



# Basketball V



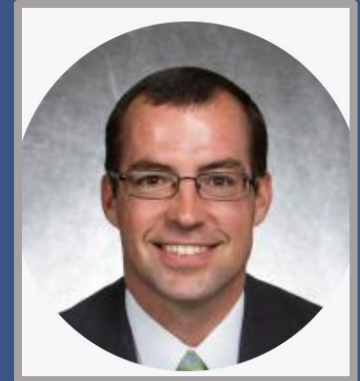
Produced by Dr. Mario  
UNC STOR 538





# Racial Prejudice of NBA Officials

- Article: *Racial Discrimination Among NBA Referees*
  - Author 1: Joseph Price from Cornell (PhD)
  - Author 2: Justin Wolfers from UPenn (Professor)
  - Claim: More Personal Fouls for Players Officiated by a Refereeing Crew of Different Race
- Breakdown of Refereeing Crew
  - Three Officials and Four Classifications
  - Black Official on Black Player
  - White Official on White Player
  - White Official on Black Player
  - Black Official on White Player

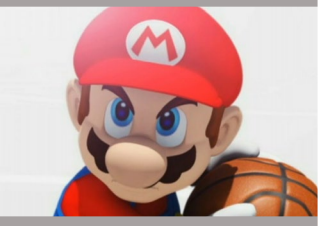




# Racial Prejudice of NBA Officials

- Dataset for Referee Bias

Game	Whites	Ref. 1	Ref. 2	Ref. 3	Black minutes	White minutes	Black ref./ Black player	White ref./ White player	White ref./ Black player	Black ref./ White player
1	1	1	0	0	396.8463	83.153734	35	1	6	10
2	2	1	1	0	283.9803	196.01969	14	14	20	8
3	2	1	1	0	274.5583	205.44166	6	14	14	9
4	3	1	1	1	369.2381	110.76186	0	9	38	0
5	3	1	1	1	387.8274	92.172632	0	8	44	0
6	2	1	1	0	350.3648	129.63517	12	6	18	6
7	3	1	1	1	342.2891	137.71092	0	19	35	0
8	2	1	1	0	315.0947	164.90532	9	9	26	5
9	2	1	1	0	337.8692	142.13078	10	11	24	9





# Racial Prejudice of NBA Officials

- Fouls Per 48 Minutes
  - Summary Table

	White Player	Black Player
White Referee	1.665	1.454
Black Referee	1.708	1.423

- Estimation:
  - 9,024 Fouls Called by Black Officials Against Black Players
  - 310,413 Minutes for Black Players When Black Official on Court

$$\text{Fouls Per 48 Minutes} = \frac{9,024}{310,413} \times 48 = 1.423$$





# Racial Prejudice of NBA Officials

- Regression Approach of Price and Wolfer

- Data Gathered

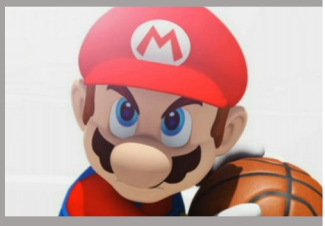
- Fouls Per 48 Minutes (F)
    - Race of Player (R)
    - Percentage of Game Officials Who are White (W)

- Model to Predict Fouls Per 48 Minutes

$$E[F] = 5.1 - 0.763 \times R - 0.204 \times W + \underline{0.182 \times R \times W}$$

Interaction

- All Parameters are Statistically Significant
- Possible Values for R: White=0 & Black=1
- Possible Values for W: 0, 1/3, 2/3, 3/3





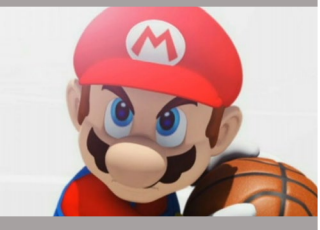


# Racial Prejudice of NBA Officials

- Regression Approach of Price and Wolfer
  - Table Showing Predicted Rates for All Scenarios

