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Anchoring, affect, and efficiency of sports gaming markets around playoff positioning

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Abstract

We consider the wagering market of National Football League (NFL) and National Basketball Association (NBA) games when participating teams have secured playoff positions. We use both the opening and closing lines (analogous to asset prices) of spread bets to examine if potential "letdown" effects, either psychologically or strategically, are priced. Results demonstrate that the initial opening line consistently provides a profitable strategy for those betting against teams that have clinched positions in the post-season. By the close of the betting cycle, closing lines move in the expected direction as the market partially prices the letdown. Many closing lines tighten to the extent that, after paying commissions, the naïve strategy of betting against clinched teams is less profitable. However, certain wagers, for example betting against NFL teams that have clinched top seeds, are statistically significantly economically profitable after paying commissions. These results support the behavioral finance concepts of anchoring, affect, in addition to lines moving towards efficiency.

Keywords: Behavioral finance; Anchoring; Affect; Market efficiency; Sports wagering

1. Introduction

Certainly one of the most tested theories in finance is market efficiency. Indeed the subject has such depth that major journals have published significant literature reviews by its first proponent (Fama, 1970, 1991). Proponents of inefficiency are also chronicled (Hirshliefer,

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2001), and an entire subfield, behavioral finance, has developed from the works of Kahneman (Kahneman and Tversky, 1979), largely as a challenge to investor rationality. In relatively short order, researchers recognized that sports gaming markets were potentially ripe for considering direct market efficiency tests. In parallel to the traditional financial markets, the gaming-based research has streamed from identifying a potential statistical inefficiency, to expanding the research to including trading costs, and finally to providing possible explanations of the persistence of cataloged economical inefficiencies (and typically ignoring the joint hypotheses problem of the testability of market efficiency [Fama, 1991]). The behavioral finance field also suggests the concept of "affect," which is the desire to associate with perceived "good" firms and projects that may thereby influence financial judgment (MacGregor, Slovic, Dreman, and Berry, 2000).

A popular anecdotal belief surrounding professional sports franchises is that once teams have secured a post-season position, they are apt to relax and lose focus, either unintentionally or as a strategic maneuver to refresh themselves for post-season tournament play.[1] This "letdown effect" can be seen as a lack of motivation on the part of players who know there is nothing significant left to play for, a strategic maneuver on the part of coaches to give their players maximum rest before the start of post-season play, or both. In this article we consider whether the market makers of American professional sports betting markets, "bookmakers," incorporate this letdown effect into the wagering lines of regular season contests, near the conclusion of the season, when exactly one team in the game has limited motivation. More important, is this limited motivation and strategic resting of players priced? Early works in more traditional financial settings indicate that after reaching a goal, some degree of letdown, for either strategic or emotional reasons, may be commonplace (Chevalier and Ellison, 1997).

We examine the most common wager: a spread bet.[2] Our questions are does the spread price this letdown as an efficient market suggests? Is this a tradable position? What are possible explanations of the existence of these tradable positions? There is some controversy about the spread and what the purpose of the spread is to the bookmaker. Is the spread similar to a local floor trader who wants, at the end of the day, a matched book (equal long and short positions)? Or is the bookmaker taking an active position? The research is mixed with proponents of both the matched book (Avery and Chevalier, 1999) and positioning hypotheses (Humphreys et al., 2013). Fortunately, the structure of our study does not need to resolve this question as we examine both the opening and closing spreads of games to seek evidence of efficiency.

Prior research in gaming markets also gives some indication that irrational bettors may be willing to pay too high of prices (by accepting inflated spreads for wagers) to support "favorites" (see, e.g., Vergin and Scriabin, 1978, and Paul and Weinbach, 2005a).[3] As most teams that have clinched playoff positions late in seasons would be favored against opponents who have not, they might draw a particularly disproportionate amount of wagers from naïve bettors, unaware of inflated spreads. There is evidence that as point spreads increase in the National Football League (NFL), the number of wagers placed on the favored teams increases (Paul and Weinbach, 2011). Some bookmakers may even intentionally set spreads off from the value they believe would result in a 50/50 split of wagered funds to increase profitability (Levitt, 2004).

To help consider these possibilities further, we look separately at opening and closing lines of games with exactly one team clinched into playoff position. If an opening line creates an opportunity for systematic profitability, it should be corrected by the closing line, and the final, market clearing price (spread) should not afford systematic profitability, if the market is efficient. This may result because of the unveiling of information between the release of the opening line and the posting of a closing line, or because of order flow from bettors convincing bookmakers to update their prices (Krieger and Fodor, 2013). We examine the opening and closing lines for both statistical and economic efficiency of wagers when the positioning of future playoffs is fixed (in the parlance of the sports market a "clinched" position). Gray and Gray (1997) note that NFL wagering inefficiencies may dissipate over time, though in their results, the suggested dissipation is in terms of years rather than the opening to closing betting cycle. In fact, should profitable results be detected, the most interesting question to many observers might be whether such effects might persist into the future, especially with the popular publication of such information.

