

# DOES SPORTSBOOK.COM SET POINTSPREADS TO MAXIMIZE PROFITS? TESTS OF THE LEVITT MODEL OF SPORTSBOOK BEHAVIOR

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The Levitt (2004) model of sportsbook behavior is tested using actual percentages of dollars bet on NFL games from the internet sportsbook, Sportsbook.com. Simple regression results suggest that Sportsbook.com sets pointspreads (prices) to maximize profits, as the Levitt model assumes, not to balance the betting dollars, as the traditional model of sportsbook behavior assumes. Sportsbook.com is found to accept significantly more wagering dollars on road favorites, larger favorites, and on the over for the highest totals in the over/under betting market. Bettor liquidity constraints and sportsbook betting limits may help explain this result.

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In his paper “Why are Gambling Markets Organized So Differently From Financial Markets,” Steven Levitt (2004) stated that sportsbooks tend to set betting pointspreads in the NFL at a price that is different than the market clearing price. Levitt stated that instead of attempting to balance the betting dollars on each side of the proposition, as commonly assumed in other models of sportsbook behavior such as Zuber et al. (1985) and Sauer et al. (1988), sportsbooks set pointspreads (prices) to maximize profits. According to Levitt, sportsbooks are more skilled than bettors at predicting the outcomes of games and use their insight into common bettor biases, such as betting big favorites and road favorites, to set pointspreads at a level slightly higher than implied by efficiency. Therefore, sportsbooks are able to earn higher profits by accepting more betting dollars on the popular side of these propositions, rather than just collecting their commission by balancing bets.

Although past studies of various sports gambling markets have shown that the overall markets appear to be efficient, there have been studies across sports that have shown that various subsets of gambling markets, such as betting big underdogs and betting home underdogs in sides (betting on the winner in a contest) markets win more than implied by efficiency. Examples of these studies include Golec and Tomarkin (1991) and Gray and Gray (1997). In totals markets, simple strategies of betting the under have also been shown to be profitable (Paul and Weinbach, 2002).

The results of these efficiency studies imply the behavior of the sportsbook could be different than attempting to balance betting dollars on each side of the

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proposition. The difficulty in attempting to discern the actions of the sportsbook is that actual betting dollars, or percentage of bets placed on each side of the proposition, have been very difficult for researchers to obtain. Sportsbooks have generally guarded this information, likely with very good reason, and researchers in this field have been left to speculate as to the actual operation of the sportsbook from their results that have either supported the efficient markets hypothesis or found slight deviations from the predicted prices.

Levitt (2004) used data from a sports betting tournament to illustrate that sportsbooks do not balance the betting dollars on each side of the proposition in the NFL sides betting market. This result holds important implications for the study of the efficient markets hypothesis in relation to sports and other prediction markets, but it does suffer from a few problems. One major concern about the Levitt (2004) study is the use of a betting tournament instead of actual sportsbook activity. The tournament in the study uses a limited number of participants and does not include all of the betting dollars that are attracted by a real sportsbook. In addition, betting in a tournament does not truly reflect marginal behavior of bettors. In the tournament studied, bettors paid a fixed cost entry fee of \$250 and made picks on the games each week. Therefore, the bettors did not face a marginal outlay of money for each of their bets, which is very different than the setting of bettors in normal wagering markets and could lead to very different results. Additionally, the fixed entry fee of \$250 for a season is likely a trivial amount for most bettors, as many bettors bet more than that amount each week of the NFL season and some bet more than that amount per game. Therefore, the sample of the bettors in the tournament may not reflect the true population of bettors who wager on NFL games.

Although the results of the Levitt study are appealing and support the results found in various efficient markets studies across sports, the nature of the tournament data is a major concern. Data from an actual sportsbook, containing percentage of all dollars bet on each side of the proposition, would be very helpful in alleviating any concerns about the results due to the problems of using the betting tournament data. Thankfully, this data has become available from a major on-line sportsbook. Each day, Sportsbook.com, a major internet sportsbook, shows the percentage of betting dollars bet on each side of each betting proposition for all major sports. Although the number of dollars bet on each game is not published, and likely varies by game, the percentage of bets taken on each side is presented each day.

