
  - In a competitive market firms produce where \( E[P] = MC \). Or, \( 3.508 = 0.01Q \). Thus, \( Q = 350.8 \) bushels.
  - Expect profits = \( (3.508 \times 350.8) - [1000 + 0.01(350.8)] = 1230.61 - 1000 - 3.508 = 227.10 \).
Uncertainty and the Market

- Uncertainty can profoundly impact market’s abilities to efficiently allocate resources.
Asymmetric Information

- Situation that exists when some people have better information than others.
- Example: Insider trading
Two Types of Asymmetric Information

- Hidden characteristics
  - Things one party to a transaction knows about itself, but which are unknown by the other party.

- Hidden actions
  - 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 in which a selection process results in a pool of individuals with undesirable characteristics.

- 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.
   - Example: Price discrimination
Auctions

- **Uses**
  - Art
  - Treasury bills
  - Spectrum rights
  - Consumer goods (eBay and other Internet auction sites)
  - Oil leases

- **Major types of Auction**
  - English
  - First-price, sealed-bid
  - Second-price, sealed-bid
  - Dutch
English Auction

- An ascending sequential bid auction.
- Bidders observe the bids of others and decide whether or not to increase the bid.
- The item is sold to the highest bidder.
First-Price, Sealed-bid

- An auction whereby bidders simultaneously submit bids on pieces of paper.
- The item goes to the highest bidder.
- Bidders *do not* know the bids of other players.
Second-Price, Sealed-bid

- The same bidding process as a first-price, sealed-bid auction.
- However, the high bidder pays the amount bid by the 2nd highest bidder.
Dutch Auction

- A descending price auction.
- The auctioneer begins with a high asking price.
- The bid decreases until one bidder is willing to pay the quoted price.
- Strategically equivalent to a first-price, sealed-bid auction.
Information Structures

- **Perfect information**
  - Each bidder knows exactly the items worth.

- **Independent private values**
  - Bidders know their own valuation of the item, but not other bidders’ valuations.
  - Bidders’ valuations do not depend on those of other bidders.

- **Affiliated (or correlated) value estimates**
  - Bidders do not know their own valuation of the item or the valuations of others.
  - Bidders use their own information to form a value estimate.
  - Value estimates are affiliated: the higher a bidder’s estimate, the more likely it is that other bidders also have high value estimates.
  - *Common values* is the special case in which the true (but unknown) value of the item is the same for all bidders.
Optimal Bidding Strategy in an English Auction

- With independent private valuations, the optimal strategy is to remain active until the price exceeds your own valuation of the object.
Optimal Bidding Strategy in a Second-Price Sealed-Bid Auction

- With independent private valuations, the optimal strategy is to bid your own valuation of the item.
- This is a dominant strategy.
  - You don’t pay your own bid, so bidding less than your value only increases the chance that you don’t win.
  - If you bid more than your valuation, you risk buying the item for more than it is worth to you.
Optimal Bidding Strategy in a First-Price, Sealed-Bid Auction

- If there are $n$ bidders who all perceive independent and private valuations to be evenly (or uniformly) distributed between a lowest possible valuation of $L$ and a highest possible valuation of $H$, then the optimal bid for a risk-neutral player whose own valuation is $v$ is $b = v - \frac{v - L}{n}$.
Example

- Two bidders with independent private valuations ($n = 2$).
- Lowest perceived valuation is unity ($L = 1$).
- Optimal bid for a player whose valuation is two ($v = 2$) is given by

$$b = v - \frac{v - a}{n} = 2 - \frac{2 - 1}{2} = \$1.50$$
Optimal Bidding Strategies with Correlated Value Estimates

- Difficult to describe because
  - Bidders do not know their own valuations of the item, let alone the valuations others.
  - The auction process itself may reveal information about how much the other bidders value the object.
- Optimal bidding requires that players use any information gained during the auction to update their own value estimates.
The Winner’s Curse

- In a common-values auction, the winner is the bidder who is the most optimistic about the true value of the item.
- To avoid the winner's curse, a bidder should revise downward his or her private estimate of the value to account for this fact.
- The winner’s curse is most pronounced in sealed-bid auctions.
Expected Revenues in Auctions with Risk Neutral Bidders

- **Independent Private Values**
  - English = Second Price = First Price = Dutch.

- **Affiliated Value Estimates**
  - English > Second Price > First Price = Dutch.
  - Bids are more closely linked to other players' information, which mitigates players' concerns about the winner's curse.
Conclusion

- Information plays an important role in how economic agents make decisions.
  - When information is costly to acquire, consumers will continue to search for price information as long as the observed price is greater than the consumer’s reservation price.
  - When there is uncertainty surrounding the price a firm can charge, a firm maximizes profit at the point where the expected marginal revenue equals marginal cost.

- Many items are sold via auctions
  - English auction
  - First-price, sealed bid auction
  - Second-price, sealed bid auction
  - Dutch auction