Examining Market Efficiency and the Reverse Favorite–Longshot Bias in National Football League Point Spread Markets After the Legalization of Sports Betting

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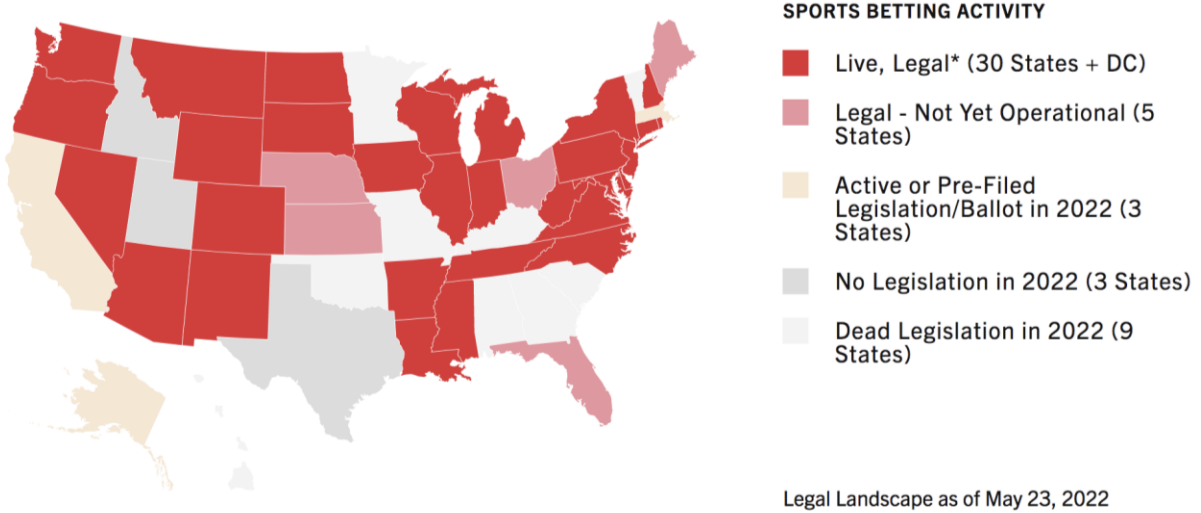
Sports Betting Background

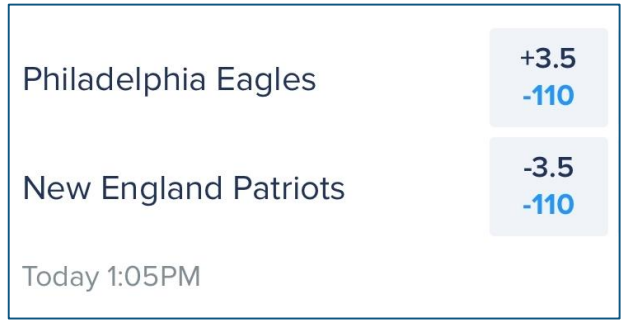
- In 1992, Congress passed the Professional and Amateur Sports Protection Act (PASPA), which prohibited state-sanctioned gambling on sports
- In May 2018, the Supreme Court struck down PAPSA in *Murphy v. NCAA*, allowing any state to legalize sports betting
- 30 states and Washington D.C. have since legalized sports betting
- Tremendous growth; rise of mobile sportsbook apps such as FanDuel
- U.S. sports betting market generated $1 billion in revenue in 2020 and is expected to grow to $6 billion by 2023



Source: "Interactive Map: Sports Betting in the U.S." *American Gaming Association*, 23 May 2022, https://www.americangaming.org/research/state-gaming-map/.

Point Spread Betting Market

- The sportsbook posts a point spread at which it is willing to transact, such as the Patriots being favored by 3.5 points
- Point spread bets generally offer "eleven for ten" odds, meaning you receive a profit of $10 for every $11 bet if your team covers the spread
  - To break even, bettors must pick correctly in 52.4% of their bets
  - The asymmetry of the eleven for ten rule provides the bookmaker with a 4.54% commission
- Like prices in the stock market, the spread for a given game may change over time as new information is absorbed
- Sportsbooks are better are predicting games than the public, may deviate from fair spread to maximize profits



Source: "FanDuel Sportsbook Debuts in Colorado." *Business Wire*, 1 May 2020, https://www.businesswire.com/news/home/20200501005442/en/FanDuel-Sportsbook-Debuts-in-Colorado.