Given the public availability of the data, we gathered the Sportsbook.com percentage bet data each day after NFL games were played. Gathering the data immediately after each week of games was played insured that we obtained the percentage of dollars bet at the closing pointspread (sides market) and total (totals market). With a full season of actual sportsbook data, we could then test the same hypotheses that Levitt tested with full sample of data on bettors, rather than data from a betting tournament.

Section II shows the regression results of a simple model of percentage of dollars bet on the favorite and on the over. These results support the findings

of Levitt for sides markets and the simple tests are extended into totals markets and explore similar sportsbook profit-maximizing behavior in that market. Section II also shows the returns to the sportsbook decision not to balance the betting dollars, which also gives the returns to a bettor who bet against the public and therefore took the same position as the sportsbook in the wager. Section III explores some possible explanations, beyond those proposed by Levitt (2004), for why the sportsbook may have the ability to set a profit-maximizing price and why betting markets are not truly open markets.

## II. SPORTSBOOK.COM DATA AND THE DECISION TO NOT BALANCE BETTING DOLLARS

Sportsbook.com, a major internet sportsbook, can be found at [www.sportsbook.com](http://www.sportsbook.com). Before regulation was changed in the U.S. in 2006 (to begin in 2007) making the transferring of money by credit card companies and financial institutions to internet sportsbooks illegal, sportsbook.com had betting clients from the United States and all over the world who could transfer money into accounts through bank transfers, credit cards, Western Union, or internet transfer systems such as Netteller.com. Sportsbook.com reports to be the leading online sportsbook in the US by a variety of measures, and highlights a peak level of activity of fifteen bets per second. The percentage of dollars bet on each side of the available proposition can be found on the page labeled “Betting Trends”.

As mentioned in the introduction, the percentages for each NFL game were gathered at the conclusion of the games. Data were gathered for both the sides (betting on a team against the points spread) and totals (betting on the total amount of points scored by both teams) markets. Included on the “Betting Trends” link on [www.sportsbook.com](http://www.sportsbook.com) was the percentage bet on each team, percentage bet on the over and the under, and the current points spread and total, which becomes the closing points spread and total after the games are played. This data, which is only available, after the market is opened, for the time leading up to the game and for one day following the game, was gathered for each game of the 2006–07 NFL regular season and is the dataset used for the regression results presented in this section.

A very simple regression model is tested, which illustrates the actions of the sportsbook very clearly. The model to be estimated is as follows for the sides (points spread) market:

$$(1) \quad (\% \text{ Bet on the Favorite})_i = \alpha_0 + \beta_1(\text{Points spread})_i + \beta_2(\text{Dummy for Road Favorite})_i + \varepsilon_i$$

The dependent variable is the percentage of dollars bet on the favorite. The independent variables include an intercept, the points spread on the game (presented as a positive number – greater favorites have larger points spreads), and a dummy for teams which are road favorites. This simple regression model

TABLE 1  
REGRESSION RESULTS FOR PERCENTAGE BET ON FAVORITES AT SPORTSBOOK.COM FOR THE  
2006–07 NFL SEASON

Dep. Var.: % of Dollars Bet on Favorite	All Favorites (256 games)	Home Favorites (175 games)	Road Favorites (81 games)
Intercept	0.5225*** (35.2366)	0.5138*** (30.2277)	0.7185*** (36.5783)
Pointsread	0.0131*** (6.5683)	0.0145*** (6.1891)	0.0054 (1.3465)
Road Favorite Dummy	0.1626*** (10.7627)		

Regression results are presented for the Sportsbook.com betting data for the 2006–07 NFL Season. The dependent variable is % of the dollars bet on the favorite. The independent variables include an intercept, the pointsread (positive value for favorite), and a dummy variable if the favorite was the road team. For each independent variable, the coefficient and accompanying t-statistic is shown. The results are shown for the sample as a whole, the sample of home favorites, and for the sample of road favorites.

