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Market Efficiency and the NHL totals betting market: Is there an under bias?

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Abstract

Sports betting and racetrack markets continue to be utilized by academic researchers to provide insights into theories relating to more complex speculative markets. Previous investigations have focused on testing the efficient markets hypotheses and behavioral biases of the participants. This paper investigates the market efficiency of the National Hockey League (NHL) goal totals over/under betting market. The market is found to be inefficient and simple wagering strategies are identified that result in profitable returns.

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1. Introduction

A significant amount of research in financial economics has been devoted to the investigation of the efficient markets hypothesis. If prices do not fully reflect available information, it would be possible to pursue a strategy that would earn above-average returns. Racetrack and sports betting markets provide a simplified version of the more traditional, financial markets. Thaler and Ziemba (1988) argue that the "advantage of wagering markets is that each asset (bet) has a well-defined termination point at which its value becomes certain. The absence of this property is one of the factors that has made it so difficult to test for rationality in the stock market. Since a stock is infinitely lived, its value today depends both on the present value of future cash flows and on the price someone will pay for the security tomorrow." The payoff of a wager is determined immediately, once the game or race is completed.

Although the early focus was placed on racetrack markets, sports betting markets such as football, baseball and basketball have received more attention in the wagering market literature in the past several years. We maintain that this is a result of the relatively lower commissions in sports betting markets. In our view, with commissions near 20%, racetrack bettors tend to view wagering as more of a recreational activity, since there is a low probability of long-term successful gambling. Alternatively, in sports betting markets, commissions range from about 2% for baseball to 5% for hockey. Sports bettors are more likely to believe that their expertise is sufficient to overcome the 4.5% commission for football as opposed to 20% at the track.[1]

There are two basic betting structures employed by sports books. In the odds or "money line" market, bettors wager whether a team will win the game, regardless of the margin of victory. This is the prevalent method used for baseball and hockey betting.[2] In these markets it has generally been found that bettors overbet the favorite team, resulting in returns to underdog wagers that are higher than returns consistent with the efficient markets hypothesis. This phenomenon, known as the reverse favorite-longshot bias, has been documented by Woodland and Woodland (1994, 2003) and Gandar, Zuber, Johnson, and Dare (2002) for baseball; and by Woodland and Woodland (2001, 2011) and Gandar, Zuber, and Johnson (2004) for hockey. In the second betting structure, point-spread, the margin of victory determines the outcome of the wager. Most of the research in this market has also documented returns to underdogs which are higher than those implied by market efficiency. Gray and Gray (1997) report this bias for football, while Paul and Weinbach (2004) verify it for basketball.

This paper is the first to test National Hockey League (NHL) goal totals betting market, for potential inefficiencies and biases. In the next section, we discuss the structure of this betting market.

2. The National Hockey League Goal Totals Betting Market

The goal totals betting market is similar to the more familiar point spread markets, except that bettors wager whether or not the combined goals scored by both teams is above (OVER) or below (UNDER) the posted line. An "under bias" has been documented by Paul and Weinbach (2002) for the National Football League (NFL), and Paul, Weinbach, and Wilson (2004) for the National Basketball Association (NBA). For sufficiently high point totals, the returns to the UNDER bettors are significantly higher than those of the OVER bettors, resulting in rejection of

[1] For an excellent discussion of sports and racetrack gambling market, see Sauer (1998).

[2] For a detailed analysis of the money line see Woodland and Woodland (2011) and Gandar, Zuber, Johnson, and Dare (2002).

the efficient markets hypothesis. For the NBA totals market, there is some evidence that this "under bias" is sufficiently strong to allow for profitable wagering opportunities.

In both the point spread and totals markets, bettors wager $11 to win $10, with the differential representing the commission or "vigorish" collected by the bookie. For example, suppose that the sports book posts a goal totals line of 6. Bettors can wager that the sum of the goals scored by both teams is either over or under 6. If the goal total is exactly 6, the game is a "push" and all money is returned. These games have been excluded from our analysis. By posting a total of 6.5, for example, bookies can avoid "pushes."

