Market efficiency in the NFL preseason totals betting market

Kyle A. Kelly
West Chester University

Yanan Chen
Villanova University

ABSTRACT

This paper checks for the efficiency of the NFL preseason totals betting market. Using data from the 1996-2019 seasons, the results shows that the preseason NFL totals betting market is efficient, with the under covering only 50.8% of the games. Subperiods of the data using five-year moving windows show that in six of the nineteen subperiods can fair bet be rejected, with three of the nineteen periods rejecting no profitability at conventional levels. The authors also check to see if the contrarian strategy of betting under games with the highest posted total is profitable. A fair bet can be rejected for betting under all games at the 75th and 85th percentiles, but not on games under the 95th percentile. In none of these subsets can the test of no profitability be rejected.

Keywords: Sports Betting Markets, Market Efficiency, NFL Totals

SECTION I: INTRODUCTION

Testing the efficiency of sports betting markets has been a popular line of research among economists. Although many papers have been written on the topic, the results are mixed. Studies by Tryfos et al. (1984), Sauer et al. (1988), Gray and Gray (1997), Boulier et al. (2006), and Sapra (2008) analyze the NFL pointspread betting market. They each conclude that, in general, the market is efficient and profitable wagering opportunities are limited. Kochman and Goodwin (2006) reach similar conclusions when analyzing the NFL totals betting market. Other studies find inefficiencies where profitable wagering opportunities exist. Wever and Aaland (2012) find inefficiencies among large underdogs in the NFL. Fodor et al. (2014) find inefficiencies in Week 1 NFL games. They find a profitable strategy of wagering on non-playoff teams facing playoff teams in the prior year. Davis et al. (2015) find that in week 2 of the NFL season, 0-1 underdogs are good bets when facing another 0-1 team. Borghesi (2008) concludes that weather effects cause inefficiencies in the NFL totals market. Paul and Weinbach (2002) find that while the overall NFL totals betting market is efficient, totals in the upper tail of the distribution are set too high. They argue that gamblers prefer betting over in games predicted to be high scoring, which results in sportsbooks setting the totals above the efficient point. A contrarian strategy of betting under is found to be profitable.

The authors test for the efficiency of NFL preseason totals betting market and check to see if bettor biases exist. Preseason NFL games present a unique challenge to sportsbooks. The outcomes of the games do not affect the regular season standings so the motivation of the teams is difficult to assess. In addition, each teams' regular starters and best players see limited playing time that varies from week to week. Finally, coaches may be reluctant to reveal too much information about the types of plays they may run during the regular season, leading to more basic offensive plays called. All these factors must be considered by both the sportsbook that sets the totals line and gamblers who must decide on which side is a good bet.

Using data from the 1996-2019 seasons, the results shows that the preseason NFL totals betting market is efficient over the entire sample period, with the under winning 50.8% of the games. Subperiods of the data using five-year moving windows show that in six of the nineteen subperiods can fair bet be rejected, with three of the nineteen periods rejecting no profitability at conventional levels. The authors also check to see if the contrarian strategy of betting under games with the highest posted total is profitable. A fair bet can be rejected for betting under all games at the 75th and 85th percentiles, but not on games under the 95th percentile. In none of these subsets can the test of no profitability be rejected.

SECTION II. UNDER BETTING STRATEGIES

Bookmakers set a "total" line that is judged to be a forecast for the total points scored for a game. For example, the total set by bookmakers for the 2019 Hall of Fame game (the first preseason game of the year) was 34 points. Traditionally, sportsbooks use the "11 for 10" rule which requires gamblers to risk $11 for every $10 won. Gamblers can bet "over" or "under" the posted total, depending on how many points they believe will be scored. The final score was 14-10 for a total score of 24 points, making all under wagers winners. Each $11 ticket wagered on the under was now worth $21, while all over wagers were worth $0. Given this structure, the break-even rate for over-under wagers is 11 out of 21 successful wagers for a 52.4% winning percentage.

The authors analyze all preseason games from 1996-2019 where a total was posted. The data was collected from www.covers.com which consists of the consensus closing line of Las Vegas sportsbooks. A common way to test for market efficiency is to estimate the following equation using OLS:

$$Total\ Score = \beta_0 + \beta_1 Vegas\ Total + \varepsilon,$$

where *Vegas Total* is the consensus closing total posted by Las Vegas sportsbooks, *Total Score* is the final combined score in game, and ε is a white noise error term. The test for market efficiency is the joint hypothesis: $\beta_0 = 0$, $\beta_1 = 1$.