\*-notation denotes significance of a t-test that the coefficient is different from zero. \* is significant at 10%, \*\* is significant at 5%, and \*\*\* is significant at 1%.

allows testing of the ideas put forth in the study of the betting tournament by Levitt (2004). First, if sportsbooks presume that bettors will overbet favorites and stronger favorites will be bet more heavily than weaker favorites, the coefficient  $\beta_1$  should be positive and significant. If the sportsbook also realizes that bettors tend to overbet road favorites, the coefficient on the dummy variable,  $\beta_2$ , should also be positive and significant. The regression results are also shown for the subsets of home favorites and road favorites. Given the separation of the data into home and road favorites, the road favorite dummy variable is not needed in the last two regression specifications.

As easily can be seen from the first regression results (the column labeled All Favorites), the results from the actual sportsbook, Sportsbook.com, are similar to the results found in the data from the betting tournament in Levitt (2004). The pointsread is shown to have a positive and significant effect on the percentage of dollars bet on the favorite. In short, as the pointsread increases, a larger percentage of bets are made on the favorite. For example, the model results predict a home favorite of 3 points would have greater than 56% of the dollars wagered on that team. A home favorite of 7 points would have more than 61% of the dollars wagered on that team. Although slightly smaller, percentage-wise, than the findings of the betting tournament in Levitt (2004), Sportsbook.com definitely does not attempt to balance the betting dollars exactly. In fact, the bigger the favorite, the more unbalanced the betting dollars become. Given big underdogs have been shown to win more often than implied by efficiency in the NFL, and other sports, it appears that sportsbooks do shade the pointsread higher, but not as high as would equalize betting action. In keeping the pointsread below the market clearing price, the sportsbook is willing to accept unbalanced wagering dollars, and therefore incur risk to attempt to maximize profits, due to the consistent bias of bettors to overbet favorites.

The dummy variable for road favorites is also positive and significant. Being a road favorite adds an additional 16% bet on the favorite. For example, a 3-point road favorite will generate greater than 72% of the wagering dollars on the favorite, while a 7-point road favorite will generate greater than 77% of the wagering dollars on the favorite. Sportsbook.com allows bettors to wager more money on road favorites, without changing the line to the market-clearing price, as they recognize the bias of bettors to overbet the road team. This likely has nothing to do with the public preferring teams that are on the road, but has more to do with the public overbetting good teams. Good teams are stronger favorites at home and will be road favorites against poorer teams. Therefore, the public willingness to overbet good teams explains both the imbalance of betting dollars on big favorites and road favorites.

A natural extension of the pointspread betting market explained in the Levitt model of sportsbook behavior is to the totals market in the NFL. Although the NFL totals market has been shown to be efficient in the overall sample, the over has been shown to be overbet at the highest totals in the NFL, with under bets winning more than implied by efficiency in this subset (Paul and Weinbach, 2002). The simple behavioral bias evident in the totals market is that bettors prefer to bet the over to the under. The over may simply be regarded by bettors as a more pleasurable proposition to root for when watching the game. The over allows one to enjoy the excitement of scoring plays, while betting the under in a game may be more difficult to enjoy as a bettor watches. Under bettors must hope for a lack of scoring, which generally involves many punts, turnovers, and generally unexciting play. If sportsbooks realize that bettors are likely to have a bias toward betting the over, particularly in games between two high-scoring teams which results in the highest totals, they are likely to allow unbalanced betting action on the over compared to the under in these games.

The totals market is tested in the same manner as the sides market above. In this case, there is no need to distinguish between home and road teams as bets on totals are based on the combined score of both teams. Therefore, the simple regression model is:

$$(2) \quad (\% \text{ Bet on the Over})_i = \alpha_0 + \beta_1(\text{Total})_i + \varepsilon_i.$$

If more wagers are accepted on the over as total increases, then  $\beta_1$  should be positive and significant. The results are presented in table II.

