Tennis Betting System

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Background

- Betting in sports is a growing industry
  - US states and countries around the world are increasing access to betting
- Tennis betting has a simple odds system that is easy to understand
  - No point spreads
  - Only two outcomes
- We built a model to effectively place bets on matches in the final three rounds of Wimbledon
- To add an element of realism we based our model on this years Quarterfinal matches

Andy Murray 2016 Wimbledon Champion

Goal

- Generate a realistic simulator to test multiple heuristic policies and determine a beneficial betting policy

Assumptions

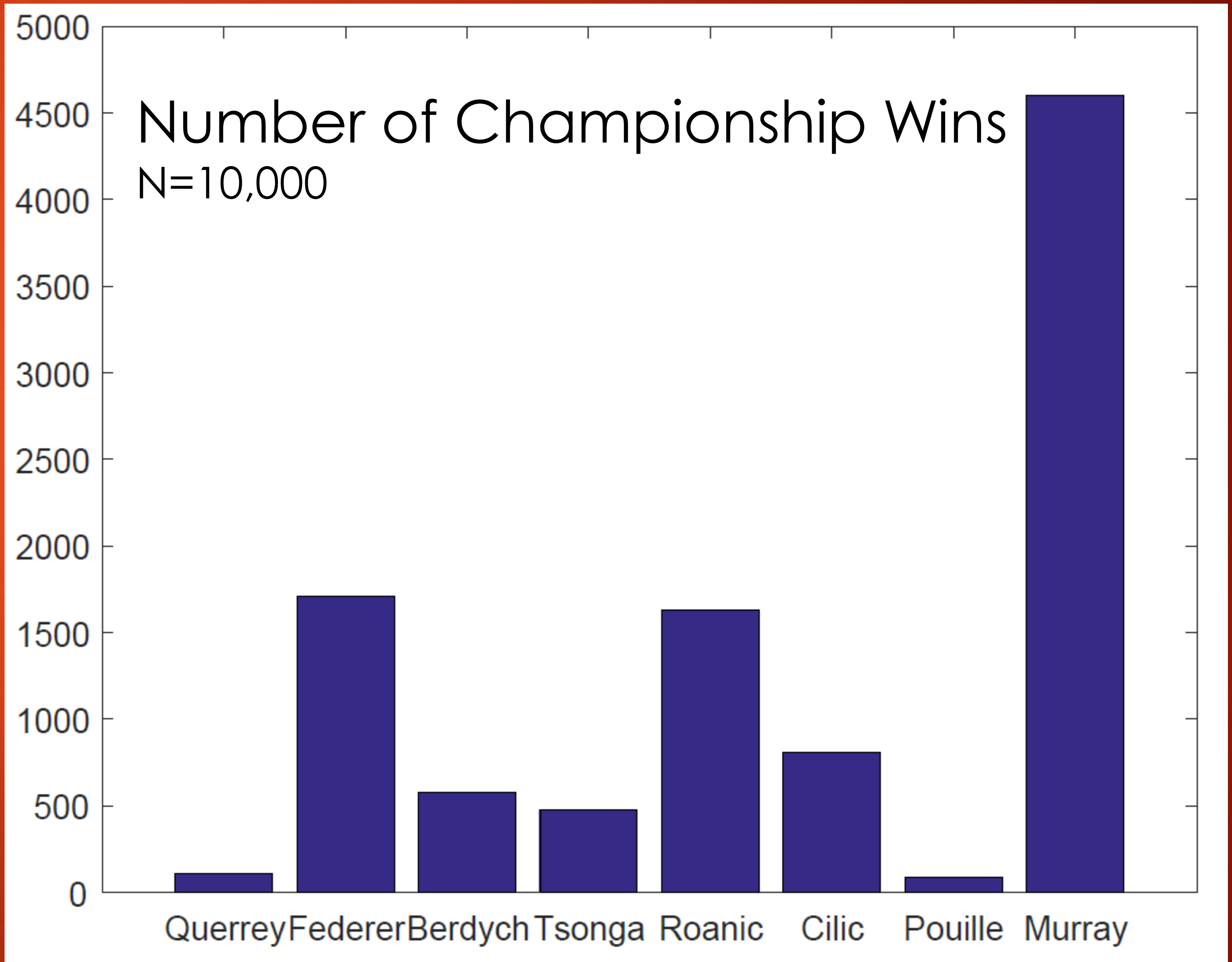
- Probabilities of each win/loss outcome are known by the bettor
- Odds are centered around this probability with some random error that is known at the time of betting
- Match outcomes are random and occur following the above distributions

