

# ***The Prediction Market for the Australian Football League***

by

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**Abstract:** The purpose of this paper is to make a novel contribution to the literature on the prediction market for the Australian Football League, the major sports league in which Australian Rules Football is played. Taking advantage of a novel micro-level data set which includes detailed per-game player statistics, predictions are presented and tested out-of-sample for the simplest kind of bet: fixed odds win betting. It is shown that player-level statistics may be used to yield very modest profits net of transaction costs over a number of seasons, provided some more global variables are added to the model. A comparison of different specifications of the linear probability model (LPM) versus conditional logit (CLOGIT) regressions reveals that the LPM usually outperforms CLOGIT in terms of profitability. It is further shown that adding significant variables to a regression specification which is clearly superior in econometric terms may reduce the efficacy of the prediction and thus profits.

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## 1. Introduction

The legal Australian Rules football prediction market is less than two decades old even though punters have doubtless been betting amongst themselves on their preferred teams for more than a century. And as the legal market is young, so is the academic literature analyzing the market small. The purpose of this paper is to make a contribution to this literature both by subjecting new empirical models to scrutiny and at the level of methodology.

Taking advantage of a novel micro-level data set which includes detailed per-game player statistics, predictions are presented and tested out-of-sample for the simplest kind of bet: fixed odds win betting. It is shown that player-level statistics may be used to yield very modest profits net of transaction costs over a number of seasons, provided some more global variables are added to the model. In particular, the numbers of kicks, marks, handballs and so on obtained by players in a game does not provide sufficient information to provide profits in a simple framework, but adding a variable indicating that a team has an *a priori* home ground advantage in the game is sufficient to generate profits. A comparison of different specifications of the linear probability model (LPM) versus conditional logit (CLOGIT) regressions reveals that the LPM generally outperforms CLOGIT in terms of profitability.

The methodological question posed here is somewhat obvious: Is it necessarily the case that a better regression, in terms of such criteria as adjusted R<sup>2</sup> or log likelihood and statistical significance of explanatory variables, will always lead to increased profitability when the predictions are used to bet in the market? The results presented in this paper refute this somewhat appealing hypothesis. It is shown that adding a variable that measures a team's performance prior to the current game in the relevant season, while unambiguously improving the regression – be it LPM or CLOGIT – reduces profits (or increases losses) in 9 out of 14 annual cases and turns overall profits into losses.

That this point is not entirely obviously may be understood from a careful reading of the pioneering paper on the AFL prediction market, Bailey and Clarke (2004). Thus, in discussing criteria for the inclusion of variables in their model, they write:

“Variables included in the multiple regression were home ground advantage, interstate travel, ground familiarisation, team quality and current form, with all variables being statistically significant with a p-value <0.0001. We have found that using such a stringent significance level creates more robust predictors.”

What makes this paper so interesting is that it presents a very thorough analysis of the complexities involved in making predictions sufficiently accurate to permit profitable betting in the AFL prediction market. Discussed are the various explanatory variables and optimizing their measurement. For example, the decomposition of home ground advantage into home player familiarity with the ground, visiting team fatigue in travelling interstate and other factors evidently adds to profits. There is also testing of the optimal way to predict explanatory variables such as past performance: Does one use moving averages of exponential smoothing or some other technique? The problem from an academic viewpoint is that the paper suppresses actual coefficient values and other details for commercial reasons.

The subsequent literature is far more specialist in nature and a very brief description of three papers will suffice.<sup>1</sup> Grant and Johnstone (2010) predict game outcomes and simulate betting by pooling forecasts of winning probabilities derived from a web-based football “tipping” competition, which has been conducted by the computer science faculty at Monash University in Melbourne, Australia, since 1995. They present exhaustive tests of different pooling and betting methods and show that statistically significant, although not large, profits may occasionally be made using this approach, although in the long term average losses prevail.

Ryall and Bedford (2010), on the hand, claim that long run profits are available in this market if a ratings based forecasting model is adopted. The model used is that of Elo (1978), originally designed for ranking chess players, and over the 2001-2008 AFL seasons they generate a return of investment of 8.8% betting a constant amount on each game and 10% using a Kelly system. These returns are greater than those presented here, but the method adopted is highly computer intensive and may be impractical if rankings are to be updated after each round.<sup>2</sup> If this model is indeed successful it would presumably yield even better results if rankings were regularly updated.

