

Statistics in Sports Gambling

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Introduction:

Gambling and sports/event gambling has been around since ancient times. Its popularity has allowed it to become a very lucrative business and stay relevant throughout the years. After some background on the history of sports gambling, we will look at some of the math and the different aspects that go into sports gambling. This includes the different types of bets, the different types of odds and converting to one another, calculating payouts based on those odds, and calculating implied probabilities and parlay odds. After these calculations we will be able to look a little further into how the house is able to maintain its edge and ensure that they always win.

History and Background:

Sports betting has been a popular business for quite some time. Records show that it dates back to the Ancient Romans where people would bet on gladiator battles and chariot races. Back in those times and up until recently, in order to make a bet, the bettor would have needed to either be at the event to make the bet, in-house, or have what is called a bookie. A bookie is someone who gave their own odds and people could bet on those odds. Bookies were usually great mathematicians as they needed to be to make sure they could pay their bettors. For the less math inclined bookies, commissions were taken instead to hedge their losses. Sports betting became so popular amongst the people that in 1992, Congress had to step in as they felt the integrity of sports may be soon compromised by the amount of betting. This pushed them to pass the Professional and Amateur Sports Protection Act (PAPSA). This act prevented any sports betting on professional and amateur sports so that players and staff apart of the sport could focus on the game and not the bets that were made on it. Relative to the sports betting timeline, this was very short lived as states pushed for sports betting to made legal. In 2011, New Jersey voters were able to enact a referendum which allowed bets at racetracks and in Atlantic City. Over the next several years, cases are brought up fighting NJ and the PAPSA as professionals still felt they needed to be protected. However, in 2018 New Jersey finally becomes victorious and PAPSA is removed. This gave individual states the power to choose to vote on whether or not to legalize sports betting. With today's technology, this allowed for betting apps such as DraftKings and FanDuel to enter the space as now Las Vegas was not the only place to make bets. Today, there are 30 states and Washington D.C. that allow sports betting (2, 5).

Within the realm of sports betting, there are many different types of bets one can make. For example, there are money-line bets where a person just bets on what team will win. There

are also spreads which is betting on the score difference, player/team props which bet on a players'/teams' stats and performance and parlays which allow a combination of any of the above bets. In this paper we will mainly focus on the odds and the parlays as this helps show how the house stays ahead.

Betting Odds:

Depending on what part of the world a bet is being displayed, it can take on different forms. While they all mean the same thing, it is important to know how to interpret each one. The three forms are fractional, decimal, and the money-line. Fractional odds are used in the UK by British and Irish bookies and look like any normal fraction. To interpret them is quite simple. the numerator represents every dollar won in the denominator. For example, with odds 13/5, for every \$5 wagered the bettor wins \$13 or 1/6 where for every \$6 wagered the bettor wins \$1. It is important to distinguish the difference in payout and profit. For 13/5, if a bettor bets \$5 and wins, their payout is the \$13 they win plus the initial \$5 stake totaling to \$18. It is a common mistake to see that and say the bettor only wins \$13 but they win \$18 with a profit of \$13. This is the same case for money-line bets.

Next are decimal odds. These are odds that are in the forms of decimals and are used in the rest of Europe. These odds are simpler to handle as calculating a payout is simply multiplying the stake by the decimal odds. For example, if the odds are 1.4 and a \$5 bet is made, then the payout is simply $\$5 * 1.4 = \7 . With decimal odds, there is no addition of the initial stake so the odds must be >1 or else the bettor loses money.

The third and final form is a money-line bet. These are the form seen in the US and take the forms of +/- a number greater than or equal to 100. For example, on one of the apps, a bettor might see a team's odds of winning a game are -110. Calculating the payout on these is a little more complicated than the previous two. If the number is positive, the number shows how much the bettor wins if they bet \$100. For example, if the odds are +210, then the bettor wins \$210 for every \$100 bet. This does not mean that the bet must be \$100 for example, betting \$10 on +210 odds leads to a winning of \$21. If the odds are negative, the number is showing how much a bettor would have to bet to win \$100. For example, with odds of -110, a bet of \$110 wins \$100. Calculating payouts is similar to the fractional odds where it is the winnings of the bet plus the initial stake. Keeping the same odds as before, if a bettor bets \$100 on +210 odds, the payout is $\$210 + \$100 = \$310$ and similarly betting \$110 on -110 odds gives a payout of $\$100 + \$110 = \$210$ (3).

To reiterate, these odds may be of different forms, but they can all mean the same thing as they are there to help calculate payouts and profits. For bettors that travel to different countries and would want to convert the odds to ones more familiar to them it is possible and quite simple. The following table shows how to convert these odds between each other.

