The Evolution of the National Basketball Association

Three Point Field Goals

Background

- NBA's 2017-18 Season saw new highs in:
  - TV ratings (rights deal valued at $24B over 9 yrs)
    - 3x increase over deal from prior term
  - Attendance (95% of all available tickets purchased)
  - Merchandise sales
  - Franchise valuations
  - Player salaries
- More capital at stake and more eyeballs on the league than ever before
  - Which factors contribute to winning?

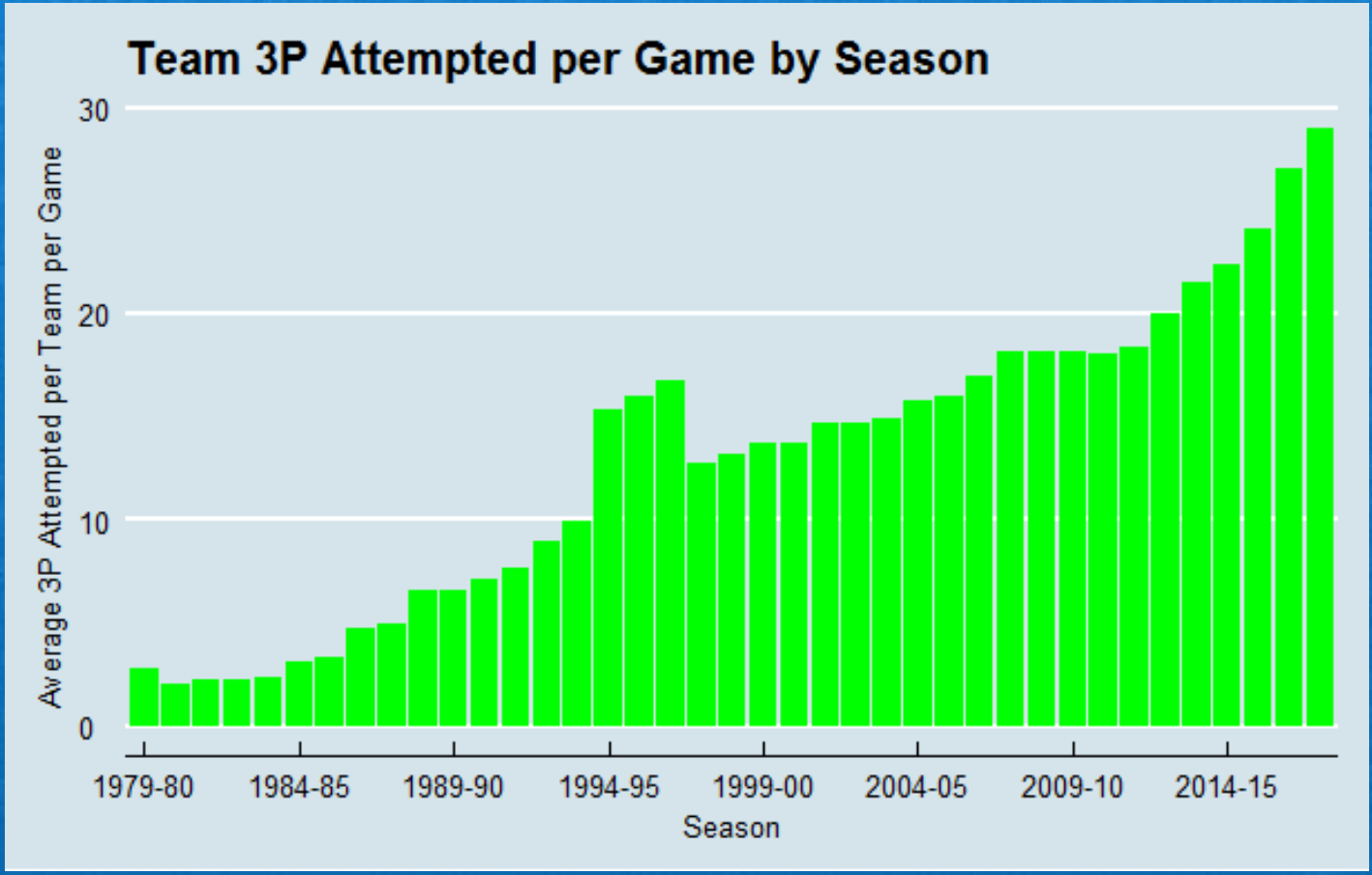
Dataset

- sports-reference.com
  - Aim to be the easiest-to-use, fastest, and most complete source for sports statistics
  - MLB, NBA, NHL, NFL, NCAAF, NCAAB, World Football
  - Incredibly detailed and well-organized
- Scraped NBA team data by team and season from 1946-47 season to 2017-18 season

