GAMBLING II

Produced by Dr. Mario

UNC STOR 390

RATING SPORTS TEAMS

- Expected Profit of Gambler for Bet on Spread
  - Assume P(Win)=P(Loss)=0.5
  - Expected Profit for Bettor

    $E[Profit] = (\$10)(0.5) - (\$11)(0.5) = -\$0.50$
  - Percent of Bets Needed to Win to Break Even

    $E[Profit] = (\$10)(p) - (\$11)(1-p) = 0 \longrightarrow p = 0.524$
  - We Need to Win 52.4% of the Bets on Spread to be Even

- Power Ratings
  - Bookmakers Use Ratings to Set Point Spreads
  - Example: Panthers +1 and Browns -12

    $E[Spread] = 1 - (-12) = 13$
  - This Can Be Adjusted for Home Edges

RATING SPORTS TEAMS

- Spreads from Power Rankings Are Usually "Fair"
- Example of Power Ratings from 2006

Team	Rating	Rank
1 Arizona Cardinals	–6.7842786	29
2 Atlanta Falcons	–3.408071	21
3 Baltimore Ravens	8.3506952	4
4 Buffalo Bills	2.4201424	12
5 Carolina Panthers	–3.059493	20
6 Chicago Bears	8.6780273	3
7 Cincinnati Bengals	3.7895627	7
8 Cleveland Browns	–6.2649554	28

Not Last

- Why Not Use Team Rank for Rating?

RATING SPORTS TEAMS

- Ideal Team Ratings
  - Average Team Represented by 0
  - Expressed in Units of Points
  - Example: Expect Panthers to be 5 Points Better Than Average Team Would Mean Their Rating is +5

- Methodology in 6 Steps
  - Step 1: Randomly Attempt to Give Trial Ratings for Each Team and Randomly Establish the Home Edge
  - Step 2: Get Actual Game Data
  - Step 3: Determine Actual Margin of Victory

$$Margin = Home\ Points - Away\ Points$$

RATING SPORTS TEAMS

- Methodology in 6 Steps
  - Step 4: Predict Margin From Ratings

$$E[Margin] = Home\ Edge + Home\ Rating - Away\ Rating$$

  - Step 5: Compute Errors from Prediction

$$Error = Margin - E[Margin]$$

								SSE 38306.43
Game #	Home	Away	Home score	Away score	Margin	Prediction	Error	Squared error
1	25	17	28	17	11	3.0440188	7.96	63.29764
2	19	4	19	17	2	9.4576993	−7.5	55.61728
3	21	14	21	26	−5	−6.359264	1.36	1.847599
4	5	2	6	20	−14	1.3013943	−15	234.1327
5	15	9	24	17	7	5.3687521	1.63	2.66097
6	8	20	14	19	−5	−8.089332	3.09	9.543973
7	30	3	0	27	−27	−15.63891	−11	129.0744
8	11	29	6	9	−3	−2.59188	−0.4	0.166562
9	31	22	16	23	−7	−1.831027	−5.2	26.71828
10	12	6	0	16	−26	−11.9336	−14	197.8635
11	26	10	18	10	8	−4.135732	12.1	147.276
12	16	7	10	23	−13	−2.357456	−11	113.2638

→ Minimize This

RATING SPORTS TEAMS

- Methodology in 6 Steps
  - Step 6: Find Optimal Team Ratings to Minimize SSE
    - EXCEL Solver
    - optim() Function in R

- Alternative: Use Basic Regression

$$Margin = \beta_o + X\vec{\beta}$$

$$X = \begin{bmatrix} 1 & -1 & \cdots & 0 & 0 \\ 0 & -1 & \cdots & 1 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 1 & 0 & \cdots & 0 & -1 \end{bmatrix}$$

Home Edge

Home

Away

RATING SPORTS TEAMS

- Strength of Schedule
  - Average the Ability of All Opponents
  - Example from 2006

