

# The Impact of COVID-19 on Sports Betting Markets



**Tauhid Zaman**

Associate Professor of Operations Management

Joint work with Khizar Qureshi

# COVID-19

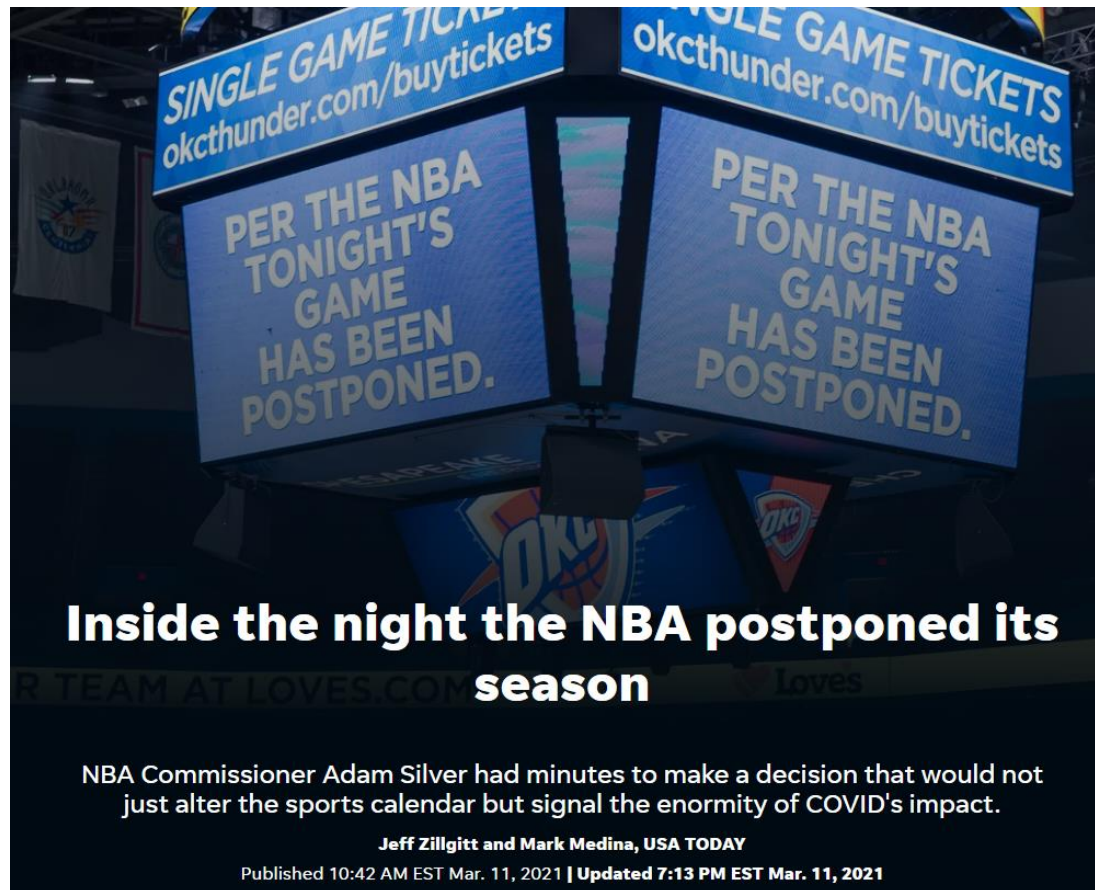
- COVID-19 pandemic spreads through the world in early 2020
- Millions dead
- Economies shut down



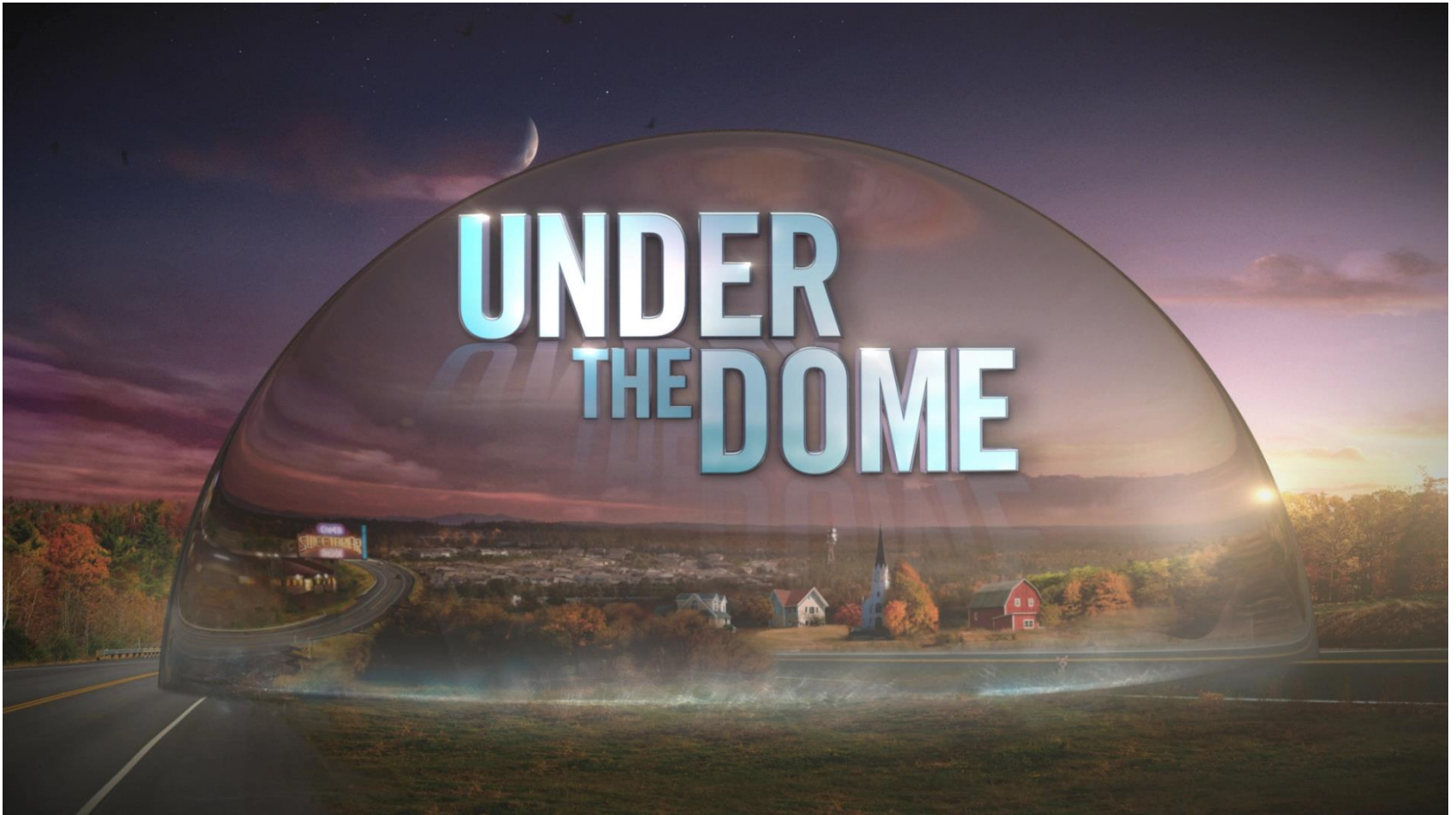
# Covid-19 and Sports

- All major sports had their seasons affected by COVID-19
- Some sports suspended their seasons
- Some sports had their seasons delayed
- All sports played with limited audiences
- No consistent policy

# Covid-19 and the NBA



# NBA Bubble





# NBA Bubble

## NBA bubble, explained: A complete guide to the rules, teams, schedule & more for Orlando games

WRITTEN BY  
**TADD HAISLOP**

[@taddhaislop](#)



# “Fans” in the Bubble



# Champions in the Bubble

Final Seconds of 2020 NBA Finals Game 6 | Lakers Celebration | Lakers vs Heat





# Covid-19 and the NHL

NEWS

## NHL to pause season due to coronavirus

'Goal is to resume play as soon as it is appropriate and prudent,' Commissioner Bettman says

NHL.com @NHLdotcom

🕒 March 12, 2020



# Covid-19 and MLB

## *M.L.B. Pushes Back Opening Day Over Coronavirus Concerns*

Amid fears over the coronavirus pandemic, the league announced that all spring training games would be halted and the start of the season would be delayed by at least two weeks.



# Covid-19 and the NFL

**GAMES** | DEC. 1, 2020

## The NFL Is Too Big to Let COVID Stop It

*By Will Leitch*

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NFL Commissioner Roger Goodell. Photo: Andy Lyons/Getty Images

# Covid-19 and the NFL





# Sports Betting Markets

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- Multiple bet types
  - Moneyline, point spreads, prop bets, parlays, ...



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# Moneyline Bets

LOS ANGELES  
LAKERS

VS

TORONTO  
RAPTORS



-130

MONEYLINE

+110



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- $UPM = \text{average profit per game made when betting \$1 on the underdog}$

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$$\text{UPM} = -1 + \frac{1}{n} \sum_{u=1}^n \frac{W_u}{p_u}$$

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- Market with many upsets:  $p_u < q_u$

$$\mathbf{E}[\text{UPM}] > 0$$



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- What sports had their UPM affected the most?
- If the UPM was positive, why was this the case?

