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Price Setting in the NBA Gambling Market: Tests of the Levitt Model of Sportsbook Behavior

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Abstract

Levitt (2004) suggested that sportsbooks do not set prices in the NFL to clear markets, as was commonly assumed, but set prices to maximize profits. This paper uses actual betting data from four sportsbooks to test the Levitt (2004) hypothesis in the NBA. For a sample of the 2004-05 to 2006-07 seasons, it is shown that favorites receive a disproportionate share of NBA pointspread bets. In addition, the percentage of bets the favorite receives increases with each additional point of the pointspread. In the totals market, it is shown that overs receive a much higher percentage of bets compared to unders and the percentage bet on the over increases with each point of the total. Unlike the NFL, however, taking a contrarian position and betting against public sentiment is not found to win more often than implied by efficiency.

Keywords: efficient markets, gambling, sportsbook

Introduction

A study by Levitt (2004) in *The Economic Journal* challenged the traditional view of sportsbook behavior. Levitt posited that sportsbooks[1] use their knowledge of common bettor biases to set prices to maximize profits, not to clear the market. By setting biased pointspreads, the sportsbook expects to earn larger profits as the less-popular side of the proposition wins more than 50% of the time. This model differs substantially from the traditional models of sportsbook behavior, such as Pankoff (1968), Bassett (1981), Zuber et al. (1985), Sauer et al. (1988), and summarized in Sauer (1998), where pointspreads are set by sportsbooks to balance the betting dollars between favorites and underdogs.

Under the traditional model, the goal of the sportsbook is to profit without risk. This position can be achieved by setting a pointspread that attracts the same amount of wagering dollars on both sides of the proposition. In non-academic work, Roxborough and Rhoden (1998) and Manteris and Talley (1991) have written books on how to manage a sportsbook. Both report that setting a pointspread that equalized betting action would be an ideal situation for the sportsbook, but these conditions are seldom met, and a sportsbook often must adjust pointspreads in an attempt to equalize betting action. Both state this action of balancing the betting dollars between each side of the proposition is desirable and limits the extent to which the sportsbook has a financial

stake in game outcomes. Bassett (1981) suggested sportsbooks who do not balance betting action because they believe their forecasts are more accurate than the market consensus are likely to be driven from the market.

Under the assumptions of the traditional models, where prices are set to clear the market, the efficient markets hypothesis could be tested with relative ease as the price is assumed to represent information from all betting participants. Findings that the efficient markets hypothesis could not be rejected, even in a market where investor (bettor) sentiment is likely to run high, served as a stamp of approval for this theory (Sauer et al., 1988).

Under the assumptions of Levitt (2004), the sportsbook does not price to clear the market and achieve even betting dollars on each side of the proposition. Sportsbooks are shown to incorporate common bettor biases, such as the overbetting of favorites and road favorites, into their prices (pointspreads). This pricing does not clear the market, as sportsbooks are shown to accept uneven betting dollars on favorites and underdogs and are therefore willing to accept risk of loss on an individual game basis for the chance at higher overall returns. Studies in the horse racing market by Shin (1991, 1992) suggested bookies may set prices that differ from unbiased forecasts as a means of protecting themselves against bettors with inside information and modeled a method to achieve this. Unlike Shin (1991, 1992), however, Levitt suggested biased pointspreads in the NFL betting market reflect a sportsbook's confidence that its forecasts are superior to those implied by the betting aggregate.

One common criticism of Levitt's (2004) analysis of sportsbook behavior is the use of data from a betting tournament to substantiate the theory, rather than use of actual sportsbook data. The tournament in question used a limited number of participants with a fixed entry fee of $250. The results from this tournament could yield vastly different results than an actual sportsbook, which has a large number of participants who place wagers of varying sizes on games they bet.

In a recent article in the *Journal of Prediction Markets*, Paul and Weinbach (2007) used actual sportsbook data to test the Levitt (2004) model of sportsbook behavior. Actual percentages of dollars wagered on the favorite and the underdog were obtained for every game of the 2006 NFL season. The results for the pointspread market were consistent with the Levitt (2004) model as betting did not appear to be balanced, with favorites—in particular road favorites—receiving a greater percentage of betting volume. In addition, the percentage bet on the favorite became greater as the pointspread on the favorite increased. Simple strategies of betting against the public, when the sportsbook was substantially unbalanced (i.e., 70%+ on the favorite) were found to earn positive returns. Paul and Weinbach (2007) also showed similar results for the totals (over/under) betting market for the NFL as www.sportsbook.com was found to be unbalanced, with bettors heavily weighted toward the over, which was consistent with the results seen for long samples of total betting in the NFL (Paul & Weinbach, 2002).

