

EARLY SEASON NBA OVER/UNDER BIAS

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ABSTRACT

In this paper we analyze the total line betting market for National Basketball Association (NBA) regular season games for the 2009-2012 seasons. Specifically, we divide seasons by week and analyze points scored, total lines and game statistics such as field goal percentage and turnovers. We find the NBA total line market is generally very efficient with points scored and total lines increasing nearly evenly over the first 17 weeks of the season before leveling off. However, the total line market is inefficient in Week 1 with 58.2% of first week games having total scores less than total lines during our sample period. This win rate is significantly higher than the 52.38% win rate required for profiting from the betting strategy. Betting under total lines on all games in the first week of the 2009-2012 NBA seasons yields average returns of 11.1% per game.

1 INTRODUCTION

In financial and gambling markets, market efficiency implies that no individual trader or bettor can benefit from a given piece of information because all other market participants are aware of this information and have already acted upon it, causing the price or betting line to move towards its “true” value. This topic of whether or not financial markets are efficient is hotly debated among economists and financial market participants (Fama, 1998, 2012). Measuring efficiency in sports betting markets is easier than in most financial markets due to the fact that sports bets have well-defined start and end points allowing for quick processing of returns (Gandar, Zuber & Dare, 2000). The extension of the concepts of financial market efficiency to the sports gambling world has been well documented (e.g. Gander et al., 1988; Gray & Gray, 1997; and Sauer, 1998).

Most studies find that these large betting markets are at least economically efficient with occasional systematic strategies that can yield profits from minor inefficiencies but these strategies are not persistent (Gray & Gray, 1997). The disappearance of these profits gained from systematic strategies is best explained by the idea that the betting market contains a group of “informed” bettors who learn from the market and take advantage of these inefficiencies, thus moving the line to the “true line” (i.e., the point where the particular strategy is no longer profitable) (Sauer, 1998). Paul et al. (2004) specifically addressed the presence of an efficient market in the NBA and found that an efficient market exists in this arena. Other studies have suggested NBA total line markets are inefficient, focusing on an assortment of variables including home-court advantage (Gandar, Zubar & Lamb, 2001; Entine and Small, 2008), winning/losing streaks (Paul & Weinbach, 2005), large spreads or totals lines (Paul, Weinbach & Wilson, 2004), and bookmaker mispricing (Baryla, Borghesi, Dare & Dennis, 2007).

It has been argued that the NBA is a more efficient betting market than the NFL (Paul, Weinbach & Wilson, 2004). This is especially surprising given the difference in the betting volume and the time lag between games for the NFL and NBA. One explanation for this is the participation of more uninformed casual bettors in the NFL betting market. Due to the time lag between games and the fact that most of the NFL’s games are played on weekends, the NFL receives a larger percentage of bets placed by casual fans than the NBA, which has games throughout the week. Another possible explanation for the enhanced efficiency of the NBA gambling market comes from betting limits that are normally set for betting on basketball contests. In this case, the bookmakers restrict the total amount individual bettors can place on a given game. These limits prevent informed bettors from placing large bets on games in which the betting line is not at its “true value.” In addition, given the vast differences in volume of wagers between the NFL and the NBA, informed NFL bettors cannot impact the line to the extent informed NBA bettors can (Paul, Weinbach & Wilson, 2004).

In a recent study regarding early season total lines in the NFL, it was found that betting the under in week one games was a profitable strategy (AUTHOR, DATE). The authors argued that offense in the NFL is more team-based than defense, thus requiring a higher level of coordination and task interdependence. Therefore in the early weeks of the season, when offenses are still developing this cohesion, defenses will have an advantage, leading to lower score totals. In the current study, we apply this hypothesis that defenses have an advantage over offenses in early weeks of the season to the NBA totals betting market.

We tested this hypothesis by observing data from the 2009-2012 NBA seasons. Over this span we found that totals began each season relatively low and slowly increased as each season progressed. Game statistics such as field goals attempted, field goal percentage, fouls, and assists also showed gradual improvement as the weeks passed in a given season. This indicates that teams

are possibly rusty, lack cohesion, or are out of shape entering the season and gradually improve with more games and practice time. In addition, as teams enhance their coordination, trust, and functioning, the impact is felt at both team and individual levels.