# Moneyline Data

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	Number of Games	Start Date	End Date
MLB	27,239	2010-04-04	2020-10-27
NBA	14,058	2007-10-30	2021-03-04
NCAAB	45,510	2007-11-05	2021-02-16
NCAAF	8,656	2007-08-30	2020-09-26
NFL	2,935	2007-09-06	2021-02-07
NHL	13,275	2007-09-29	2021-03-22

# COVID-19 Games

- We designated certain games as “COVID-19” if they were played during the pandemic

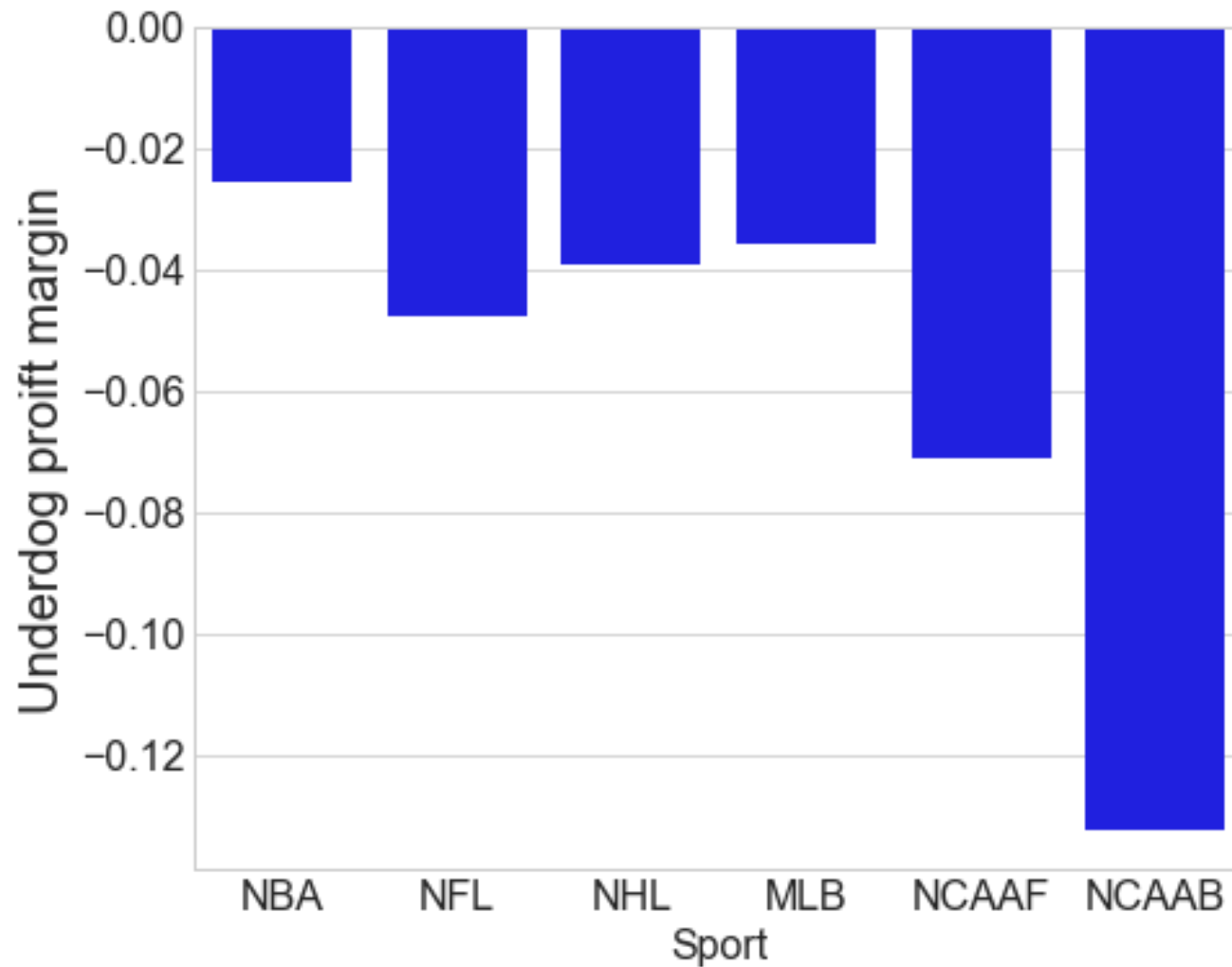


# COVID-19 Games

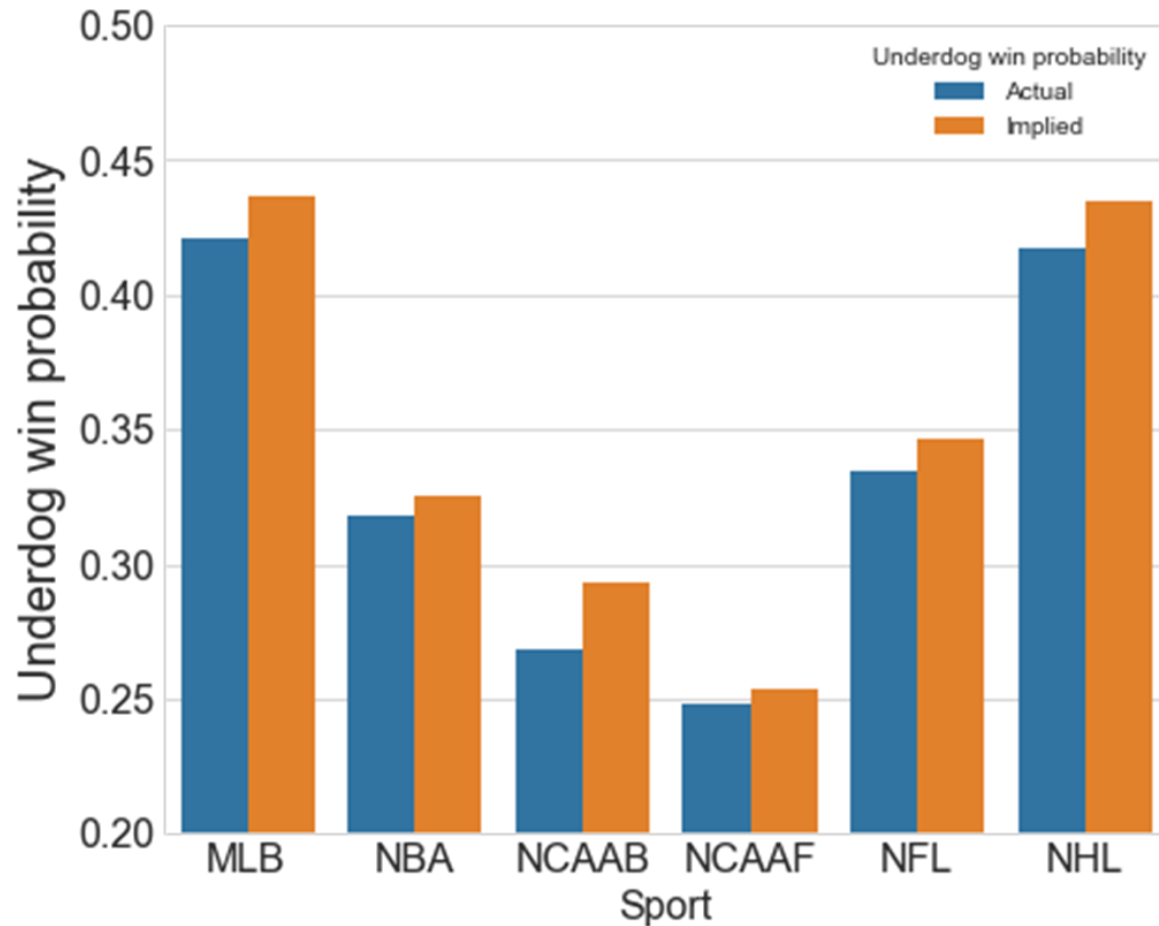
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	Number of COVID-19 Games	COVID-19 Games Start Date
MLB	944	2020-07-23
NBA	705	2020-07-30
NCAAB	3,782	2020-11-25
NCAAF	699	2020-09-03
NFL	269	2020-09-10
NHL	616	2020-08-01