This paper explores a similar market, the betting market for the NBA, using betting percentage data on the favorite and underdog in the pointspread market and over and under in the totals market. The NBA market does differ from the NFL betting market, which could lead to different results. The NBA plays an 82-game regular season (compared to the 16-game season in the NFL) with games nearly every night of the week. Each game in the NBA does not draw as much interest, either from viewers or from bettors, as a typical NFL game played on Sunday or Monday night. Therefore the NBA market is likely to contain a smaller number of market participants, less per game betting volume, and lower house-set limits than the market for the NFL.

Data for this paper were gathered from Sports Insights, which sells data to subscribers on the percentage of bets made on each proposition within each game. This data includes the percentage bet on favorites and underdogs in the pointspread market and overs and unders in the totals market, which is similar to the www.sportsbook.com data used in Paul and Weinbach (2007).

Sports Insights provides data aggregated across four sports-books showing the percentage of bets on the favorite and underdog (and overs and unders) for its subscribers. The four on-line sportsbooks are www.BetUS.com, www.CaribSports.com, www.SportBet.com, and www.Sportsbook.com.[2] The key difference between the two sources of data is www.sportsbook.com reports the percentage of the dollars bet, while Sports Insights reports percentages based on the *number of bets* placed on each

side of the proposition. Therefore, the Sports Insights data reflects the combined number of bets from all four sportsbooks for each game for both the side (pointspread bet) and the total (over/under bet).

Given the nature of the Sports Insights data, it is possible that a small number of bets could offset a large number of bets if the dollar amount of the wagers is substantially different. Although possible, we assume this to be unlikely given the wagering limits that exist on bets, particularly in the NBA compared to the NFL and in totals markets in general, and the similarity of the results found within this study, with respect to unbalanced betting, compared to Levitt (2004) and Paul and Weinbach (2007).

Regression and Betting Simulation Results

The data from Sports Insights were purchased from its website, http://www.sportsinsights.com. At the time of purchase, its data included all games from the 2004-05 to 2006-07 seasons. Data were gathered for both the sides (betting on a team against the pointspread) and totals (betting on the total amount of points scored by both teams) markets.

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

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

The dependent variable is the percentage of dollars bet on the favorite. The independent variables include an intercept, the pointspread on the game (presented as a positive number—greater favorites have larger pointspreads), and a dummy for teams that are road favorites. If bettors prefer favorites, with stronger favorites being bet more heavily than weaker favorites, the coefficient β_1 should be positive and significant. If bettors overbet road favorites, the coefficient on the dummy variable, β_2, should also be positive and significant.

The totals market is tested in the same manner as the sides market. The simple regression model for the totals market is:

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

If more wagers are accepted on the over for games with higher totals, then β_1 should be positive and significant.

We assume these sportsbooks, which are available to bettors worldwide through the Internet, accept these unbalanced positions and do not attempt to lay off these bets to other sportsbooks. If each sportsbook is assumed to lay off unbalanced betting action to a bigger sportsbook, betting imbalances could be studied only with the betting information from the biggest sportsbook in the market. Although consistent layoff is possible, we assume this is not likely due to the international nature of the sportsbook data obtained from Sports Insights. In related research, Strumpf (2003) analyzed data from six illegal sportsbooks and found that some of the smaller books chose to lay off some, but not all, of their unbalanced positions, and the larger books generally chose not to lay off their imbalance. Therefore, we assume the large international sportsbooks included within the Sports Insights data would more likely resemble the larger of the illegal sportsbooks.

