Martingale vs Fixed-Fractional Betting

Conditions

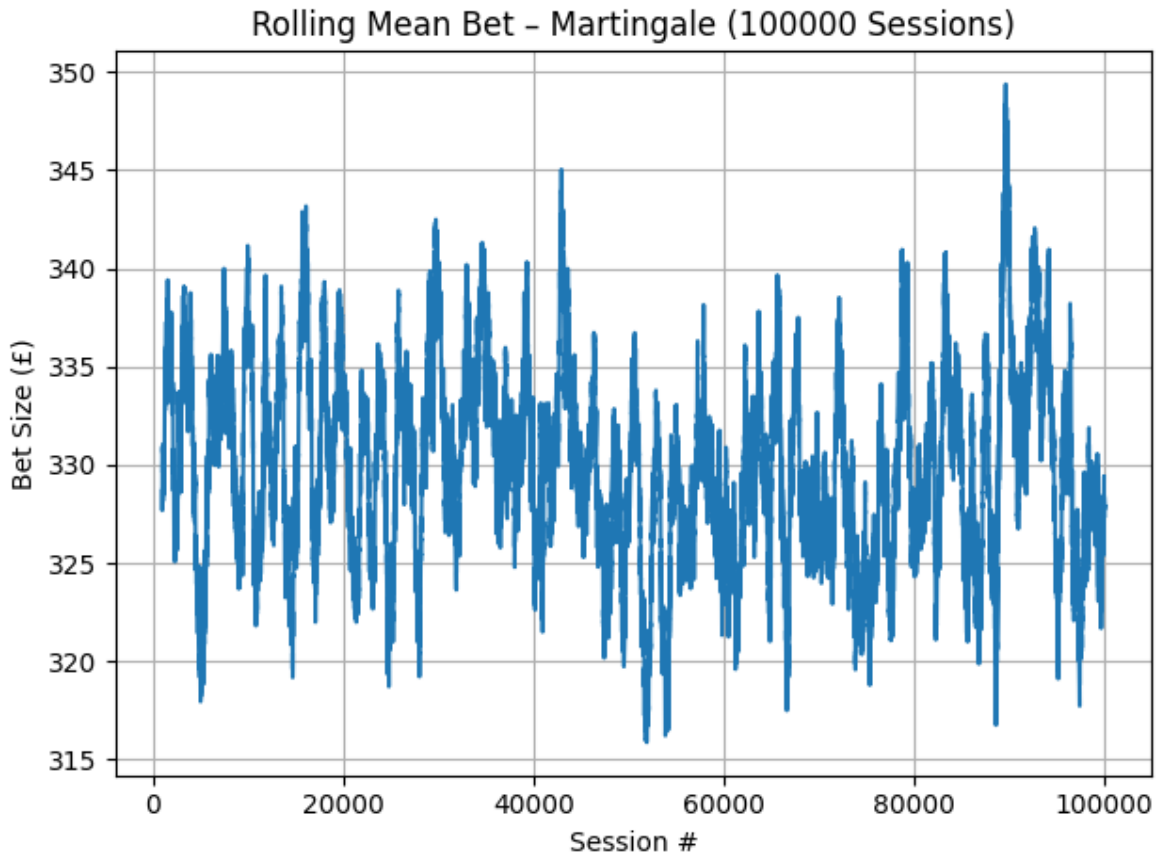
- All bankrolls start at £10,000
- Simulations contain 50 games and are ran 100,000 times (5,000,000 total games)
- 1 round = 1000 simulations
- Fixed-Fraction: £200 bet
- Martingale: £200 bet

