How To Make A Living Betting Horses: The Mathematical Proof

By

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Introduction

Predicting the outcome of a horse race attracts many, many people who are attracted to everything from the excitement of the race itself to the intellectual challenge and the analysis of the vast amounts of historical and projected data currently available to the betting public. Tens of millions of dollars can be bet in a single day when high value races are run such as the Triple Crown races or the Breeders' Cup races. Such days bring out the very knowledgeable bettors, but, more importantly, the novice bettors out for a very good time at the race track without much care for their betting dollar.

The question presented in this white paper is whether an individual bettor can secure more than their fair share of those millions of dollars bet on high value days and all of the rest of the days of the year? This white paper will conclusively answer the question loudly and with authority in the affirmative. Even better, the process will be explained in mathematical detail.

Over the decades several authors have offered mechanical systems of one sort or another to "beat the races". Mechanical systems are ones that suggest a bettor can convert certain inputs, such as odds, weight, previous performances, earnings, jockey, trainer, and so on, into a long-term financially successful outcome. A winning bettor must come to understand that virtually none of these mechanical systems can work long-term because the factors considered are statistical phenomenon, but the factors are also nonstationary in nature. An investigator can sift through many years of past race records and find what appears to be significant patterns. Unfortunately, a simple prediction of who will win the race cannot be found in a nonstationary environment.

It should be clear that if a bettor truly wants to be successful on a long-term basis, then the bettor must look for a different approach to making a profit betting on horses. There is a direction to be investigated. It is called the Expected Value Equation. The Expected Value Equation controls the financial outcome in all forms of gambling.

Simply stated, if a bettor wants to be truly successful on a long-term basis, then the bettor must learn to take advantage of the Expected Value Equation. The bettor must identify a sufficiently high number of expected value betting advantages so that a sufficient expected value profit can be generated to support the bettor and their lifestyle going forward. For a horse racing bettor to make a long-term profit the goal is to find a sufficiently large number of profitable betting opportunities. Such opportunities are not present in every race. The successful bettor must wait for their opportunities to come along and then pounce without disturbing the actual post time odds.

Where can the average bettor start? The Expected Value Equation for horse Racing is stated quite simply as follows:

EV = (Probability of Winning x Amount Won) – (Probability of Losing x Amount Lost)

The equation is quite simple. Let's examine how to take advantage of the Expected Value Equation to become a long-term successful bettor. Mathematically speaking, the answer is found when comparing the objective probability of a horse winning the race to the subjective probability of a horse winning the race. Long-term profit can be secured when the subjective probability, as determined by the betting public, is less than the objective probability of a horse winning the race. That means the odds stated on the tote board are higher than the objective odds. The higher odds stated on the tote board constitutes a premium the horse will pay upon winning the race.

Subjective Probability

Betting on horse racing in the United States is based on a 100% subjective system called the pari-mutuel method. In the pari-mutuel method every bettor makes a subjective determination of which horse they will bet on to win the race. (The white paper only considers bets to win.) The money bet to win goes into a pot. The track takes a cut out of the pot and what is left is distributed to bettors who bet the winning horse.

It is necessary to understand that the pari-mutuel method is a betting procedure based upon the subjective probabilities to win assigned to each horse in the race by all of the bets made by all of the bettors for the race. This process determines the actual potential payoffs on every horse in the race based upon the amount of money bet on every horse in the race.

To convert the process to a mathematical model let's assume n bettors $B_1, B_2, \dots B_n$ bet on a race with m horses $H_1, H_2 \dots H_m$. Every bettor B_i makes their subjective decision on which horse or horses to bet in each given race. All of the bets become the estimate of the relative value of each horse H_j in the race expressed in terms of odds. In effect, a n x m subjective probability matrix $\{P_{ij}\}$ has been formed and P_{ij} represents the probability, in the opinion of B_i, that H_j will win the race. The tote board reveals the subjective probabilities determined by all bettors that horses $H_1, H_2 \dots H_m$ respectively, will win the race.

B_i examines the probabilities displayed on the tote board $\pi_1, \pi_{2,\dots}\ \pi_m$ and places his/her bets theoretically designed to maximize his/her subjective expectation. β_{ij} is the amount of money wagered by bettor B_i on horse H_j and b_i is the total amount of money bet on one or more horses in the race by B_i and we have the following:

$$\sum_{j=1}^{m} \beta_{ij} = b_i$$

It is assumed that every horse in the race has at least $1 bet on it to win the race.

The following relationship is caused by the pari-mutuel format:

$$\sum_{i=1}^{n} \beta_{ij} = k\pi_j$$

when *k* is the constant of proportionality relating the amount bet on each horse to its pari-mutuel probability.

It is assumed that all bettors always seek to maximize their profit when making any of their bets. Therefore, it is assumed that B_i will only place a bet when his/her subjective expectation E_i is positive. This can be expressed:

$$E_i = \frac{P_{ij}}{\pi_j} > 1$$

This equation holds for the subjective expectation that for every dollar bet by B_i more than $1 will be won by B_i.