Unlike the NFL totals market in which the over/under lines stay roughly the same as the season progresses, we found that closing over/under lines in the NBA totals tend to increase by roughly the same amount as the actual totals as the seasons progress, implying that NBA totals were more efficiently priced over time and therefore there were fewer opportunities to profit from this knowledge of low early season point totals. Despite the NBA totals market being more efficient than the NFL, we find betting the under for all week one games over the 2009-2012 seasons yields a profit in all four seasons with an average seasonal return of 11%.

2 DATA AND METHODOLOGY

The sample for our study is regular season NBA games from the 2009-2012 seasons. Closing total line data for this period was gathered from Sports Insights. Total line bettors are not interested in which team wins or loses, but rather the total combined points scored in the game by both teams. The total line is set by bookmakers and bettors can choose to wager that the point total will exceed (the over) or fall short of (the under) this total line. In order to realize a profit the bettor must win at least 52.38% of their bets to overcome the commission charged by the bookmaker. Commissions in the sports gambling market come in the form of a vigorish, which is usually 10% of the wager. This vigorish is returned to the bettor who takes the winning side of the bet along with two times the original wager amount, while the losing bettor receives no repayment of vigorish or the wager amount. If the point total matches the total line, the game is ruled a push and the wager amount and vigorish are returned to all bettors.

The theoretical goal of the bookmaker is to set a line attracting equal dollar amounts to the opposing sides of the bet, meaning they have no net position on either side while still earning 5% of the total betting amounts from the charged vigorish. If one side of the line is receiving a disproportionate amount of the total dollars wagered, the bookmaker will adjust the line in an attempt to even out the amounts wagered for the over and the under. In essence, the bookmaker will seek to adjust the line so as to split the amount of wagering on either side of the bet, guaranteeing a profitable outcome for the house.

We also employ intragame data provided by basketballgeek.com.¹ This data gives a detailed account of all events in the game, including fouls, free throws, total shots, turnovers, rebounds, jump balls, timeouts and other

¹ This data is only available for the first two seasons of our main sample (2008 and 2009).

valuable data. Using this data, we calculate free throw percentage, field goal percentage, total number of fouls, total number of turnovers, total number of assists as a percentage of made field goals, and total number of shots for each game.

3 RESULTS

Table 1 presents descriptive statistics for the full sample of NBA regular season games from 2009-2012 and for each individual season. Mean scores for the 2009, 2010 and 2011 seasons range from 199.11 points per game and 200.80 points per game. The mean score in 2012 is much lower at 192.52 points per game. In each of the four seasons, the difference between mean score and mean total line is less than one half of a point. This is strong evidence of the overall efficiency of NBA total lines. This efficiency is further supported by the distribution of total line bet results. For the full sample period, 48.4% of games had total scores less than the total line, 50.5% of same games had total scores greater than the total line and the remaining 1.1% of games had total scores equal to total lines. For individual seasons, the largest deviation from 50% observed for any result/year is 52.0% of games with total scores less than total lines in 2011. This falls below the 52.38% win rate required to profit, again illustrating the efficiency of this gambling market. Results in Table 1 suggest the NBA total line market is efficient over the course of each season and over our four year sample period.

Table 1: Descriptive Statistics

This table presents descriptive statistics for our sample of NBA regular season games in the 2009-2012 seasons. Statistics are presented for the total sample and by season. Mean Score is the mean combined score for the two teams competing in a game. Mean Over/Under is the mean of the latest reported total lines. Overs, Pushes, and Unders are the number of games where the combined score of the two teams competing in a game is greater than, equal to, and less than the total line.

Season	N	Mean Score	Over/Under	Difference	Overs	Pushes	Unders	% Over	% Push	% Under
2009	1,227	199.93	199.47	0.46	610	15	602	49.7%	1.2%	49.1%
2010	1,202	200.80	200.82	-0.02	584	18	600	48.6%	1.5%	49.9%
2011	1,227	199.11	199.53	-0.42	583	6	638	47.5%	0.5%	52.0%
2012	990	192.52	192.06	0.46	473	13	504	47.8%	1.3%	50.9%
Total	4,646	198.36	198.26	0.10	2,250	52	2,344	48.4%	1.1%	50.5%

Table 2 presents mean total scores and total lines after dividing the sample by calendar week.² Mean scores increase as the seasons progress until about the 17th week where total scores level off around 200 points. This is consistent with the notion of players being rusty or teams needing time to acclimate to playing together. We hypothesize that this will have a greater impact on offensive play than on defensive play. Mean total lines are remarkably consistent with total lines from week to week. Total lines increase at a similar rate and level off slightly later. In only 1 out of 23 weeks is the difference between mean total score and mean total line significantly different from 0. This single instance occurs in week 11 where the mean total score exceeds the mean total line by 5.20 points. This difference is more than twice the magnitude of any other weekly difference; with only 6 other weeks have mean differences been greater than 1 point.³ These results also suggest the NBA total line market is remarkably efficient. Total lines increase closely with total scores as each season progresses.