Another possible outcome for some games in this sample is the presence of large betting imbalances due to mistakes made by sportsbooks in setting pointspreads. Correcting these mistakes by moving the pointspread in the direction of the imbalance becomes complicated by the possibility of being "sided" or "middled." These are cases where the sportsbook could lose on both sides (or lose on one side and "push" on the other) when the actual score differential (favorite minus underdog score) lies between pointspreads that existed at different times before the start of the game. Sportsbooks may not be willing to move the pointspread as far as they would otherwise due to the risk of substantial loss when being "middled" or "sided." We assume this is not the case for many games, as sportsbooks who consistently make mistakes would be driven out of business, but acknowledge the possibility that balances could exist in these positions not due to the profit-maximization motive noted by Levitt (2004). For an example of how the possibility of being "middled" or "sided" affected the NFL betting market after the introduction of the 2-point conversion, see Paul, Weinbach, and Mahar (2007).

Table 1 presents the summary statistics for the data. Table 2 presents the results for the pointspread market for the NBA. Table 3 presents the results for the totals market in the NBA. Coefficients on the independent variables are shown, with t-stats in parentheses.

Table 1: Summary Statistics for Sports Insights NBA Betting Data: 2004-05 to 2006-07 Seasons (3,625 games)

Variable:	Pointspread (Absolute Value)	Total	Percent Bet on Favorite	Percent Bet Underdog	Percent Bet on Over	Percent Bet on Under
Mean	5.887	194.654	58.143	41.857	58.986	41.014
Median	5.5	194	59	41	60	40
Standard Deviation	3.226	10.933	11.954	11.954	14.198	14.198

Table 2: NBA Sides Regression Dependent Variable: Percentage of Bets on the Favorite 2004-05 to 2006-07 Seasons (3,625 games)

Independent Variables	Coefficient (T-Statistic)
Constant	51.239***
	(123.432)
Pointspread	0.524***
	(9.368)
Road Favorite Dummy	13.770***
	(34.144)

Table 3: NBA Totals Regression Dependent Variable: Percentage of Bets on the Over 2004-05 to 2006-07 Seasons (3,625 games)

Independent Variables	Coefficient (T-Statistic)
Constant	35.517***
	(8.481)
Total	0.1206***
	(5.613)

From the results in Tables 2 and 3, it appears the results for the NBA are similar to the results in the NFL (Paul & Weinbach, 2007) in relation to the percentage of bets placed on the favorites and overs. As the pointspread on the favorite increases, the percentage of bets on the favorite also increases, by over a half of a percentage point for each additional point on the pointspread. Similar to what is described in Levitt (2004), road favorites are also found to be significantly overbet, as the dummy variable for a road favorite is positive and significant. An additional 13% of the bets accumulate on the favorite when the favorite is playing on the road. Given the significance and the positive signs found on the pointspread variable and the road favorite dummy, it appears NBA bettors tend to wager on the best teams more often than they wager on poor teams.

The results for the totals market also illustrate NBA bettors prefer to bet on the over relative to the under. Given the normal range of totals in the NBA, the regression results show bettors tend to bet the over more than 50% of the time, with larger imbalances occurring as the total increases. This overbetting of the over, particularly at the highest totals, is consistent with previous findings in the NBA where market efficiency was rejected in the

subset of games with the highest totals where, historically, unders have won more often than overs (Paul, Weinbach, & Wilson, 2004).

Betting Simulations of Wagering on the Less Popular Propositions

Tables 4-7 present the results of simple betting simulations of wagering against the more popular betting propositions, favorites and overs. Given the findings of Tables 1 and 2, the higher the pointspread (total), the greater the percentage of the bets on the favorite (over). Therefore, we show the results for various categories of favorites (10 points or greater, eight points or greater, etc.) and totals (200 points or greater, etc.). Results for the pointspread market are shown for all favorites, all home favorites, and all road favorites. Totals involve both teams; therefore, the distinction of home or road is not necessary.

Underdog winning percentages are compared to the threshold of a fair bet. The null hypothesis of a fair bet denotes that any given strategy should win 50% of the time. Rejection of this null hypothesis implies a bias in the pointspread in a particular direction. The stronger null hypothesis is the null of no profitability. The null hypothesis of no profitability tests compares the actual win percentage of the betting strategy to a win percentage of 52.38%, the percentage necessary to break even given the commission charged by the sportsbook. Sportsbooks use an 11-for-10 betting rule, where $11 must be wagered to win $10 (a winning $11 bet yields $21 dollars—the bettor's original $11 plus $10 in winnings). To overcome the implicit commission in the 11-for-10 betting rule, gamblers must win more than 52.38% of the time to earn profits.