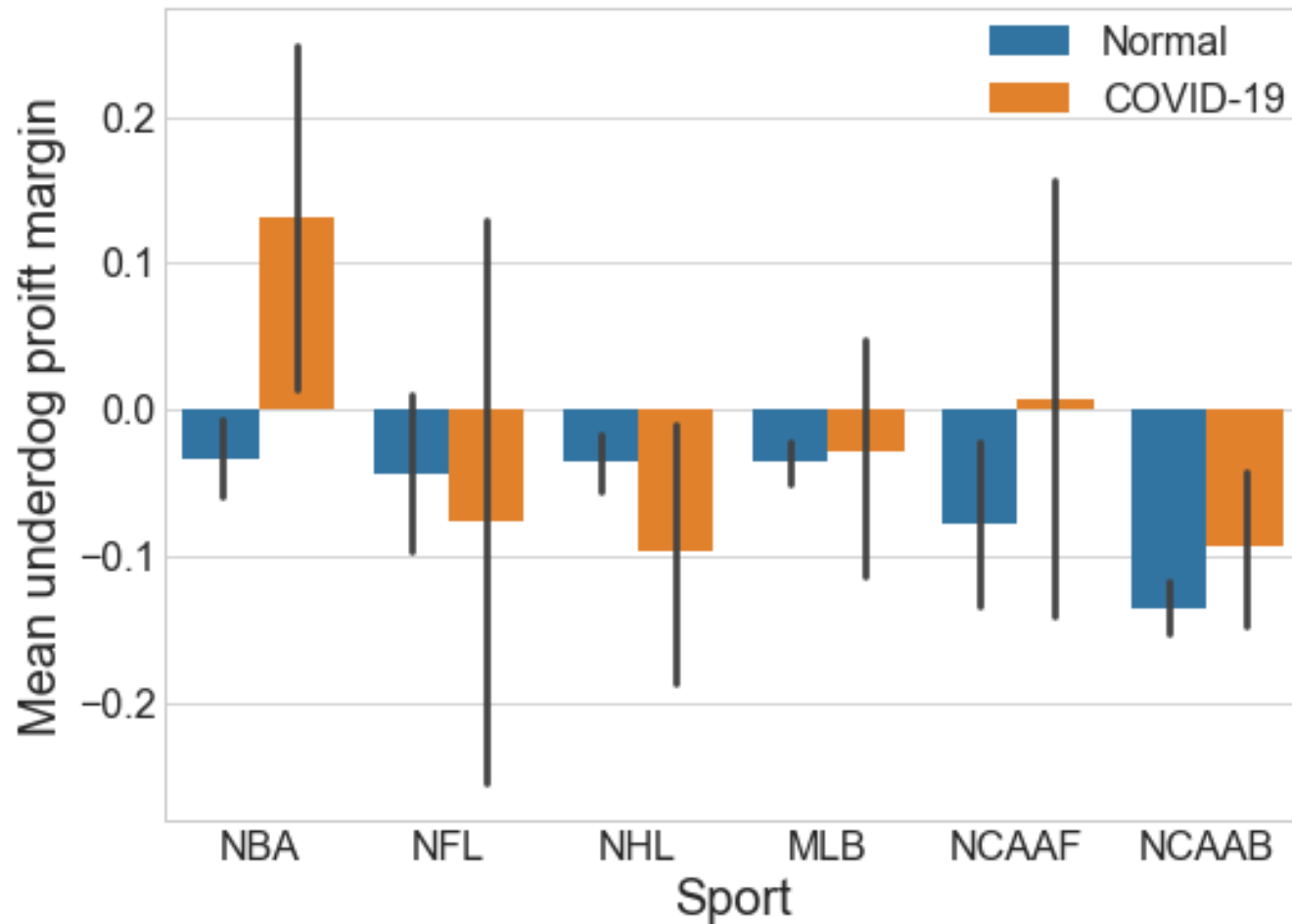
# UPM: All Sports



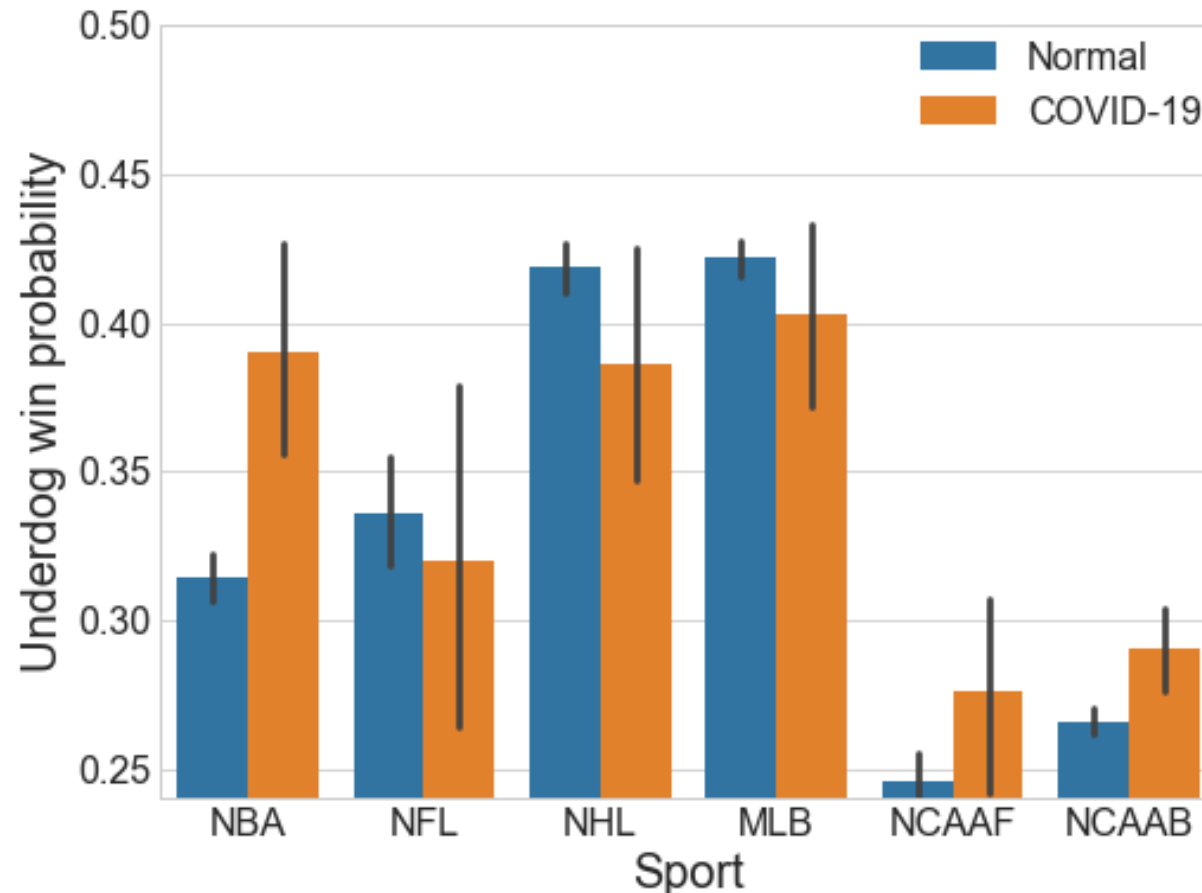
# Underdog Win Probability: All Sports



# UPM and COVID-19: All Sports



# Underdog Win Probability and COVID-19: All Sports



# UPM Across Sports

- UPM is negative in normal times for all sports
- During COVID-19, only the **NBA** had a significant positive UPM



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2. Check for games with high underdog odds
3. Check if anyone was injured on the underdog team
4. Place bets on underdogs with high odds and no injuries

# Daily Betting Protocol

**BOVADA**

SPORTS CASINO LIVE DEALER POKER HORSES

\$ 0.00

Trending Events

- NFL
- College Football
- NBA
- College Basketball
- NHL
- MLS Playoffs
- Spain La Liga
- England Premier League
- Davis Cup
- Esports
- #whatsyawager
- Props Builder

Game Lines NBA American Odds

NBA - NEXT EVENTS ^

Basketball - NBA (4)

		Spread	Win	Total
11/28/21 9:30 PM	Detroit Pistons	+10.0 (-115)	+360	O 213.0 (-110)
	Los Angeles Lakers	-10.0 (-105)	-500	U 213.0 (-110)
11/29/21 8:00 PM	Charlotte Hornets	+5.5 (-115)		O 224.0 (-110)
	Chicago Bulls	-5.5 (-105)		U 224.0 (-110)
11/29/21 8:00 PM	Oklahoma City Thunder	+2.0 (-110)		O 215.0 (-110)
	Houston Rockets	-2.0 (-110)		U 215.0 (-110)
11/29/21 9:00 PM	Portland Trail Blazers	+7.5 (-110)		O 222.0 (-110)
	Utah Jazz	-7.5 (-110)		U 222.0 (-110)

NBA - PROP BUILDER ^

Play Mini Games

BLACKJACK

BLACKJACK CLASSIC

777 DELUXE

LUCKY WHEEL

Balance \$0.00

BET SLIP


OPEN BETS

Playable Balance: \$ 0.00

Bet Slip is Empty


Not sure where to start?  
[Learn how to place a bet](#)

# Daily Betting Protocol



NFL ▾ NBA ▾ MLB ▾ NHL ▾ CFB ▾ MORE ▾ DFS ▾ BET ▾


Yahoo! Forums Tickets App ▾ Help



 Player Name


NBA HomeSeason ToolsPlayer NewsNBA BettingOddsColumnsVideosTeamsInjury ReportDepth ChartsStandingsPodcastContractsDFS



## NBA INJURY REPORT


Team: ALL ▾

**ATLANTA**

Name	POS	Status	Date	Injury	Returns
<a href="#">Bogdan Bogdanovic</a> 	SF	Sidelined	Nov 26, 2021	Foot	Week-to-week
<a href="#">Cam Reddish</a> 	SF	Sidelined	Nov 26, 2021	Wrist	Day-to-day
<a href="#">De'Andre Hunter</a>	SF	Sidelined	Nov 11, 2021	Wrist	Targeting late-January return
<a href="#">Onyeka Okongwu</a>	PF	Sidelined	Jul 21, 2021	Shoulder	Targeting mid-December return

**BOSTON**

Name	POS	Status	Date	Injury	Returns
<a href="#">Dennis Schroder</a> 	PG	Sidelined	Nov 26, 2021	Ankle	Day-to-day
<a href="#">Robert Williams</a> 	C	Sidelined	Nov 23, 2021	Illness	Day-to-day

**BROOKLYN**

Name	POS	Status	Date	Injury	Returns
<a href="#">Joe Harris</a>	SG	Sidelined	Nov 13, 2021	Ankle	Out indefinitely
<a href="#">Nicolas Claxton</a>	PF	Sidelined	Oct 26, 2021	Illness	Out indefinitely
<a href="#">Kyrie Irving</a>	PG	Sidelined	Sep 26, 2021	Medical Protocols	Out indefinitely

## NBA HEADLINES

DET: Killian Hayes (thumb) will play on Sunday

ATL: MRI confirms sprained left wrist for Cam Reddish

ATL: Bogdan Bogdanovic (ankle) out at least 2 weeks

IND: Caris LeVert nets season-high 23 points in blowout

MLW: Jrue Holiday posts 23/7/9 line in easy win

ORL: Mo Bamba (lower back) questionable for Monday

ORL: Cole Anthony (right ankle) ruled out for Monday

POR: Norman Powell (right quad) ruled out for Monday

GS: Stephen Curry lights up the Clippers for 33 points

MIA: Tyler Herro (soreness) questionable to play Monday

[MORE HEADLINES >](#)


'21-'22 NBA Season Tools: Play with confidence!


NBA Betting Tools: Edge Finder, Key Numbers & more!

On YouTube: Roundball Stew airing LIVE, analysis & more!