Table 2: Weekly Over/Under Results

This table presents the number of games where total points scored by the two teams competing in a game are over (under) the latest reported total line. The percentage of games when the combined score is less than the closing total line is also presented. Games that resulted in a push are excluded when calculating % Under. Indicated significance levels are from a z-test for the percentage of games with a combined score less than the latest total line exceeding 52.38%. Mean Score is the mean combined score for the two teams competing in a game. Mean Over/Under is the mean of the latest reported total lines. Differences between total points scored and the latest total lines are also reported with indicated significance levels from t-tests for differences of means. Line Error is the absolute value of the difference between total points scored and the latest total line as a percentage of the latest total line. Error rank is the ranking of weeks (from largest to smallest) based on Line Error. The sample is all NBA regular season games in the 2009-2012 seasons. Results are presented for each week separately and for the total sample. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

Table 2 also provides the number of games with total scores greater or less than total lines after dividing the sample by calendar week. In 2 of 23 weeks the percentage of games with total scores less than total lines is statistically greater than the 52.38% required to yield a profit after accounting for the vigorish. In Week 1, 58.2% of games have total scores less than total lines. While total scores and total lines are not significantly different from one another in Week 1, the mean score is lower than the mean total line.

² The first seven days of the season are classified as Week 1 games, the next seven days as Week 2 games, etc.

³ We do not attempt an explanation for the Week 11 anomaly.

Table 2

Week	Over	Under	% Under	Mean Score	Mean Over/Under	Difference	Mean Line Error	Error Rank
1	84	117	58.2% **	195.13	195.55	-0.42	7.32%	2
2	98	120	55.0%	196.00	195.95	0.05	7.24%	5
3	105	102	49.3%	194.29	194.60	-0.31	7.90%	1
4	98	112	53.3%	195.00	195.36	-0.37	6.55%	18
5	109	92	45.8%	197.75	196.47	1.29	6.29%	21
6	97	117	54.7%	197.15	197.43	-0.27	6.63%	15
7	93	112	54.6%	196.56	197.65	-1.09	6.52%	20
8	96	111	53.6%	196.85	196.95	-0.10	6.54%	19
9	102	121	54.3%	194.86	196.45	-1.59	6.61%	16
10	116	97	45.5%	196.94	196.45	0.48	6.77%	14
11	125	81	39.3% ***	202.75	197.55	5.20 ***	7.11%	8
12	101	108	51.7%	199.72	198.92	0.80	6.61%	17
13	101	116	53.5%	198.06	199.16	-1.11	7.03%	10
14	115	101	46.8%	198.65	198.47	0.17	6.24%	22
15	114	99	46.5%	198.97	198.99	-0.02	7.23%	6
16	104	114	52.3%	198.89	199.00	-0.10	6.83%	13
17	106	103	49.3%	200.19	200.28	-0.09	6.99%	11
18	79	90	53.3%	200.42	201.15	-0.73	6.86%	12
19	82	72	46.8%	202.00	201.47	0.53	7.28%	3
20	66	93	58.5% *	199.03	201.52	-2.49	7.23%	7
21	67	82	55.0%	201.46	201.62	-0.15	7.07%	9
22	86	73	45.9%	202.37	201.19	1.18	6.12%	23
23	106	111	51.2%	201.81	201.42	0.39	7.27%	4
Total	2,250	2,344	51.0%	198.36	198.26	0.10	6.86%	

This is consistent with the notion that the total line market is inefficient in the first week of the season as bookmakers and bettors fail to fully account for the traditionally slow start of NBA offenses. Mean line errors are also presented each week, calculated as the absolute value of differences between total scores and total lines scaled by total lines. Not surprisingly, three of the five largest mean line errors occur in the first 3 weeks of the season, suggesting increased difficulty in setting lines early in seasons.