Team	Mean strength	Rank
1 Arizona Cardinals	−2.09677832	29
2 Atlanta Falcons	−1.15809019	25
3 Baltimore Ravens	−0.47256958	20
4 Buffalo Bills	3.107639211	2
5 Carolina Panthers	−0.87202078	21
6 Chicago Bears	−2.63199544	30
7 Cincinnati Bengals	1.164556765	8
8 Cleveland Browns	1.110025495	9

- Using Mean Absolute Error
  - Games With Unusual Spreads Are Outliers
  - Median Minimizes Mean Absolute Error
  - Power Ratings Less Impacted by Outliers

RATING SPORTS TEAMS

- Offensive/Defensive Ratings
  - Related to the Over/Under
  - Offensive Rating = Ability to Score Points
    - Positive = Scores More Points Than Average
    - Negative = Scores Less Points Than Average
  - Defensive Rating = Ability to Stop Scoring
    - Positive = Gives Up More Points Than Average
    - Negative = Gives Up Fewer Points Than Average

RATING SPORTS TEAMS

- Offensive/Defensive Ratings
  - Predicted Points Scored by Home Team

    $Average + 0.5(Home\ Edge) + Home\ Off.Rating + Away\ Def.Rating$
  - Predicted Points Scored by Away Team

    $Average - 0.5(Home\ Edge) + Away\ Off.Rating + Home\ Def.Rating$
  - Divided Up Home Edge Equally
  - Average = Average Number of Total Points
  - Can Be Used to Create Overall Rating

    $Team's\ Off.Rating - Team's\ Def.Rating$
  - Use These to Predict Team Points
  - Add Expected Home Points and Expected Away Points to Estimate Over/Under

RATING SPORTS TEAMS

- Ranking Based on Wins and Losses
  - Controversy in College Football
  - Choosing Top Teams for College Football Playoffs
    - Overall Record
    - Strength of Conference
    - Strength of Out-of-Conference Schedule
    - Head-to-Head Competition
    - Comparative Outcomes of Common Opponents
    - Conference Championships
    - Used to Be Chosen by Computer
    - Now Chosen by Committee
  - Problem with Considering Game Scores?

RATING SPORTS TEAMS

- Ranking Based on Wins and Losses
  - Using Team Ratings to Estimate the Probability of Winning
  - Let p Represent the Probability the Home Team Wins
  - Use Logistic Regression to Estimate p

$$p = \frac{e^{home\ rating - away\ rating + home\ edge}}{e^{home\ rating - away\ rating + home\ edge} + 1}$$

  - Not Minimizing Least Squares but Maximizing Likelihood
  - Home Rating = Impact the Home Team Has on Winning Game
  - Away Rating = Impact the Away Team Has on Winning the Game
  - Can Be Used to Predict Head-to-Head Games
  - Problem Considering Wins/Losses?

RATING SPORTS TEAMS

- Rating Method by Fivethirtyeight
  - Utilizes Elo Rating for Sports
    - Elo Rating Popularized in Chess
    - Judges Teams/Players From Head-to-Head Results
    - Fivethirtyeight Uses Elo Ratings to Forecast Outcomes
  - Elo in NFL
    - Every Team Has a Power Rating
    - Average is 1500
    - Winner Gains Points Equal to the Points Lost by the Loser
  - Formula for Odds of Team Winning

$$P(A) = \frac{1}{10^{-\frac{EloDiff}{400}} + 1}$$

RATING SPORTS TEAMS

- Rating Method by Fivethirtyeight
  - *EloDiff* is Based On a Few Things
    - Difference Between Team Ratings
    - Home Edge Adjustment Scaled by Distance Traveled
    - Rest Adjustment for Teams Coming Off a Bye Week
    - Playoff Adjustment (Favorites Tend to Dominate Underdogs)
    - Quarterback Adjustment (Due to Importance of this Position)
  - Dividing *EloDiff* by 25 Has Been a Good Estimate of Spread
  - Winning Team Gains Points Based on a Few Things
    - K-factor = Regulates How Quickly Ratings Change
    - Forecast Delta = Difference Between The Result and Predicted Probability
    - Margin of Victory Multiplier

FINAL INSPIRATION

If you don’t remember history,
you won’t know if you repeat it.

-Mahatma Mario