## PLAYER NEWS

NFL NBA CFB NHL MLB PL GOLF NAS

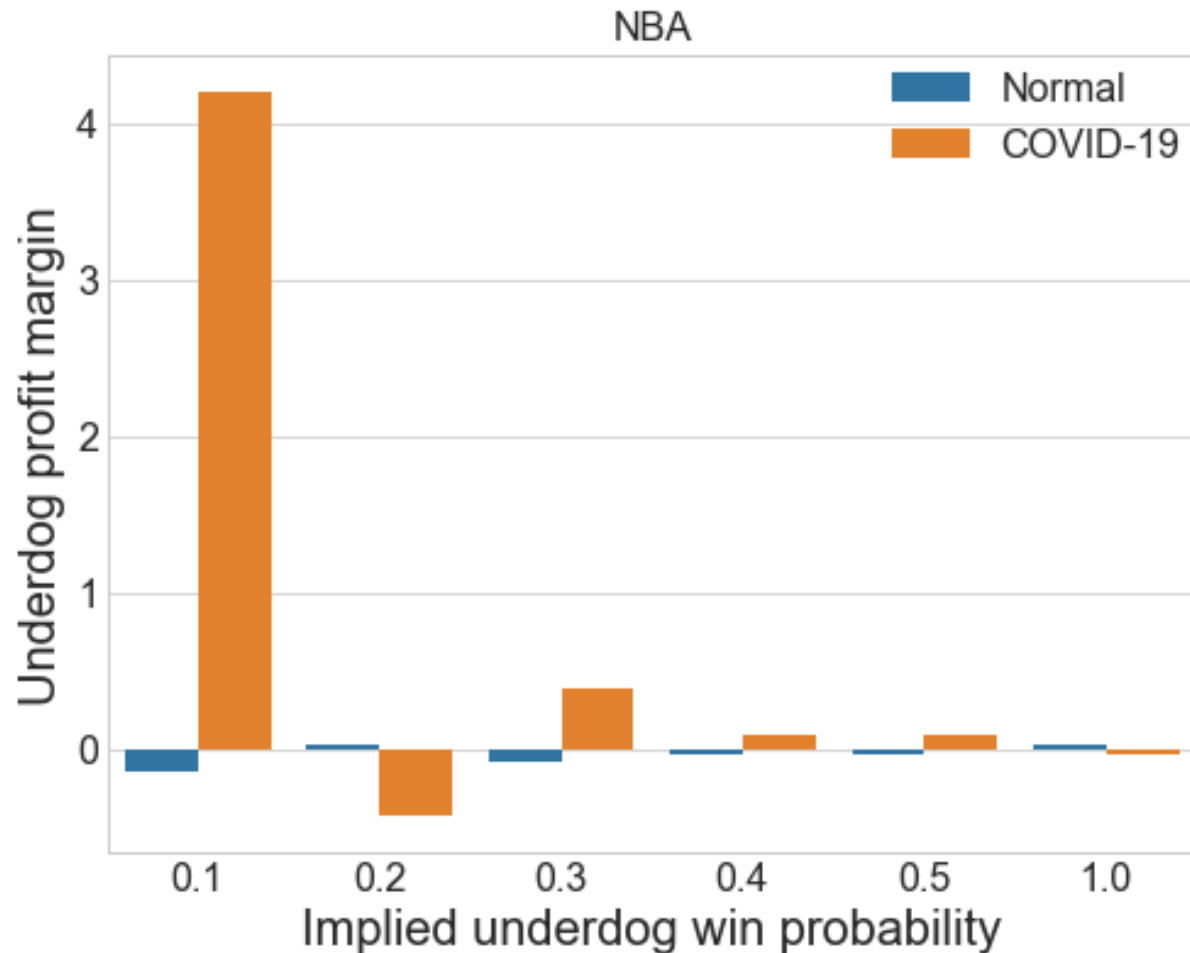
**KILLIAN HAYES**  
PG, DETROIT PISTONS



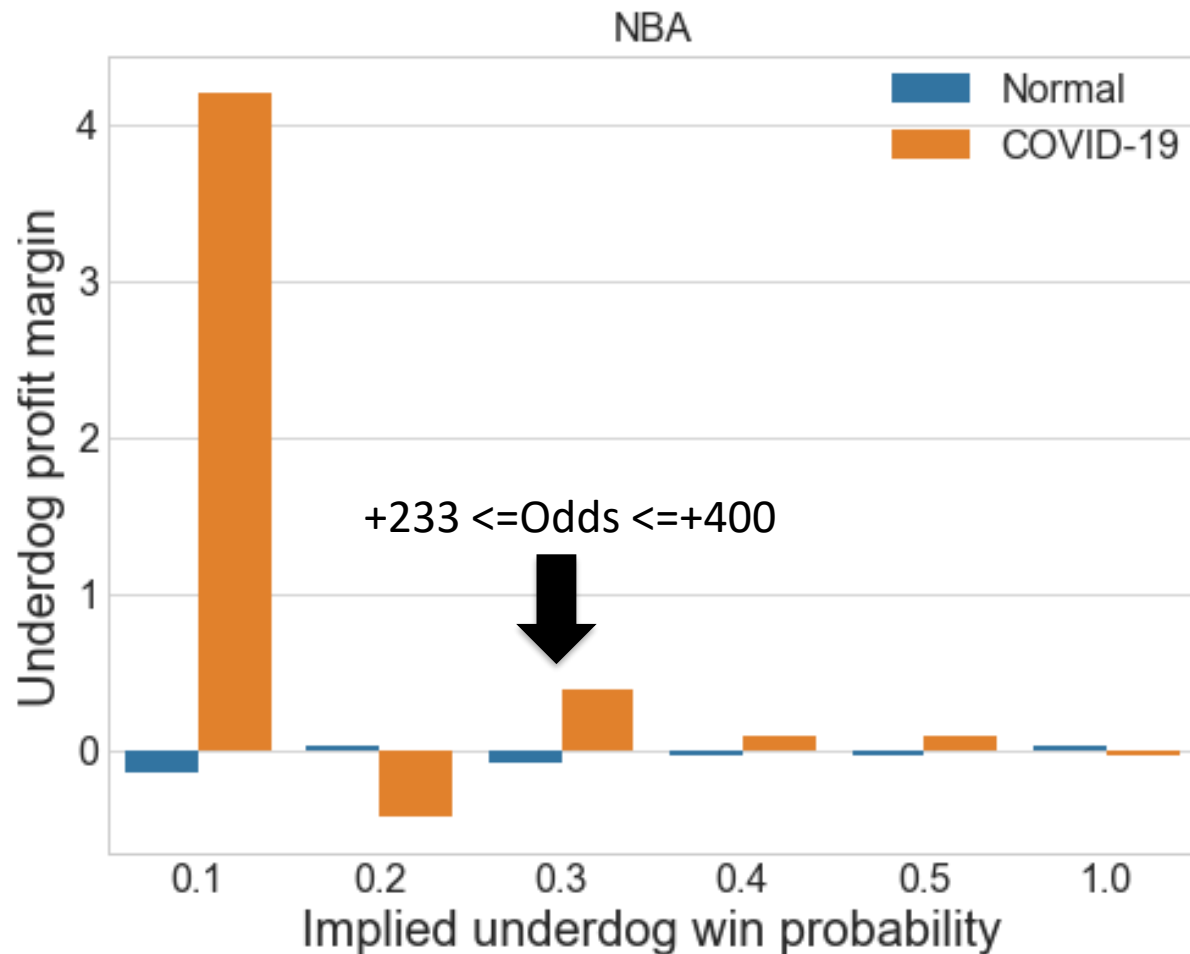
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# Which NBA Games Were Mispriced?

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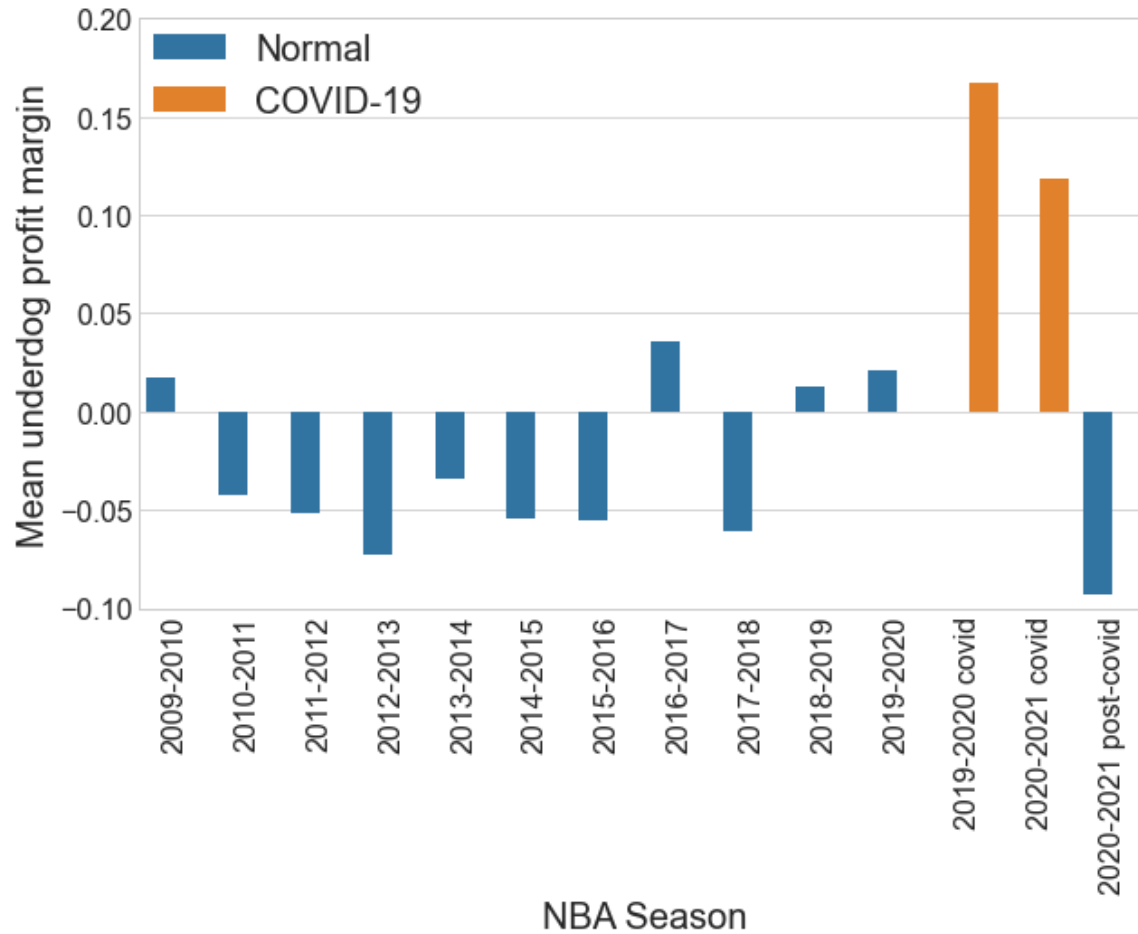
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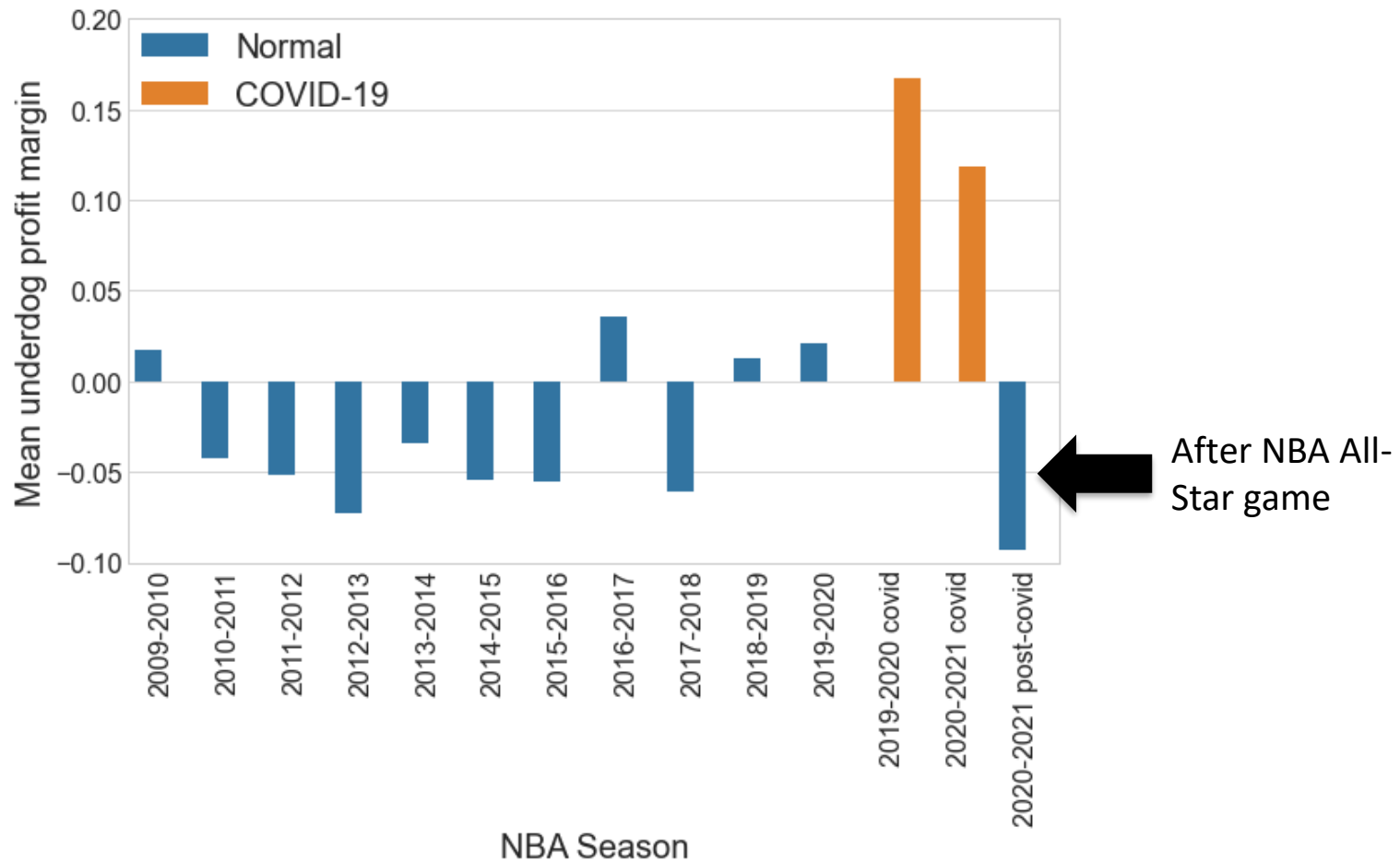