In our study, we find that betting lines are set systematically too aggressively, in favor of teams that have clinched post-season berths, for the remainder of the regular season. We detect this using both a traditional statistical test evaluating the prices of point spreads in games of professional football and basketball, as well as by the profit levels recognized by wagering on such clinched teams. We also detect differences in wagering effectiveness between the opening line and the closing line. Opening lines are consistently biased towards teams that have clinched playoff positions, often providing a potentially profitable bet, even after considering commissions. In nearly every case, however, the markets at least partially correct, providing support that gaming markets correct over time (see Gray and Gray, 1997 and Krieger and Fodor, 2013). In some cases, closing lines correct to the point that betting against clinched playoff teams no longer produces a viable betting position. This is evidence of the market becoming more efficient during the betting cycle. We also find some subsets (e.g., NFL teams locking top seeds or National Basketball Association [NBA] teams locking specific seeds) where evidence of inefficiency of the betting market, because of letdown bias, persists at the closing line. These results further support "anchoring" theory, which suggests that markets are slow to update beliefs tied to inefficient prices (Kahneman and Tversky, 1979; Kahneman, 1992; Beggs and Graddy 2009).

2. Behavioral finance implications

Attempting to better understand why such opportunities persist motivates a turn to behavioral finance. Anchoring (see Kahneman and Tversky, 1979) is the theory that the first price offered, in our case the opening spread, unduly influences the market clearing price. In another unorthodox market, Beggs and Graddy (2009) find support for anchoring in the case of art auctions. Anchoring effects continue to develop as a source of current and relevant research. In a trio of recent studies, the 52-week highs for stocks and indices are anchors (there are many confirming empirical studies of the 52-week high referencing). George and Hwang (2004) find that the current stock price coupled with the 52-week high price creates an anchor as information incorporates into the stock price, but traders are reluctant to push

prices far away for the 52-week high. Peng and Xiong (2006) provide a theoretical structure and show that limited investor attention leads to investors processing more market and sector information than firm-specific information. Li and Yu (2012) find two anchors are important in explaining the price movements, both the 52-week high and the historical high. Anchoring also occurs within industry earnings. Cen, Hillary, and Wei (2013) find the industry median acts as an anchor in forecast earnings, as well as the difference between the forecast earnings and industry earnings. In the gaming literature, McAlvanah and Moul (2013) examine the case of Australian bookies and horseracing finding that when a horse "scratches" (i.e., is abruptly withdrawn after betting has started), the odds are not fully adjusted on the remaining horses. The adjustments recover only about 80% of the lost profit margin. We propose an anchoring-based theory as potentially explanatory of a new gaming-market result.

"Affect" is the theory that an individual's motivations to associate with desirable capital projects, firms, and teams influence decisions that deviate from a pure risk-return rationale. MacGregor, Slovic, Dreman, and Berry (2000) demonstrate via experiment that the affective reaction, that is, the desire to associate with positive firms, influences financial judgment, a willingness to overvalue an asset. Moreno, Kida, and Smith (2002) find that, in capital budgeting, affective reactions influence risk taking. The desire to associate with positive affectations can result in accepting projects that would be otherwise rejected. More recently, Aspara and Tikkanen (2011) find that the more positive an individual's attitude towards a firm—affective self-affinity—can further the extra investment motivation. Bernile and Lyandres (2011) find, in the case of publicly traded European soccer clubs, that investors are overly optimistic about "their" team's success. In sports gaming, early evidence suggests that bettor irrationality might generate from the desire to side with the favored team (Vergin and Scriabin, 1978; Paul and Weinbach, 2005a), which would be the team that has clinched a post-season milestone in the context of our study.

The overall impression from our NFL analysis is that betting against NFL teams after clinching playoff berths or locking playoff seeds appears to be a lucrative strategy relative to the opening line. The opening point spreads set for NFL games systematically appear to underappreciate the letdown tendencies of teams that have clinched playoff positions, and thus, savvy bettors may profit.

Bookmakers themselves may have various perspectives on any inefficient lines they are setting. An aggressive bookmaker is aware of this inefficiency and allows it to exist (at least for now) because he or she is taking a calculated risk (in which case the informed, contrarian bettor is benefitting because of naïve public bettors) by, for example, making the line on a contest "New England-12" when the real handicapped line the bookmaker secretly believes to be fairest is "New England-11," but naïve bettors (say, e.g., 70% of dollars wagered) will still bet New England even while laying 12 points (1 point "too many").

Alternatively, the bookmaker could act more conservatively to achieve a balanced book. For example, the bookmaker may make the line to the above hypothetical game "New England-13" to achieve a more balanced volume of dollars wagered on the contest (there will be more dollars bet on New England's opponent if it is getting 13 points [2 points "too many"] rather than 11 [the "fair" line in the bookmaker's eyes] or 12 [the aggressive price designed to lure in additional wagers at poor odds]). In such a case, the opportunity for the contrarian bettor is even greater than in the aggressive bookmaker case.

We do not know the exact mix of aggressiveness or conservatism held by the sports books providing the lines used in our sample; furthermore, unlike a game of dice or playing cards, whose exact odds can be determined with simple probability calculations, there is no guarantee (especially for one specific game) that the bookmaker "correctly" estimates the "fair" line. Regardless of bookmaker intention/philosophy the opportunity for bettors to profit from strategies based on a lack of awareness of a potential letdown effect would be present. We suspect that any notable results we discover will be based on a mix of bookmaker aggressiveness and conservatism.