In Tables 4-7 below, none of the win percentages based on these simple strategies could reject the null of no profitability (and infrequently have win percentages greater than 52.38%). Therefore, only tests for the null of a fair bet (win percentage equals 50%) are shown. The log likelihood ratio test shown by Even and Noble (1992) is used to test the null hypothesis. The log likelihood ratio test offers the advantage of not imposing an equal mean and median restriction on the forecast errors. Significant results are noted for the log likelihood ratio tests with * representing significance at the 10% level.

For the sample of all favorites (Table 4), games with larger favorites tend to have the underdog cover the pointspread a greater percentage of the time. These percentages are not high enough (52-53%) to reject the null of no profitability, but betting the underdog for all favorites greater than eight was found to reject the null of a fair bet at the 10% level.

Table 5 provides the results for home favorites. For the sample of home favorites, the only rejection of a fair bet was found in the group of all favorites greater than two. Table 6 shows the results for road favorites. Although betting the underdog when the road favorite is favored by six or greater or eight or greater wins more than 52.38% of the time, none of the subsets of games were found to reject the null of a fair bet.

The null hypothesis of a fair bet could also not be rejected in the market for NBA totals. Table 7 shows the win percentages for the strategy of bet all unders for dif-

Table 4: Betting Simulations for All Favorites—Strategy of Bet the Underdog

All Favorites Greater Than:	Favorite Wins	Underdog Wins	Underdog Win Percentage	Log Likelihood Ratio Test: Fair Bet
10	173	202	53.867%	2.245
8	372	425	53.325%	3.127*
6	694	753	52.039%	2.406
4	1125	1160	50.766%	0.536
2	1528	1580	50.837%	0.939
All	1745	1793	50.678%	0.651

Table 5: Betting Simulations for All Home Favorites—Strategy of Bet the Underdog

All Home Favorites Greater Than:	Favorite Wins	Underdog Wins	Underdog Win Percentage	Log Likelihood Ratio Test: Fair Bet
10	165	194	54.039%	2.345
8	341	380	52.705%	2.111
6	594	643	51.981%	1.992
4	885	947	51.692%	2.099
2	1127	1207	51.174%	2.793*
All	1242	1318	51.484%	2.257

Table 6: Betting Simulations for All Road Favorites—Strategy of Bet the Underdog

All Road Favorites Greater Than:	Favorite Wins	Underdog Wins	Underdog Win Percentage	Log Likelihood Ratio Test: Fair Bet
10	8	8	50.000%	0.000
8	31	45	59.211%	2.594
6	100	110	52.381%	0.496
4	240	213	47.020%	1.610
2	401	373	48.191%	1.013
All	503	475	48.569%	0.802

Table 7: Betting Simulations for Totals—Strategy of Bet the Under

Totals Greater Than:	Overs	Unders	Over Win Percentage	Log-Likelihood Ratio Test: Fair Bet
210	152	137	52.595%	0.779
205	320	297	51.864%	0.858
200	548	525	51.072%	0.493
195	820	803	50.524%	0.178
190	1128	1134	48.867%	0.016
185	1448	1444	50.069%	0.006
180	1676	1645	50.467%	0.289
All Totals	1831	1779	50.720%	0.749

ferent thresholds of high totals (and for all games). None of the groupings produced results statistically different from 50%, with an almost even split between overs and unders, despite the large imbalance in the percentage of the bets on these games.

Betting Simulations of Wagering Against Public Sentiment

Another possible potential winning strategy of interest, based on the results of the betting percentages regressions, is to bet against public sentiment. If large betting imbal-

Table 8: Betting Simulations of Betting the Opposite of Public Sentiment—Pointspread and Totals Markets

Percentage Bet is Greater Than: of Bet on Dog	Favorites – Win Percentage Ratio Test	Favorites – Log Likelihood of Bet on Under	Overs – Win Percentage	Overs – Log Likelihood Ratio Test
80%	50.685%	0.014	48.469%	0.184
70%	52.474%	1.386	48.469%	0.735
60%	51.484%	1.365	48.750%	1.100
50%	51.061%	1.167	48.797%	1.516
All	50.678%	0.651	49.280%	0.749

ances illustrate preferences of bettors for favorites and overs, perhaps sportsbooks respond by shading the pointspread or total in the direction of this sentiment. This appears to be the case in the NFL (Paul & Weinbach, 2007) and it is useful to know if it also holds true for the NBA.