# NBA UPM vs Season

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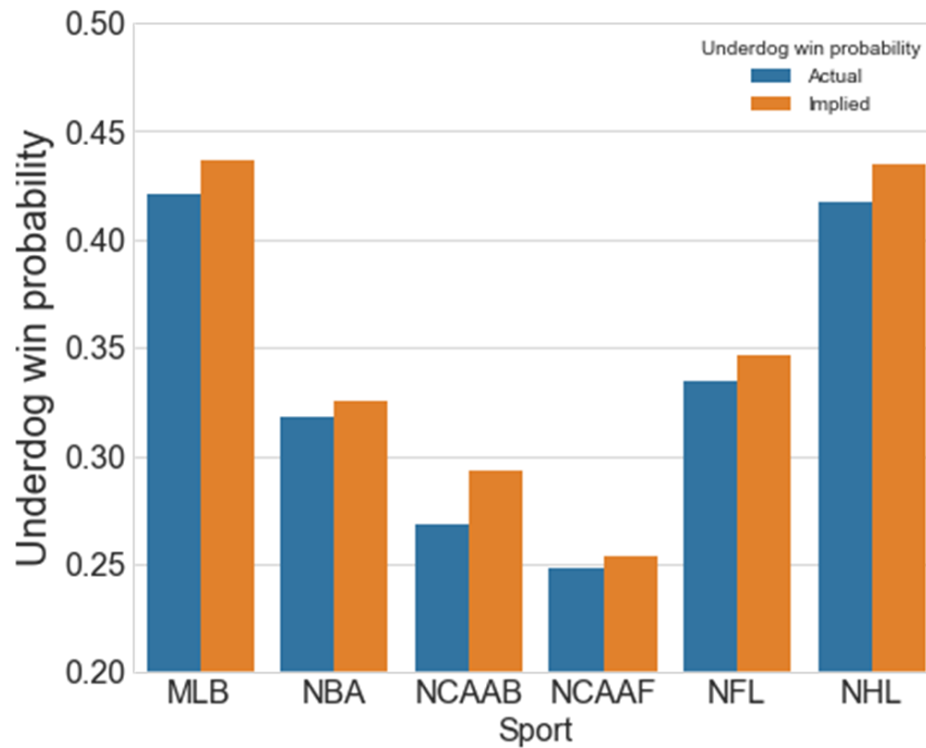


# NBA Market is Broken

- Most of the inefficiency came from games with underdog odds between +233 and +400
- The inefficiency went away after the All-Star Break

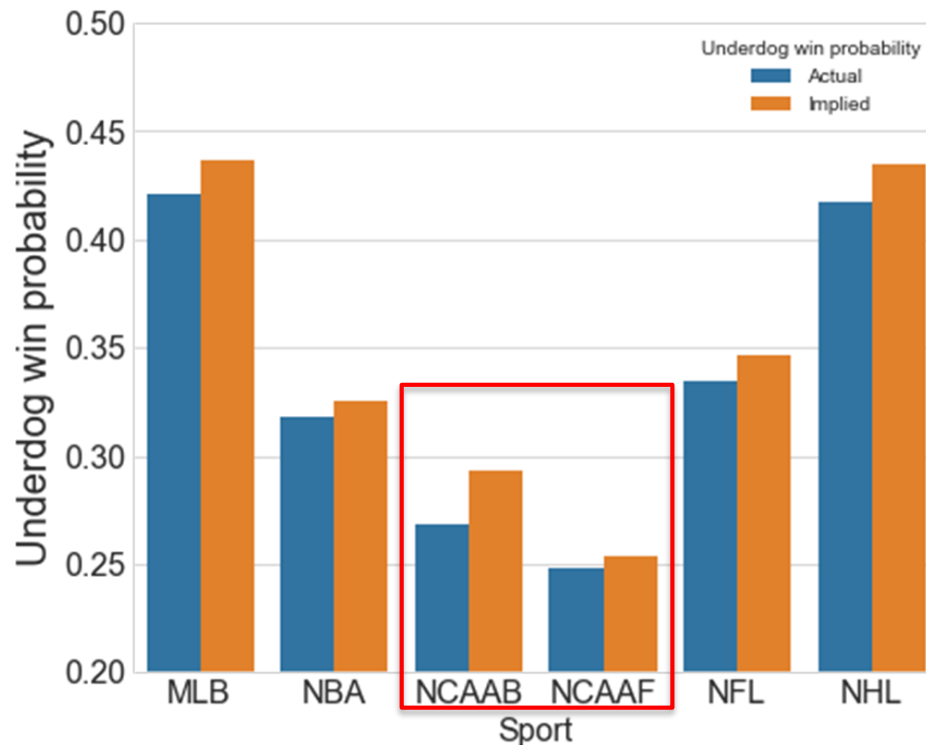
**WHY DID NBA MARKET BREAK  
DURING COVID-19?**

# Underdog Win Probability: All Sports



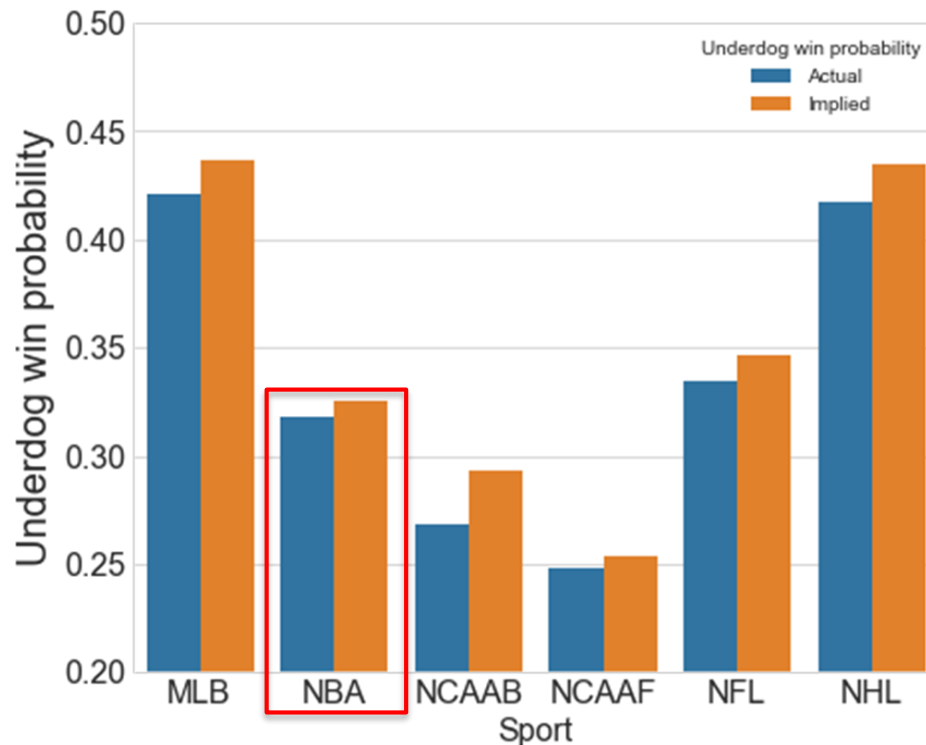
# Underdog Win Probability: All Sports

- Broad talent spread in college sports leads to fewer upsets (lower underdog win probability)



# Underdog Win Probability: All Sports

- Why does the NBA have so few upsets?
  - NBA has a narrow talent spread because it is a professional league