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<sup>1</sup> See Weinberg (2008) for a discussion of other papers.

<sup>2</sup> The results cited are based on seasonal updates only.

Finally, Sargent and Bedford (2010) show how exponentially-smoothed, one-step forecasts of Australian Football League (AFL) player performance data are improved by first applying a nonlinear smoother to the raw data. In this respect, their paper builds upon Bailey and Clarke (2004) in its analysis of exponential smoothing as yielding improved forecasts over simple and moving averages. Player performance is defined as an index based upon several player-level statistics of the kind used in the paper (kicks, handballs, etc.), but no use of the predictions in simulated (or real) betting in the AFL prediction market is presented.

The central feature of the analysis present here is its attempt at simplicity if not naivety. Thus, the regressions run are of the simplest kind and the variables used are extremely basic: no attempt is made to index player performance, the emphasis being on the raw data. Further, home ground advantage is represented by a dummy variable, thus precluding any degrees of advantage. Finally, in order to predict player performance reliance is upon simple means alone. The reason for this approach is two-fold: First, it is interesting to ask whether profits are obtainable, however modest they may be, without resorting to complications – and the answer turns out to be positive. Second, testing the methodological hypothesis that the better the regression, the more profitable will be the predictions it yields, requires that as many confounding factors as possible be removed from the analysis.

## **2. Australian Rules Football<sup>3</sup>**

Australian Rules football, also known as Australian football, "Aussie rules", or simply football or "footy", is a code of football played with an prolate spheroid ball, on large oval-shaped fields, with four posts at each end: two tall posts in the center – "goal posts" – and two shorter, outer ones – "behind posts" or "point posts". The playing field may be 135-185 meters long and 110-155 meters wide.

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<sup>3</sup> Some of this section is drawn from Weinberg (2008). For further details on the game and its rules, see there.

Footy, as it is generally known today, originated in Melbourne in 1858 and was devised to keep cricketers fit during the winter months. The football season is from March to August (early autumn to late winter in Australia) with finals in September. Some claim that *Marngrook* – a traditional Aboriginal ball game played for millennia in what is now western Victoria – provided the first lawmakers of football with some of the fundamentals of Australian Rules football. However, opinion across the footy-loving Australian public is divided as to Marngrook's contribution to the modern game.<sup>4</sup>

A football game consists of four twenty-minute quarters plus time added for stoppages. Most quarters effectively last between 25 and 30 minutes. Each team has 18 players on the field at any given time and four substitutes are available for unrestricted, repeated substitutions as deemed fit by the coach. Since footy allows players to handle the ball as well as kick it and since there are no off-side rules, the game is in many ways similar to basketball in the speed and extent of scoring. For the 1998-2007 seasons, the average game score per team was 95 points, with a minimum of 23, a maximum of 222, and a standard deviation of 28. A comprehensive introduction to the game is provided by <http://www.footy.com.au/dags/FAQ1v1-5.html> and [http://en.wikipedia.org/wiki/Australian\\_rules\\_football](http://en.wikipedia.org/wiki/Australian_rules_football). The URL for the official web site of the AFL is <http://www.afl.com.au/>. For videos of game highlights see <http://www.youtube.com/watch?v=xIOvSv9Q1Gk>.

### 3. AFL Prediction Markets

The three major types of betting market in the AFL are fixed odds betting for the win, line betting and even-money line betting. While, for the purposes of this paper, win betting is the focus of attention, a brief description of the associated markets is provided in this section.<sup>5</sup>

A typical line wager in the AFL requires that the bettor risk \$1 for the chance to receive around \$1.9.<sup>6</sup> This \$1.9-for-\$1 dividend requires that bettors pick winners in 52.63% of bets to

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<sup>4</sup> For further details on this dispute, see <http://www.aboriginalfootball.com.au/marngrook.html>.