Our results demonstrate that the sports gaming markets may initially be inefficient as the letdown effect is not priced correctly. The market does partly correct, and by the closing line, most historically available betting strategies are no longer as statistically powerful as at opening; however, some cases of statistical significance remain, even at closing lines. This may be particularly indicative of anchoring (Kahneman and Tversky, 1979; Kahneman, 1992; Beggs and Graddy, 2009). Contributing to this inefficiency may be the over optimism or desire to bet with favorites (see Bernile and Lyandres, 2011; Vergin and Scriabin, 1978; Paul and Weinbach, 2005a). Even in the many cases lacking statistical significance, historical results are generally very supportive of the opportunity to successfully wager against clinched playoff teams for profit. It is possible that, in the future, such opportunities for profit may continue because of affect and anchoring effects. It is also possible that, in the future, greater attention drawn to such a successful strategy may cause more future bettors to wager against clinching teams; thus, shifting point spreads to more "correct" levels. The remainder of the article proceeds as follows: Section 3 describes the data. Section 4 describes our method and results. Section 5 briefly concludes.

3. Data

Our primary source of historical point spread data (opening and closing lines) for NFL and NBA analysis and game score data are sportsinsights.com, which began collecting data in the middle of 2003. Sportsinsights.com provided wagering data through the middle of 2012. Thus, our initial focuses herein are the 2003–2012 NFL and NBA seasons. NFL historical point spread and game score data for the 2012 regular season is taken from Sunshine Forecasts[4] to complete the initial data set. Opening lines are those set initially when bookmakers offer a "price" on the game to the betting public.[5] Betting action may move these prices up until the start of contests. This is particularly true if books are attempting to balance wagering dollars on each side of a contest. Evidence of this desire is mixed (e.g., see Levitt (2004) and Paul and Weinbach (2011)). Additionally, information may develop regarding teams' strategic and/or management intentions for upcoming games after opening lines are issued. For example, teams may not make the decision to rest important players until after the opening line of a game has been made. In such a case, a market might be perfectly efficient to introduce one opening line and change this line as information develops; thus, we also track the performance of wagering relative to the closing lines of contests, which are those in place immediately preceding the start of a game. Evidence of market inefficiency

relative to closing lines of contests is particularly important in demonstrating evidence of our hypotheses.

We consider whether teams underperform gambling markets' expectations after reaching benchmarks determining post-season positioning. We begin by considering whether teams that have clinched any position in the upcoming post-season tournament underperform. However, many of these teams still have considerable incentive to compete vigorously in remaining regular season games because playoff seeding is at stake.[6] Thus, we further narrow our sample to consider only those teams that are "locked" into specific playoff positions (i.e., regardless of all future regular season results, a team's playoff seed can neither improve nor decline). To determine the historical dates when professional sports teams clinched playoff berths, locked in playoff positions, or more specifically clinched top seeds in their respective playoff tournaments, we conduct web searches for news stories regarding the teams that participated in each season's playoffs. We hand collect the dates when playoff berths were secured or seeds were locked, taking care to distinguish between the actual date of the contest and the publishing date of news stories.

The dates of some teams' clinching of playoff berths or locking of positions could not be readily obtained from web searches. Archived web news stories regarding clinching dates are relatively accessible in recent years but are more difficult to acquire for earlier seasons. To avoid using only a handful of contests in seasons from further back in our data set, we instead elect to utilize some date cutoffs for different portions of our analysis.[7] For our purposes, clinching dates could be determined for all NFL playoff berths from 2003 to 2012 and all locked playoff seeds could be determined from 2004 to 2012; however, NBA playoff berth clinching dates could only be regularly ascertained for the 2007–2012 period, though locked dates of playoff seeds for NBA playoff tournaments could be determined for the 2004–2012 period.

4. Method and results

We analyze clinching teams' spreads in the regular season contests after their clinching date(s) of accomplishments. We analyze the spreads of the next game, the next three games, and, if possible, all remaining games after a clinching performance.[8] We question, specifically, if the letdown effect is priced into spreads, and if not, if those spreads afford a profitable wagering opportunity.[9] To avoid confounding concerns, we include only games when the clinching team competes against an opponent that has not clinched its own playoff berth.[10]

We begin by considering the efficiency of point spreads in NFL and NBA contests, after a team has clinched a playoff berth, locked in a particular playoff seed, or more particularly a top playoff seed, using the approach of Zuber et al. (1985). This test requires the estimation of the simple regression model:

$$ActualPointDiff_i = a + b(OpeningLine_i) + e_i \quad (1)$$

for the consideration of performance relative to the opening line of a contest, and

$$ActualPointDiff_i = a + b(ClosingLine_i) + e_i \quad (2)$$

for the consideration of performance relative to the closing line of a contest.

$ActualPointDiff_i$, the dependent variable, is the opponent's final score in game i, minus the clinched team's final score in the game. The independent variables of the regressions, $OpeningLine_i$ and $ClosingLine_i$, are the opening and closing bookmaker lines of game i as reported by sportsinsights.com or Sunshine Forecasts. To conduct the test, we estimate the unrestricted version of Eqs. (1) and (2) and note the residual sum of squares of the regression. We use this information, along with the residual sum of squares when the restrictions $a = 0$ and $b = 1$ are imposed, to calculate F test statistics for each specification. A significant F-statistic denotes evidence against the efficiency of the opening or closing line of games as accurate predictors of game results. Our results for the NFL and NBA are shown in Table 1.

