Good Decision, Bad Outcome

• Important to distinguish quality of **decision** from quality of **outcome**
  - Buying lottery ticket
    - Even if you win lottery, buying ticket was likely a bad decision
    - Not everyone understands that…
Good Decision, Bad Outcome

- Important to distinguish quality of decision from quality of outcome
  - Buying lottery ticket
    - Even if you win lottery, buying ticket was likely a bad decision
  - Stanford and the 1989 Loma Prieta earthquake
    - Incurred over $150M in damage
    - Stanford chose to “self-insure” (i.e., not buy insurance)
      - Stanford’s earthquake reserve fund had $3.4M in 1989
      - Earthquake insurance cost $5M/annually
      - Had a $100M deductible
    - This was not a bad decision, it was just a bad outcome
Overton Window

- Joseph Overton was a policy analyst at Mackinac Center for Public Policy
- “Overton Window”
  - Concept named based on Overton’s suggestion that an idea’s political viability depends on where it falls on the spectrum of acceptability with respect to public opinion (not policy maker preferences)
  - Shifting the Overton window involves persuading the public to expand the window
  - Limits the set of alternatives/choices that policy makers might consider viable to pursue

Example of Shifting Overton Window

- Support for same-sex marriage in the US

Sunk Cost Principle

- A decision is made by considering only the possible futures that it might generate.
- Sunk Cost Principle: Any resources consumed in the past are pertinent to the present decision only to the extent that they have provided information useful in assessing the likelihood of a decision leading to possible futures.
  - “Look at the time and money we have already wasted”
  - Wasted resources should have no bearing on present decision.
Sunk Cost Example

• You are CEO. Two proposals are presented:
  ▪ Last year, you approved Project A. It will generate $100M in revenue when complete and cost $90M.
    ◦ You spent $90M so far. You now found out that it will cost an addition $20M to complete the project and realize $100M in revenue. Otherwise, no revenue will be realized.
  ▪ Also presented with Project B that will generate $80M in revenue. Can complete Project B for cost of $20M.

• If you have $20M to invest today, which project do you fund?

• If you had $100M to invest today, which project(s) do you fund?
Value of Perfect Information

- Howard calls this “value of clairvoyance”
  - What is the maximal amount you should pay to get information in a decision making process?

- Example:
  - How much would you pay to know that result of coin flip before you make your decision?
  - Information in decision making is only valuable to the extent that is potentially changes your decision
    - No value to paying for information that would never impact your decision.
Value of Perfect Information

• Another example:
  - How much would you pay to know that result of coin flip before you make your decision?
  - Consider maximal value of choice in each condition:
    - Heads: $6 (choose to play)
    - Tails: $4 (choose not to play)
    - Expected value with perfect information: $6 	imes 0.5 + 4 	imes 0.5 = $5$
    - Choice with maximum expected value: play = $4.5$
    - Value of perfect information = $5 – 4.5 = $0.5$
Value of Perfect Information

- Consider decision to invest money
  - Choices: Bonds, Stocks, Mixed fund
  - Economy is either Strong, Neutral or Weak

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<td>10</td>
<td>25+6+3 = 34</td>
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- What is value of knowing state of economy (variable)?
Value of Perfect Information

• Consider decision to invest money
  ▪ Choices: Bonds, Stocks, Mixed fund
  ▪ Economy is either Strong, Neutral or Weak

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• What is value of knowing state of economy (variable)?
  o Consider maximal value in each state of economy (variable)
  o Expected value with perfect information (EVPI):
    \[(0.5)(100) + (0.2)(30) + (0.3)(10) = 50 + 6 + 3 = 59\]
  o Value of Perfect Information = EVPI – max EV = 59 – 48 = 11
  o Most you should pay for perfect information about variable

Returns per investment

- Strong: 50%, 100%, 80%
- Neutral: 30%, 20%, 25%
- Weak: 10%, -20%, -5%
- Expected value (EV): 34, 48, 43.5

Expected value (EV) calculation:

- Bonds: (0.5)(50) + (0.2)(30) + (0.3)(10) = 25 + 6 + 3 = 34
- Stocks: (0.5)(100) + (0.2)(20) + (0.3)(-20) = 50 + 4 - 6 = 48
- Mixed fund: (0.5)(80) + (0.2)(25) + (0.3)(-5) = 40 + 5 - 1.5 = 43.5
Making a Series of Decisions

• Consider this game:

- Play? yes
  - 0.5 $12
- Play? no
  - 0.5 -$10

• Would you play?
Making a Series of Decisions

• Consider this game:

  0.5
  yes
  0.5
  no

Play? $12
  no $0

• Would you play 100 times?

• Binomial distribution
  • PMF looks like “bell curve”. This is not a coincidence.

In life, you don’t know how many times you’ll play, but if you never play the first time, you can’t get to 100
Normal Random Variable

• \( X \) is a **Normal Random Variable**: \( X \sim N(\mu, \sigma^2) \)
  - Probability Density Function (PDF):
    \[
    f(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \quad \text{where} \quad -\infty < x < \infty
    \]
  - \( E[X] = \mu \)
  - \( Var(X) = \sigma^2 \)
  - Also called “Gaussian”
  - Note: \( f(x) \) is symmetric about \( \mu \)
  - Common for natural phenomena: heights, weights, etc.
  - Often results from the sum of multiple variables
Carl Friedrich Gauss

- Carl Friedrich Gauss (1777-1855) was a remarkably influential German mathematician
- Started doing groundbreaking math as teenager
  - Did not invent Normal distribution, but popularized it
- He looked more like Martin Sheen
  - Who is, of course, Charlie Sheen’s father