The House Always Wins: Sports Betting in the Economics Classroom

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Introduction

- Sports Betting seems to be inseparable from sports these days.
  - With revenues growing from (approx.) $1B in 2019, to $4B in 2021, to $13.7B in 2024, it has turned into quite the cash cow.
    - Compare that with the NFL's total revenue of approximately $23B in 2024.
- This has led to new opportunities in the classroom as students (and especially young men) have become interested in statistics.
  - We can leverage this to teach better decision-making under uncertainty.
    - And help them see how they are being taken advantage of.
    - Let's walk through a couple of examples.

Sports Betting

- What is it about sports betting that draws people in?
  - There are multiple factors at play.
    - First, it's fun!
      - Adding a monetary consequence to a spectator event can make a person feel the excitement of the win (or loss) more intensely.
    - But it's also much more interesting in a probabilistic sense.
      - The house edge in sports betting is not as clear to observe as it is in other casino games.
        - For example, it's well known that the house edge in roulette is $^{1}/_{13}$, or roughly 7.7%.

Sports Betting

Sports Betting

- In contrast, the true probability of any sporting event is unknowable.
  - We only get a single observation of the specific event.
    - Our frequentist approach to probability (as seen in roulette) simply will not work for sports betting.
    - We must rely on subjective beliefs.
      - And if our beliefs are better than those of the sportsbook, we'll win money on average.
        - I think a lot of people (young men in particular) fall into this category.
        - They think they can beat the book.

Sports Betting

- The house edge in sports betting is a lot harder to see.
  - Let's start by defining a money line.
    - A money line is a positive or negative number that expresses how likely an outcome is.
      - Positive money lines are less likely, whereas negative money lines are more likely.
      - We always compare them to $100.
    - For Game 7 of the NBA Finals, the money line for the Pacers was +215, and for the Thunder it was -265.
      - We should read that for the Pacers as "If I risk $100, I have the chance to win $215."
      - For the Thunder, "If I risk $265, I have the chance to win $100."

Sports Betting

- Interestingly, the money line tells us how likely the sports book thinks an event will happen, and we can convert these money lines into probabilities.
- We can convert a positive money line to an implied probability using a simple formula:

$$p(m) = \frac{100}{100 + |m|} \qquad p(+215) = \frac{100}{100 + 215} = 0.317$$

  - This suggests that the sports book thought that the Pacers had a 31.7% chance to win Game 7.
- Let's do the same thing for the Thunder.
  - With a negative money line, we have to adjust the formula slightly.

$$p(m) = \frac{|m|}{100 + |m|} \qquad p(-265) = \frac{265}{100 + 265} = 0.726$$

    - And this suggests that the sports book thought the Thunder had a 72.6% chance to win last night.

Sports Betting

$$\text{Pacers: } 0.317 \quad \text{Thunder: } 0.726$$

- Wait a minute. Let's add up those probabilities:

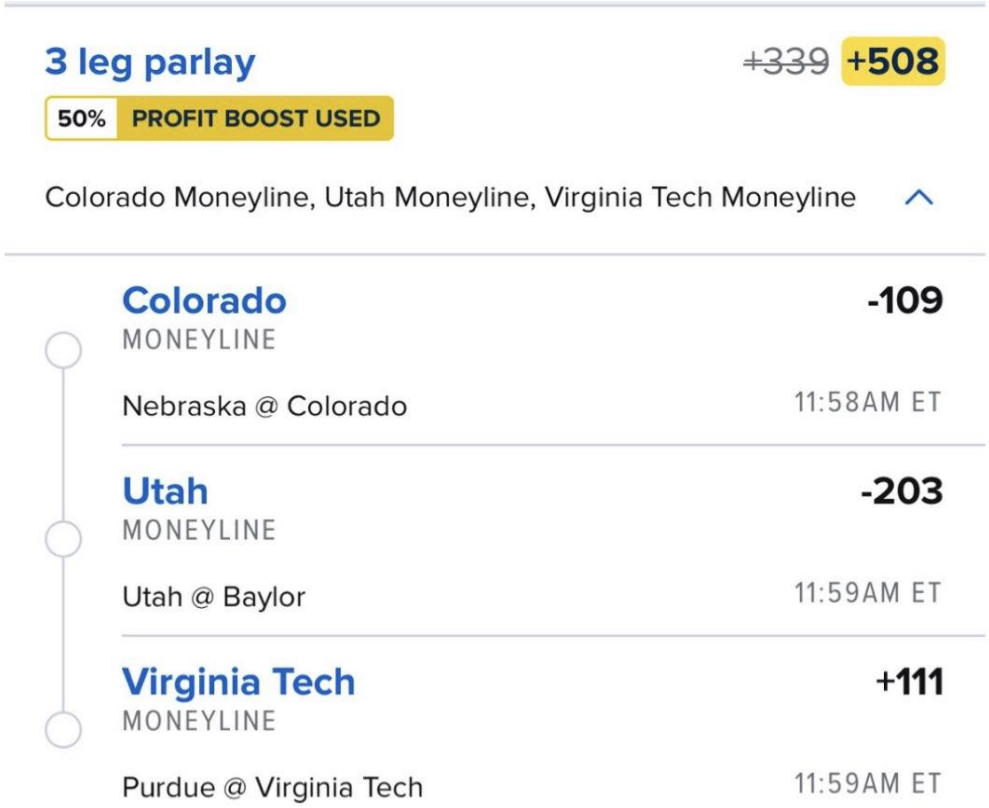
$$\text{Total: } 0.317 + 0.726 = 1.043$$

- They add up to more than 1, which is bad for probability theory, but good for the sports book.
  - That extra 4.3% is the house edge for the sports book.
    - It's how they make money off people betting on the event.
- It's just like the roulette example: They aren't paying winners what is fair based on the likelihood of the events.
  - They need to make money, too.

