Percentile Differences in Three Point and Long Two Point Attempts

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Background

- Increasing three point shots and decreasing mid range shots over time
- How replaceable three point shots are by high percentage mid range shooters?

Expected Points of a Shot

- Taking shooting percentage of different types of shots as the probability of making that type of shot
- We can find the expected point of a shot by multiplying that percentage by either 2 or 3.

Data and Methods

- Using play by play and player box score data
- Find the expected value of long mid-range and three point shots with the given shooting percentages of each player
- Rank the shooting percentages of each player within their percentiles to see how the quintiles of mid-range and three point shots compare in the expected points they produce

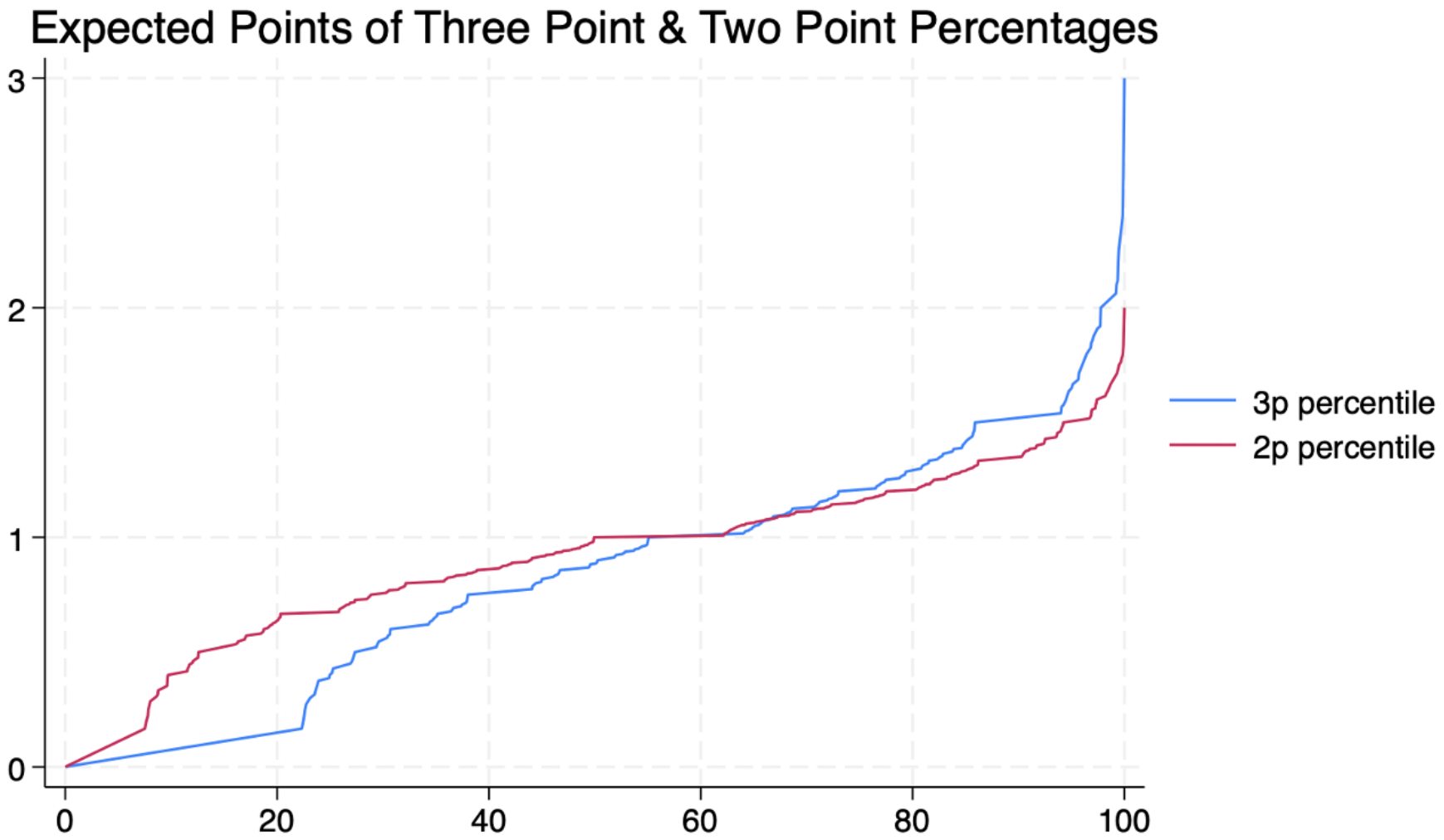
Data

- The player box score does not include distance of shot, so it is used to compare the baseline two point and three point expected points
- The play by play data includes shot distance where short two pointers are taken to be shots less than 8 ft. and mid-ranges are shots above 8 ft.
- Separate close and mid-range expected points can be compared to three point shots