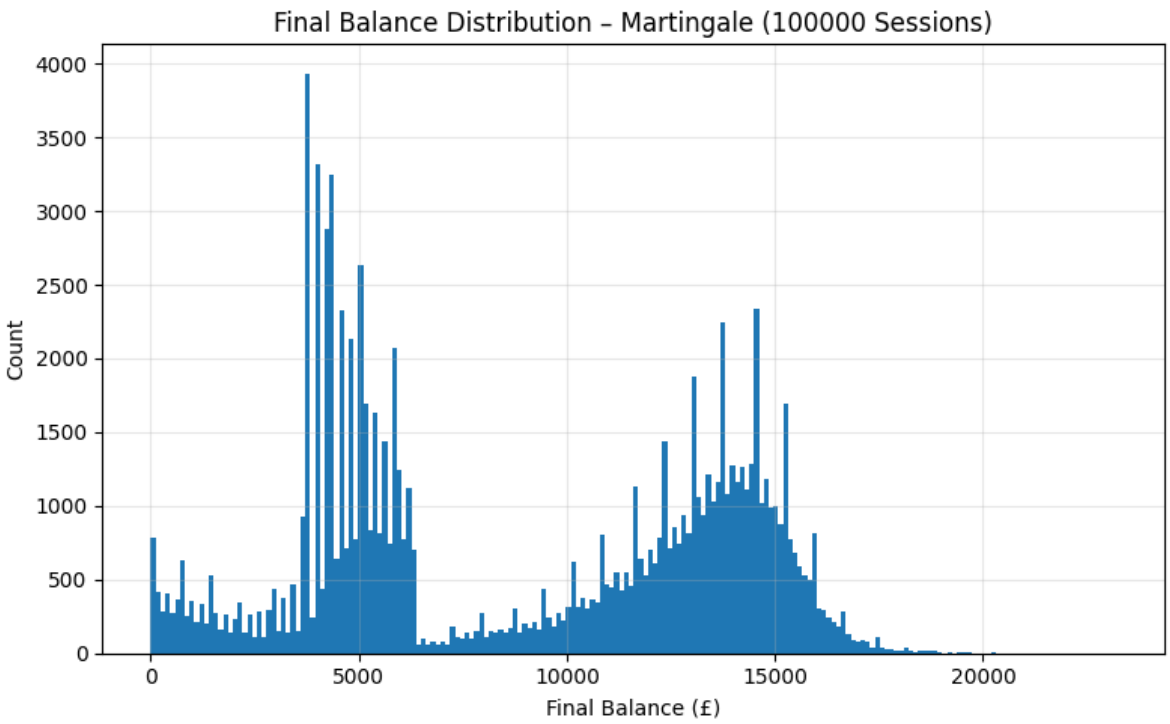
Results

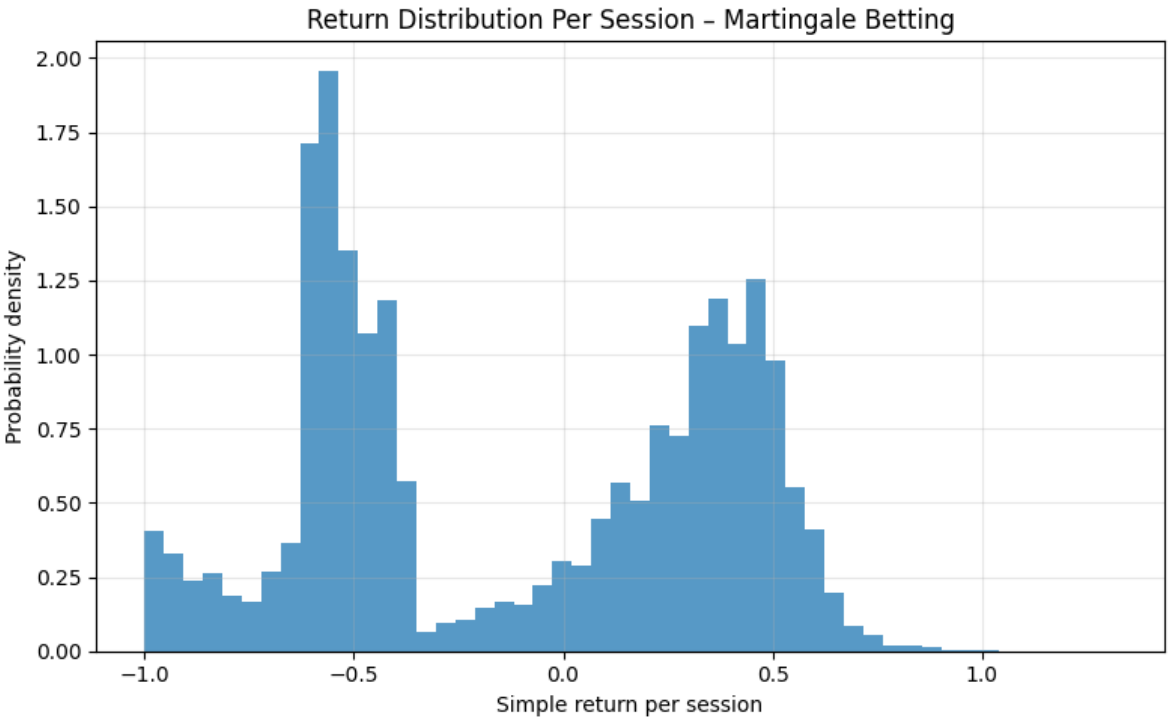
Metrics	Martingale	Fixed-Fractional
Win rate (%)	41.25	41.26
Loss rate (%)	49.03	49.02
Expected return per session (%)	-10.64	-5.37
Standard Deviation (%)	48.53	13.09
Sharpe ratio	-0.219	-0.410
Probability of ruin (%)	46.36	0.00
Average drawdown (%)	35.33	12.30