If the hockey totals betting market is perfectly efficient, then all betting strategies should result in an expected win rate of 50%. Any betting strategy that produces a win rate greater than 50% would provide evidence against the efficient markets hypothesis. A second test examines whether any documented inefficiencies are sufficiently large to allow for profitable wagering. To generate positive expected returns, the 11 for 10 rule requires that the win rate exceeds 11/21 or 52.38%.

In recent years, sports books have moved away from the typical (-110, -110) money line to more easily achieve a balance of money wagered on the OVER and UNDER bets, while minimizing movements in the posted total. Before resorting to a change in the totals by 1/2 goal or point, which exposes them to risk, bookies can adjust the money line price. These modifications are typically small, with the odds rarely deviating much from even. An example of a typical line for 2010 is

Team	Bet Type	Total	Money Line Price
Tampa Bay Lightning	OVER	5.5	+103
Los Angeles Kings	UNDER	5.5	-111

The OVER bettor wagers $10.00 to win $10.30 while the UNDER bettor gambles $11.10 to win $10.00. The data we analyzed did not report the money line. However, the effect of the omission on the results is likely to be negligible. If the money line required the UNDER bettor to wager more than the OVER bettor in a predominant number of games, then the favorability of the UNDER wager reported in this article would be diminished. However, examination of the posted lines for the 2010-2011 season reveals no such pattern.[3]

Data for markets such as football and baseball are easily retrieved from numerous sources. Historical data for smaller markets such as hockey totals has been more difficult to locate. We were able to obtain over 5000 games covering four and a half seasons. Lines were posted by Pinnacle, one of the largest online betting services, approximately one hour before the start of the game. The data was collected and posted online by sportspunter.com, an internet sports handicapping site.

The number of games is easily sufficient to allow for the normal approximation to the binomial distribution. The appropriate test statistic, Z, is given by

$$Z = \frac{\left(\frac{W}{N} - \mathrm{p}\right)}{\sqrt{\frac{\mathrm{p}(1-\mathrm{p})}{\mathrm{n}}}},$$

[3] The money line is also a component of the NFL and NBA totals market. Previous research in these markets did not incorporate the money line in their analysis, presumably due to lack of their availability. See for example, Paul and Weinbach (2005) and Paul, Weinbach and Wilson (2004).

where W represents the number of winning UNDER wages, N is the number of UNDER bets and $p = .5000$ for market efficiency and .5238 for profitability.

3. Tests of Efficiency and Profitability

Table I reports the returns to betting the UNDER for each of the five seasons of available data. For all five seasons the winning percentage is above the efficient markets benchmark of 50%. Four of five of the seasons are statistically significant at the 10% level of significance for one-sided tests. For all seasons combined, the efficient markets hypothesis is rejected with a P-value of .00075.

Table I: Season totals outcomes and tests of market efficiency for the UNDER bettor

Season	N	W	Win Percentage	Z	p-values
2005-2006	1,197	627	52.38%	1.65	.0497
2006-2007	1,196	633	52.93%	2.02	.0215
2007-2008	1,247	654	52.45%	1.73	.0420
2008-2009	1,260	636	50.48%	0.34	.3677
2009-2010	575	305	53.04%	1.46	.0722
ALL	5,475	2,855	52.15%	3.18	.0007

In Table II, the data is organized according to the goal totals line. Reported results for the NHL are remarkably consistent with the football and basketball totals betting markets. We observe that for sufficiently high totals lines, the returns to the UNDER wagers deviate significantly from market efficiency. For total goals lines of 5.5 and above, three of the four lines, including the grouping of games with totals of at least 7, reject the market efficiency at a 10% level of significance. Furthermore, there is some evidence profitability, although it is not consistently observed for every goal total. The winning percentage of 54.20% for the UNDER bettor, when the goal total is 5.5 goals, rejects the null hypothesis of a mean return of zero in favor of the alternative hypothesis of profitability, with a p-value of .0341. Although there appears to be a definite "under bias," the evidence for profitability is relatively weak. The win percentages are not monotonically increasing with the goal totals lines and one could argue that the presence of profitability is consequence of data snooping. However, profitability was observed for the mode closing total of 5.5 goals, representing almost 46% of all games.