We first note that, in Panel A, which addresses line efficiency for NBA and NFL teams after clinching a playoff berth, no evidence of point spread statistical inefficiency is detected via the Zuber et al. (1985) tests. We do, however, find evidence of line inefficiency in Panels B and C, which provide the line efficiencies for NBA and NFL teams after locking a specific playoff seed and clinching the top overall playoff seed, respectively. In Panel B, in the opening line case, we find evidence of inefficiency of lines set for NBA teams that have locked playoff positions. NBA teams that are set in specific playoff positions have inefficient lines, as detected from F-tests, for the next game (next three games, all remaining games) at the 5% (1%, 5%) level. When we consider the closing lines, the significance of these NBA results declines (also in Panel B) to the 10% (5%, 10%) level for the next game (next three games, all remaining games) sample. This supports the conjecture that the letdown effect is not priced initially in the opening line, but by the time closing lines are established, results are not as strong, indicating that the letdown effect is priced somewhat more fully by the closing line than the opening line.

In Panel C, we note that when concentrating our focus on the subset of teams that have clinched the *top seed* in their upcoming playoff tournament, some significant results emerge for the NFL, as well as the NBA. For opening lines, the small sample of 19 NFL games with locked top seeds shows statistical evidence of inefficient spreads at the 10% level, and NBA lines are inefficient at the 5% level for the three-game sample after the locking of top playoff seeds for the opening line. When we expand to look at all NBA contests after the locking of top seeds, opening and closing lines are inefficient at the 10% level.

It is not surprising, given our hypothesis that the letdown effect is underappreciated, that results are stronger for the subsample of games where teams are locked into playoff position and, therefore, have nothing tangible to play for (Panels B and C). Conversely, many teams that have simply clinched playoff berths (Panel A) are still looking to improve playoff seeding in remaining games. However, we also note that the smaller samples of Panels B and C, providing lower statistical power, require a higher hurdle in the available samples to achieve significant results than would be necessary in Panel A (where no evidence is seen).[11]

Our initial indication, therefore, is that NBA and NFL spreads do not fully appreciate and price the letdown effect for games after the locking in of playoff seeds. Put more plainly, our conjecture is that with playoff seeds locked, betting markets do not fully appreciate the relative lack of effort that teams (or their managers) will put forth in subsequent "meaning-

Table 1 Zuber et al. (1985) tests of line efficiency of NBA and NFL games for teams that have clinched post-season benchmarks

	n	a	b	*F*-stat
Panel A: Line efficiency for teams after clinching playoff berth				
Opening lines				
NFL teams, next game after clinching	70	0.32	0.98	0.77
NFL teams, all games after clinching	160	0.55	1.01	0.91
NBA teams, next game after clinching	77	−0.68	0.89	0.59
NBA teams, next three games after clinching	190	0.13	0.95	0.37
NBA teams, all games after clinching	536	0.67	0.99	1.44
Closing lines				
NFL teams, next game after clinching	70	0.06	0.77	0.56
NFL teams, all games after clinching	160	0.08	0.96	0.07
NBA teams, next game after clinching	77	−1.09	0.73	0.88
NBA teams, next three games after clinching	190	0.08	0.94	0.16
NBA teams, all games after clinching	536	0.55	1.03	0.57
Panel B: Line efficiency for teams after locking specific playoff seed				
Opening lines				
NFL teams, next game after locking seed	33	−0.76	0.88	0.06
NFL teams, all games after locking seed	41	1.75	0.86	0.32
NBA teams, next game after locking seed	58	4.10***	1.01	3.50**
NBA teams, next three games after locking seed	119	3.63***	0.99	5.00***
NBA teams, all games after locking seed	167	3.18***	1.18	4.90**
Closing lines				
NFL teams, next game after locking seed	33	−1.93	0.92	0.33
NFL teams, all games after locking seed	41	0.54	0.92	0.09
NBA teams, next game after locking seed	58	3.39**	1.07	2.84*
NBA teams, next three games after locking seed	119	2.83***	0.95	3.57**
NBA teams, all games after locking seed	167	2.08**	1.12	2.53*
Panel C: Line efficiency for teams after clinching top playoff seed				
Opening lines				
NFL teams, next game after clinching conference	13	2.32*	0.93	2.49
NFL teams, all games after clinching conference	19	5.77***	0.88	3.29*
NBA teams, next game after clinching conference	12	1.86	1.24	0.31
NBA teams, next three games after clinching conference	35	3.31***	1.05	3.99**
NBA teams, all games after clinching conference	63	2.99*	0.95	3.14*
Closing lines				
NFL teams, next game after clinching conference	13	1.71	0.91	1.55
NFL teams, all games after clinching conference	19	5.50***	0.85	2.72*
NBA teams, next game after clinching conference	12	2.04	1.19	0.18
NBA teams, next three games after clinching conference	35	3.01**	1.03	2.91*
NBA teams, all games after clinching conference	63	2.75*	0.77	2.47*

