



Football VI

Produced by Dr. Mario | UNC STOR 538



Flaws of NFL Overtime



❖NFL Overtime

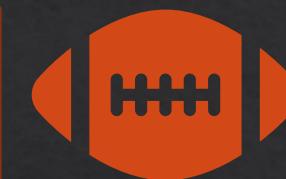
- ❖ Occurs in the Situation of a Tied Game
- ❖ Coin Toss Winner Has Two Choices
- ❖ Choice 1: Kickoff
- ❖ Choice 2: Receive
- ❖ Overtime is Sudden Death
- ❖ If No Team Wins in Overtime, Game Results in a Tie
- ❖ Receiving Team Wins 60% of the Time (1994-2006)
- ❖ Proposed Moving Kickoff to Make it Harder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

$$P(\text{Win on First Possession}) = p$$

- ❖ **Receiving Team Fails to Score But Scores on Later Possession**

$$P(\text{Win on Second Possession or Later}) = (1 - p)(1 - p)K$$

Assume Independence



Flaws of NFL Overtime



❖ Based on Previous Statements

$$K = p + (1 - p)(1 - p)K \quad \text{Is This Nonsense?}$$

$$K = \frac{p}{1 - (1 - p)(1 - p)} = \frac{p}{2p - p^2} = \frac{p}{p(-p + 2)} = \frac{1}{2 - p}$$

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

$$P(\text{Win on First Possession}) = q$$

❖ Probability Receiving Team Wins on Second Possession

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

❖ 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





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

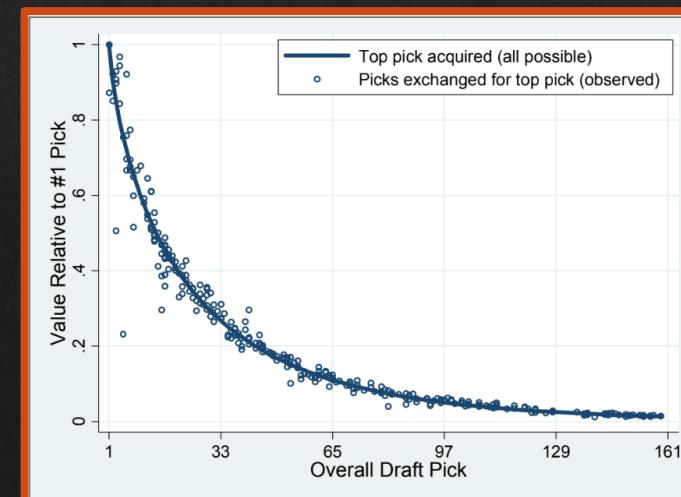


- ❖ Model for Value

- ❖ Used Exponential Function

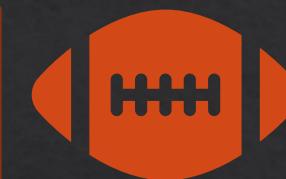
$$v(n) = e^{-a(n-1)^b}$$

- ❖ 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

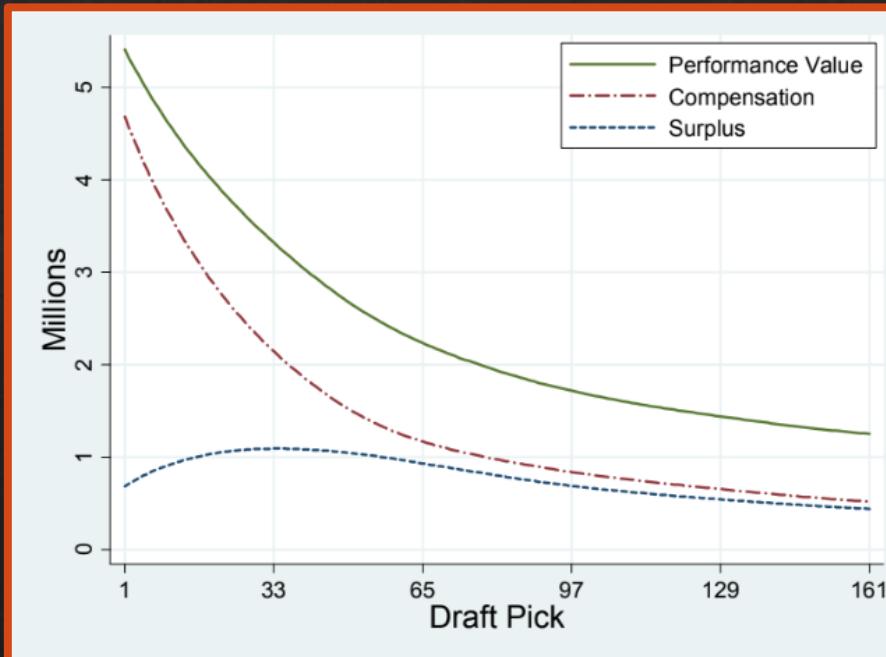


Value of High Draft Picks in NFL



❖ 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