		Loser							
	Player	Querry	Federer	Berdych	Tsonga	Raonic	Cilic	Pouille	Murray
Winner	Querrey		0.06	0.29	0.32	0.14	0.11	0.55	0.05
	Federer	0.94		0.62	0.65	0.56	0.59	0.93	0.42
	Berdych	0.71	0.38		0.51	0.44	0.48	0.87	0.11
	Tsonga	0.68	0.35	0.49		0.42	0.43	0.69	0.22
	Raonic	0.86	0.44	0.56	0.58		0.55	0.75	0.36
	Cilic	0.89	0.41	0.52	0.57	0.45		0.71	0.31
	Pouillle	0.45	0.07	0.13	0.31	0.25	0.29		0.02
	Murray	0.95	0.58	0.89	0.78	0.64	0.69	0.98	

Distribution of match outcomes for each possible match outcome

Model

- Built simulator to identify who wins each match
- Used uniform random variable generation to identify the winner of each match and fill out semifinal and final bracket
- Came up with a realistic distribution of championship wins for each quarterfinal participant
- Generated realistic odds based on match probabilities
  - Odds have a random error that is known at time of betting
  - A rake (R) is incorporated to sway the odds in the odds maker's favor



State Variables

- Current amount of money (M_t) M_1=1,000
- Current Matchups (G_t) G_1={1,5;2,6;3,7;4,8}
- Current Match odds (O_t)

Decision Variable

- Bets $(B_{ij})_t$ (Amount, Player)

Constraints

- Sum of bets for each round must be less than current balance
  - $\sum_1^i \sum_1^j (B_{ij})_t \leq M_t$ (For all rounds t)

Exogenous Information

- Match outcomes (G_{t+1})