Table 1 presents estimates of intercepts and slopes for the regression model of actual point differential realized in NFL and NBA games on the opening and closing spreads of these games (Eqs. 1 and 2). The dependent variable of the simple OLS regression, *ActualPointDiff*, is the opponent team's final score in the game, minus the clinched team's final score in the game. The independent variables of the regression are $ClosingLine(OpeningLine_i)$, which is the closing (opening) bookmaker line of game i as reported by SportsInsights or Sunshine Forecasts (http://www.repole.com/sun4cast/data.html). The closing (opening) line is reported relative to the team which has clinched a playoff berth, locked in a specific seed in the upcoming post-season, or more specifically the top seed. The sample is from the 2003-2012 NFL regular seasons for playoff berth clinching and 2004-2012 for locking of NFL playoff positioning (including top seeds). The sample is from the 2007-2012 NBA regular seasons for playoff berth clinching and 2004-2012 for locking NBA playoff positioning (including top seeds). Panel A presents results for the performance of teams after clinching playoff berths. Panel B presents results for the performance of teams after being "locked" into playoff position. Panel C presents results for the performance of teams after clinching top seeds in playoff competition. Games in which a team's opponent has already clinched a playoff berth are omitted from the sample as our research question involves a potential relative lack of motivation for teams which have already clinched playoff-related goals. Dates at which teams clinched playoff berths or top seeds or were locked into playoff positions are taken from internet searches of historical sports news stories. *F*-statistics are presented which test the joint hypothesis that a = 0 and b = 1, a test for efficiency of the betting line noted by Zuber et al. (1985) and other authors.

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

less" games. This lack of effort may manifest itself through the management's resting of star players or the lack of advanced strategy or effort in execution put forth by the remaining players. It is perhaps not surprising that this result particularly appears in games after top seeds are achieved, for these are the cleanest examples of opportunities for teams to rest. By contrast, after the clinching of general playoff berths, many teams may still be motivated to put forth maximum effort to gain a higher playoff seed, which may explain the lack of statistical significance in the results of Panel A.[12]

Evaluating the efficiency of betting lines based on the Zuber et al. (1985) approach is an interesting first step, but this ignores the most relevant and interesting questions for betting markets. Namely, do betting lines create the anticipated dynamic in which bettors cannot overcome the commission charged on wagering by using a strategy? Do sports gambling markets set efficient prices for wagers, or is it possible that the marketplace neglects the impact of the letdown effect of teams that have clinched playoff positions? These questions cannot be answered by simply considering the Zuber et al. (1985) test.

If, for example, teams that have just clinched playoff berths or locked seeds or top seeds are as likely to cover spreads as their opponents, but were disproportionately outscored, relative to spreads, in those games in which they failed to cover, then the rationality/efficiency test of Zuber et al. (1985) may detect a systematic error in the line. However, that line might actually be completely efficient for purposes of wagering. The reverse is also possible. We might find insignificant test statistics for line efficiency of clinching teams given the approach of Zuber et al. (1985), but if this result is driven by covering relatively few spreads by large amounts and failing to cover relatively more spreads by small amounts, then a profitable opportunity for wagering, by simply betting against teams that have recently clinched playoff positions, may exist.

Thus, we analyze whether systematically betting against recently clinched teams, because of an under-appreciation of the letdown effect, may be a profitable endeavor. Because of the typical 10% vigorish charge (the commission charged by the bookmakers on winning wagers), a bettor must actually win over 52.38% of equal wagers to make a profit;[13] hence, the best way to consider the performance of a proposed betting strategy is relative to this rate. We omit contests that result in tied (or "pushed") wagers from this portion of the analysis.

Tables 2 (NFL) and 3 (NBA) provide results for the regular season performances of teams that have clinched a post-season benchmark. Subsequently, for a strategy of betting against these teams to prove successful, the clinching team must fail to cover in a minimum of 52.38% of games (if a clinched team fails to cover, a bet against this team would result in a "win"). We present one-sided *p*-values for the results, relative to our hypothesis of underperformance by clinched teams.[14] Panel A provides results for teams that have clinched a playoff berth; Panel B provides results for teams that are locked into any specific conference seed; Panel C provides results for teams that are locked into the overall top conference seed. As in Table 1, we consider results relative to the opening and closing spreads separately. Table 2 presents our analysis of the retrospective performance of wagering against NFL teams that have clinched playoff positions.

We find in Panel A that wagering against NFL teams that clinched a playoff berth, at the opening line offered by bookmakers, has been a profitable strategy over the 2003–2012 seasons. When analyzing the opening line spreads, NFL teams fail to cover the spread at a

Table 2 Betting on NFL teams that have clinched post-season benchmarks

	Next game	All remaining games
Panel A: Teams that clinched a playoff berth		
Opening line results		
n	70	160
Covered	28	68
Failed to cover	42	92
Percentage filed to cover	60.00	57.50
One-sided *p*-value vs. 52.38%	0.101	0.097*
Closing line results		
n	70	160
Covered	30	71
Failed to cover	40	89
Percentage failed to cover	57.14	55.63
One-sided *p*-value vs. 52.38%	0.213	0.205
Panel B: Teams that locked any seed in conference		
Opening line results		
n	30	38
Covered	13	14
Failed to cover	17	24
Percentage failed to cover	56.67	63.16
One-sided *p*-value vs. 52.38%	0.319	0.092*
Closing line results		
n	30	38
Covered	15	16
Failed to cover	15	22
Percent failed to cover	50.00	57.89
One-sided *p*-value vs. 52.38%	—	0.248
Panel C: Teams that locked top seed in conference		
Opening line results		
n	13	19
Covered	4	4
Failed to cover	9	15
Percent failed to cover	69.23	78.95
One-sided *p*-value vs. 52.38%	0.112	0.010**
Closing line results		
n	13	19
Covered	5	5
Failed to cover	8	14
Percent failed to cover	61.54	73.68
One-sided *p*-value vs. 52.38%	0.254	0.032**