# Points Statistics of Sports

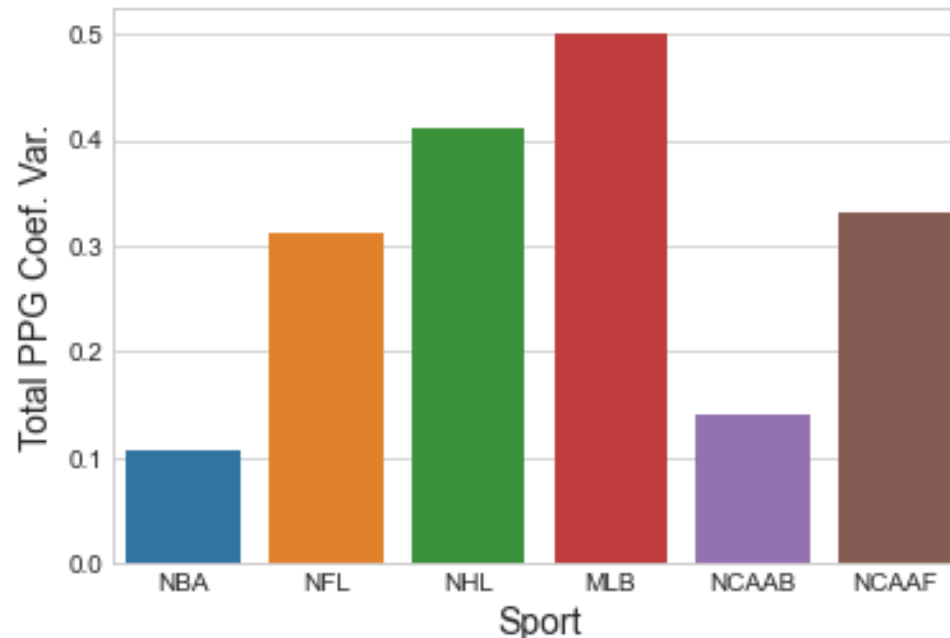
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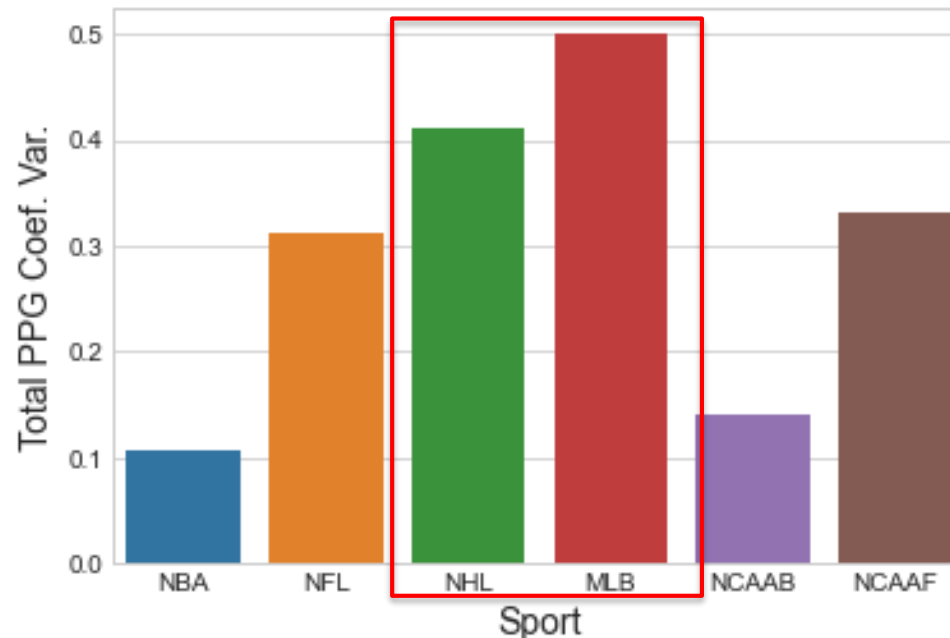
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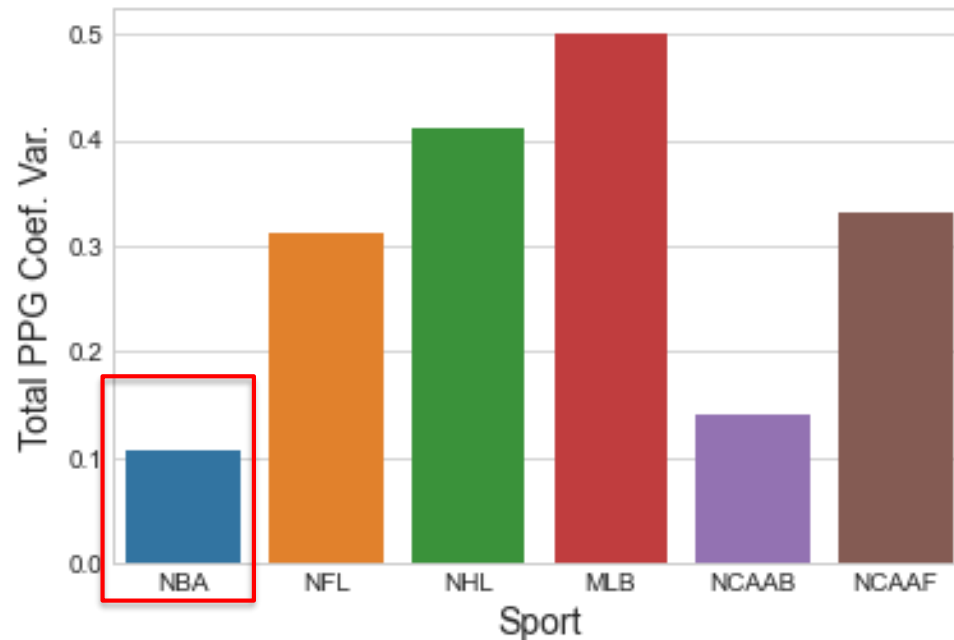
# Underdog Win Probability: All Sports

- MLB and NHL have highest coefficient of variation
  - Games in these sports are inherently more random
- This likely leads to more upsets



# Underdog Win Probability: All Sports

- NBA has lowest coefficient of variation
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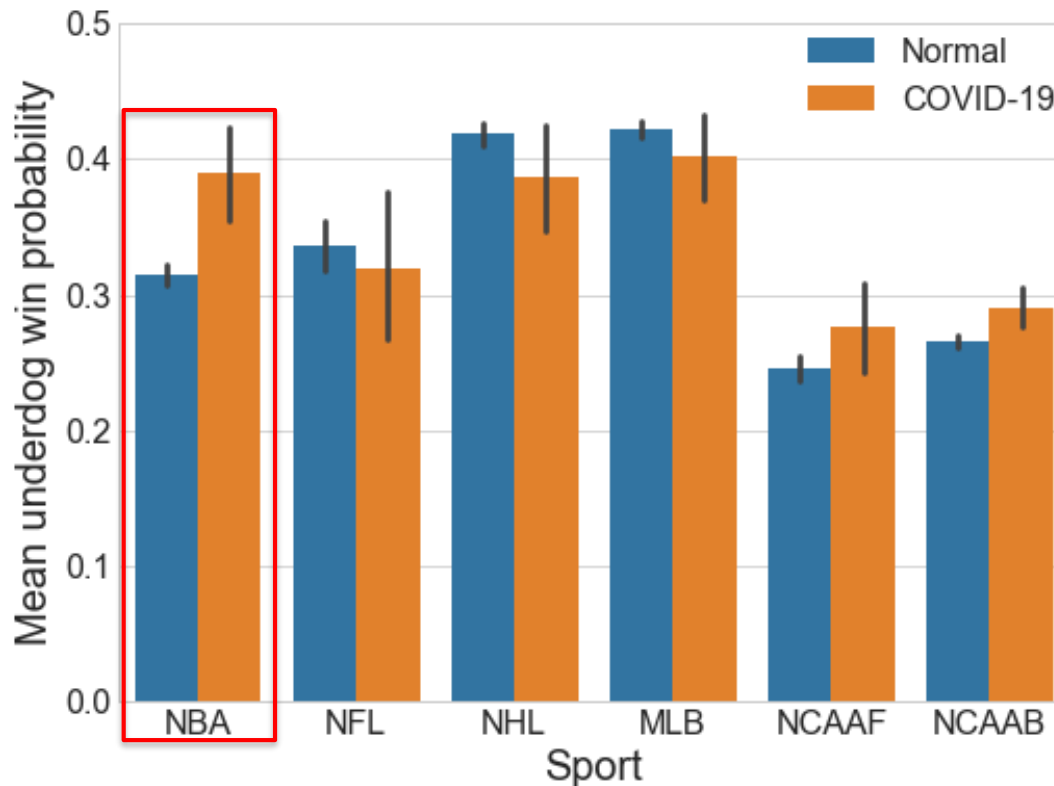
# Hypotheses for Non-Broken Markets

- NCAAAF, NCAAB –spread in skill level is too broad to increase upsets
- NHL, MLB – gameplay is too random to increase upsets
- NFL – nothing really changed during COVID-19 to increase upsets