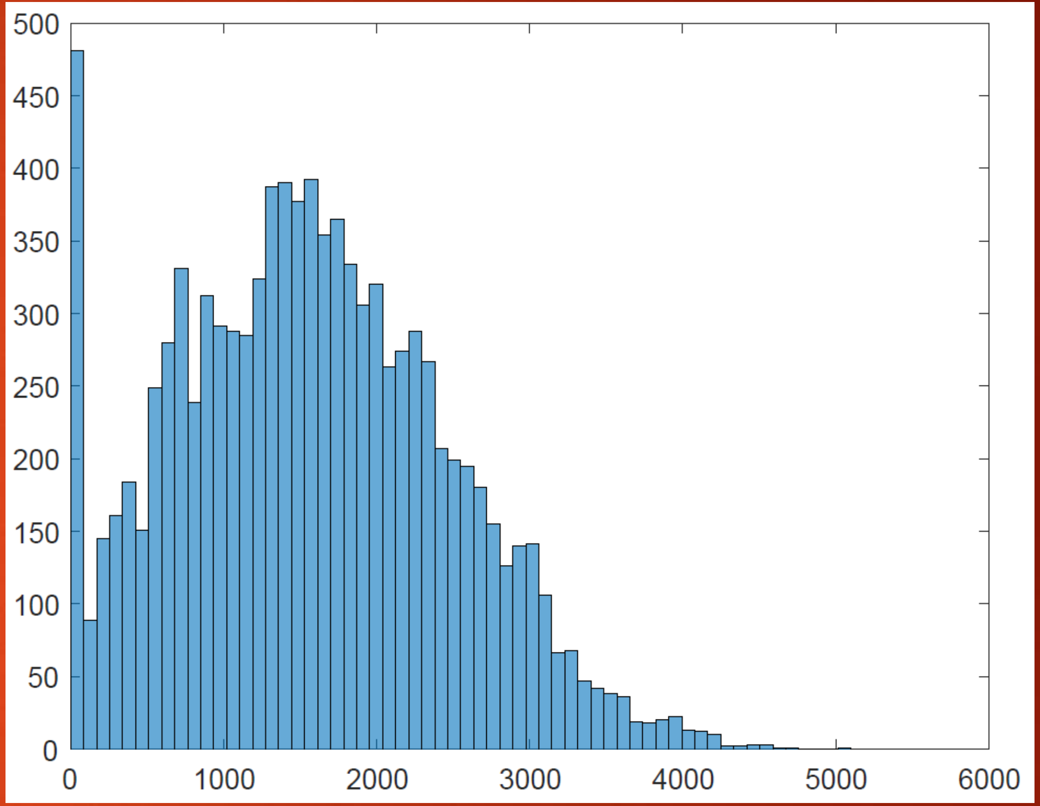
Update Equation

- $M_{t\;+\;1\;=}\,Mt - \sum_1^i \sum_1^2 B_{ij} + \sum_1^i \sum_i^j [B(_{ij})(O_{ij}) * INDICATOR((G_{ij(_t)} = Gij_{(^t\;+\;1_)})]$
- Each rounds balance is the previous balance plus the winnings of the previous round minus the current bets
- O_{ij}=(1/P_{if}) * ε – R
- Odds are generated for each round but they are known at the time of betting and not exogenous

Heuristic Approach

- First Policy
  - Place either a small bet or large bet on matches with moderately favorable and significantly favorable odds respectively
    - Difference in known probability and set odds are used for comparison
  - The small and large bet amounts are held constant throughout the rounds
  - Different sized bets were tested to identify bet amounts

Trial	Small Bet	Large Bet	mean
1	100	500	1427
2	200	500	1419
3	300	500	1388
4	50	500	1402
5	75	500	1451
6	75	525	1611
7	75	550	1609
8	75	575	1632
9	75	600	1692
10	75	625	1698
11	75	650	1706
12	75	675	1741
13	75	700	1697
14	75	725	1641



Distribution of results for policy with lower bet of 75 and higher bet of 675 (High expected value, large number of busts)

Heuristic Approach

- Second Policy
  - Place either a small bet or large bet on matches with moderately favorable and significantly favorable odds respectively
    - Difference in known probability and set odds are used for comparison
  - This time the bets increase as rounds progress
    - Small bet increases $50 each round
    - Large bet increase $100 each round
  - Different sized bets were tested to identify bet amounts

Trial	Small Bet	Large Bet	mean
1	75	500	1689
2	100	550	1688
3	125	600	1718
4	150	650	1692

Heuristic Approach

- Third Policy
  - Place either a small bet or large bet on matches with moderately favorable and significantly favorable odds respectively
    - Difference in known probability and set odds are used for comparison
  - The small and large bets are proportional to the amount of money we start a round with
  - Different percentages were tested to identify bet amounts

Trial	Low %	High %	mean	Std Dev
1	10%	50%	1673	
2	15%	50%	1664	1384
3	7%	50%	1704	1391
4	7%	25%	1305	599
5	5%	50%	1742	1396
6	5%	25%	1309	551

Final Policy

- Two Policies have been developed a conservative approach and an aggressive approach

	Low Bet	High Bet	Mean	Std Dev	Win %
Aggressive	5%	50%	1742	1396	64%
Conservative	5%	25%	1309	551	68%

- Depending on a better's goal either policy may be more attractive
  - Conservative policy comes out ahead more frequently but has a smaller ceiling and a smaller expected outcome

Theoretical Optimum

- Bet the total current balance the player with the longest odds who wins their match (you know the future)
- Bets like this would have had an ending balance average of $38,039
- Our aggressive policy produced results 4.4% as good as this optimum
- This is still a good policy because it’s impossible to know the future