Table 2 presents the results for betting on NFL regular season games from 2003 through 2012 in which only one team had clinched a post-season benchmark. The opening and closing line spreads and the final scores for the games were gathered from SportsInsights or Sunshine Forecasts (http://www.repole.com/sun4cast/data.html). To determine whether a team with a clinched benchmark "covered" the bet, the spread was added to the locked teams score, and the opponent's score was then subtracted. If the outcome was positive, the locked team covered the spread; if the outcome was negative, the locked team failed to cover the spread. Games in which both teams had locked their respective playoff seeds were ignored, as were games that resulted in a tie (or "push"). All results are provided relative to both opening spreads and closing spreads. Panel A provides the results for teams that clinched a playoff berth in their conference. Results are subcategorized into Next Game and All Remaining Regular Season Games, which refer to the original clinching date. Panel B provides the results for teams that locked the overall top seed in their conference, and Panel C provides results for teams that locked any seed in their conference. The sample is from the 2003-2012 NFL regular seasons for playoff berth clinching (Panel A) and 2004-2012 for locking of NFL playoff positioning (Panels B and C). Web searches were used to hand collect when teams clinched playoff berths and subsequently locked specific playoff seeds. A strategy must win in over 52.38% of occurrences in order to be profitable, given the "11-for-10" commission charged to sports bettors. *p*-values relative to this benchmark are reported.

* and ** denote statistical significance at the 10% and 5% levels, respectively.

Table 3 Betting on NBA teams that have clinched post-season benchmarks

	Next game	Next 3 games	All remaining games
Panel A: Teams that clinched a playoff berth			
Opening line results			
n	77	190	536
Covered	36	92	258
Failed to cover	41	98	278
Percent failed to cover	53.25	51.58	51.87
One-sided *p*-value vs. 52.38%	0.457	—	—
Closing line results			
n	77	190	536
Covered	38	94	262
Failed to cover	39	96	274
Percent failed to cover	50.65	50.53	51.12
One-sided *p*-value vs. 52.38%	—	—	—
Panel B: Teams that locked any seed in conference			
Opening line results			
n	57	117	165
Covered	21	44	69
Failed to cover	36	73	96
Percent filed to cover	63.16	62.39	58.18
One-sided *p*-value vs. 52.38%	0.052*	0.015**	0.068*
Closing line results			
n	57	117	165
Covered	21	47	73
Failed to cover	36	70	92
Percent failed to cover	63.16	59.83	55.76
One-sided *p*-value vs. 52.38%	0.052*	0.053*	0.192
Panel C: Teams that locked top seed in conference			
Opening line results			
n	12	34	60
Covered	5	13	26
Failed to cover	7	21	34
Percent failed to cover	58.33	61.76	56.67
One-sided *p*-value vs. 52.38%	0.340	0.137	0.253
Closing line results			
n	12	34	60
Covered	4	14	28
Failed to fover	8	20	32
Percent failed to cover	66.67	58.82	53.33
One-sided *p*-value vs. 52.38%	0.161	0.226	0.441

Table 3 presents the results for betting on NBA regular season games from 2004 through 2012 in which only one team had clinched a post-season benchmark. The opening and closing line spreads and the final scores for the games were gathered from SportsInsights or Sunshine Forecasts (http://www.repole.com/sun4cast/data.html). To determine whether a team with a clinched benchmark "covered" the bet, the spread was added to the locked teams score, and the opponent's score was then subtracted. If the outcome was positive, the locked team covered the spread; if the outcome was negative, the locked team failed to cover the spread. Games in which both teams had locked their respective playoff seeds were ignored, as were games that resulted in a tie (or "push"). All results are provided relative to both opening spreads and closing spreads. Panel A provides the results for teams that clinched a playoff berth in their conference in the 2007-2012 seasons. Results are subcategorized into Next Game, Next 3 Games, and All Remaining Regular Season Games, all of which refer to the original clinching date. Panel B provides the results for teams that locked the overall top seed in their conference, and Panel C provides results for teams that locked any seed in their conference. Both Panel B and C are from the 2004-2012 seasons. Web searches were used to hand collect when teams clinched playoff berths and subsequently locked specific playoff seeds. A strategy must win in over 52.38% of occurrences in order to be profitable, given the "11-for-10" commission charged to sports bettors. One-sided *p*-values relative to this benchmark are reported.

* and ** denote statistical significance at the 10% and 5% levels, respectively.