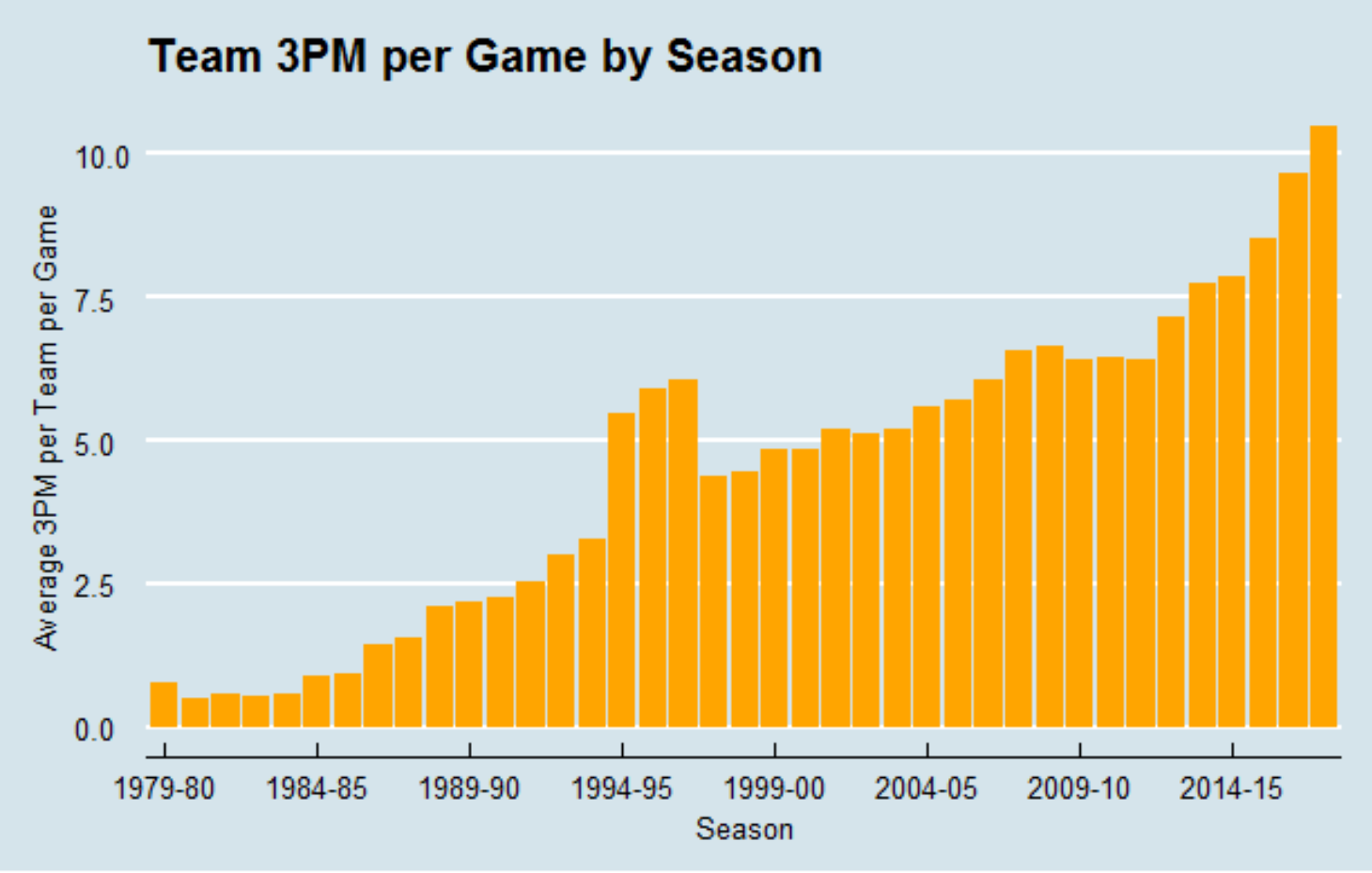
Data

- Season
- League (NBA, ABA, etc..)
- Team
- Wins
- Losses
- Average Player Age
- Average Player Height
- Average Player Weight
- Games
- Minutes
- Field Goals
- Field Goals Attempted
- FG Pct %
- Three Pointers
- Three Pointers Attempted
- Three Point Pct
- Two Pointers
- Two Pointers Attempted
- Two Point Pct
- Free Throws
- Free Throws Attempted
- Free Throw %
- Offensive Rebounds
- Defensive Rebounds
- Total Rebounds
- Assists
- Steals
- Blocks
- Turnovers
- Personal Fouls
- Points