Table 8 shows the results of betting against public sentiment. Results are shown based on a simple strategy of betting against the public in games where the sportsbook is heavily weighted (greater than 80%, greater than 70%, etc.) on the favorite or the over. Win percentages of simple strategies of bet on the underdog and bet on the under are shown along with the log likelihood ratio test for the null of a fair bet.

Betting against public sentiment does not appear to be a profitable venture in the NBA for pointspread or totals wagers. Win percentages of these strategies tend to hover around 50% for any chosen threshold. No matter how large the imbalance of bets, wagering against (or with) the public money tends to leave the bettor winning about half of his bets and losing the commission on these bets over time.

Discussion and Conclusions

Using data on the percentages of bets in the pointspread and totals markets, the results for the NBA show some similarities to the results found in the NFL (Paul & Weinbach, 2007), but also illustrate some important differences. The Levitt (2004) model of sportsbook behavior states that sportsbooks do not price to clear the market, but set prices to maximize profits. Therefore, the goal of the sportsbook is not to attain even betting action on both sides of the wagering proposition, as commonly assumed in the traditional models of sportsbook behavior, but to maximize profits. This sportsbook strategy leads to unbalanced betting action, which likely will be biased toward favorites (to an even greater extent in road favorites) in pointspread markets and overs in totals markets.

Our results for the NBA illustrate bets were not evenly balanced in its pointspread or totals markets. Using the data from Sports Insights for the 2004-05 to 2006-07 seasons, it was shown that bigger favorites attract more bets on the favorite. Additionally, road favorites were also shown to attract an even larger number of bets than home favorites. In the totals market, overs were found to attract more bets than unders. All of these results are similar to the findings of the Paul and Weinbach (2007) analysis of the NFL betting market.

The key differences between the NBA and the NFL lie in the other tests performed in the Regression and Betting Simulation Results section of this paper. Betting against public sentiment in NBA games was not found to reject the null hypothesis of a fair bet, let alone generate profits. This is different than the results in the NFL (Paul & Weinbach, 2007), where a simple strategy of betting against public sentiment (at various thresholds) was found to generate positive returns.

Although the betting dollars appear to be significantly imbalanced, the win percentages on betting favorites and underdogs (and overs and unders) are generally a 50/50 proposition. Given the NBA betting market is a smaller and less liquid market than the betting market for the NFL, perhaps the sportsbooks do not worry about the game-to-game betting imbalances and are not as willing to attempt to exploit known betting biases as they are in the market for the NFL. The NFL could be a unique set-

ting where there is a large liquid market with many uninformed bettors wagering based on sentiment, not information. In other sports, the betting volume and percentage of uninformed bettors may not be large enough to justify attempting to price (set pointspreads) to exploit bettor biases. Therefore, unlike what is suggested by Levitt (2004), perhaps sportsbooks are not attempting to exploit known bettor biases in every case to maximize profits, but, in some cases, are setting what they believe to be accurate betting lines in order to capture their commission in the long-run (over the course of a season or many seasons).

If betting on the NBA, or any other sport, is a repeated game, which it likely is due to the consumption nature of betting for entertainment (socially benign) or due to an addiction (less benign), it is possible the best course of action for the sportsbook is to set a price that is an optimal and unbiased forecast of the outcome of the game without worrying about clearing the market on an individual game basis. Given most bettors will wager night after night and game after game, if pointspreads and totals are set so that a winning bet on either side of the proposition is equally likely, sportsbooks will still capture their vigorish on losing bets as all bettors are expected to win 50% of the time over the course of the season. This action of setting a price as an optimal and unbiased forecast, rather than attempting to clear the market on a game-by-game basis, may require fewer transaction costs on the part of the sportsbook and will still generate profits due to their commission.

This strategy of setting an optimal and unbiased forecast as the pointspread protects the sportsbook against informed bettors ("wise guys") that may exist in this market. If the pointspread is set where underdogs or unders are likely to win more than 52.4% of the time, wise guys have an incentive to bet heavily against public sentiment and take profits for themselves (away from the sportsbook). By setting the pointspread as a forecast of the actual outcome of a game, the sportsbook lowers the risk of losing large sums of money to informed bettors. A small group of informed bettors may actually be the only bettors with which sportsbooks are concerned. Betting limits restrict the actions of informed traders (the so-called action of "booking to face"—altering limits or restricting wagers based on who is wagering), to help minimize the possibility of losing money to informed bettors. The greater liquidity in the market for NFL wagering may allow the sportsbooks to set biased pointspreads and totals, but relatively smaller betting volume in the NBA may prevent this practice from truly being profitable.