<sup>5</sup> The remainder of this section is drawn, with only minor modifications, from Weinberg (2008).

break even.<sup>7</sup> In the event the outcome is identical to the line, known as a "push" or a "no bet", the gambler's wager is refunded.

The even-money line (or *points*) wager is quite similar to the line wager, yet the dividend is always \$2. Therefore, in this case, the percentage of winning bets required to break even is 50. Different bookmakers offer different point spreads on the AFL. These spreads are between 6 and 10 points, i.e., spreads of 3 and 5 points on either side of the line. The result of a match falls in the 6 points spread around 6% of the games, hence, by offering a 6 points spread at even-money, the bookmaker retains around 6% of his turnover, which is around 0.5% higher in the 6 points spread than its equivalent in the line market,<sup>8</sup> and around 2% higher than in the fixed-odds market.

The even-money line bet is based on a bid/ask spread, which is the difference between the price available for an immediate sale (bid) and an immediate purchase (ask). For example, if the even-money line is 35 for team A to win and 28 for team B to lose, the bettor can either bet on team A to win by 35 or more or on team B to lose by 28 or less. No one can bet on the spread between 29 and 34 points, the range of possible bets in which the bookmakers win all bets. This is parallel to a bid of 28 and an ask of 35, where the broker makes his money.

The fixed-odds win wager in the AFL, which is the subject of simulation in this paper, requires the bettor to risk \$1 for the chance to receive a fixed sum if successful.<sup>9</sup> As in the above prediction markets, the bookmaker sets odds to earn around 5% of the total bet if his book is

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<sup>6</sup> In contrast to the U.S. market, the winning dividend per \$1 point-spread wager in the AFL is not fixed. The range of this dividend in the 2001-2007 period was \$1.78-\$2.05, while in 70% of the games it was \$1.9, the mean being \$1.9 as well.

<sup>7</sup> The percentage of winning bets (*WP*) necessary to break even, 52.63 percent, is obtained by setting the expected value of the random variable, a gamble  $WP * 0.9 + (1 - WP) * (-1)$ , equal to zero. See, for further discussion, Vergin & Scriabin (1978), Gandar *et al* (1988), and Dana & Knetter (1994).

<sup>8</sup> Response to a query by Hamish Davidson from Sportsbetting.com.au.

<sup>9</sup> The range of actual payouts in the 2001-2007 period is \$1.02-\$14 (Mean = \$2.39).

balanced.<sup>10</sup> Nevertheless, unlike the line and even-money line betting markets, there is no certain percentage of winning bets necessary to break even in the fixed-odds market, since the range of actual payouts is huge.<sup>11</sup> This market provides the central focus of this paper.<sup>12</sup>

Other betting methods are also available in the AFL: Draw, where the bettor bets on the chance that the final result will be a draw; Point-spread in 10 point gaps; 1-39 and 40+, where the bettor bets on the chance that the point-spread will be between 1 and 39 points or 40 and above; Highest scoring quarter; First goal scorer in each quarter; Most goals kicked; Most free kicks; and also various future odds bets, including different medals, Premiership, Final eight, Highest placed Victorians or non-Victorians, Team to reach Grand Final, First coach to depart and many others.<sup>13</sup>

#### 4. Data and Analysis

The raw data used in this paper are derived from publicly available sources, i.e., internet-based sports statistical information. The game data come from the official league website, <http://www.afl.com.au> and from <http://stats.rleague.com/>, while betting data are from <http://www.sportsbetting.com.au>.<sup>14</sup> The data consist of individual player statistics for all AFL games from the first round of the 1998 season through the Grand Final of 2007, team

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<sup>10</sup> The average bookmakers' commission in 2001-2006 was 4.5%. Bailey & Clarke (2004) noted that the commission could be as low as 2-3%.

<sup>11</sup> In the very rare event where the outcome is a draw, the fixed-odds bettor wins half the amount he would have won had his team won (see: <http://www.bookiering.com/>). There were only 15 drawn games during seasons 1998 through 2007 inclusive.

<sup>12</sup> It should be noted that a prediction market exists also for win betting at fixed odds during the course of each game, but a discussion of this market is beyond the scope of this paper. See, for example, <http://betting.betfair.com/education/sports/04-australian-rules/australian-rules-260908.html> for further details.