Sports Betting

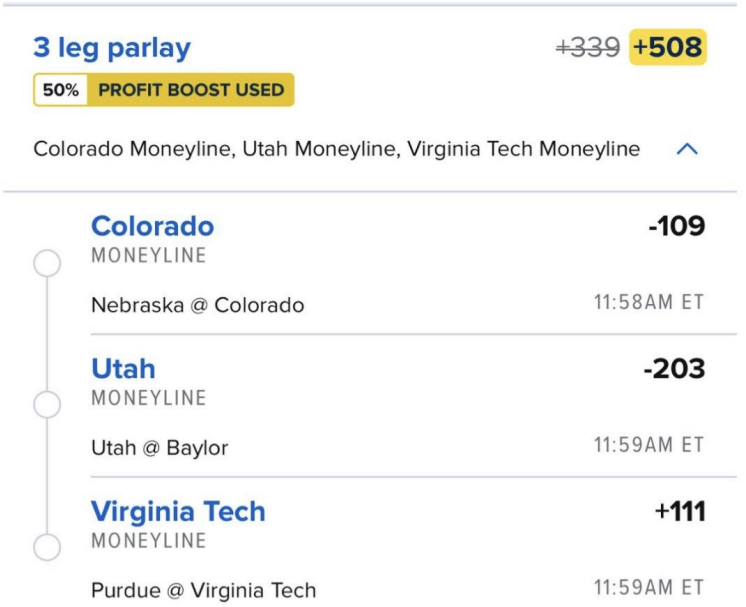
- These are just the basics of sports betting.
  - We should expect to lose money on average unless we know more about the sporting events than the sports book, which is unlikely.
- Honestly, most people don't even bet single money lines.
  - A lot of people like to parlay bets, which is when you take a group of bets and package them together into one big bet.
    - For example, a 3-leg parlay would need three things all to happen in order to get paid.
      - You get nothing if only two of the three happen.
    - People tend to see the big number on the money line for a parlay and notice that they can win a lot with just a small wager.

Sports Betting



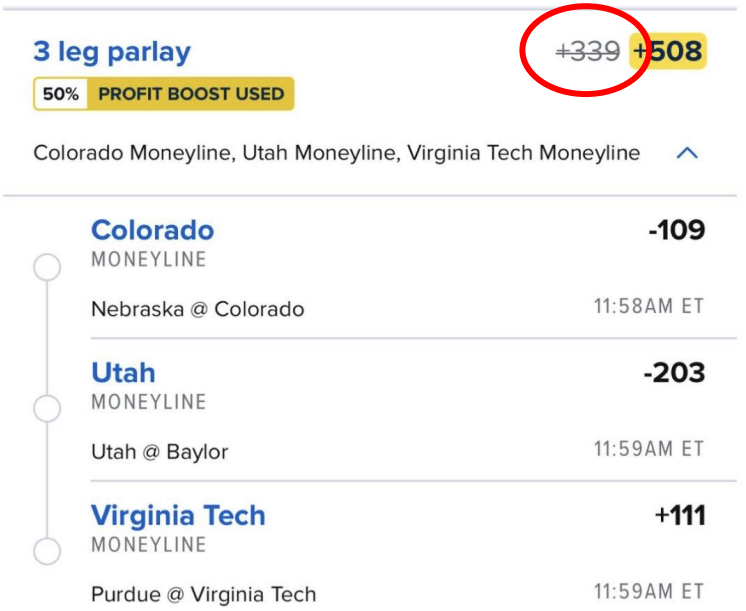
Sports Betting

- Let's analyze this parlay.
  - The three money lines are -109, -203, and +111, respectively.
    - We can convert these into *implied* probabilities, which are 0.52, 0.67, and 0.47, respectively.
  - Remember, a parlay is a joint outcome. It pays only when all three events happen.
    - This is a joint probability, and we can combine them into a single event.
      - Assuming these three events are independent, we can calculate this probability by multiplying the three earlier probabilities together, obtaining 0.17.



Sports Betting

- Lastly, let's convert this probability of 0.17 back into a money line, which gives us +504.
  - And no, that +508 is not the original offer the sportsbook made, that was a "deal."
    - The sportsbook offered +339 originally, which translate into roughly a 6% house edge on the parlay.
      - This is a second house edge on top of the house edges that existed in each of the money lines from the start!
      - Without the boost, the bettor will make more money on average betting all three events individually, and only breaks even with their boost.



Sports Betting

- I don't think sports betting is going away any time soon.
  - In fact, would it surprise you if I said that our students have been conditioned to gamble since they were little kids?
    - Ever seen a mystery toy?
    - Ever seen a loot box?
  - Would it surprise you to know that most 18-year-old men suddenly spend a lot less money on loot boxes and a lot more on sports betting?
- My hope is that if we arm students with knowledge of how these systems work that they'll make better informed choices.