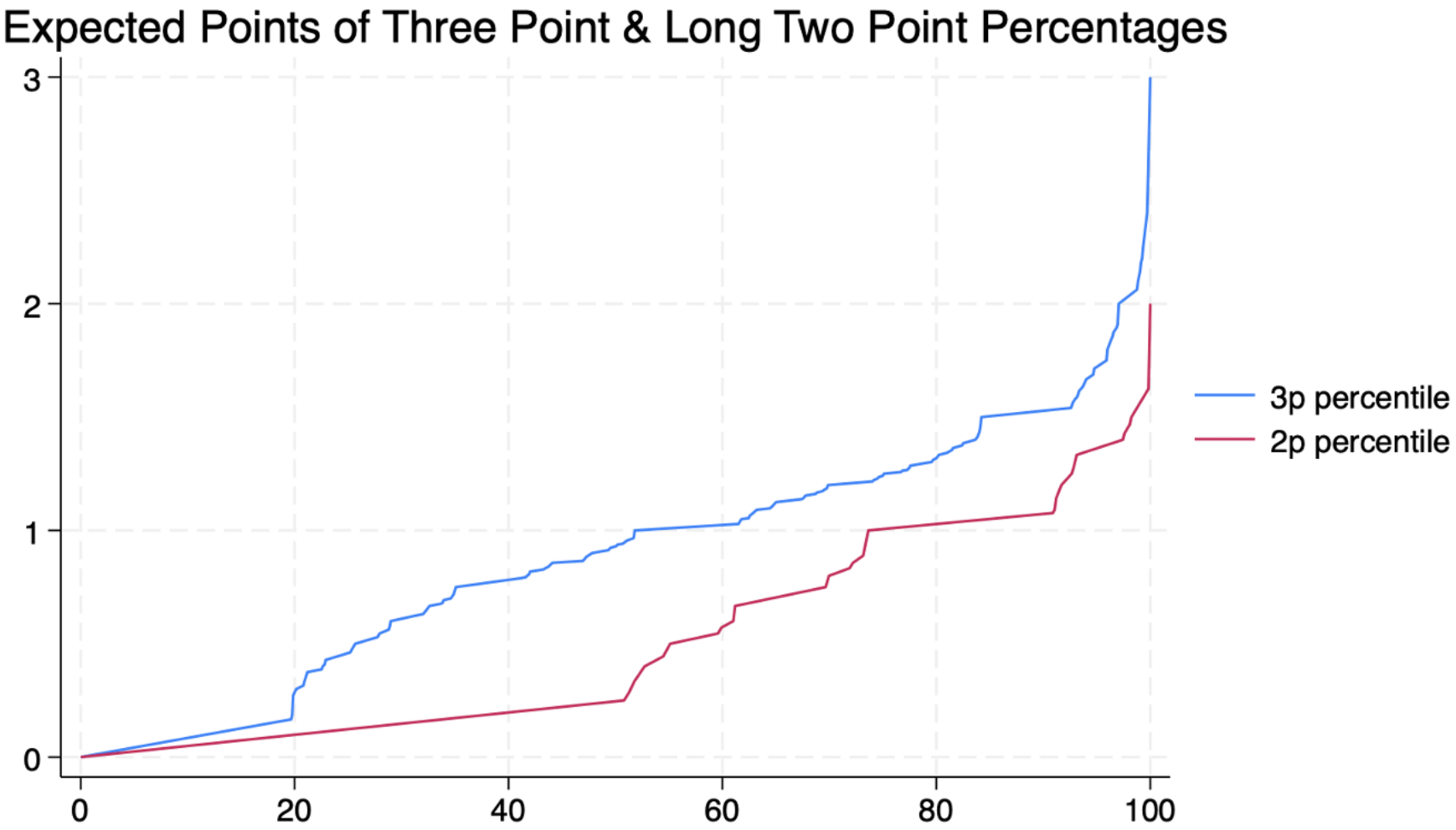
Initial Summary Statistics

- Of the play by play data:
- 16246 total two point attempts
  - 0.512 total percent
- 14198 close attempts
  - 0.534 total percent
- 2047 long two point attempts
  - 0.360 total percent
- 11490 total two point attempts
  - 0.336 total percent