The proportionality constant determines parimutuel odds for win bets as follows when K represents the track takeout:

$$k = (1 - K) \sum_{i=1}^{n} b_i$$

This can also give us:

$$\pi_j = \frac{\sum_{i=1}^{n} \beta_{ij}}{(1 - K) \sum_{i=1}^{n} b_i}$$

Look at the tote board and you will see the odds for each horse. The odds are quoted as (1 - $\pi_j)/\pi_j$ to 1.

Objective Probability

Let's suppose that there was a way to determine the "real" probability ρ_j of a horse in the race to win as opposed to the subjective probability generated by the pari-mutuel process π_j that horse H_j will win then it is possible to develop a long-term profitable betting strategy for the race. In fact, this is what makes the dream of “beating the races” a reality.

Let the total amount of money bet on the *j*th horse $k\pi_j$ (see above) be separated into the number of dollars bet by the subjective pari-mutuel crowd s_j and the number of dollars bet by a person knowing the “real” probabilities t_j so that the total amount of money bet to win in the race is now considered to be in two separate pots. The profit $F(t_1, t_2, \ldots t_m)$ realized based on the knowledge of the “real” probabilities with bets on *m* horses can be stated as follows:

$$F(t_1, t_2, \ldots, t_m) = (1-K)\left[\sum_{j=1}^{m}(s_j + t_j)\right]\sum_{j=1}^{m}\frac{\rho_j t_j}{s_j + t_j} - \sum_{j=1}^{m} t_j$$

The formula represents an objective function to optimize betting when the real probabilities of each horse winning the race are known and compared to the subjective probabilities. The decision variables are the t_j known “real” probabilities of winning. The goal of the function is to maximize profits. This becomes actionable for the average bettor who can gain access to the “real” probabilities and whose bets are based on situations where a horse’s “real” probability of winning the race is greater than the subjective probability of the pari-mutuel bettors. Of course, profitable opportunity does not occur in every race.

In conclusion, a bettor with knowledge of the “real” probabilities of each horse winning the race simply must wait and find opportunity to make what will be a profitable bet long-term. Simply stated, the objective of a bettor with knowledge of “real” probabilities for every horse in a race is to find horses where the subjective bettors assign a reduced probability of winning the race for a given horse. When the tote board displays a higher potential payoff for a horse compared to the “real” probabilities then long-term profit potential exists. Just do not bet so much money as to negatively impact the subjective betting pools and reduce the profitable opportunity to ashes.

Application

It is time for you to believe that understanding the mathematics behind your betting decisions can significantly enhance your profitability. One of the key concepts to grasp is Expected Value (EV). This concept helps you determine whether a particular bet is likely to be profitable in the long run. Let's explore what Expected Value is and how it applies to horse racing betting.

What is Expected Value?

Expected Value is a statistical measure used to calculate the average outcome of a bet if it were repeated many thousands of times. In simpler terms, it tells you what you can expect to win or lose on average per bet. The formula for Expected Value is:

Expected Value (EV) = (Probability of Winning × Amount Won per Bet) **−** (Probability of Losing × Amount Lost per Bet)

Applying Expected Value to Horse Racing Betting

When betting on horse races, calculating the Expected Value of a bet helps you identify which bets are worth taking. Here’s a step-by-step guide on how to use this equation:

1. Determine the probability of winning for horses you are thinking of betting**:**
    - Acquire the “real” probability of your chosen horse winning the race. This should be based on reliable AI-generated predictions.
2. Calculate the Potential Winnings:
    - Find out how much you stand to win if your horse wins. This is the odds offered on the tote board multiplied by the number of dollars you bet.
3. Assess the Probability of Losing:
    - The probability of losing is simply 1 minus the probability of winning.
4. Calculate the Amount Lost per Bet:
    - This is generally the amount you wager, since you lose your bet if the horse doesn’t win**.**

An Example Calculation

Let's say you’re considering a bet on a horse named "Thunderbolt," which has a “real” probability of winning stated at 20% (0.20) and the odds offered are 5/1. You decide to bet $10.

- Probability of Winning: 20% or 0.20
- Probability of Losing: 80% or 0.80
- Amount Won per Bet: $10 times 5 = $50
- Amount Lost per Bet: $10

Insert these values into the Expected Value formula:

EV= $(0.20\times50) - (0.80\times10) =$ $2

This means that, on average, you can expect to win $2 for every $10 bet you place on "Thunderbolt." Since the EV is positive, this is a profitable bet in the long run.

Why Expected Value Matters

Understanding and using Expected Value is crucial for making informed betting decisions and long-term profit. It helps you:

- Identify Profitable Bets**:** Only place bets where the EV is positive, indicating potential long-term profitability. You may win or lose the current bet, but betting in such mathematical circumstances will be profitable over the long-term.
- Manage Risk: Avoid bets with negative EV, which are likely to lead to losses over time.
- Make Data-Driven Decisions: Rely on statistical analysis rather than intuition and endless analysis, improving your betting outcomes.
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Conclusion

Expected Value is a powerful tool for any serious horse racing bettor. By incorporating EV into your betting strategy, you can make smarter, more profitable decisions. At WynnAI, we provide AI-driven “real” probabilities for every horse in the race to help you identify bets with positive expected value, enhancing your chances of success.