As can be seen from the regression results, the total has a positive and significant effect on the percentage of dollars bet on the over. Simply, the higher the total, the greater amount of money bet on the over. The range of totals in the 2006–07 season was between 31 and 55 with an average total of 40.5 and a median of 40.5. Given that range, a total of 31 is predicted, from the model, to attract 55% of the wagers on the over, while a total of 55 is predicted to attract 76% of the wagers on the over. A total of 40.5, the sample mean, is predicted to attract 63% of the wagers on the over. In summary, sportsbook.com is willing to accept a much higher percentage of the wagers they receive on the over rather

TABLE 2  
REGRESSION RESULTS FOR PERCENTAGE BET ON OVERS AT SPORTSBOOK.COM FOR THE 2006–07  
NFL SEASON

Dep. Var.: % of Dollars Bet on Over	Entire Sample (256 games)
Intercept	0.2669*** (3.5720)
Total	0.0090*** (4.8916)

Regression results are presented for the Sportsbook.com betting data for the 2006–07 NFL Season. The dependent variable is % of the dollars bet on the over for wagers on the total. The independent variables include an intercept and the total. For each independent variable, the coefficient and accompanying t-statistic is shown.

\*-notation denotes significance of a t-test that the coefficient is different from zero. \* is significant at 10%, \*\* is significant at 5%, and \*\*\* is significant at 1%.

than the under. This is likely due to knowledge of the behavioral biases of bettors toward the over. Not only are NFL totals set too high, for the games with the highest totals, but bettors still overbet the over in great numbers.

Given that sportsbook.com chooses not to balance the betting dollars on each game and total, how successful was this profit-maximizing strategy for Sportsbook.com in the 2006–07 season? In addition, since the percentage bet on each proposition is public information on the sportsbook.com website, how did bettors fare who took a contrarian view and bet against the public in games where the percentage bet on the favorite or the over exceeded a certain threshold? These two questions are easily answered, simultaneously, by simply observing the win-loss records for betting the underdog (sides market) or the under (totals market) when the percentage of dollars bet on the favorite or the over exceed a certain number. For purposes of simplicity, we choose thresholds of 55%, 60%, 65%, and 70% for comparison purposes. Although these percentages are somewhat arbitrary, they would be very simple rules for bettors to follow and illustrate the success that sportsbook.com has in using their profit-maximizing strategy. Table III presents the results for the sides market and table IV presents the results for the totals market. In table III, the percentage used for the betting rule to bet against the more popular side of the proposition is presented in the first column, the number of favorite wins in the second column, number of underdog wins in the third column, the underdog win percentage

TABLE 3  
SIMPLE POINTSPREAD BETTING SIMULATION: BET THE OPPOSITE OF THE PUBLIC (BET THE UNDERDOG) WHEN THE PERCENTAGE OF DOLLARS BET ON THE FAVORITE EXCEEDS A GIVEN PERCENTAGE

Percentage Bet on the Favorite	Favorite Wins	Underdog Wins	Underdog Win Percentage	Earnings for contrarian bettors who bet \$110 on the Underdog in Each Game
70% +	37	66	64.08%	\$2530
65% +	53	83	61.03%	\$2470
60% +	73	94	56.29%	\$1370
55% +	83	112	57.44%	\$2070

TABLE 4

SIMPLE TOTAL BETTING SIMULATION: BET THE OPPOSITE OF THE PUBLIC (BET THE UNDER) WHEN THE PERCENTAGE OF DOLLARS BET ON THE OVER EXCEEDS A GIVEN PERCENTAGE

Percentage Bet on the Over	Over Wins	Under Wins	Under Win Percentage	Earnings from \$110 Bet on the Under in Each Game
70% +	40	47	54.02%	\$300
65% +	57	65	53.28%	\$230
60% +	78	75	49.02%	-\$1080
55% +	90	93	50.82%	-\$600

(following the betting strategy) is presented in the fourth column, and the returns to a hypothetical bettor who wagered \$110 (to win \$100 given the sportsbook commission) on each game that met the betting rule. Table IV presents the same for totals, where overs replace favorites, and unders replace underdogs in the betting strategies.

It appears that the strategy of accepting more wagers on the favorite was very beneficial to sportsbook.com in 2006–07. In situations where bettors wagered 70% or more of the money on the favorite, the underdog won over 64% of the time. Win percentages for the underdog exceed 56% in all categories listed. For bettors who used the publicly available information to essentially bet the same side as the sportsbook (given the wagering is imbalanced, sportsbook.com is an active participant in these wagers and is “betting” on the underdog to win), large profits were garnered.

