Football VII

Produced by Dr. Mario | UNC STOR 538

Flaws of NFL Overtime

❖ NFL Overtime
  - ❖ Occurs in the Situation of a Tied Game
  - ❖ Coin Toss Winner Has Two Choices
  - ❖ Choice 1: Kickoff
  - ❖ Choice 2: Receive
  - ❖ Overtime is Sudden Death
  - ❖ If No Team Wins in Overtime, Game Results in a Tie
  - ❖ Receiving Team Wins 60% of the Time (1994-2006)
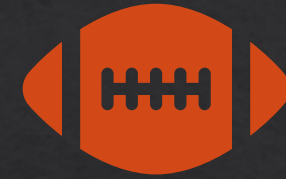 - ❖ Proposed Moving Kickoff to Make it Harder for Receiving Team

It is better to receive, than to give.

- Mahatma Mario

Flaws of NFL Overtime

❖ **Mathematical Model of Sudden Death Overtime**
  ❖ Let p = Probability Average NFL Team Scores in a Possession
  ❖ Assumption: Each Team Has Identical Probability of Scoring
  ❖ Ties Happen Less Than 5% of the Time
  ❖ Assumption: Game Will Endure Forever
  ❖ Let K = Probability Team Receiving Wins the Game

❖ **Two Ways Receiving Team Wins**
  ❖ Receiving Team Scores on First Possessions

$$P(Win\ on\ First\ Possession) = p$$

  ❖ Receiving Team Fails to Score But Scores on Later Possession

$$P(Win\ on\ Second\ Possession) = (1-p)(1-p)K$$

Assume Independence

❖ **Based on Previous Statements**

$$K = p + (1-p)(1-p)K$$ ← Is This Nonsense?

$$K = \frac{p}{1-(1-p)(1-p)} = \frac{p}{2p-p^2} = \frac{p}{p(-p+2)} = \frac{1}{2-p}$$
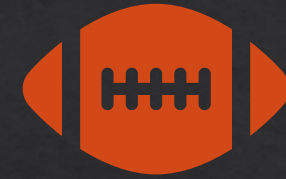
Must Be Greater Than 50%

❖ **How Would the NFL Make Overtime Fair?**

Flaws of NFL Overtime

❖ **Checking Mathematics Empirically**
  ❖ **Using NFL Data (2003-2006)**

  $$p = 31\%$$

  ❖ **Therefore, the Probability Receiving Team Wins in Overtime**

  $$K = \frac{1}{2 - 0.31} = 0.59 \approx 60\%$$

❖ **Changing the Rules**
  ❖ **In 2012, NFL Modified Overtime Rules**
  ❖ **Receiving Team Needs a Touchdown to Win the Game**
  ❖ **Since then 52.7% of Coin Toss Winners, Win the Game**

Flaws of NFL Overtime

❖ **Modified Mathematics**
 ❖ **Let p = Probability Average NFL Team Scores in a Possession**
 ❖ **Let q = Probability Average NFL Team Scores a Touchdown in a Possession**
 ❖ **Probability Receiving Team Wins on First Possession**

$$P(Win\ on\ First\ Possession) = q$$

 ❖ **Probability Receiving Team Wins on Second Possession**

$$P(Win\ on\ Second\ Possession) = (1-q)(1-p)K$$

❖ **Now, Based on Mathematics**

$$K = q + (1-q)(1-p)K \longrightarrow K = \frac{q}{1-(1-q)(1-p)}$$

❖ **Based on 2019, q = 22.4% and p = 36.4%**

$$K = \frac{0.224}{1-(1-0.224)(1-0.364)} = 44.23\% \longrightarrow \text{Math is Dope}$$

Value of High Draft Picks in NFL

❖ **Impact of the NFL Draft**
  - ❖ NFL is Considered to Be the Fairest League in the Land
  - ❖ Teams Draft in Inverse Order From Browns to Best
  - ❖ There are 8 Rounds in the NFL Draft
  - ❖ 6.1 Million People Watch on Average
  - ❖ 100,000 People Attend on Average
  - ❖ Early Draft Picks are Believed to Be More Valuable Than Late Draft Picks
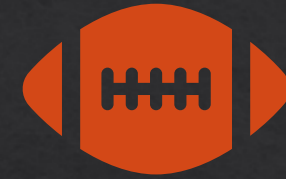
❖ **Research by Cade Massey and Richard Thaler**
  - ❖ Article Called *The Loser's Curse*
  - ❖ Collected Data on All Draft Day Trades From Recent Years
  - ❖ Define *v(n)* = Value of the *n*th Pick
  - ❖ Not About the Player But About the Position
  - ❖ Suppose Team Traded 12th and 28th Pick for 4th Pick

$$v(12) + v(28) = v(4)$$

Value of High Draft Picks in NFL

❖ **Model for Value**
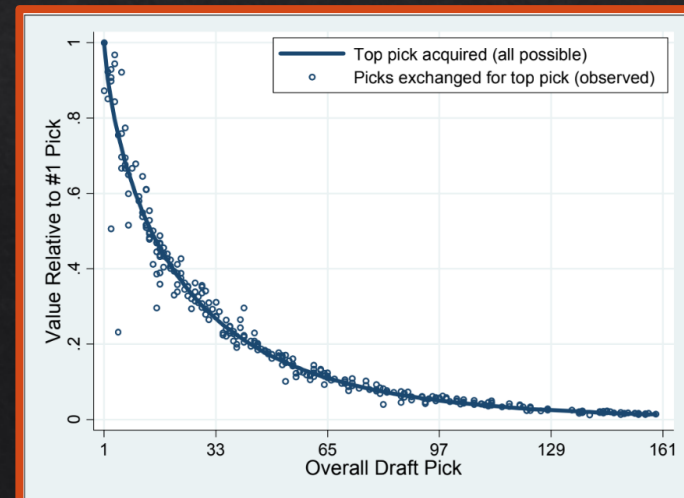
  ❖ **Used Exponential Function**

  $$v(n) = e^{-a(n-1)^b}$$

  ❖ **Based on Weibull Distribution**
  ❖ **Estimated Parameters *a* and *b* Based on Data From Trades**
  ❖ **Trades Can Be Used to Identify the Perceived Value of the Picks**
  ❖ **Final Estimates: *a = -0.148* & *b=0.7***