Conversion formulas		
x	To	Calculation required
Fractional	Decimal	Step 1: Divide (solve) fraction Step 2: Add 1
Fractional	American	Step 1: Divide (solve) fraction Step 2: If answer ≥ 1 , then $100 \times \text{answer}$ If answer < 1 , then $-100/\text{answer}$
Decimal	Fractional	Step 1: Deduct 1 Step 2: Convert to fraction
Decimal	American	Step 1: If Decimal odd > 2 , then $100 \times (\text{DecimalOdd} - 1)$ If Decimal odd < 2 , then $-100/(\text{DecimalOdd} - 1)$
American	Decimal	Step 1: If American odd > 0 , then $(\text{AmericanOdd}/100) + 1$ If American odd < 0 , then $(-100/\text{AmericanOdd}) + 1$
American	Fractional	Step 1: If American odd > 0 , then $\text{AmericanOdd}/100$ If American odd < 0 , then $-100/\text{AmericanOdd}$

 Investopedia

Figure 1

Parlays:

A parlay is a string of bets all made together to make one big bet. To start, betting odds are just probabilities of an event happening. When people make their bets, they are betting on the probability of the event. Because parlays are the bet the two or more events are to happen, it is the probability of the intersection of the events to occur. From probability axioms, the probability of the intersection of events cannot be larger the probability of the individual events. This means that the odds set on parlay bets are much larger than the individual bets and therefore results in larger payouts. This also makes the parlay bets riskier as the bettor is betting on a smaller probability. In the parlay, if one of the events does not occur, the parlay is no longer valid the bettor loses (6).

5 Team Parlay

#4481902.18 - 02/13/2021 1:35PM





Philadelphia 76ers At Phoenix Suns

Ben Simmons Over 22.5

BEN SIMMONS - PTS + REB

W

-115



Indiana Pacers At Atlanta Hawks

Domantas Sabonis Double Double/Indiana To Win

PLAYER PERFORMANCE DOUBLES

W

+164



Houston Rockets At New York Knicks

Eric Gordon Over 27.5

ERIC GORDON - PTS + REB + AST

W

-108



Brooklyn Nets At Golden State Warriors

Joe Harris Over 2.5

JOE HARRIS - MADE THREES

W

-122



Miami Heat At Utah Jazz

Rudy Gobert Double Double/Utah To Win

PLAYER PERFORMANCE DOUBLES

W

+100

\$3.00

+3359

\$103.78

TOTAL WAGER

ODDS

WON ON FANDUEL

Figure 2

Taking a look at this example parlay, the bettor has bet team and player props with individual odds that alone would not payout a lot. If the bettor bet \$1 on each event, the total payout would be \$10.26. However as seen in Figure 2, in the parlay the payouts of all the events on a \$3 bet would be \$103.78 on odds of +3359. Calculating parlay odds is not too difficult (6). To do so:

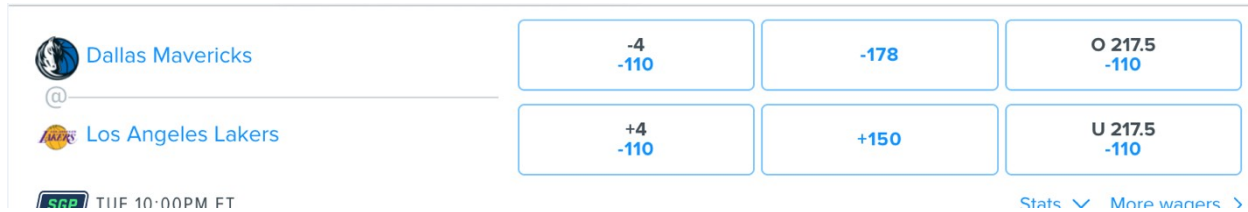
1. Convert the odds into decimal form
2. Multiply the odds together
3. Multiply by the bet amount
4. Subtract the bet amount

Ex: if three events all had odds of -110, the parlay odds would be calculated to be +597 giving the bettor winnings of almost 6x their initial bet.

House Always Wins:

The famous saying when betting is, "The house always wins." Some people take this as a challenge, some see it as propaganda to challenge and encourage people to beat the house, and others see it for the truth that it really is. While the house does not win every bet as that would be highly improbable, the house always has the edge whether it be in casino games or in this

case, sports betting. This can be seen through the calculations of implied probabilities on betting odds.



 Dallas Mavericks  Los Angeles Lakers  TUE 10:00PM ET	-4 -110 +4 -110	-178 +150	O 217.5 -110 U 217.5 -110
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Stats  More wagers 

Figure 3

Calculating the implied probability is very simple. The formula is just the stake divided by the total payout. Therefore, if the odds are -110, the implied probability of the event happening is $\frac{110}{100+110} = 52.38\%$. Above are real life odds on the NBA game from February 28th, 2021. The odds for the Dallas Mavericks to win the game are -178 and the LA Lakers have odds of +150. In the NBA no game can end with a tie so the probability of one team winning is 100%. Calculating the implied probabilities based on these odds, Dallas is at 64% and the Lakers are at 40%. Notice these probabilities add up to 104% > 100%. How is that possible? This is because that extra 4% is the built-in house edge. Even if the perfect ratio of people were to bet on each team, FanDuel would still have their expected profit of $4/104 = 3.85\%$ (3). This shows how the house always wins with sports betting as the odds are not truly fair. They are very close but the mathematicians and the algorithms that the companies and casinos have, take into account so many variables and inputs to ensure that they still make a profit. Some might see this as unfair or unethical, however from a business standpoint, it would be a terrible business model to not hedge their risk and make sure that they do not lose money.

Conclusion:

While sports betting has been around for centuries, the introduction of online sports betting has never made it more accessible and easier as with a few clicks bets can be placed in an instant. However, because of this it is important to know how the bets and odds work, along with knowing the implied probability of the event that you are betting on. Knowing the risks helps to make smarter bets and hedge losses just as the apps and casinos do for themselves. While the house may always win, the odds can be used to help bettors win as well.

Note: The purpose of this paper is not to encourage or teach how to win with sports betting. Its purpose is to inform as the author is in no position and has no credentials to show that betting is a great thing.

References

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