60.00% rate (p-value = 0.101). In all remaining regular season games, teams with a clinched playoff berth fail to cover the opening line spread in 92 out of 160 games, a 57.50% rate (p-value = 0.097). These figures indicate a viable strategy is present in betting against NFL teams that have clinched a playoff berth, eclipsing the 52.38% required rate for success.

We additionally consider results relative to closing lines in Panel A. In the game after the clinching of a playoff berth, 40 of 70 NFL teams have failed to cover the closing line spread (57.14%). This outperforms the 52.38% mark necessary to offset the commission, but not at a significant rate, statistically (p-value = 0.213). Betting against locked-seed NFL teams in all remaining regular season games would win 55.63% of wagers in our sample period, again above the profitability mark, but not statistically significantly better than the 52.38% mark (p-value = 0.205). A potential cause of the inferior results for the closing line sample is that some knowledgeable bettors might seize upon the potential letdown effect and thus push spreads away from clinched teams. If the letdown effect is not correctly priced in the opening line the spread, by the time of the closing line, may no longer afford a statistically significant profitable wager.

We consider, in Panel B of Table 2, betting against teams that are locked into any playoff seed (thus, having no strategic motivation in the game for upcoming playoff positioning, unlike many teams in Panel A). For the opening line case, results eclipse the 52.38% benchmark for the next game (17 of 30 locked teams, 56.67%, fail to cover) and for all remaining regular season games (24 of 38 locked teams, 63.16%, fail to cover). Statistical evidence is weak for the next-game results (p-value = 0.319) but are marginally significant when considering all remaining games (p-value = 0.092).

Again, the performance of these teams is worse against opening line spreads than closing line spreads. Out of the 30 games immediately after the game in which a seed was locked, teams fail to cover only half of the time. Out of 38 total post-lock regular season games, the locked team fails to cover 22 times against the closing line, resulting in a p-value of only 0.248.

In Panel C of Table 2, we see that wagering against NFL teams that have clinched the top seed in their conference has been a very profitable venture over the nine seasons from 2004 to 2012, especially for bets placed relative to the opening line spreads. Of 13 games immediately after the clinching of a top seed, the locked team has failed to cover the opening spread nine times, a 69.23% rate (p-value = 0.112). Of the 19 total regular season games played by NFL teams after clinching top conference seeds, the team has failed to cover 15 times relative to the opening line, a 78.95% rate (p-value = 0.010).

These significance levels are impressive given the very limited sample sizes afforded by the NFL. Performances of strategies betting against top seed locks, relative to closing line spreads, are similar, though significance declines given the small sample sizes at work. In the first game after locking the top seed, teams fail to cover 8 out of the 13 games, a 61.54% rate (p-value = 0.254). For all remaining regular season games, top seed locks fail to cover 14 out of 19 contests, a 73.68% rate (p-value 0.032). While all of these sample sizes are very small, the near-75% success rate of the strategy of betting against teams locked into top NFL seeds in all remaining games results in statistically significant winning rates above 52.38%. After considering the costs of placing wagers, we find this lone example of statistically significant inefficiency in NFL gaming markets, but we also note the many cases of historical

success of such wagering strategies that do not reach the high threshold of statistical significance. We present our results in Table 3 using similar betting strategies, historically, for the NBA.

In Panel A, we note that betting against NBA teams after they clinch playoff berths has not proven profitable over the 2007–2012 seasons. Relative to the opening line spreads, the success rate of such wagering in the next game is only 53.25%, barely eclipsing the 52.38% mark needed to demonstrate positive returns. Further, the success rates of betting against teams that have clinched playoff berths in the next three games or all games after clinching exceed 50%, but they do not exceed the positive return benchmark of 52.38%. Like in the NFL results of Table 2, using closing line spreads results in slightly worse results.

Panel B, which provides the results of NBA teams that have clinched any playoff seed, are strongly indicative of a lack of full pricing of the letdown effect. Again, wagering against playoff teams at opening lines proves more favorable, with success rates of wagering against locked position teams in the next game 63.16% (significant at 10%) , next three games 62.39% (significant at 5%), and all remaining games 58.18% (significant at 10%). For closing spreads, these rates are 63.16% for the next game (significant at 10%), 59.83% for the next three games (significant at 10%), and 55.76% for all remaining games after clinching, indicating historical profitability. A bettor using a strategy of wagering against NBA teams locked into a specific playoff seed would eclipse the 52.38% mark needed for success in all of the situations documented in Panel B.

In Panel C, we see that wagering against NBA teams after they have locked conference top seeds has indeed proven quite historically profitable (this over the 2004–2012 seasons). With small sample sizes of 12, 34, and 60 games, respectively, for the next game, next three games, and all games after the locking of top seeds, the results are not statistically significantly greater than 52.38%, for either opening or closing lines, but the success rates are still encouraging (like in Panel B).