<sup>13</sup> A list of Australian and nearby registered interactive bookmakers and their respective websites can be found in <http://www.betting-ring.com/australia.html>.

<sup>14</sup> The author wishes to thank Paul Jeffs, who runs <http://stats.rleague.com/> and Hamish Davidson of Sportsbet Pty. Ltd for providing different subsets of these data in a readily useable form and Guy Weinberg, Nissim Pinto and Olga Singer for invaluable assistance in organizing the data.

performances, dates, grounds and the last available fixed odds for the win for each team. This amounts to 81400 player level observations over 1850 games.

The variables employed in the prediction models are defined as follows<sup>15</sup>:

**win<sub>jk</sub>** = 1 if team *j* won game *k* and 0 if it lost or (very rarely<sup>16</sup>) drew. This is the dependent variable in all regressions.

**kicks<sub>ijk</sub>** = the number of kicks obtained by player *i* of team *j* in game *k*.

**marks<sub>ijk</sub>** = the number of marks taken by player *i* of team *j* in game *k*.

**handballs<sub>ijk</sub>** = the number of handballs provided by player *i* of team *j* in game *k*.

**tackles<sub>ijk</sub>** = the numbers of tackles by player *i* of team *j* in game *k*.

**clangers<sub>ijk</sub>** = the number of clangers for which by player *i* of team *j* was responsible in game *k*.

**rebound50s<sub>ijk</sub>** = the number of times player *i* of team *j* retrieves the ball and sends it out of the opposing team's 50 meter attacking zone in game *k*.

**hitouts<sub>ijk</sub>** = the number of hitouts obtained by player *i* of team *j* in game *k*.

**clearances<sub>ijk</sub>** = the number of times player *i* of team *j* clears the ball out of defense in game *k*.

**freesfor<sub>ijk</sub>** = the number of free kicks received by player *i* of team *j* in game *k*.

**freesagainst<sub>ijk</sub>** = the number of free kicks given away by player *i* of team *j* in game *k*.

**dummy\_home<sub>jk</sub>** = 1 if team *j* has an *a priori* home ground advantage in game *k*, 0 otherwise.

**neutral<sub>jk</sub>** = 1 if team *j* is playing game *k* at a neutral ground, 0 otherwise.

**clinch\_1<sub>jk</sub>** = 1 if team *j* has already clinched a place in the finals before the start of game *k*, 0 otherwise.

**elim\_1<sub>jk</sub>** = 1 if team *j* has already been eliminated from the finals before the start of game *k*, 0 otherwise.

**winpct\_1<sub>jk</sub>** = the proportion of games that team *j* has won this season prior to game *k*.<sup>17</sup>

In addition to these data, we have the bookmakers' odds for a win bet on each of the teams playing. The process of econometric prediction and out-of-sample betting simulation is as follows:

1. Four parallel pairs of regression specifications are run, one quartet using the Linear Probability model (LPM) and the other using McFadden's (1973) conditional logit model (CLOGIT). The first pair of regressions contain player-level variables only and these are shown for the whole sample in Table 1, regressions LMP 1 and CLOGIT 5, respectively. For purposes of prediction, however, the regressions are run on the data subset containing all observations from the first round of 1998 through the 2000 Grand Final. These regressions are used to predict the winning probabilities of the teams in round 1 of 2001 by substituting the mean values of the player-level explanatory variables for the

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<sup>15</sup> Subscripts are used here to facilitate the definitions of the variable, but are dropped thereafter.

<sup>16</sup> There are 15 drawn games in the sample.

<sup>17</sup> Thus, this variable is never defined for the first round of a season.