Even and Noble (1992) show this test is invalid when forecast errors are skewed. Furthermore, estimates of the regression are of limited value to a gambler. A gambler is only interested if a game goes over or under the posted total and is not concerned with the magnitude of the difference between the total score and the posted total. Also, this test does not allow for the assessment of whether various betting strategies lead to profitable outcomes. The authors instead use the exact binomial test proposed by Woodland and Woodland (2005). The test for market efficiency is then a test for a fair bet with the null hypothesis being that the proportion (p) of bets won equals 0.5: p = 0.5. Since gamblers must risk \$11 to win \$10, a test for no profitability becomes p = 11/21.

The authors start by checking the overall efficiency and profitability of betting under all games. The results are presented in Table 1. The under covered only slightly higher than half of all games at 50.8%. The P-values for a fair bet and no profitability are both larger than conventional significant levels, leading us to conclude that the overall market is efficient as indicated in table 1 (appendix).

The authors next check to see if any inefficiencies exist in subsets of the data. Figure 1 plots the under winning percentage for each season. There is a considerable amount of variability in winning percentage around 50% from year to year. This makes assessing whether inefficiencies exist in any given year difficult, since at most only 66 games are played in the preseason. Given this shortcoming, the authors analyze the data using five-year moving windows. This increases the sample size and allows for a better assessment of whether inefficiencies exist across time. The results are presented in Table 2. In six of the nineteen time periods can a fair bet be rejected at conventional levels, while in three of the nineteen time can no profitability be rejected as indicated in figure 1 and table 2 (appendix).

It is interesting to note that in recent seasons, starting with the 2011-2015 seasons window, the under winning percentage was higher than 50% and stayed higher through the last window of 2015-2019. Furthermore, in each of the last three windows starting with 2013-2017, can the null hypothesis of a fair bet and of no profitability be rejected. Can gamblers cash in on the under moving forward? Perhaps. Figure 1 shows that betting the under was profitable during the 2014 through 2017 seasons, with the under covering at a rate of 62.5%, 57.1%, 57.1%, and 64.1%, respectively. This trend reversed in the 2018 with the under covering only 49.2% of the time, but increased to 56.3% in 2019.

Paul and Weinbach (2002) argue that gamblers have a bias in favor of betting the over on games predicted to be high scoring and that contrarian strategies of betting the under in these games led to profitable opportunities. Using data from the NFL regular season, they found that under bets on posted totals that are 7 points, 6 points, and 5 points above mean posted total led to statistically significant winning percentages of 58.7%, 57.0%, and 55.1%, respectively. It is

plausible that such biases may exist in the NFL preseason as well. Since the outcome of the game has no bearing on the regular season, gamblers may simply bet the over for entertainment purposes. The authors test to see if a bias exists on games with a posted total in the upper tail of the distribution by analyzing games in the 95th, 85th, and 75th percentile. Table 3 shows the summary statistics of total points scored (Total Score) along with the posted totals line (Vegas Total). The 95th, 85th, and 75th percentiles were 43 points, 41 points, and 39 points. The results are reported in Table 4. The winning percentage on the under was greater than 50% for all three subsamples. For the 75th and 85th percentiles the hypothesis of a fair bet can be rejected at the 5% level. However, in none of the subsamples can the hypothesis of no profitability be rejected as indicated in table 3 table 4 (appendix).

SECTION III: CONCLUSION

This paper checks for inefficiencies in the NFL preseason totals betting markets. The authors find that the overall market from 1996-2019 season was efficient with the under covering 50.8% of the games. When analyzing variations in the under winning percentage across time using five-year moving windows, in six of the nineteen subperiods can a fair bet be rejected, while in three of the nineteen subperiods can the null hypothesis of no profitability be rejected.

The authors also check to see if betting the under on games with the highest posted total was profitable. Using the 75th, 85th, and 95th percentiles as subsets, under bets covered more than 50% of the games for each subset. A fair bet can be rejected for the 75th and 85th percentiles, however, in none of the subsets could the null of no profitability be rejected

These findings suggest that the preseason NFL betting market is, in general, efficient. However, in certain subperiods and certain subsets of the data inefficiencies may exist.

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APPENDIX

Table 1: Over-Under Record All Games

Over-Under-Push	Under %	P-value, H_0: p = 0.5	P-value, H_0: p = 11/21
778-752-21	50.8	0.657	0.908

Notes: Results of a strategy of betting under all NFL preseason games from 1996-2019. The p-value of a fair bet and no profitability are shown in the last two columns.

