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Evaluating Profitability in Sports Betting Using Probabilistic Models and Betting Strategies*

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Abstract

Sports betting has become a global multibillion-dollar industry, serving not only entertainment but also increasingly speculative investment purposes. The global-scale betting market is valued at over $240 billion and is expected to continue expanding in the coming years [5]. Bookmakers typically operate with stable profit margins of 9-10% [3, 11], raising the question of whether sustainable long-term profit is possible on the consumer side. This paper investigates whether a combination of probabilistic models and diverse betting strategies can yield a statistically significant positive expected value in football match betting. This research focuses on three central questions:

- Do prediction models estimate match outcomes more accurately than bookmaker odds?
- Is there a betting strategy that consistently yields sustainable profits?
- What factors most influence performance: data quality, modeling approach, or the chosen betting strategy?

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Betting is fundamentally a decision-making problem, to exploit discrepancies between true probabilities and market odds [2].

Six predictive models are applied, including classic statistical approaches—such as the Poisson model [9], logistic regression [6], and Elo ratings [7]—as well as simulation-based techniques like the Monte Carlo method [10]. Additionally, two custom form-based models are introduced: the Veto and Balance models. These are intuitive, heuristic tools that estimate probabilities based on recent team performance. The Veto model employs an asymmetric logic, while the Balance model applies a symmetric averaging rule. Both are designed to serve as lightweight alternatives to more complex statistical methods. To assess the profitability of betting, five distinct strategies are examined: Flat Betting (uniform stakes), Martingale and Fibonacci (progressive staking systems), Value Betting (based on expected value), and the Kelly Criterion [8], which aims to maximize long-term bankroll growth. These strategies represent diverse financial and behavioral profiles [12], making them suitable for comparative analysis.

The research is supported by a custom-developed Python-based sports betting simulation system, leveraging the API-Football database. The system automates predictions, executes simulated bets, and provides statistical and visual evaluation. Simulations are conducted on artificially constructed sets of 25 matches, each representing a distinct betting session. This structure allows for a fair comparison of different model–strategy combinations. Only completed matches with known outcomes are included, thereby eliminating predictive bias.

The analysis focuses not only on predictive accuracy but also on practical profitability. The main contribution of this work lies in simultaneously evaluating the theoretical predictive performance and real-world applicability of models across multiple strategies. The results provide insight into whether sports betting can be framed as a quantitative decision-making problem, and what limitations exist in leveraging statistical advantages within an efficient, information-driven market [1, 4].

References

[1] D. Cortis: *Expected values and variance in bookmaker payouts: A theoretical approach towards setting limits on odds*, Journal of Prediction Markets 9.1 (2015), pp. 1–14, doi: 10.5750/jpm.v9i1.987, url: http://ubplj.org/index.php/jpm/article/view/987.

[2] S. Dobson, J. Goddard: *The Economics of Football*, Cambridge: Cambridge University Press, 2008.

[3] ESPN: *U.S. sports betting industry posts record $13.7B revenue in 2024*, https://www.espn.com/espn/betting/story/_/id/43922129/us-sports-betting-industry-posts-record-137b-revenue-24, Hozzáférés ideje: 2025-04-23, 2024.

[4] D. Forrest: *Soccer betting in Britain*, in: Handbook of Sports and Lottery Markets, ed. by D. B. Hausch, W. T. Ziemba, Elsevier, North Holland, 2008, pp. 421–446.

[5] Grand View Research: *Online Gambling Market Size, Share & Trends Analysis Report*, Letöltve: 2024. április 5., 2023, url: https://www.grandviewresearch.com/industry-analysis/online-gambling-market.

[6] A. Groll, C. Ley, G. Schauberger, H. Van Eetvelde: *Prediction of football match outcomes: a comparison of predictive models and the role of social factors*, International Journal of Forecasting 34.3 (2018), pp. 366–378, doi: 10.1016/j.ijforecast.2018.02.006.

[7] L. M. Hvattum, H. Arntzen: *Using ELO ratings for match result prediction in association football*, International Journal of Forecasting 26.3 (2010), pp. 460–470, doi: 10.1016/j.ijforecast.2009.10.002.

[8] J. L. Kelly: *A New Interpretation of Information Rate*, Bell System Technical Journal 35.4 (1956), pp. 917–926, doi: 10.1002/j.1538-7305.1956.tb03809.x.

[9] M. J. Maher: *Modelling association football scores*, Statistica Neerlandica 36.3 (1982), pp. 109–118, doi: 10.1111/j.1467-9574.1982.tb01597.x.

[10] G. Pantuso, F. Lera-Lopez: *Monte Carlo simulation in sports betting: a football application*, Journal of Sports Analytics 3.3 (2017), pp. 161–172, doi: 10.3233/JSA-170241.

[11] S&P Global: *American Gaming Association: Legal sports betting hits record revenue in 2023*, https://www.spglobal.com/market-intelligence/en/news-insights/articles/2024/2/american-gaming-association-legal-sports-betting-hits-record-revenue-in-2023-80522087, Hozzáférés ideje: 2025-04-23, 2024.

[12] L. Vaughan Williams: *Information Efficiency in Financial and Betting Markets*, Cambridge: Cambridge University Press, 2008.