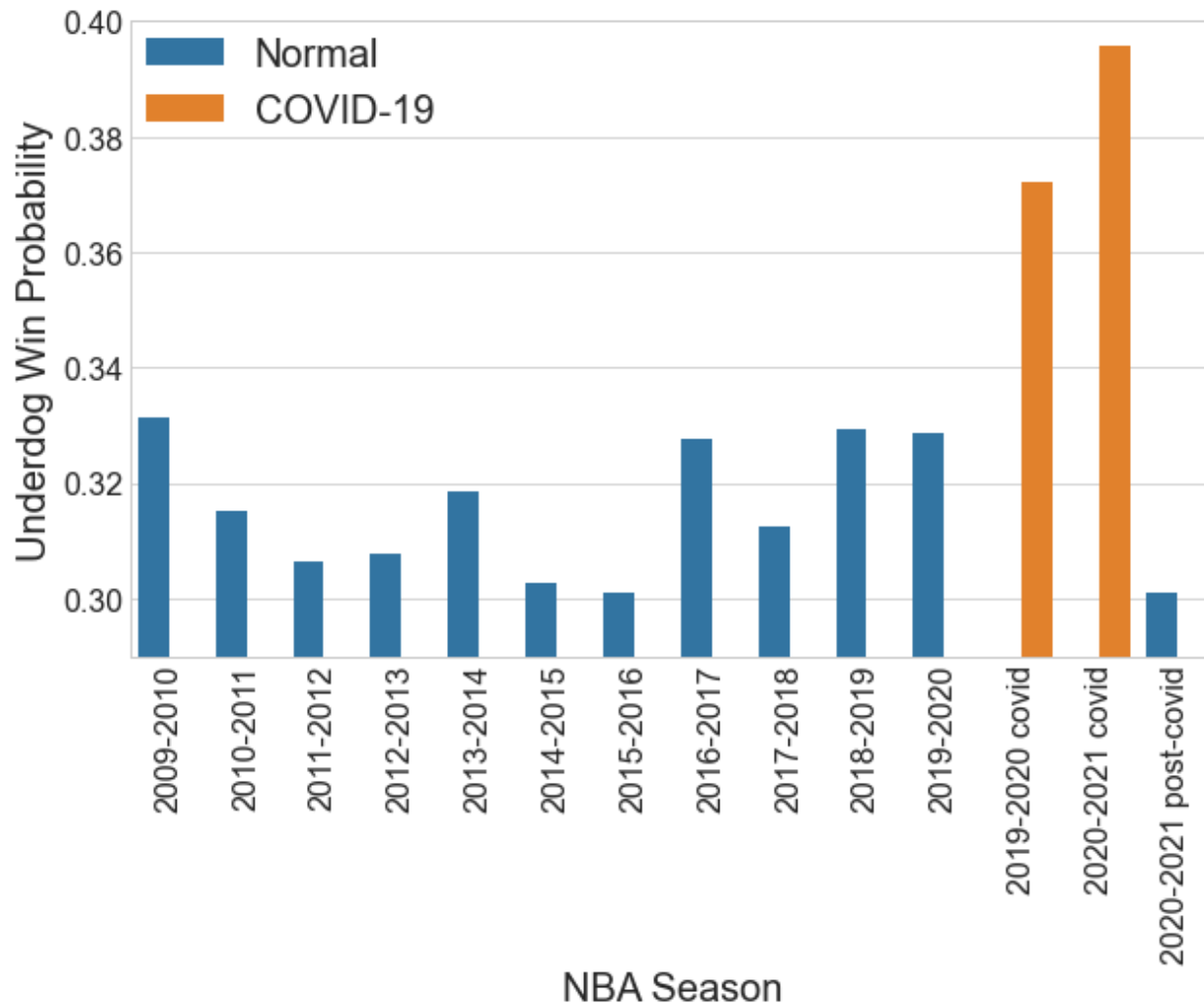


# NBA Broken Market

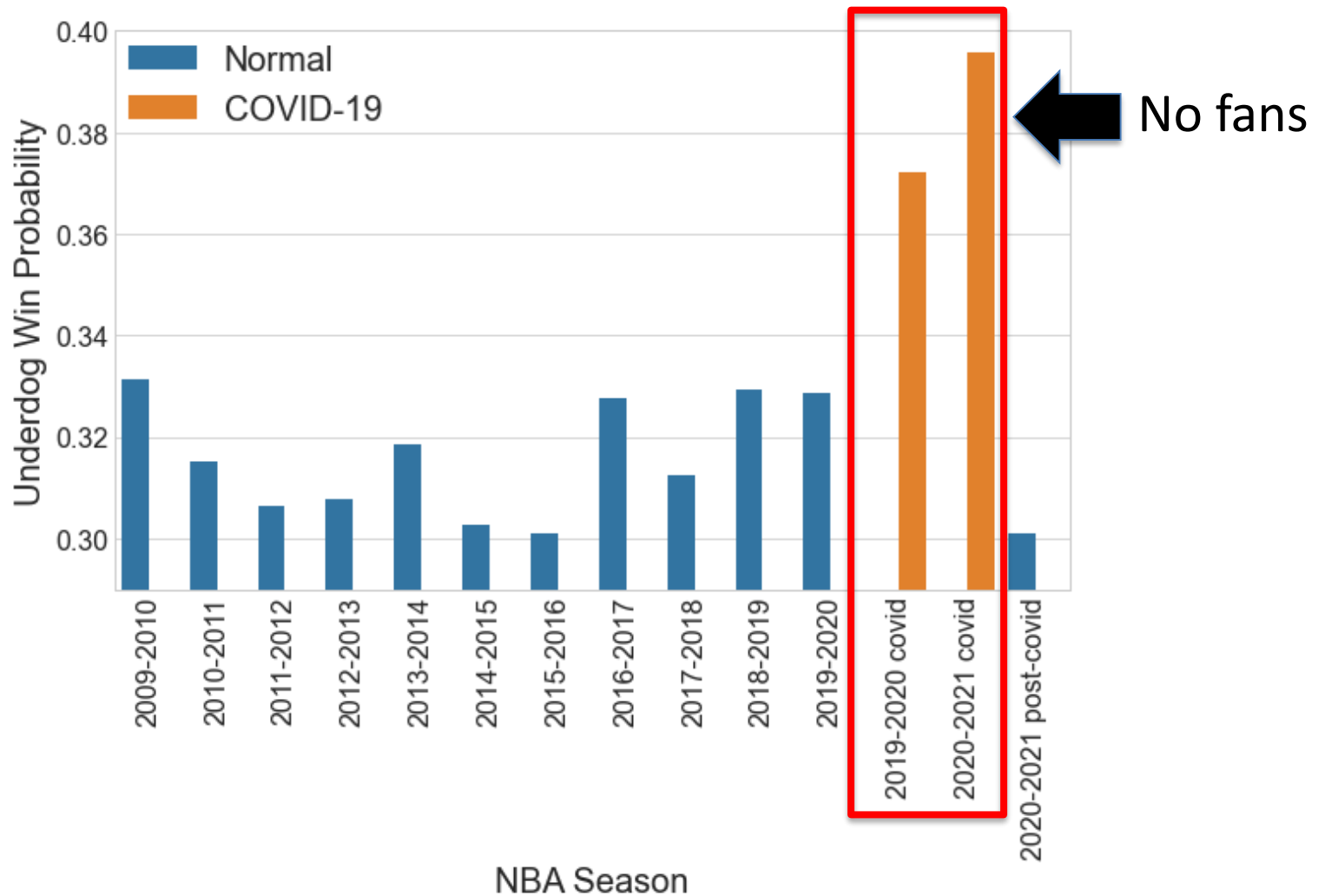
- Why did NBA upsets increase during COVID-19?



# Upsets vs Season

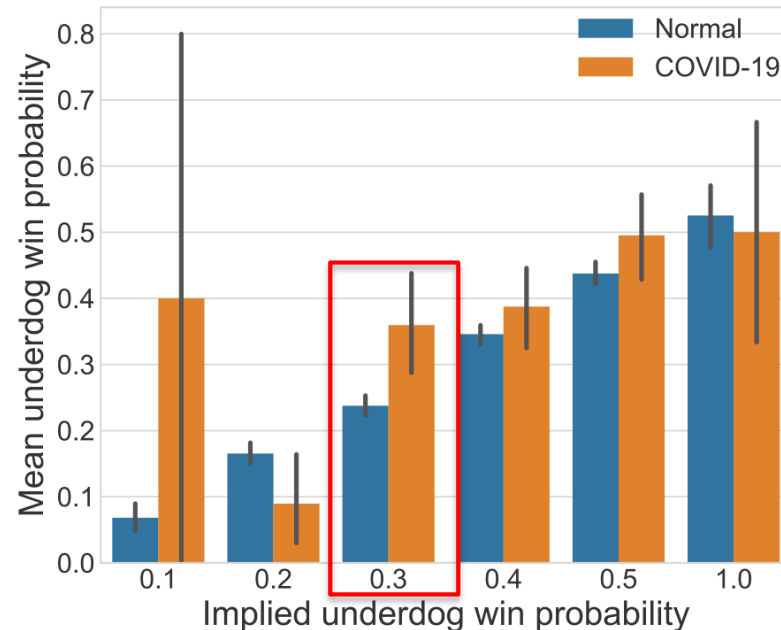


# Upsets vs Season



# Medium Underdogs

- **Medium underdogs** – implied win probability between 0.2 and 0.3 (odds between +233 and +400)
- Medium underdogs had the largest (statistically significant) increase in upsets



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  - We see this during COVID-19 when fans were absent
- **Hypothesis:** fans create a bias that lowers the probability of an upset for medium underdogs
- Betting markets did not adjust to this change

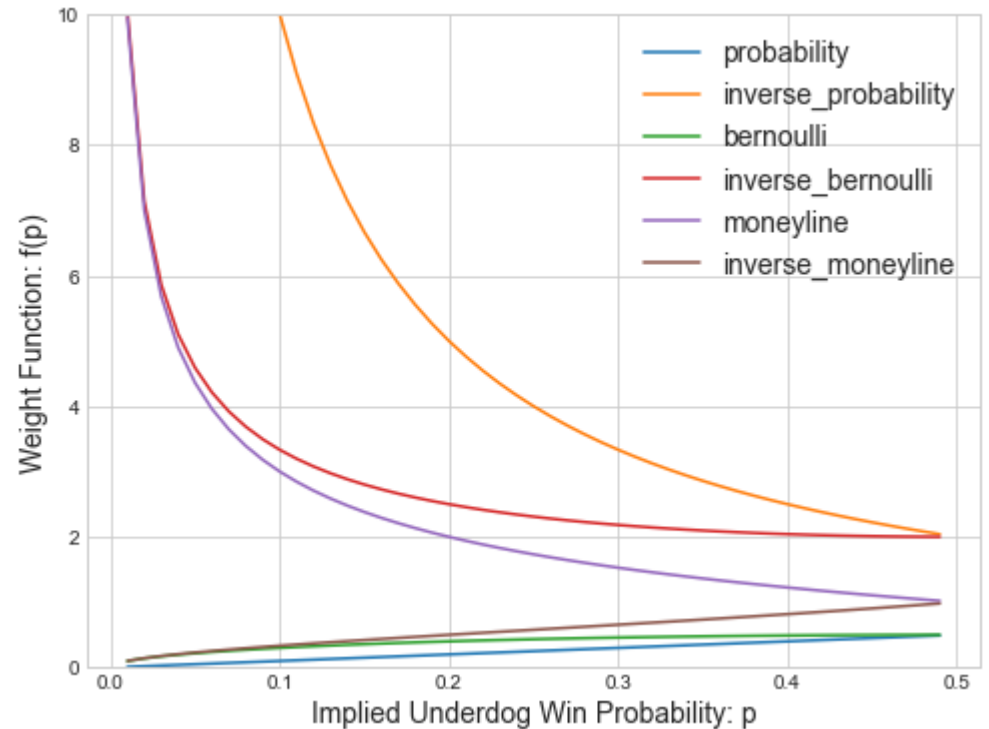
# **BETTING STRATEGIES**

# Betting Strategies During COVID-19

- Start with an initial bankroll
- Bet a fixed fraction of the total bankroll each day on the underdogs
- Allocate different fraction of daily wager based on the given odds (implied win probability)

# Weighting Functions

Name	Weight Function
Probability	$p_u$
Inverse Probability	$\frac{1}{p_u}$
Bernoulli	$\sqrt{p_u(1-p_u)}$
Inverse Bernoulli	$\frac{1}{\sqrt{p_u(1-p_u)}}$
Moneyline	$\sqrt{\frac{1-p_u}{p_u}}$
Inverse Moneyline	$\sqrt{\frac{p_u}{1-p_u}}$