As in the NFL wagering results of Table 2, it appears that wagering against teams that have clinched playoff benchmarks, while they are concluding their regular seasons, is a profitable strategy in the NBA, especially based on opening lines. Small differences in the specific findings are, however, present. Wagering against NFL teams after clinching any playoff berth (without necessarily being locked into a particular seed position) has been historically successful, while this has not been the case in the NBA (Panel A of Tables 2 and 3). Results for the NFL show the greatest statistical strength for the subsample of teams locked into the top seeds in remaining regular season games (Table 2, Panel C), while results for the NBA show the greatest statistical strength for the sample of all teams locked into playoff position (Table 3, Panel B).[15]

5. Conclusion

We examine the efficiency of the NFL and NBA sports gaming markets after teams secure post-season positions. Teams clinching post-season berths are commonly overvalued initially in the opening lines offered by bookmakers, perhaps because of the lack of information regarding the status of certain players on these teams or uncertainty regarding such teams'

intentions for competing with maximum effort to win the remaining contests of the regular season. This effect is generally stronger for the subsample of professional teams that are locked into specific playoff positions (particularly in the NBA), including the top seed in their upcoming post-season playoff tournament (particularly in the NFL). As these teams, by definition, have little true incentive to play at optimal levels (or may choose to strategically rest players), the betting public may be particularly slow to recognize this situation or unable to overcome their bias towards perceived superior teams, even when these teams do not have the same incentives they did in establishing their superior records.

Closing lines, analogous to the last market clearing prices, generally demonstrate some correction in the appropriate direction. In some cases, closing lines correct to the extent that a naïve betting rule does not overcome betting commissions. However, many cases persist in which closing lines persist that are statistically and economically profitable for bettors willing to wager against those teams that may experience a letdown effect. Our results are consistent with markets correcting towards efficiency while also providing evidence of affect (the desire to associate with perceived winners) and anchoring theories.

Football and basketball are followed closely and even casual fans or gamblers can readily understand the emotional and strategic reasons for a letdown after achieving specific goals. Despite this, even after trading costs, we find statistical evidence supporting behavior biases of affect and anchoring.

Notes

1 For some discussion from another market, consider: http://www.telegraph.co.uk/sport/football/competitions/premier-league/10810560/Do-Premier-League-teams-ease-up-when-they-have-nothing-to-play-for.html.

2 Bookmakers set point spreads, or "lines," in the most common form of handicapping games. The point spread issued by the bookmaker (often a casino or internet company) establishes the "favorite" and the "underdog" of a game. This point spread serves as a correction based on the perceived likelihood of each team winning a game. The favorite is considered more likely to win a game, and thus, the spread is instituted to place the two sides of a wager on more equivalent footing. A wager is graded based on subtracting the spread from the favorite's final score and comparing this adjusted figure to the score of the underdog. Whichever side then has the higher score is the winning team of the "against the spread" wager. The team that wins an against-the-spread wager is said to have "covered" the game or the spread.

3 This is not to be confused with the "longshot bias" found in parimutuel betting (Thaler and Ziemba, 1988). Woodland and Woodland (1994) also note that, in the case of baseball, this bias is reversed but not to the point where this bias is a tradable strategy.

4 http://www.repole.com/sun4cast/data.html.

5 Sportsinsights.com "opening" lines are based on overnight lines issued for NBA games played the following afternoon/evening. NFL opening lines from sportsinsights.com are based on lines issued on Sunday evenings for games to be played the following week (Thursday through the following Sunday) with the exception of teams about to

be involved in Monday games the following day. For Monday game participants, opening lines for Thursday–Sunday games are usually issued late Monday night or Tuesday morning.

6 Typically, teams with higher playoff seeds draw supposedly weaker opposition in the opening round of post-season competition, and earn the advantage of playing the majority of an odd-numbered series of post-season games at their home venue.

7 The substance of the results shown herein remain nearly unchanged when the few contests from preceding years are included (e.g., a few NBA playoff berth clinching dates are determined and these observations used as well). We merely cutoff the sample dates to limit the randomness of only including some observations from earlier years in certain categories of analysis.

8 We track performance in the next game, and all remaining regular season games for NFL contests with one clinched playoff participant (very rarely are positions determined more than three games before the 16-game NFL regular season concludes). We track performance in the next game, next three games, and all remaining regular season games for NBA contests with one clinched playoff participant.

9 As mentioned previously, the letdown effect can include strategic maneuvering on the part of coaching staffs to rest players before the post-season. Because these moves are sometimes delayed until after the initial spreads are set, some of the adjustments of opening lines towards closing lines is related to information realization of the betting markets.

10 Thus, as noted before, the majority of these games feature "good" teams (those qualifying for post-season play) against those of perceived lower quality. Hence, most games have the clinched teams favored. However, this is not always the case, particularly when news develops before an upcoming game that the clinched team might not use its best players in the contest.

11 Such a framework persists in Tables 2 and 3 as well.

12 In unpublished results, *F*-statistics are also insignificant for the full sample of NBA and NFL teams after the clinching of playoff berths (beyond the next three games) and for the full sample of NBA teams after clinching top seeds (beyond the next three games).

13 Details of this calculation may be found in Levitt (2004).

14 Winning wager rates greater than 52.38% are indicative of historical profitability. Statistical significance of rates being greater than 52.38% is a high threshold given the limited power available and the small sample. Examples of significance above the 52.38% benchmark are quite limited in the literature. (Fodor et al. 2013).

15 We note that in the NBA, home court advantage in the NBA Finals, pitting winning teams from each conference's post-season tournament, is granted to the team with the superior regular season record. Thus, it may be possible that locked top conference seeds in the NBA may still have tangible reason to compete in remaining regular season games. However, we investigate this hypothesis and find results no more significant than those of Table 3, Panel C.

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