Table II: Outcomes for the UNDER bettor by goal totals

Goal Totals	N	W	Win Percentage	Z: Market Efficiency (p-values)	Z_p: Profitability (p-values)
≤ 4.5	17	6	35.29%	-1.46 (.9283)	
5.0	718	329	45.82%	-2.24 (.9874)	
5.5	2,513	1,362	54.20%	4.21 (.0000)	1.82 (.0341)
6.0	1,401	731	52.18%	1.63 (.0516)	
6.5	743	376	50.61%	0.33 (.3706)	
≥ 7.0	83	51	61.45%	1.98 (.0241)	1.54 (.0613)
Combined Totals					
≤ 5.0	735	335	45.58%	-2.40 (.9917)	
5.5	2,513	1,362	54.20%	4.21 (.0000)	1.82 (.0341)
≥ 6.0	2,227	1,158	52.00%	1.89 (.0297)	
ALL	5,475	2855	52.15%	3.18 (.0007)	

4. Conclusion

Results obtained in this paper are remarkably similar to those reported for other totals markets such as football and basketball. There is a definite "under bias," as bettors are observed to prefer wagering on the OVER, for sufficiently high goal totals. Consequently, favorable wagering opportunities exist for betting the UNDER. The efficient markets hypothesis was rejected in several cases and there were some limited opportunities for profitable wagering. As more data becomes available, it will be interesting to test whether this bias diminishes over time, as have many other bias in the sports-betting literature.

There are several explanations for this behavior, but the most plausible seems to be the one provided by Paul and Weinbach (2002, see p. 259): "Psychologically, if a gambler has a rooting interest in his or her bet and is not just viewing the activity as an investment option, it makes logical sense that the over becomes a more popular bet than the under, as rooting for scoring tends to be easier than cheering for a lack of scoring." This argument is consistent with the theory advanced by Conlisk (1993) that gambling is a consumption good and individuals will sacrifice expected returns for the entertainment value of gambling. While this line of argument applies to the "under bias" in this totals market, it cannot be offered as an explanation for the longstanding favorite-longshot and reverse-favorite longshot biases.

REFERENCES

Conlisk, J. (1993) "The utility of gambling" *Journal of Risk and Uncertainty* **6(3)**, 255-275.

Gandar, J., R. Zuber, and R. S. Johnson (2004) "A reexamination of the efficiency of the betting market on national hockey league games" *Journal of Sports Economics* **5**, 152-168.

Gandar, J., R. Zuber, R. S. Johnson, and W. Dare (2002) "Re-examining the betting market on major league baseball games: Is there a reverse favorite-longshot bias?" *Applied Economics* **34**, 1309-1317.

Paul, R. J., and A. P. Weinbach (2005) "Bettor misperceptions in the NBA: The overbetting of large favorites and the "hot hand"" *Journal of Sports Economics* **6(4)**, 390-400.

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

Paul, R. J., A. P. Weinbach, and M. Wilson (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.

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

Woodland, L. M. and B. M. Woodland (forthcoming) "The reverse favorite-longshot bias in the National Hockey League: Do bettors still score on longshots?" *Journal of Sports Economics.*

Woodland, L. M. and B. M. Woodland (2003). "The reverse favourite-longshot bias and market efficiency: An update." *The Bulletin of Economic Research* **55**, 113-123.

Woodland, L. M. and B. M. Woodland (2001). "Market efficiency and profitable wagering in the national hockey league: Can bettors score on longshots?" *Southern Economic Journal* **67**, 983-995.

Woodland, L. M. and B. M. Woodland (1994). "Market efficiency and the favorite-longshot bias:the baseball betting market" *Journal of Finance* **49**, 269-279.