The strategy of sportsbook.com to accept more wagers on the over rather than the under in the totals market was successful, but not as profitable as the sides market. In situations where 70% or more of the bets were on the over, unders won more than 54% of the time. Even with a threshold of 55%, unders won more than half of the time. Bettors who attempted to use this public information to place their own bets found profitability only when betting against the public in games where the betting dollars were most lopsided toward the over.

### III. PROFIT MAXIMIZING BEHAVIOR OF THE SPORTSBOOK AND WHY IT PERSISTS

Levitt (2004) states a variety of reasons that sportsbooks could profit by setting a price other than the market-clearing price in the betting market for the NFL (and other sports). Levitt suggests that the sportsbook is expected to be more skilled at predicting game outcomes and has insight into behavioral biases of bettors. These results do beg the question (as Levitt asks in his paper), however, why skilled bettors do not recognize the biases of the betting public and bet simple strategies against them? In theory, this would take away the profit opportunities of the sportsbook and would remove the biases seen in closing lines. In short, it would make the market efficient. We wish to comment on two factors that were not addressed by Levitt to speculate as to

why this market has exhibited biased closing pointspreads and totals and why patterns of unbalanced betting action may persist.

First, individual bettors and betting syndicates may face liquidity issues which could allow the sportsbook to price to maximize profits rather than clearing the market. Collectively, contrarian bettors may not be able to wager enough money to counter the betting biases of the public. Therefore, sportsbooks may not be concerned with this level of betting by informed bettors and could leave the pointspreads and totals where they currently set them.

If bettors do have the knowledge and liquidity to bet against the betting public, they might not be willing to handle the huge variance in betting markets. Outcomes of sporting events are quite noisy and strategies that are profitable in the long-run can incur large losses week-to-week, month-to-month, and season-to-season. For instance, if a bettor were to follow the betting strategy (bet home underdogs) put forth in the Levitt article for the following NFL season of 2005–06, bettors would have incurred large losses. For individual bettors, and even for larger betting syndicates, a year like 2005–06 could cause the loss of their entire bankroll. Given the great variance in outcomes in sporting events, groups with the liquidity to ride out the variance may find greater expected returns in other financial markets as opposed to sports betting. Therefore, there may be limited bettors/groups that are willing to bet large sums of money on NFL games as an investment strategy. This allows the sportsbook to continue their practice of pricing to maximize profits.

A second possible explanation for the persistence of this pricing by the sportsbook is that the market itself is not truly free and open. The sportsbook has power within this market and it gives them the opportunity to offer prices that are in their favor. One source of power is that the sportsbook has the right to refuse any bet. They do not have to accept a bet on any particular proposition, nor from any particular person or group. An extension of this is the existence of limits on wagers. Limits place a restriction on the size of a bet by any particular person. These limits are generally aimed at suspected informed bettors as the sportsbook often acts under the practice of “booking to face”. “Booking to face” refers to the practice of monitoring betting activity and adjusting betting rules for particular customers. Given that the sportsbook may recognize informed bettors, or “runners” for informed bettors or betting syndicates, the sportsbook can use this information to their advantage. The sportsbook may relax or enforce limits on the size of the bets of informed traders, allowing the sportsbook to set a profit-maximizing price rather than a market-clearing one. This structural advantage by the sportsbook allows them to post biased lines and accept unequal betting action in certain situations they deem favorable. If the market were truly open and sportsbooks were mandated to accept all wagers of any size, the biases of closing pointspreads would likely be reduced, because informed traders would have greater opportunity to bet on the opposite side of the general public when public biases are built into the lines.



#### IV. CONCLUSIONS

The findings of the Levitt (2004) model of sportsbook behavior, where sportsbooks set a profit-maximizing price (pointspread) rather than a market-clearing price, are tested using actual percentages of betting dollars from a real sportsbook, Sportsbook.com. The findings of Levitt (2004) came from a betting tournament where the data reflected the betting actions of a small group of tournament participants, not the full betting activity accepted by a sportsbook. In addition, the tournament data involved a one-time small fixed cost of entry (\$250), instead of the usual marginal activity of betting where bettors have an actual monetary outlay for each game on which they wager. These problems being noted, however, the Levitt model of sportsbook behavior does go a long way in explaining the results of pointspreads being slightly biased in the NFL and other sports.

