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# The Fibonacci Strategy Revisited: Can You Really Make Money by Betting on Soccer Draws?

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This article investigates the strategy of betting on soccer draws using the Fibonacci sequence. In the previous literature, this strategy has been found to be both simple and profitable, indicating that the soccer betting market is not efficient. The strategy is tested both in a simulated market and on a real data set of almost 60,000 European soccer matches. Contrary to the previous findings in the literature, all tested versions of the Fibonacci betting strategy are found to lose money.

Keywords: Fibonacci betting strategy, market efficiency

JEL classification: L83; G14

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# 1 Introduction

When investigating market efficiency, economists often turn to sports betting markets, since each asset (placed bet) has a certain value at a specific time (after the match). There are two types of efficiency typically studied in sports betting markets – strong and weak efficiency (Thaler and Ziemba, 1988). In a strongly efficient market, each bet has the same negative expected value – for example, a \$1 bet on any match result can be expected to pay back just 90 cents. In a weakly efficient market, bets might have different expected values, but these are still always negative.

There is ample evidence that sports betting markets are not strongly efficient – for example, bets on favorites and home teams lose less money than bets on longshots and away teams (a good overview can be found in Sauer, 1998). There are also some authors that claim to have found profitable strategies, mostly when betting on European soccer (e.g. Kuypers, 2000; Goddard and Asimakopoulou, 2004; Vlastakis et al., 2009), but these strategies usually rely on hard-to-implement models and identify only a small number of profitable betting opportunities. One notable exception is the Fibonacci betting strategy first proposed by Archontakis and Osborne (2007), which is claimed to be both simple and profitable, although risky.

The Fibonacci betting strategy is designed for betting on soccer results. It is based on the Fibonacci sequence (1, 1, 2, 3, 5, 8, 13...), where the first two numbers equal one and each successive number is the sum of the two previous numbers. The strategy works as follows: bet \$1 (the first number in the sequence) on a draw, if losing, bet \$1 (the second number) on a draw in the next match, if losing again, bet \$2 (the third number) on a draw in the next match, and so on until a draw actually occurs; after that, start the whole sequence from beginning. Archontakis and Osborne (2007) prove that each sequence of bets ending in a draw is profitable if draw odds are always at least 2.618 (usually true). The authors also tested the Fibonacci strategy on 32 games in 2002 FIFA World Cup and found that it would have generated a profit.

The Fibonacci betting strategy was later tested by Demir et al. (2012) on a sample of 32 seasons of top European soccer competitions and found profitable in all 32 cases. The strategy was also found to be profitable in a simple simulated strongly efficient market using 1,000 simulations. The authors characterize the Fibonacci betting strategy as “simple and profitable” (p. 30), but requiring a lot of capital if draws fail to occur for a long time.

This article first investigates the behavior of the proposed strategy in a simulated strongly efficient market and shows that it actually is not and cannot be profitable in such a market. However, under certain conditions the strategy could still be profitable in a real market. Consequently, the strategy is tested on a data set of almost 60,000 European soccer matches and also found to be losing money.

## 2 Simulated strongly efficient market

This section replicates one version of a simulated strongly efficient market used in Demir et al. (2012). In this market, draws are independent events, the probability of each draw is 0.3, and the betting odds offered on each draw are 3. In such a market, each \$1 bet has the expected payout of  $0.3 * 3 = \$0.9$ , so the expected value of such a bet is -10 cents (this corresponds to the usual profit margin of bookmakers).

To evaluate the Fibonacci betting strategy, the betting must actually stop at some point in time. One option, used in both Archontakis and Osborne (2007) and Demir et al. (2012), is to stop betting after X matches. However, this could generate huge losses if X is high and no draws occur. A second, more realistic option is to stop betting if the total profit is at least \$X or less than or equal to -\$X. This corresponds to the gambler willing to risk \$X and wanting to earn at least this amount – something that a profitable strategy should be able to do more often than half the time. Table 1 shows the results for three different settings for each option; each set of results is based on 10,000,000 computer simulations.

	Stop betting after X matches			Stop betting if profit $\geq$ \$X or $\leq$ -\$X		
	X = 10	X = 20	X = 40	X = 10	X = 100	X = 1,000
Maximum number of bets	10	20	40	24	166	1,208
Average number of bets	10	20	40	11.2373	75.4538	451.5707
Maximum single bet	55	6,765	102,334,155	8	89	987
Maximum profit	22	2,585	39,088,170	13	134	1,377
Minimum profit	-143	-17,710	-267,914,295	-17	-188	-1,986
Relative frequency of positive profit	0.7386	0.8628	0.9316	0.4476	0.4273	0.4071
Relative frequency of negative profit	0.2340	0.1299	0.0675	0.5524	0.5727	0.5929
Average sum of bets	28.3961	165.6527	2366.8091	22.1124	342.2596	4,267.2651
Average sum of winnings	25.5603	148.9913	2139.7781	19.9050	308.0609	3,840.0997
Average profit	-2.8358	-16.6614	-227.0310	-2.2074	-34.1986	-427.1654
Profit margin	-0.0999	-0.1006	-0.0959	-0.0998	-0.0999	-0.1001

Table 1: Fibonacci strategy in a strongly efficient market, 10,000,000 simulations for each setting