1998-2000 period into the obtained regression results. The second pair of regressions add two dummy variables, the first indicating whether or not the home team has an *a priori* home ground advantage and the second indicating whether or not the stadium in which the current game is being played is a neutral ground, offering no *a priori* advantage to either side.<sup>18</sup> These are regressions LPM 2 and CLOGIT 6, shown for the whole data set in Table 1. Note that “neutral” does not appear in any CLOGIT regression because it must always, by definition, receive the same value for both teams in a game and the conditional logit regression conducts its estimation by distinguishing between the two teams in a game exclusively. Regressions LPM 3 and CLOGIT 7 add to the extant explanatory variables two team-level dummy variables which indicate whether or not the team has clinched a place in the finals or whether the team has definitely been eliminated from the finals race immediately prior to the game to be played, respectively. Finally, regressions LPM 4 and CLOGIT 8 add a further team-level variable which measures the proportion of wins accumulated by the team so far in the current season prior to the current game.

2. On the basis of these regressions, predicted winning probabilities for the teams in each game of round 1 of the 2001 season are calculated as follows. For each player in the team, each regression predicts a probability which may be interpreted as that player’s predicted contribution to the team’s winning probability. In the case of the conditional logit regressions, these probabilities sum to 1 for each game. Thus, summing them across players in any given team yields the predicted winning probability for that team. The linear probability model requires an extra step since probabilities do not generally sum to 1 for each game.<sup>19</sup> Accordingly, these predictions are normalized over each game and the resultant sums per team taken as the predicted winning probabilities for the relevant team.
3. Given the teams’ predicted winning probabilities and the bookmakers’ prices for a win bet on each team, the simulated betting is on those teams for which the predicted winning probability exceeds 0.5 (i.e. the predicted favorites in the game) and the

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<sup>18</sup> For a thorough analysis of the subtleties of home and neutral grounds in the AFL, see Schnytzer and Weinberg (2008).

<sup>19</sup> It is interesting to note, however, that the predicted probabilities per game always fall between 0 and 1.

amount bet is in proportion to the predicted winning probability. This betting system is adopted as it is the method adopted by many Australian professional punters.<sup>20</sup>

4. The results for round 1 of 2001 being now known, as it were, the data for this round are added to the data set and all the regressions rerun to predict the winning probabilities for each team in round 2 of 2001 and betting is again simulated. This process continues with new regressions being run round by round until the end of the 2007 and the total results of simulated betting calculated year by year. These results are shown in Tables 2 and 3.<sup>21</sup>

Prior to a discussion of the betting results, some discussion of Table 1 is in order. While these specific regression results are for the entire data set and thus do not feature in any of the simulations, they turn out to be representative of virtually all the other regressions run. Thus, in all regressions run subsequent to the third round of 2002, all player-level variables are statistically significant at well better than one percent. Prior to that period, the variable measuring the number of free kicks given away by a player in the game is generally statistically insignificant.

Adding variables above the player level consistently improves the regressions. Thus, the variable(s) measuring home ground advantage are always statistically significant at better than 0.1% and always more than double the adjusted (or pseudo)  $R^2$ . Adding information regarding whether or not a team has clinched a place in the finals or has been definitely eliminated improves the regressions yet further and the proportion of games won prior to the current game again improves the model.

If the success of predictions is a function of the “goodness” of the econometric model, then it might be expected that models LPM 4 and CLOGIT 8 would perform best, since in every evident statistical respect they appear to be better than their predecessors. This is true not only of the statistical significance of the added variable and adjusted or pseudo  $R^2$ s as shown in Table 1 but also from regression F-tests and log likelihoods (not shown). Since both sets of regression models are nested, a comparison of these statistics is valid. However, as a perusal of Tables 2 and 3 indicates, things are not so simple!

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<sup>20</sup> The author thanks Terry Pattinson (formally Australian sports betting bookmaker and currently Head of In-Play Development for William Hill PLC) for this insight.

<sup>21</sup> This method of betting simulation (but with different betting criteria) was used for one season of American football in Zuber, Gandar and Bowers (1985).

The first thing to become clear is that using player level data alone (at least in the simple way adopted here) in making predictions as a basis for betting yields losses in five of the seven simulated betting seasons be it using the linear probability model or the conditional logit model. Overall, the latter does slightly better with cumulative losses of 8.4% as against 10.4%. Adding details of the venue to the player level data improves returns considerably, converting losses into cumulative profits of 3.5% for the LPM and 2.2% for CLOGIT. Adding details about the teams' progress or otherwise towards a place in the finals adds a further 2% to the LPM model but has no impact upon CLOGIT.