The purpose of this study was to use actual data from a large world-wide sportsbook to test the hypothesis put forth in Levitt (2004). Sportsbook.com, a large internet casino available to bettors around the world, makes the percentage of dollars bet on each side of the proposition available to the public on their internet site each day leading up to a game and on the day after the game. We gathered this data for the NFL for each game played in the 2006–07 regular season and tested the hypotheses stated in Levitt (2004). Specifically, we tested whether bettors exhibited natural biases toward overbetting road favorites and big favorites and that sportsbooks are willing to accept unbalanced betting dollars on these games rather than attempting to perfectly balance the bets, as traditionally assumed in sportsbook models.

The findings of the simple regression results for Sportsbook.com were striking. A much larger percentage of dollars are bet, and accepted, on road favorites. In addition, the higher the pointspread on the game, the higher the percentage of dollars that is bet, and accepted, on the favorite. Specifically, being a road favorite increases the percentage of bets on that team by more than 16%. Also, with each additional point that a favorite is favored by, the percentage of dollars bet on that team rises by 1.31%. Seven-point favorites, for example, have a higher percentage of bets on them than a three-point favorite. Put simply, fans overbet the best teams in the league which leads to sportsbooks accepting a much higher percentage of the wagering dollars on big favorites and road favorites. This leads to a closing pointspread in this market which maximizes profits as the sportsbook does not strictly attempt to set a market clearing price.

Given that dollars wagered on totals (over-under) bets were also available, we also tested to see if Sportsbook.com was willing to accept unbalanced wagering dollars on totals wagers. Specifically, we tested to see if bettors overbet the over and if the sportsbook is willing to accept more dollars on the over. Bettor bias toward the over is quite easy to recognize as a simple strategy of betting the under in the NFL was shown to win more often than implied by efficiency (Paul and Weinbach, 2002). In the totals market, as well as the pointspread market, Sportsbook.com does not appear to be balancing bets on each side of the

proposition. Far more bets are wagered, and accepted, on the over rather than the under. For the mean total in the sample, 40.5 points, the amount wagered on the over accounts for 63% of the bets. Again, it appears that Sportsbook.com sets a price in this market (the total) to maximize profits, not to clear the market.

The question of why an informed bettor or group of bettors would not also recognize these biases of the betting public and use the same betting strategy that the sportsbook uses to maximize profits is certainly an interesting and important one to address. A few possible explanations, in addition to what was stated in Levitt (2004), are noted. One possible explanation for the persistence of this behavior by the sportsbook is suggested to be the high variance in game outcomes which can create liquidity problems for potential contrarian bettors or syndicates. Another important reason for the persistence of this sportsbook behavior is that the sports betting market is not truly a free market because sportsbooks may place limits on wagers (generally targeted at informed bettors) and the sportsbook has the right to refuse any wager they desire. These institutional advantages give the sportsbook the power to set price to profit-maximize as opposed to pricing to clear the market.

#### REFERENCES

- J Golec and M Tamarkin 'The degree of inefficiency in the football betting market: Statistical tests' *Journal of Financial Economics* (1991) 30 311–323.
- P Gray and S Gray 'Testing market efficiency: Evidence from the NFL sports betting market' *Journal of Finance* (1997) 52 1725–1737.
- S Levitt 'Why are gambling markets organised so differently from financial markets' *The Economic Journal* (2004) 114 223–246.
- R Paul and A Weinbach 'Market efficiency and a profitable betting rule: Evidence from totals on professional football' *Journal of Sports Economics* (2002) 3 256–263.
- R Sauer, V Brajer, S Ferris and M Marr 'Hold your bets: Another look at the efficiency of the gambling market for National Football League games' *Journal of Political Economy* (1988) 96 206–213.
- R Zuber, J Gandar and B Bowers 'Beating the spread: Testing the efficiency of the gambling market for National Football League games' *Journal of Political Economy* (1985) 93 800–806.