Value of High Draft Picks in NFL

❖ **Determining Value of Player According to On-Field Impact**
- ❖ **Not on Roster**
- ❖ **No Starts**
- ❖ **1-8 Starts**
- ❖ **9-16 Starts**
- ❖ **Pro-Baller**

❖ **Determining Value of Player According to Salary**

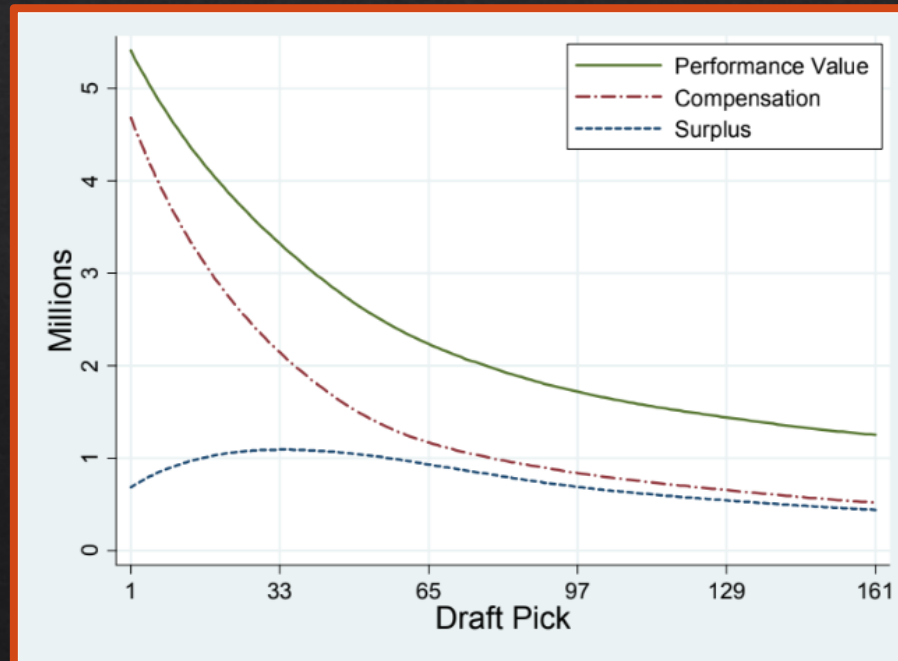| Mean Salary	Performance Level
$ —	not on roster
$ 1,039,870	no starts
$ 1,129,260	1 to 8 starts
$ 4,525,227	> 8 starts
$ 9,208,248	Pro Bowl

Salary of Quarterbacks

Value of High Draft Picks in NFL

❖ **Examination of Surplus**
  ❖ Drafted NFL Players are Paid According to Draft Position
  ❖ Determined By Player Value Minus Average Player Salary
  ❖ Discovered Average Surplus By Draft Position Increased
  ❖ Meaning Later Picks Contributed More Value

Value of High Draft Picks in NFL

❖ **Critique's by Phil Birnbaum**
  - ❖ Well-known in Sabermetrics
  - ❖ Major Flaw: Assumption Players Who Play the Same Position and Are in the Same Performance Category are Equally Valuable
  - ❖ Example: Quarterback with 1 Game Equivalent to QB with 8 Games
  - ❖ Need Better Measure of Player Performance Than Usage in Starts

❖ **Using Combine 40-YD Dash to Predict Running Back Performance**
  - ❖ Important to Identify Good Draft Picks
  - ❖ Analysis Done by Bill Barnwell
  - ❖ 40-YD Dash Time Negatively Correlated With YDs Gained and Carries (-0.36)
  - ❖ Book States This Implies That Faster Runners Perform More Poorly Than Slower Runners
  - ❖ Does this make sense?

Value of High Draft Picks in NFL

❖ **Adjustment for Weight**
  ❖ **Thanks Bill Barnwell**

$$\text{weight-adjusted 40-yard dash score} = \frac{200 \times \text{weight in pounds}}{(\text{40 yard time in seconds})^4}$$

❖ **New Measure Has a 0.45 Correlation with Yards and Carries**
❖ **Accounts for Data from 1999 to 2008**
❖ **Calibrated to Average Out to 100 Across All Running Backs**

❖ **Any Other Criticism's of Value Model by Massey and Thaler?**

Value of High Draft Picks in NFL

❖ **The Winner's Curse**
- ❖ Look for Reasons of the Draft's Inefficiency
- ❖ Winner's of Auctions Pay More Than the Object is Worth
- ❖ Surplus Analysis Shows Picks Below #43 are at a Disadvantage
- ❖ Because of Trades, Teams are Bidding on Picks
- ❖ In What Other Ways are Winner's Cursed?

Final Inspiration

If you're not first, be last.

- Mahatma Mario