Research Question and Motivation

- Most sports bettors are avid sports fans and are often prone to overconfidence bias
  - Overestimate their ability to correctly predict the outcome of a game
- Mobile sportsbooks try to maximize entertainment value of gambling via gamification
  - Free bets, odds boosts, and leaderboards
- **Can we examine the efficiency of the NFL point spread market and the tendencies of bettors through the lens of behavioral economics in order to determine what biases may exist?**
  - **Is it possible to profit off of behavioral biases (in excess of transaction costs)?**
- **Has the gamification of online sports betting led to inefficiency or abnormally large losses among the betting public?**
- **Did the change in legalization lead to a systematic departure from efficient pricing?**
- Existing literature documents various inefficiencies, such as **reverse favorite-longshot bias** (Gil & Levitt, 2007; Woodland & Woodland, 2001; Golec & Tamarkin, 1991)

Data and Methodology

- Point spread and outcome data collected for each regular season game from 2010 – 2021 NFL seasons
- OLS Regressions
  - Test for statistical market efficiency on a season-by-season basis
  - Is there a systematic difference in point spread rationality in the pre- and post-legalization periods?
- Tested profitability of various mechanical and behavioral strategies
- Probit model trained on data from 2018 – 2020, used to forecast and predict 2021 NFL games

Strategies Tested:

1. Bet on the favorite when $0 \leq |\text{spread}| \leq 5$
2. Bet on the underdog when $|\text{spread}| > 5$
3. Bet on the underdog when WINU > WINF
4. Bet against the team that has the majority of public money wagered on it
5. Bet on the underdog if the percentage of public money wagered on the favorite is greater than 50%
6. Only bet on home underdogs
7. Only bet on away underdogs

Results

- OLS Regressions: Fail to reject the null hypothesis that the NFL point spread market is characterized by rational expectations
- Profitability of Simple Betting Strategies
  - None of the strategies tested were profitable from 2010 – 2017 (pre-legalization)
  - Betting on the underdog when greater than 50% of public money wagered on the favorite (Rule 5) produced statistically significant profits in both 2018 – 2020 and 2021
  - Two additional strategies were profitable in the post-legalization period (Rules 4 and 7)
- Probit model revealed bias favoring away underdogs (against home favorites)

Results

Rule 4. Bet against the team that has the majority of public money wagered on it

Rule 5. Bet on the underdog if the percentage of public money wagered on the favorite is greater than 50%

Rule 7. Only bet on away underdogs

Table 5: The Profitability of Certain Technical Rules: Results from the 2018 – 2020 NFL Seasons

Mechanical Rules	Wins (W)	Bets (B)	W/B (%)	Profit/Loss ($)	Z_1	p_1	Z_2	p_2
Rule 1	178	405	43.95 (0.497)	-651.82	-2.45**	0.01	-3.42	0.99
Rule 2	181	344	52.62 (0.500)	15.465	0.97	0.33	0.08	0.47
Rule 3	72	124	58.06 (0.495)	134.55	1.81*	0.07	1.27	0.10
Behavioral Rules								
Rule 4	387	718	53.90 (0.499)	208.18	2.09**	0.04	0.81	0.21
Rule 5	282	491	57.43 (0.495)	473.64	3.32***	0.00	2.25**	0.01
Rule 6	152	293	51.88 (0.501)	-28.18	0.64	0.52	-0.18	0.57
Rule 7	256	456	56.14 (0.497)	327.27	2.64***	0.01	1.61*	0.05

Standard deviations for W/B in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: The Profitability of Certain Technical Rules: Results from the 2021 NFL Season

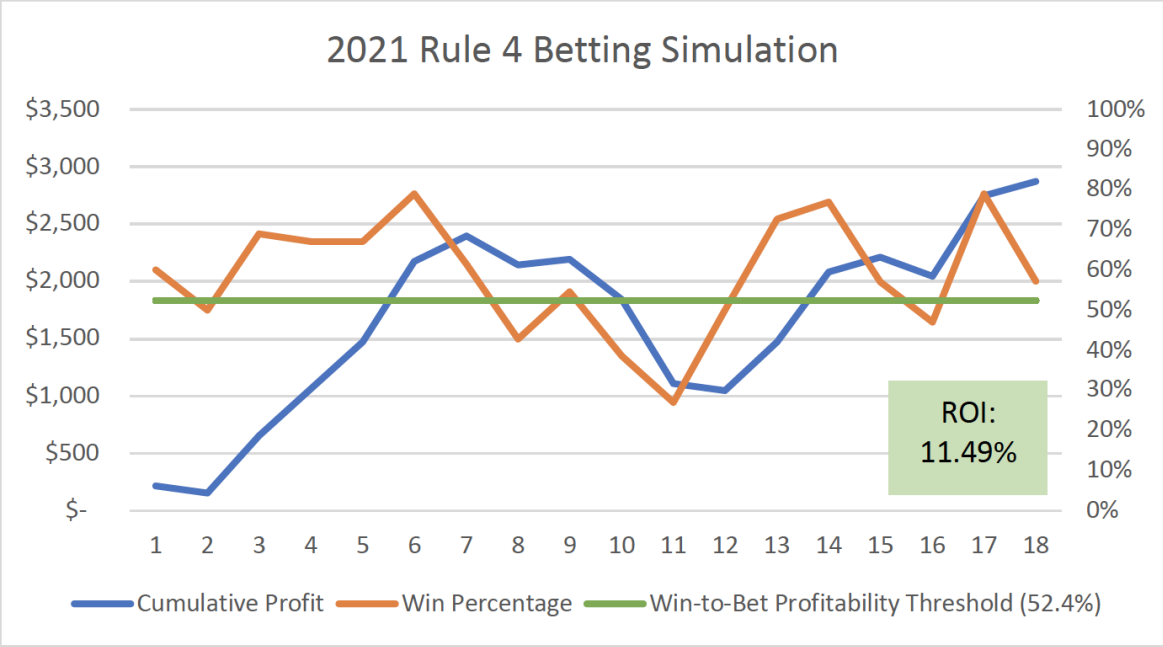
Mechanical Rules	Wins (W)	Bets (B)	W/B (%)	Profit/Loss ($)	Z_1	p_1	Z_2	p_2
Rule 1	61	135	45.19 (0.500)	-185.46	-1.12	0.26	-1.68	0.95
Rule 2	68	136	50.00 (0.502)	-61.82	0.00	1.00	-0.56	0.71
Rule 3	18	33	54.55 (0.506)	13.64	0.52	0.60	0.24	0.41
Behavioral Rules								
Rule 4	146	250	58.40 (0.499)	287.27	2.66***	0.01	1.90**	0.03
Rule 5	60	95	63.16 (0.485)	195.46	2.64***	0.01	2.16**	0.02
Rule 6	57	109	52.29 (0.502)	-1.82	0.48	0.63	-0.02	0.51
Rule 7	85	162	52.47 (0.501)	2.73	0.63	0.53	0.02	0.49