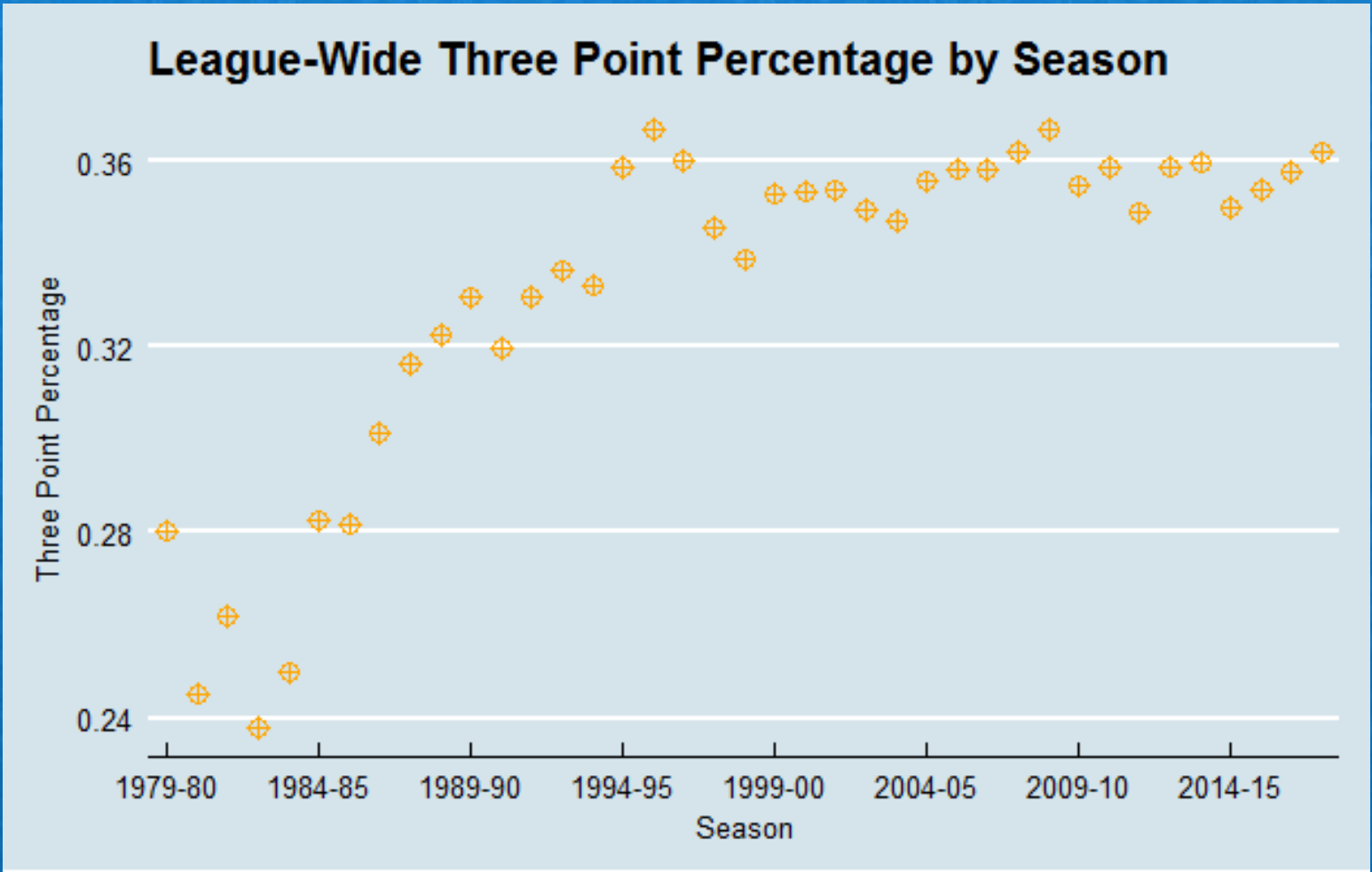
Three Pointers Attempted



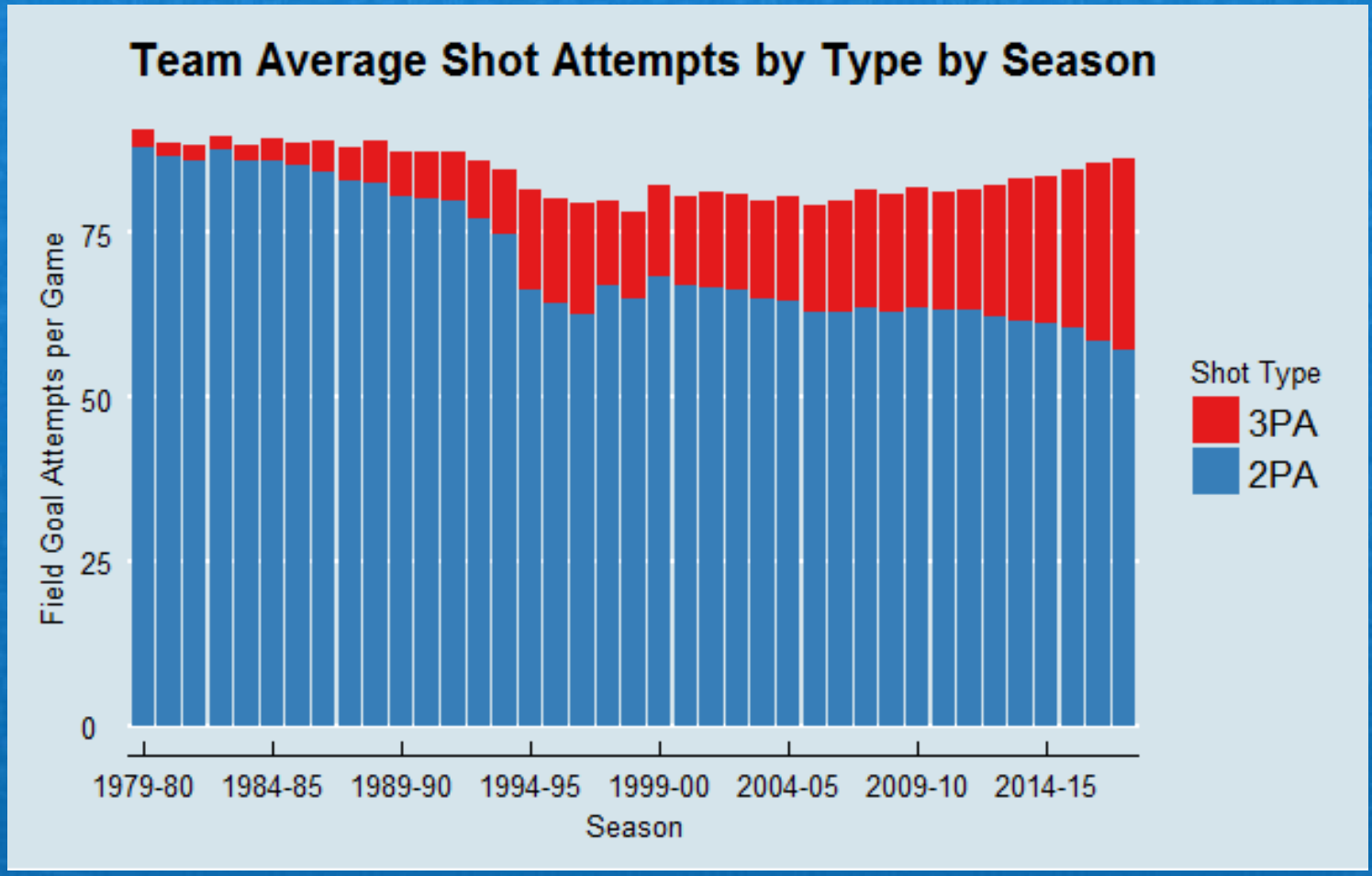
Three Pointers Made



Three Point Percentage



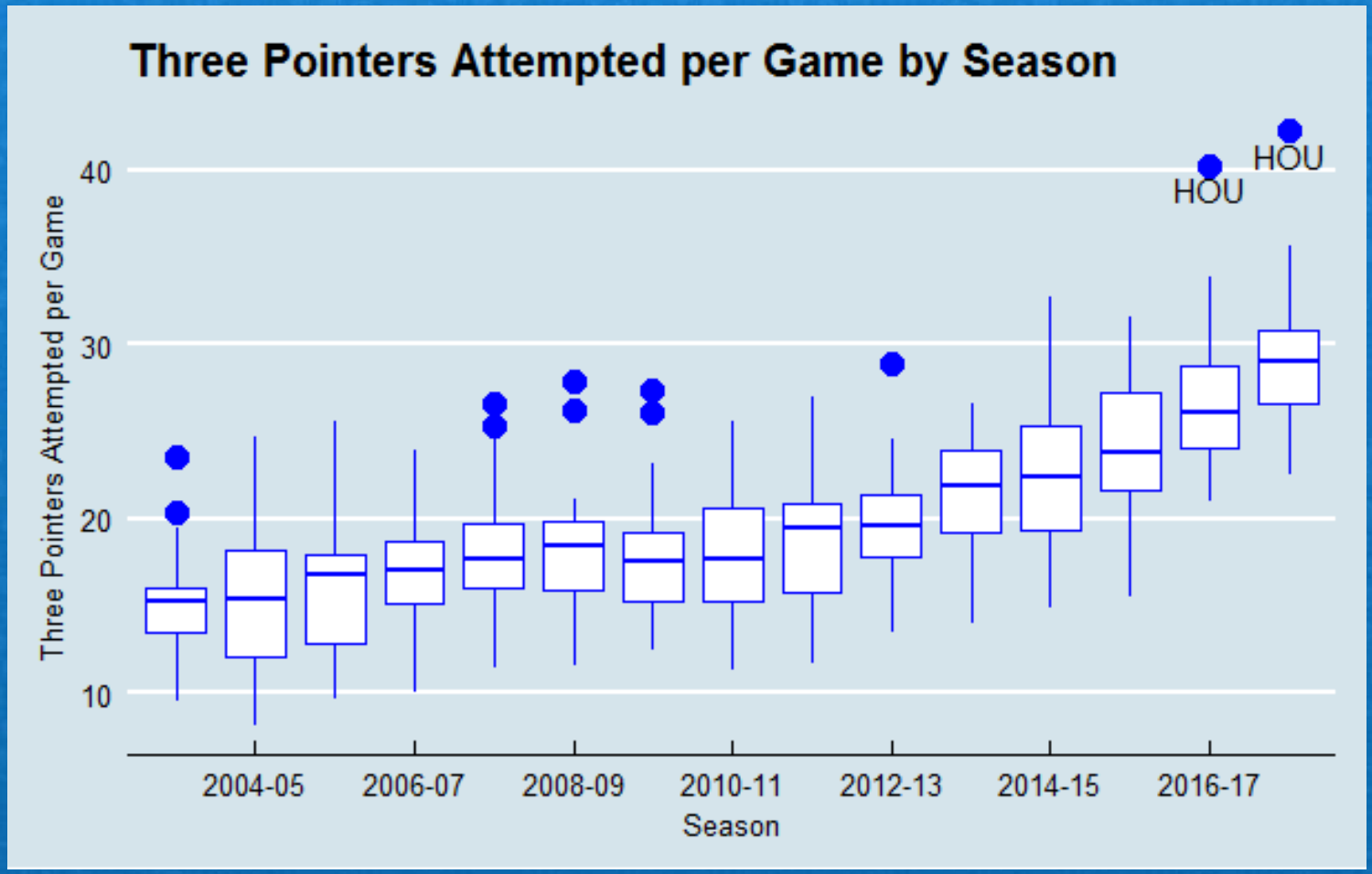
Shot Selection by Season



High Profile Example - Individual

- Stephen Curry
  - Drafted by Golden State Warriors in 2009
  - 2012-13: 272 3PM (5th most all-time)
  - 2014-15: 286 3PM (3rd most all-time)
  - 2015-16: 402 3PM (1st all-time)
  - 2016-17: 324 3PM (2nd most all-time)
  - 3x NBA Champion (2015, 2017, 2018)
  - 2x NBA Most Valuable Player Award
  - 5yr/$201M contract signed on 7/1/17

High Profile Example - Team



High Profile Example - Team

- Daryl Morey
  - General Manager of the Houston Rockets
  - Northwestern CS, MIT Sloan MBA, Parthenon