From Tables 2 and 3 it is clear that the best returns from simulated betting over the entire period derive from either specifications 2 or 3 but definitely not from 4. Thus, it would seem to be that better regressions may not lead to better prediction, *per se*, although there is a strong reason why this should not be surprising. The generally low percentage of variance in winning probabilities explained by these regressions makes it clear that there is missing variable bias. Further, since the regressions are used for predictions, it is obvious that many relevant variables ( e.g. the mental states of the players at game time, their precise physical states, to name just two groups of variables) will never be known. Accordingly, the coefficients in the regressions are inevitably biased as are those in the (real or imputed) regressions of the bookmakers. Now, given the latter, bookmakers' odds are also likely to be biased<sup>22</sup> in many ways which may only be discovered if a serendipitously "better" prediction model is run. The bettor will thus come up with an edge that seems to defy the formal rule of econometrics. Thus, suppose that in a number of games, the addition of **winpct\_1** to, but absence of say **clinch\_1** from, bookmakers' models<sup>23</sup> raises their price *wrongly* above 0.5. Given the large numbers of missing variables in these regressions and the unknown interactions between them, this is certainly not far-fetched. And suppose that a bettor who omits **winpct\_1**, but includes **clinch\_1**, arrives *correctly*, owing to the imponderable total impact of missing variables bias, at a winning probability of less than 0.5. If there are sufficient cases such as this one, the results shown in specifications 3 and 7, respectively, in Tables 2 and 3, where returns are generally better than in specifications 4 and 8, which add **winpct\_1**, will make perfect sense.

Finally, it may be noted that the results as shown are certainly quite modest, with a best 7-year cumulative return of only 5.6% for LPM 3 in Table 2. But here, the results would have

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<sup>22</sup> See Schnytzer and Weinberg (2008) for evidence of bias in favor of home teams, playing against interstate visiting teams, in states outside of Victoria, but no favorite-longshot bias.

<sup>23</sup> Again, real or implicit.

looked far better had they been framed differently. Instead of training with data from 1998 through 2000 and better from 2001 onwards, suppose that training used data from 1998 through 2003 and began in round 1 of 2004. Then, the cumulative return by the end of 2007 would be a not entirely unrespectable 12.8%. Of course, this sleight-of-hand is made possible by the fact that in many models (but noticeably not specifications 4 of both Tables 2 and 3), results improve as time goes by. Whether this is because the predictions improve as more observations are added to the regressions, and/or for some other reason(s), is unclear.

## 5. Conclusions

Taking advantage of a novel micro-level data set which includes detailed per-game player statistics, predictions have been presented and tested out-of-sample for the simplest kind of bet: fixed odds win betting over the AFL seasons from 2001 through 2007. Data from the beginning of 1998 through the end of 2000 have been used as the source for the initial predictions, while the data have then been updated round-by-round. It has been shown that player-level statistics may be used to yield very modest profits net of transaction costs over this period, provided some more global variables, such as whether or not one team has an *a priori* home ground advantage and what progress the team has made towards a place in the finals, are added to the model. A comparison of different specifications of the linear probability model (LPM) versus conditional logit (CLOGIT) regressions reveals that the LPM usually outperforms CLOGIT in terms of profitability. It is further shown that adding significant variables to a regression specification which is clearly superior in econometric terms may reduce the profits derived from the forthcoming predictions.

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**Table 1 Regression Results for the Entire Sample (1998-2007)**