# Betting Strategy Returns [%]

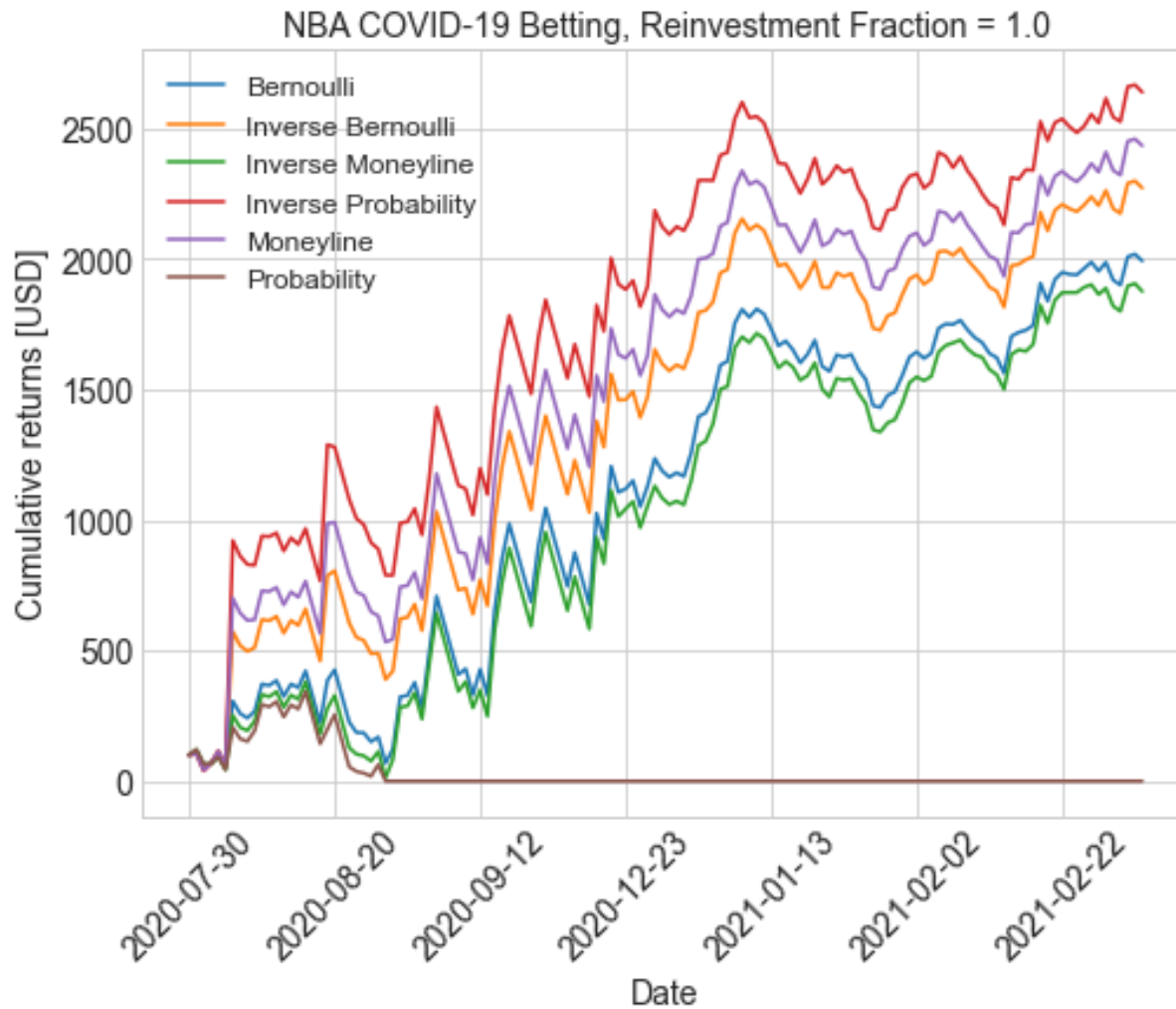
# Betting Strategy Returns [%]

Weight function	Reinvestment Fraction									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Bernoulli	291.73	483.47	675.2	866.93	1058.67	1250.4	1442.13	1633.87	1825.6	2017.33
Inverse Bernoulli	319.77	539.53	759.3	979.06	1198.83	1418.59	1638.36	1858.12	2077.89	2297.65
Inverse Moneyline	280.49	460.97	641.46	821.95	1002.44	1182.92	1363.41	1543.9	1724.38	1904.87
Inverse Probability	356.57	613.14	869.71	1126.28	1382.85	1639.42	1895.99	2152.55	2409.12	2665.69
Moneyline	335.85	571.7	807.54	1043.39	1279.24	1515.09	1750.94	1986.78	2222.63	2458.48
Probability	275.21	450.42	625.63	800.85	976.06	1151.27	1326.48	0	0	0

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Inverse Moneyline	280.49	460.97	641.46	821.95	1002.44	1182.92	1363.41	1543.9	1724.38	1904.87
Inverse Probability	356.57	613.14	869.71	1126.28	1382.85	1639.42	1895.99	2152.55	2409.12	2665.69
Moneyline	335.85	571.7	807.54	1043.39	1279.24	1515.09	1750.94	1986.78	2222.63	2458.48
Probability	275.21	450.42	625.63	800.85	976.06	1151.27	1326.48	0	0	0

# Cumulative Returns





# Paper

## The Impact of COVID-19 on Sports Betting Markets

Khizar Qureshi

Massachusetts Institute of Technology, Cambridge, MA 02139, kqureshi@mit.edu

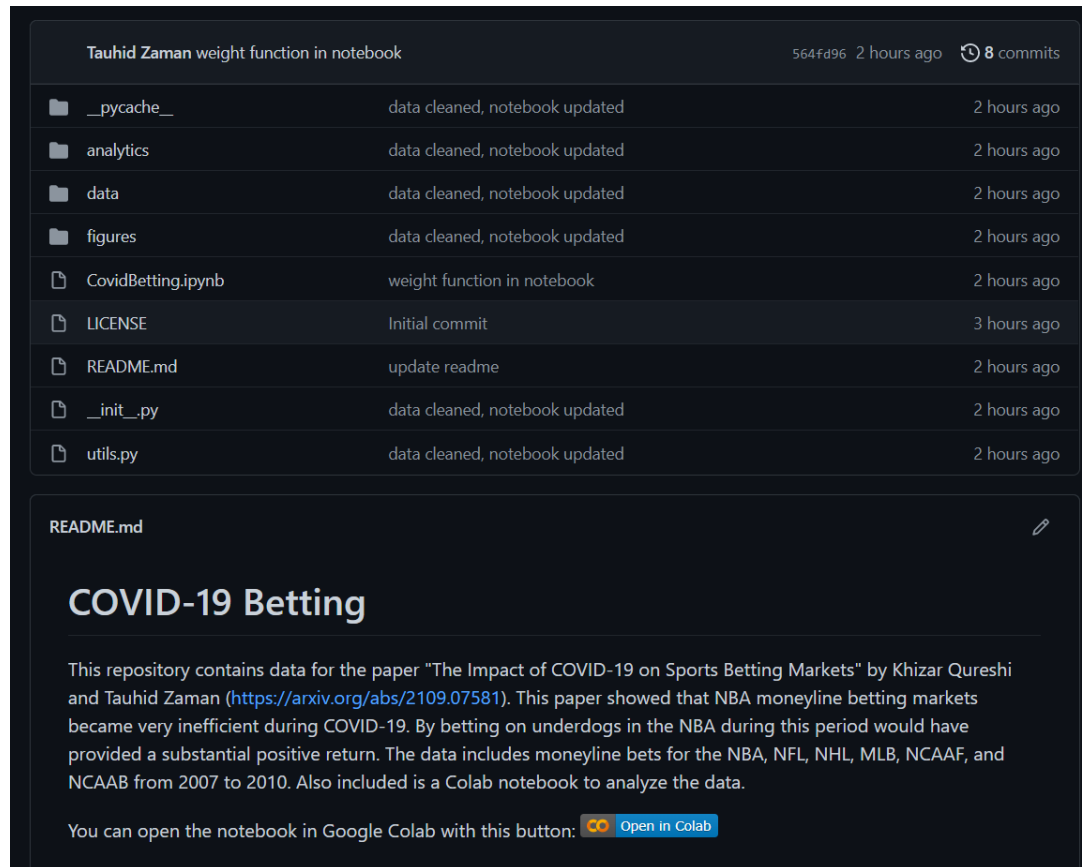
Tauhid Zaman

Yale University, New Haven, CT 06511, tauhid.zaman@yale.edu

We investigate the impact of the COVID-19 pandemic on the betting markets of professional and college sports. We find that during the pandemic, the moneyline betting markets of the National Basketball Association (NBA) became very inefficient. During this period, if one bet uniformly on underdog teams in the NBA, one could achieve a 16.7% profit margin. It is hypothesized that this inefficiency is due to the absence of live audiences during the NBA games. Such inefficiencies are not seen for any other sport. Much of the inefficiency comes from a small fraction of games with moneyline odds in the 233 to 400 range. We find that with clever strategies, one is able to achieve a 26-fold gain on an initial investment by betting on NBA underdogs during this time period.

# Code

- Data and code is at [https://github.com/zlisto/covid\\_betting](https://github.com/zlisto/covid_betting)
- Colab notebook available to get you started



Tauhid Zaman weight function in notebook 564fd96 2 hours ago 8 commits

File	Commit Message	Time
__pycache__	data cleaned, notebook updated	2 hours ago
analytics	data cleaned, notebook updated	2 hours ago
data	data cleaned, notebook updated	2 hours ago
figures	data cleaned, notebook updated	2 hours ago
CovidBetting.ipynb	weight function in notebook	2 hours ago
LICENSE	Initial commit	3 hours ago
README.md	update readme	2 hours ago
__init__.py	data cleaned, notebook updated	2 hours ago
utils.py	data cleaned, notebook updated	2 hours ago

README.md

## COVID-19 Betting

This repository contains data for the paper "The Impact of COVID-19 on Sports Betting Markets" by Khizar Qureshi and Tauhid Zaman (<https://arxiv.org/abs/2109.07581>). This paper showed that NBA moneyline betting markets became very inefficient during COVID-19. By betting on underdogs in the NBA during this period would have provided a substantial positive return. The data includes moneyline bets for the NBA, NFL, NHL, MLB, NCAAF, and NCAAB from 2007 to 2010. Also included is a Colab notebook to analyze the data.

You can open the notebook in Google Colab with this button: [Open in Colab](#)

# Conclusion

- NBA games had many more upsets than normal during COVID-19
- NBA moneyline bets did not adjust to this
- Upsets likely due to lack of fans
- By betting during this period, one could achieve a 2600% return