Graphs

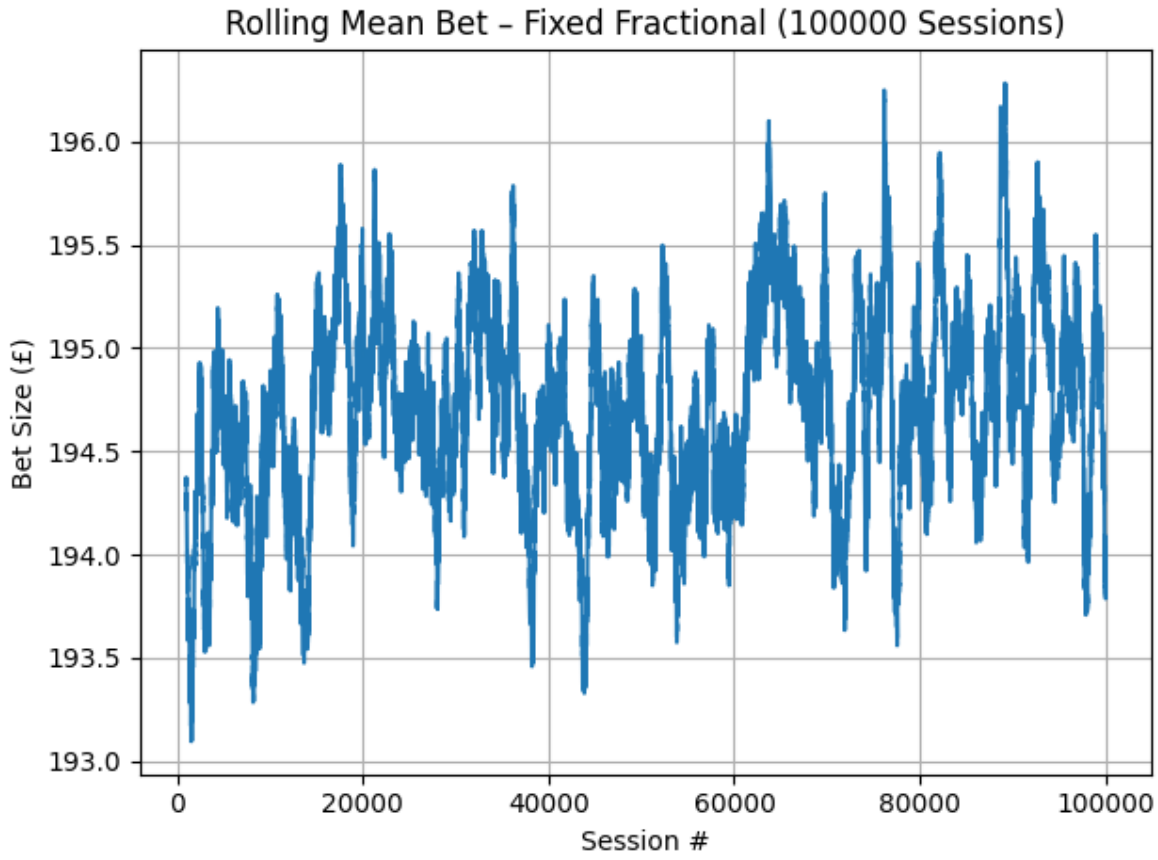
Martingale

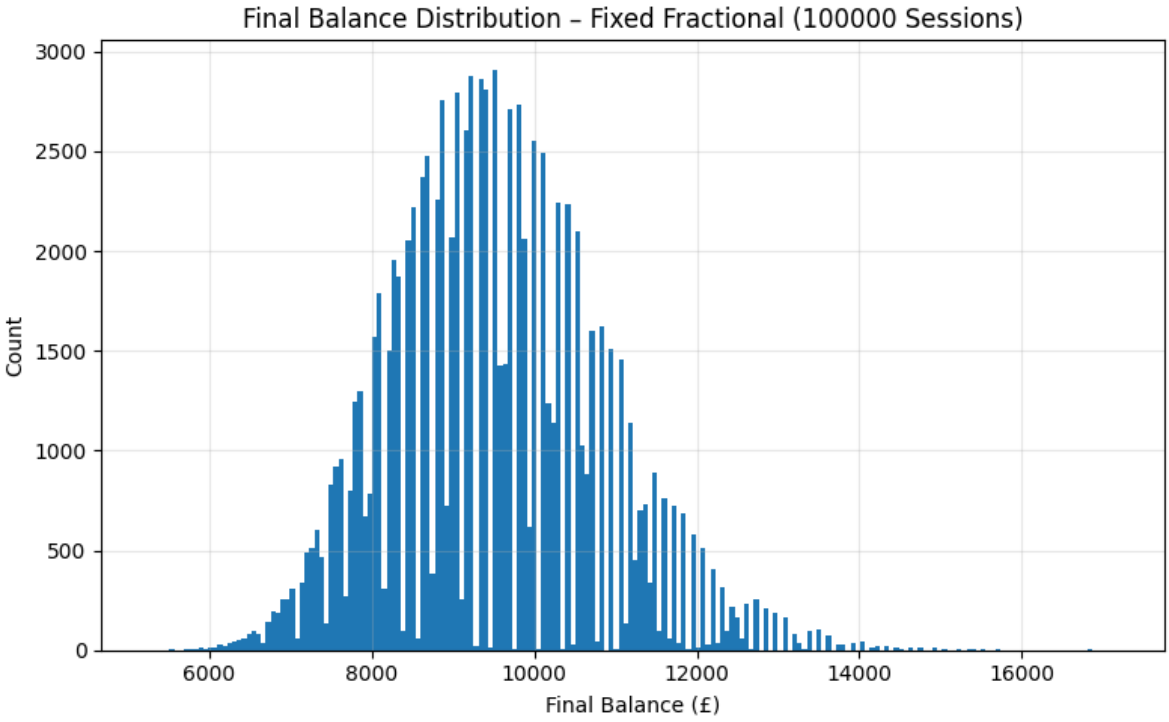


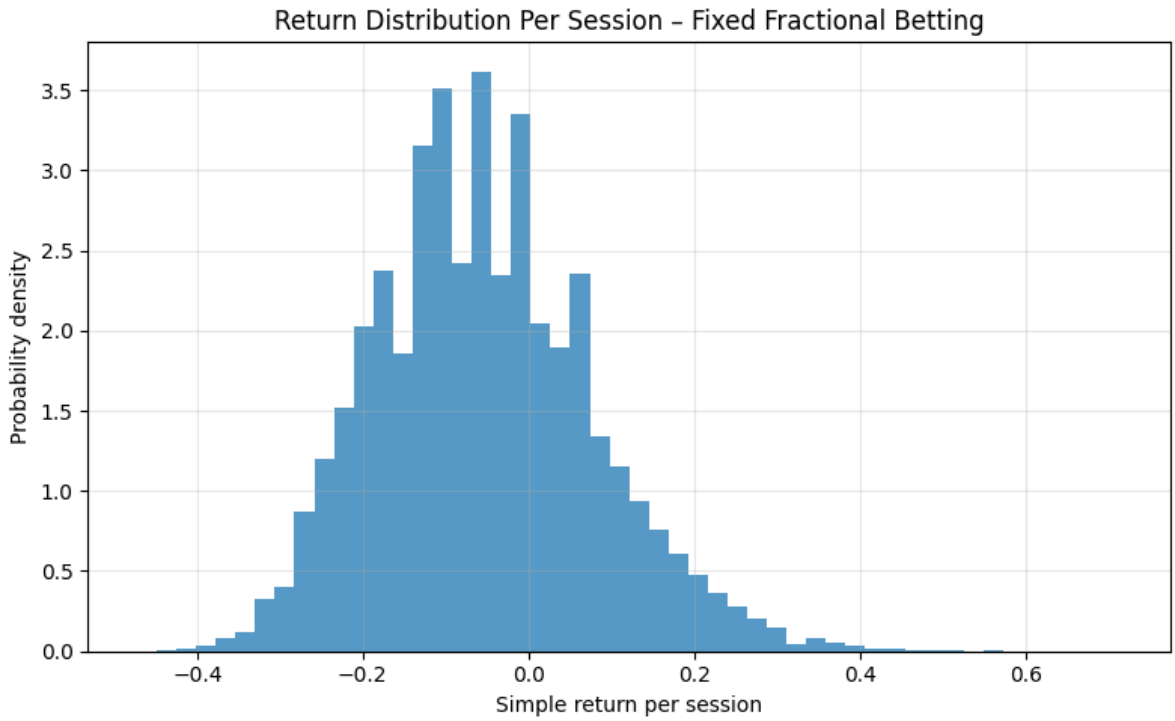

Final Balance Distribution – Martingale (100000 Sessions)
Count
Final Balance (£)
0
500
1000
1500
2000
2500
3000
3500
4000
0
5000
10000
15000
20000


Return Distribution Per Session – Martingale Betting
Probability density
Simple return per session
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
−1.0
−0.5
0.0
0.5
1.0

Fixed-Fractional






Return Distribution Per Session – Fixed Fractional Betting
Probability density
Simple return per session
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
−0.4
−0.2
0.0
0.2
0.4
0.6

Report

Project overview

I built a Monte-Carlo blackjack simulator to compare two bet sizing approaches: Martingale vs Fixed-Fractional. Same rules, same first-hand stake, different risk profiles. The goal was to measure risk, ruin, and how returns behave when your sizing rule changes.

How I modelled the game

- Rules: dealer stands on 17 (S17), 3:2 payout on player blackjack
- Player decision rule: a simple “basic-lite” strategy - stand on hard 17+, stand on soft 19+, otherwise hit.
- Mechanics: each hand starts with two cards to the player and dealer; Aces are handled properly (11 -> 1 if needed). If the player busts, the hand ends immediately (no dealer draw).

Strategies I compared

- Martingale - start with the same base stake as Fixed-Fractional’s first hand; double after losses, reset to base after any non-loss.
- Fixed-Fractional - bet a fixed % of current bankroll each hand (so sizing scales up/down with equity).

Conclusion

Fixed-Fractional preserves capital and loses more slowly than Martingale under the same rules and initial stake. Volatility and drawdowns are much lower, and ruin is ~0%, whereas Martingale concentrates risk in rare but catastrophic streaks.