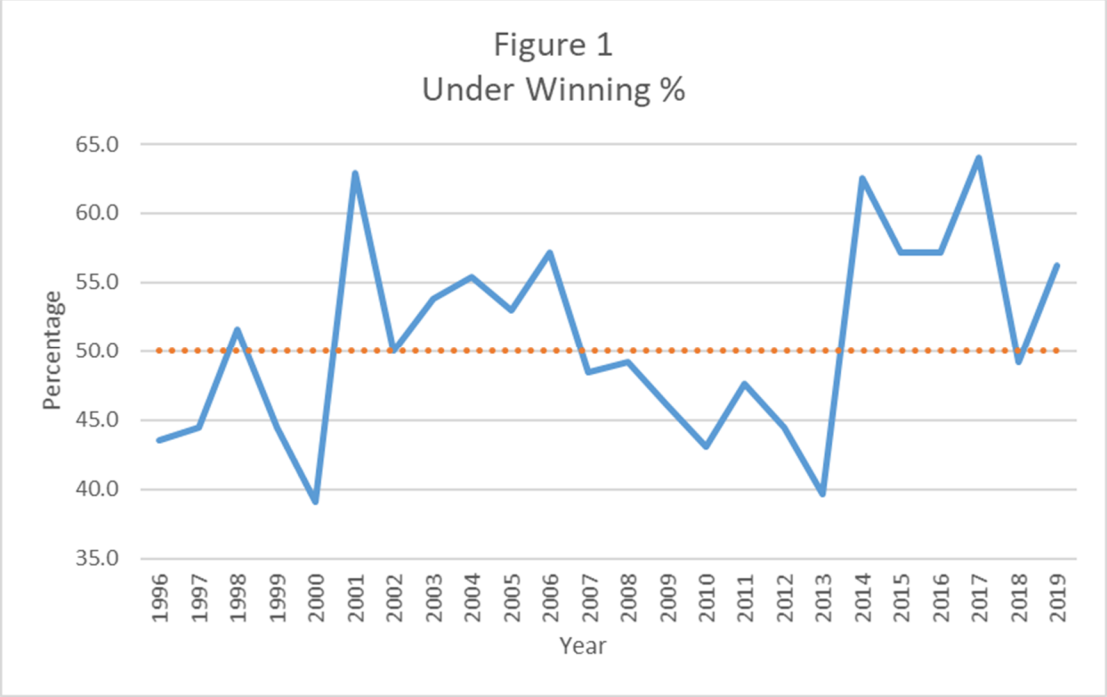

Table 2: Over-Under Record by Season

Seasons	Over-Under-Push	Under %	P-value, H_0: p = 0.5	P-value, H_0: p = 11/21
1996-2000	174-140-5	44.6	0.969	0.997
1997-2001	162-152-5	48.4	0.694	0.912
1998-2002	160-157-4	49.5	0.545	0.832
1999-2003	160-160-2	50.0	0.478	0.787
2000-2004	154-168-2	52.2	0.202	0.508
2001-2005	146-178-1	54.9	0.033**	0.164
2002-2006	150-175-2	53.8	0.075*	0.280
2003-2007	150-173-3	53.6	0.091*	0.316
2004-2008	152-169-5	52.6	0.158	0.440
2005-2009	158-163-5	50.8	0.369	0.698
2006-2010	164-156-5	48.8	0.652	0.893
2007-2011	170-150-4	46.9	0.856	0.972
2008-2012	172-147-5	46.1	0.911	0.986
2009-2013	178-141-5	44.2	0.978	0.998
2010-2014	167-151-6	47.5	0.800	0.955
2011-2015	157-159-8	50.3	0.433	0.751
2012-2016	151-165-8	52.2	0.199	0.501
2013-2017	139-178-6	56.2	0.012**	0.081*
2014-2018	134-185-4	58.0	0.002***	0.019***
2015-2019	138-181-1	56.7	0.009***	0.066*

Notes: Results of a strategy of betting under all NFL preseason games from 1996-2019, using five-year windows. The p-value of a fair bet and no profitability are shown in the last two columns.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 3: Summary Statistics

Week	Total Score	Vegas Total
Mean	38	37.4
Median	37	37
Standard Deviation	12.8	3
95th percentile	61	43
85th percentile	51	41
75th percentile	47	39

Notes: Summary statistics of total points scored and posted total for all games with a posted total from 1996-2019.

Table 4: Over-Under Record on Highest Totals

Vegas Totals	Over-Under-Push	Under %	P-value, H_0: p = 0.5	P-value, H_0: p = 11/21
43 or Higher (95th)	37-46-3	55.4	0.136	0.253
41 or Higher (85th)	105-131-5	55.5	0.039**	0.152
39 or Higher (75th)	197-242-5	55.1	0.014**	0.115

Notes: Results of a strategy of betting under posted totals for 43 points or higher, 41 points or higher, and 39 points or higher for NFL preseason games from 1996-2019. The p-value of a fair bet and no profitability are shown in the last two columns.
** Significant at the 5% level.