Table 3 provides support for the slowly starting offenses as the cause for low total score in the first week of NBA seasons. Game statistics are presented for Week 1 games and for all later weeks over the 2009 and 2010 seasons. For these seasons, the mean score in Week 1 is 5.0 points lower. On average there are 2.39 more turnovers per game and 2.31 fewer shots. The percentages of field goals and free throws made are both lower by more than 1% in Week 1. These differences can all be taken as evidence of rusty players. In Week 1 24.90% of shots are the result of an assist compared to 26.07% in later weeks, suggesting less cohesion on offense in Week 1. All differences are significant at the 10% level or better.

Table 3: Game Statistics

This table presents games statistics for NBA regular season games over the 2009-2010 seasons. Week 1 includes all games played in the first seven days of the season and Later Weeks includes all games played in weeks 2-23. Mean Score is the mean combined score for the two teams competing in a game. Mean Over/Under is the mean of the latest reported total lines. Fouls and Turnovers are the mean numbers of combined fouls and turnovers per game respectively. Field Goal Percentage is the percentage of field goals made in the game. Assist percentage is the number of assists divided by the number of made field goals. Free Throw Percentage is percentage of free throws made in the game. Differences of means are reported with indicated significance levels from t-tests for differences of means. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

Variable	Week 1	Later Weeks	Difference
N	95	2,262	
Mean Over/Under	196.6	200.4	-3.81 ***
Mean Score	195.4	200.4	-5.00 *
Fouls	42.28	39.53	2.75 ***
Turnovers	30.57	28.18	2.39 ***
Shots	159.6	162.5	-2.31 ***
Field Goal Percentage	44.96%	46.08%	-1.11% **
Assist Percentage	24.90%	26.07%	-1.16% **
Free Throw Percentage	75.15%	76.43%	-1.29% *

Table 4 presents evidence of the opportunity to profit from the inefficiency of betting lines in Week 1. In each of the four seasons examined, more than 52.38% of games have total scores less than total lines. Individual season percentages range from 53.1% in 2011 to 66.0% in 2009, corresponding to profits of \$1.30 and \$25.90 per dollar bet. Overall the average percentage profit for all games in the sample is 11.1% or \$11.10 per \$100 bet. Betting \$100 (plus \$10 vigorish) on each of the 201 Week 1 games in the sample gives a total of \$22,110 and total profits of \$2,460.

Table 4: Profitability

This table presents profitability results assuming a bettor places a wager on the total score of every week one game falling below the latest reported total line. Results are presented for the full sample of NBA regular season games over the 2009-2012 regular seasons and for each of these seasons separately. The number of games with total points greater than the latest total line (Over) and the number of games with total points less than the latest total line (Under) is also reported. \$ Profit is reported assuming \$100 is wagered on each game and \$10 is paid in vigorish.

Season	N	Over	Under	% Under	\$ Profit	% Profit
2009	47	16	31	66.0%	\$1,340	25.9%
2010	50	22	28	56.0%	\$380	6.9%
2011	49	23	26	53.1%	\$70	1.3%
2012	55	23	32	58.2%	\$670	11.1%
Total	201	84	117	58.2%	\$2,460	11.1%

4 CONCLUSIONS AND AREAS FOR FUTURE RESEARCH

This study examines the efficiency of NBA total lines and a potential opportunity for exploiting this betting market. The significance and magnitude of betting the under for all games during the first week of the season is robust across a four-year longitudinal dataset. These results suggest a market exploitation opportunity during this time frame that exceeds the required rate of return to ensure profitability beyond the cost of the bet and vigorish charged.

Future research should examine the time lapse between games for a team and the total for the game following that break. Such a situation could also provide potential for a market exploitation opportunity. For example, if both teams have a significant break prior to a contest, then the total for that game might be significantly influenced in comparison to a situation where both teams have had very little break prior to the contest. Further, what are the implications of this on the game outcome and likelihood of meeting or exceeding the total line posted by a bookmaker? It could be, of course, that the layoff period enters into the bookmaker's calculated lines and totals. Finally, specific to research on total lines, future study should further investigate the findings of Gander, Zuber and Dare (2000) that lines move toward efficiency from the opening to game time. If such is the case, once again, market exploitations must be present.

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