  - Basketball philosophy heavily reliant on analytics
  - Creator of "True Shooting Percentage" metric:
    - TS% = $\frac{PTS}{2\ (FGA+(0.44\ X\ FTA))}$ X 100
  - Co-founder MIT Sloan Sports Analytics Conference
  - Houston Rockets 2017-18 league-leading 65 wins
    - James Harden 2017-18 NBA MVP
      - 265 3PM in 2017-18 (9th all-time)
      - Signed 5yr/$200M extension on 7/8/17

Hypothesis Testing

- League-wide, is this a good strategy?

- Is there a statistically significant difference in mean winning percentage for teams that launch an above median amount of three-pointers as compared to those below the median?
  - Yes! ($p = 0.038$)

Hypothesis Testing

- Do these teams make three-pointers at a higher rate?

- Is there a statistically significant difference in mean three point shooting percentage between these two groups?
  - No! ($p > 0.05$)
    - Group Above Median 3PA: 35.6%
    - Group Below Median 3PA: 35.4%

Hypothesis Testing

- What other advantages do teams gain when merely *attempting* three-pointers at a higher rate?

- Is there a statistically significant difference in mean *two-point shooting percentage* between the two groups?
  - Yes! (p: 0.01)
  - What's going on here?

Hypothesis Testing

- Intuition:
  - Teams that attempt three-pointers at a higher rate, while not necessarily converting three-point attempts at a higher rate, draw defenses farther away from the basket
  - This “spacing out” of the defense may contribute to higher percentage two-point field goal attempts
- Further analysis would be needed to verify this claim

Additional Testing

- Claim: Teams that shoot more three-pointers, attack the basket less, and shoot less free throws as a result.
  - False (p = 0.59) 22.8 FTA/gm vs. 22.7 FTA/gm
- Claim: Teams that shoot more three-pointers score more points
  - True (p = 0.003) 104.8 ppg vs. 102.5 ppg
- Claim: As players age, they become less athletic and rely more heavily on three-point shooting
  - False (p = 0.4286)
- Claim: Teams that shoot more three-pointers have more "long rebounds" resulting in more offensive rebounds
  - False (p = .8967) 10.2 ORB/gm vs. 10.4 ORB/gm

Further Work

- Player Level Analysis
  - Group Interaction
- Salaries
- Spacial Data
  - SportVU
- Tanking
  - Sam Hinkie
  - Philadelphia 76ers