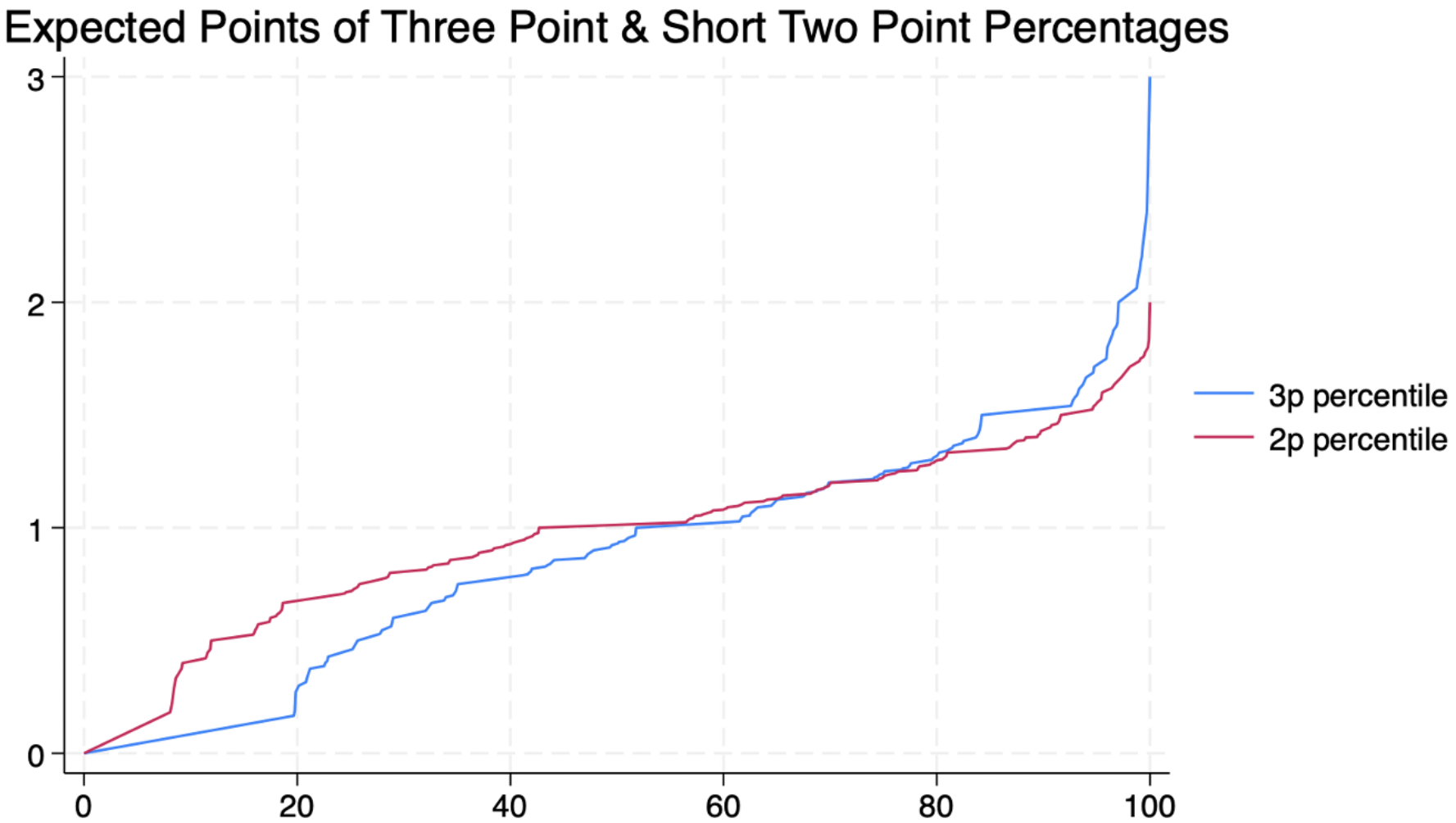
Results


Expected Points of Three Point & Two Point Percentages
3
2
1
0
0
20
40
60
80
100
3p percentile
2p percentile

Results


Expected Points of Three Point & Long Two Point Percentages
3
2
1
0
0
20
40
60
80
100
3p percentile
2p percentile

Results


Expected Points of Three Point & Short Two Point Percentages
3
2
1
0
0
20
40
60
80
100
3p percentile
2p percentile

Results

- Long two point attempts are inefficient hence why there is a big decrease in their usage
- Short two point attempts are closer in following trends of total two point attempts than long two point attempts
- 50th percentile three point shooter's expected points can be replicated by around a 70th percentile two point shooter with long twos.

Player Impact Implications

- Shooting percentage is not the only indicator of player impact when shooting from different distances
- Many different actions in basketball; hence the impact two pointers and three pointers can have are not limited by their percentages
- One metric we can use is PIPM which, without its luck adjustment factor, is a linear summation of different /36 stats with their coefficients to create a player impact metric (Goldstein 2019).

Difference of Shot Types with PIPM

- Since PIPM is a linear sum, the difference in the player impact of shooting a three pointer or a long two pointer is simply subtracting the impact created by these two actions

$$1.634 \cdot 3 \cdot \alpha - 0.75\alpha - (1.634 \cdot 2 \cdot \beta - 1.101\beta) \quad (1)$$

- Where 1.634, -0.75, -1.101 are the points scored, 3pa/36, 2pa/36 coefficients and α, β are the three point and two point percentages (Goldstein 2019).
- Long range two point attempts are even more inefficient in their impact than before due to the coefficients and cost of attempts

Limitations, Impact, and Room for Future Study

- The biggest limitation is with the lack of impact of defensive coverage and the types of shots and their effects on the shooting of players
- Optimization of how much each shot type should be taken based on players, teams, opponents' shooting, offensive and defensive metrics

References

- Goldstein, J. (2019, March 29). *Player Impact Plus-Minus.* Basketball Index. https://www.bball-index.com/player-impact-plus-minus/

End

- Thanks for listening!