If the sportsbook is setting a price (pointspread) that is an optimal and unbiased predictor of the outcome of a game, rather than a price (pointspread) that would clear the market based on the actions of bettors, the cause of findings in support of the efficient markets hypothesis in previous research involving betting markets becomes suspect. If the individual wagers of bettors are not driving the prices (pointspreads) to be optimal and unbiased predictors of the outcome of games, but the sportsbook is offering this price independent of the betting actions of market participants, the source of support for the efficient markets hypothesis found from studying sportsbook behavior does not stem from the wisdom of bettors themselves, but from the wisdom of the sportsbook (and the outside consultants who assist in setting pointspreads and totals).

References

Bassett, G. (1981). Point spreads versus odds. *Journal of Political Economy*, *89*(4), 752-768.

Even, W., & Noble, N. (1992). Testing efficiency in gambling markets. *Applied Economics*, *24*, 85-88.

Levitt, S. (2004). Why are gambling markets organized so differently from financial markets? *The Economic Journal*, *114*, 223-46.

Manteris, A., & Talley, R. (1991). *Superbookie.* Chicago, IL. Contemporary Books, Inc.

Pankoff, L. (1968). Market efficiency and football betting. *Journal of Business*, *41*, 203-214.

Paul, R., & Weinbach, A. (2002). Market efficiency and a profitable betting rule: Evidence from totals on professional football. *Journal of Sports Economics*, *3*, 256-263.

Paul, R., Weinbach, A., & Wilson, M. (2004). Efficient markets, fair bets, and profitability in NBA totals 1995-96 to 2001-02. *Quarterly Review of Economics and Finance*, *44*(4), 624-632.

Paul, R., Weinbach, A., & Mahar, J. (2007). The betting market response to the 2-point conversion in the NFL. *Journal of Business and Economic Perspectives*, *33*(1), 98-109.

Paul, R., & Weinbach, A. (2007). Does sportsbook.com set pointspreads to maximize profits? Tests of the Levitt Model of Sportsbook Behavior. *Journal of Prediction Markets, 1*(3), 209-218.

Roxborough, M., & Rhoden, M. (1998). *Race and sports book management.* Las Vegas, NV: Las Vegas Sports Consultants.

Sauer, R., Brajer, V., Ferris, S., & Marr, M. (1988). Hold your bets: Another look at the efficiency of the gambling market for National Football League games. *Journal of Political Economy*, *96*, 206-213.

Sauer, R. (1998) The economics of wagering markets. *Journal of Economic Literature*, *36*(4), 2021-2064.

Shin, H. S. (1991). Optimal betting odds against insider traders. *The Economic Journal*, *101*, 1179-1185.

Shin, H. S. (1991). Prices of state contingent claims with insider traders, and the favourite-longshot bias. *The Economic Journal*, *102*, 426-435.

Strumpf, K. S. (2003). *Illegal sports bookmakers*. Unpublished manuscript. Retrieved on June 23, 2008, from http://people.ku.edu/~cigar/

Zuber, R., Gandar, J., & Bowers, B. (1985). Beating the spread: Testing the efficiency of the gambling market for National Football League games. *Journal of Political Economy*, *93*, 800-806.

Endnotes

[1] Sportsbooks use outside consultants and services, such as the Las Vegas Sports Consultants, to assist in setting pointspreads, odds, and totals. Most sportsbooks hire their own oddsmakers for individual sports to assist the sportsbook manager. Therefore, sportsbooks do have the discretionary power to set a price other than those suggested by the outside services and consultants. When we suggest the sportsbook sets a pointspread, we wish to note that not all credit goes to the individual sportsbook, but much of the credit goes to professionals who model and forecast pointspreads, odds, and totals as consultants to this industry.

[2] www.Sportsbook.com is included as one of the four sportsbooks that share their percentage of bets data with Sports Insights. The percentages included in the Sports Insights data present the percentage of bets made on each side of the proposition, not the percentage of actual dollars bet as in Paul and Weinbach (2007).