Predicted Foul Rate per 48 Minutes

%Whitereferees	Blackplayer = 1	Blackplayer = 0	Black-White Rate
0	$5.10 + .182(0)(1) - .763(1) - .204(0) = 4.337$	$5.10 - .204(0) = 5.1$	-0.763
1/3	$5.10 + .182(1/3)(1) - .763(1) - .204(1/3) = 4.329$	$5.10 - .204(1/3) = 5.032$	-0.702
2/3	$5.10 + .182(2/3)(1) - .763(1) - .204(2/3) = 4.323$	$5.10 - .204(2/3) = 4.964$	-0.642
1	$5.10 + .182(1)(1) - .763(1) - .204(1) = 4.315$	$5.10 - .204(1) = 4.896$	-0.581

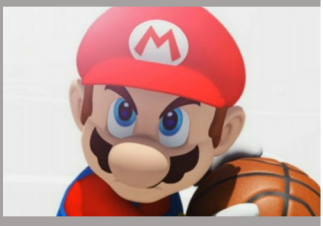




# Fixing College Basketball Games

- Justin Wolfers

- Professor of Public Policy at Wharton
- Claimed 5% of College Basketball Games are Fixed
- Players Intentionally Play Worse (Point Shaving)
- Is This Claim Defensible or is Justin Salty Because UPenn Ain't Making it to the Tournament?



- Assumptions for Point Spreads

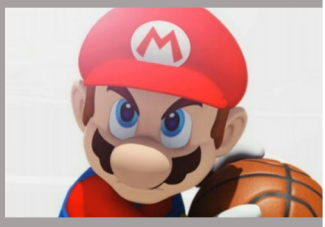
- Prediction Errors are Evenly Distributed Around 0 (Unbiased and Symmetric)
- Let  $X$  = Point Spread of Favorite and  $E[X] = 7$
- Consider Intervals:  $A=(1,6)$  &  $B=(8,13)$
- We Expect That Over a Long Period...

$$P(X \in A) \approx P(X \in B)$$





# Fixing College Basketball Games



- Justin's Discovery of the Serious Conspiracy
  - Considered Games Where a Team was Favored by More than 12 Points (Strong Favorites)  
Forecast Errors Not Symmetrically Distributed
  - 46.2% of the Time, Favorite Won by Less Points
  - 40.7% of the Time, Favorite Won by More Points
  - The 5.5% Difference Due to Players Cheating?
- Problem With This Conclusion
  - Spreads Change as People Make Bets
  - Therefore, Closing Spreads May not Represent the Actual Expectation of the Spread





# Fixing College Basketball Games

- General Notation

- Let  $X$  = Point Spread of Favorite and  $E[X] = S$
- Consider Intervals:  $A=(1,S-1)$  &  $B=(S+1,2S-1)$

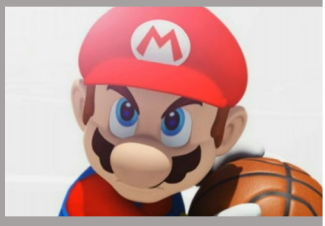
- Rebuttal by Heston and Bernhardt

- Examined Strong Favorites Where the Spread Increased from the Opening Line
- More Betting on the Favorite Causes this Increase Which Would Lead to a Lack of Incentive for Point Shaving

$$P(X \in A) = 45.15\% > 39.54\% = P(X \in B)$$

- Examined Strong Favorites Where the Spread Decreased from the Opening Line
- More Betting on the Underdog Causes this Decrease Which Would Lead to an Incentive for Point Shaving

$$P(X \in A) = 45.12\% > 39.54\% = P(X \in B)$$





# Fixing College Basketball Games

- Conclusion

- Discrepancy Existed Under Both Scenarios
- Indicates Another Reason For This Phenomenon
- Strong Favorites May Actually Care About Winning the Game More Than They Care About Making Vegas Happy
- Teams Leading By a Wide Margin May Relax the Increase in Points and Focus on Defense and Slowing the Game Down





# Final Inspiration

The greatest thing that happened  
to Cleveland is the worst thing  
that happened to LeBron James.

- Mahatma Mario