Standard deviations for W/B in parentheses

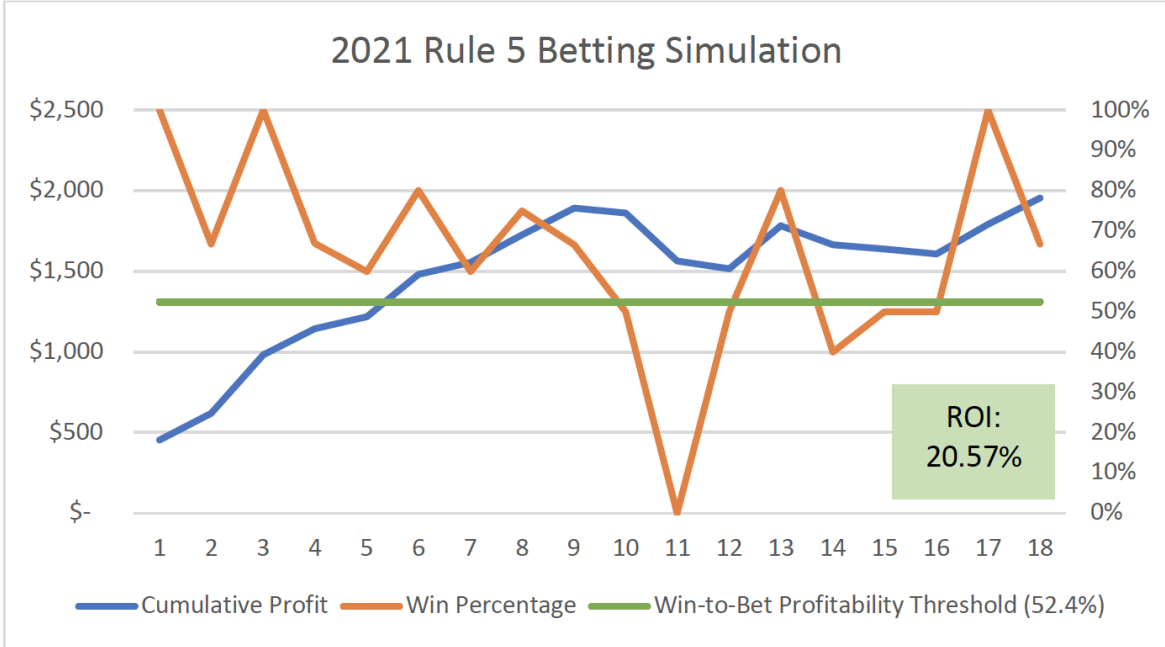
*** p<0.01, ** p<0.05, * p<0.1

Betting Simulations

Rule 4: Bet against the team that has the majority of public money wagered on it



Rule 5: Bet on the underdog when the percentage of public money wagered on the favorite is greater than 50%



Discussion and Implications

- Profitable gambling opportunities do exist: speculative inefficiencies are present in the post-legalization NFL point spread market
- Hard to beat Vegas: sports betting is often a losing game
- Why do millions of Americans continue to frequently gamble on the NFL?
  - The additional utility derived from the suspense and surprise of cheering for the team that one has bet on must outweigh the risk (and reality) of financial losses
- Promotions can lead to $2,000 in average customer lifetime value
- American Gaming Association CEO Bill Miller: It is the NFL's responsibility "to educate fans and promote responsible gaming"
- **How can states regulate online sportsbooks and their marketing tactics to limit exploitation? What role should each entity play in preventing against gambling addiction or serious financial harm?**

Thank You!

PLEASE DIRECT ANY QUESTIONS TO

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