Using the first option of stopping after X matches, the strategy produces highly asymmetrical returns; it has a high probability of generating a small profit and a low probability of generating a large loss. The second option provides more symmetrical results, but the strategy brings a positive profit in less than 50 percent of the cases. The key result is that for each setting, the average sum of bets is higher than the average sum of winnings, so the average profit is negative and the strategy (on average) loses money. This can also be proven theoretically: If the gambler bets  $X_1$  on match number 1,  $X_2$  on match number 2 ...  $X_n$  on match number n, the expected winnings are  $0.3 * 3 * X_1$ ,  $0.3 * 3 * X_2$  ...  $0.3 * 3 * X_n$ , so the expected sum of winnings =  $0.9 * \text{sum of bets}$  and the expected profit

margin = (expected sum of winnings – sum of bets)/sum of bets = -0.1 (close to the simulated value for all settings). Both the simulation results and the theoretical proof contradict the findings in Demir et al. (2012); however, they stopped betting after 150 matches and used only 1,000 simulations – not enough to properly explore the whole range of possible outcomes.<sup>1</sup>

### 3 Real market

Although the Fibonacci strategy is not and cannot be profitable in a strongly efficient market, it could still be profitable in a real market under the following two conditions: first, some bets on draws have positive expected values; second, the amounts bet on such matches are high enough to more than compensate for expected losses from the other bets. This could happen if bookmakers underestimated the probability of a draw after a long string of non-drawn matches.

To test whether the Fibonacci strategy is profitable in a real betting market, this article uses data from 171 completed seasons of 19 top European soccer competitions that took part from 2004/05 to 2012/13. The data set contains 59,725 match results with valid betting odds.<sup>2</sup>

The Fibonacci strategy is simulated in the following way: for each match in the data set, there are 1,000 bettors that start their betting on this match. Each bettor then continues betting on draws in the closest available match in the same competition, but only on one match in the same day. If there are more matches played on the same day, there are two alternative settings: first, the bettor chooses randomly from all matches on that day; second, the bettor chooses randomly from all matches with the highest betting odds on a draw on that day (used in Demir et al., 2012). After the end of the season, the bettor continues betting on the next season of the same competition. At the end of the last season (2012/13), the bettor goes back in time to the first season (2004/05) of the same competition. The betting ends after 20 matches (one setting) or if the total profit is at least \$100 or less than or equal to -\$100 (another setting). Therefore, there are  $2 * 2 = 4$  combinations of settings and  $59,725 * 1,000 = 59,725,000$  simulations for each setting. The simulation results are summarized in Table 2.

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<sup>1</sup> The highly asymmetrical returns if stopping after X matches are the complicating factor; for the profit margin to converge, the simulated sample should contain a sufficient number of even the worst-case outcomes of no draws at all. If stopping after 40 matches, the probability of such an outcome is  $(1 - 0.3)^{40} \approx 6.4 * 10^{-7}$ , so even 10,000,000 simulations used in this article are barely enough for this specific setting.

<sup>2</sup> The 19 competitions are the top Belgian, top 2 German, top 4 English, top 2 French, top Greek, top 2 Italian, top Dutch, top Portuguese, top 2 Scottish, top 2 Spanish, and top Turkish league. The data set was downloaded from the website [football-data.co.uk](http://football-data.co.uk) on June 10<sup>th</sup>, 2013, and contained 61,646 match results; however, 1,921 matches (3 %) did not have associated valid betting odds, so they were discarded. The betting odds were quoted by a major British bookmaker William Hill.

	Choose randomly from same-day matches		Choose randomly from same-day matches with highest draw odds	
	Stop betting after 20 matches	Stop betting if profit $\geq$ \$100 or $\leq$ -\$100	Stop betting after 20 matches	Stop betting if profit $\geq$ \$100 or $\leq$ -\$100
Maximum number of bets	20	375	20	168
Average number of bets	20	57.8339	20	44.8804
Maximum single bet	6,765	89	6,765	89
Maximum profit	43,175	668.95	29,645	666.95
Minimum profit	-17,710	-189	-17,710	-189
Relative frequency of positive profit	0.8560	0.4314	0.8417	0.4170
Relative frequency of negative profit	0.1438	0.5686	0.1581	0.5830
Average sum of bets	270.0189	289.6924	397.3635	257.7025
Average sum of winnings	232.6497	259.6695	341.4649	227.3980
Average profit	-37.3692	-30.0230	-55.8986	-30.3044
Profit margin	-0.1384	-0.1036	-0.1407	-0.1176

Table 2: Fibonacci strategy in a real market, 59,725,000 simulations for each setting

For all four combinations of settings, the Fibonacci strategy has a negative average profit and therefore loses money. In fact, the estimated profit margins do not substantially outperform the profit margin of the simplest possible strategy of betting \$1 on a draw in each match in the data set (-0.1130). Again, this result contradicts the findings in Archontakis and Osborne (2007) and Demir et al. (2012); however, their results were based on extremely limited numbers of trials (1 and 32, respectively).

## 4 Conclusion

In this article, the Fibonacci strategy for betting on soccer has been tested both in a simulated strongly efficient market and on a data set of almost 60,000 European soccer matches. All tested versions of the strategy lose money in both simulated and real markets. This sharply contradicts the previous findings in the literature. The previous positive results were likely caused by a very low number of trials. In conclusion, the Fibonacci betting strategy, previously presented as both simple and profitable, is actually simple, but not profitable.

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