	LPM 1	LPM 2	LPM 3	LPM 4	CLOGIT 5	CLOGIT 6	CLOGIT 7	CLOGIT 8
Variables	coefficient (t-stat)	coefficient (t-stat)	coefficient (t-stat)	coefficient (t-stat)	coefficient (z-stat)	coefficient (z-stat)	coefficient (z-stat)	coefficient (z-stat)
kicks	.0118 (20.45)	.0112 (19.72)	.0108 (18.67)	.0105 (18.04)	0.0495 (20.52)	.0483 (19.75)	.0467 (18.43)	.0462 (17.47)
marks	.0070 (7.86)	.0072 (8.34)	.0071 (8.05)	.0071 (7.97)	0.0317 (8.48)	.0335 (8.82)	.0338 (8.61)	.0369 (8.99)
handballs	.0048 (7.98)	.0041 (6.85)	.0040 (6.65)	.0037 (6.00)	0.0238 (9.23)	.0209 (8.02)	.0201 (7.41)	.0190 (6.70)
tackles	.0043 (4.03)	.0044 (4.16)	.0041 (4.78)	.0043 (3.94)	0.0154 (3.35)	.0157 (3.38)	.0159 (3.28)	0.0170 (3.38)
clangers	-.0276 (-19.92)	-.0278 (-20.45)	-.0270 (-19.42)	-.0261 (-18.53)	-0.1167 (-19.35)	-.1212 (-19.80)	-.1168 (-18.39)	-.1151 (-17.31)
rebound50s	-.0141 (-13.66)	-0.0128 (-12.61)	-.0121 (-11.64)	-0.116 (-11.11)	-.0663 (-14.95)	-.0622 (-13.83)	-.0590 (-12.65)	-.0580 (-11.91)
hitouts	.0027 (6.68)	.0025 (6.11)	.0024 (5.86)	.0023 (5.64)	.01099 (6.60)	.0102 (6.04)	.0098 (5.57)	.0096 (5.24)
clearances	-.0086 (-7.08)	-.0078 (-6.54)	-.0075 (-6.16)	-.0074 (-6.02)	-.04134 (-8.22)	-.0389 (-7.61)	-.0380 (-7.17)	-.0388 (-7.01)
freesfor	-.0123 (-6.33)	-.0140 (-7.36)	-.0144 (-7.38)	-.0142 (-7.19)	-.0502 (-6.27)	-.0589 (-7.25)	-.0593 (-7.04)	-.0590 (-6.69)
freesagainst	.0121 (5.79)	.0150 (7.31)	.0145 (6.93)	.0139 (6.56)	.0506 (5.79)	.0651 (7.33)	.0638 (6.93)	.0629 (6.52)
dummy_home		.2081 (49.43)	.2049 (47.68)	.2102 (48.48)		.8467 (47.72)	.8586 (46.61)	.9272 (48.02)
neutral		.1052 (25.12)	.1098 (25.68)	.1147 (26.53)				
clinch_1			.1665 (19.19)	.1006 (11.47)			1.2217 (17.28)	.7590 (10.57)
elim_1			-.1700 (-23.04)	-.0960 (-12.69)			-1.7097 (-27.01)	-.9258 (-14.10)
winpct_1				.3006 (39.41)				2.5817 (51.38)
Adj or pseudo R <sup>2</sup>	0.0180	0.0477	0.0581	0.0821	0.0147	0.0371	0.0530	0.0852
No. of observations	81400	81400	77440	73918	80740	80740	76780	7326

Note: All coefficients are significantly different from zero at better than 0.1%. Number of observations differs because winpct\_1 is undefined for round 1 of each season and because CLOGIT drops the 15 drawn games from the regression. In no LPM regressions were estimated variances negative, all predicted winning probabilities lying in [0,1]. Thus, some observations are lost where estimated variances are zero.

**Table 2 Betting Simulation Results for the Linear Probability Model**

Linear Probability Model												
Year	<i>Specification 1</i>			<i>Specification 2</i>			<i>Specification 3</i>			<i>Specification 4</i>		
	Amount Bet	Profit	Cumulative Rate of Return	Amount Bet	Profit	Cumulative Rate of Return	Amount Bet	Profit	Cumulative Rate of Return	Amount Bet	Profit	Cumulative Rate of Return
<b>2001</b>	596.96	-36.02	-0.0603	833.34	-60.27	-0.0723	777.58	-43.52	-0.0560	602.37	-11.42	-0.0190
<b>2002</b>	664.05	-257.22	-0.2325	855.07	-143.41	-0.1206	800.24	-61.26	-0.0664	792.97	-53.78	-0.0467
<b>2003</b>	630.81	-189.94	-0.2554	875.29	-42.97	-0.0962	819.84	-10.98	-0.0483	632.32	-25.17	-0.0446
<b>2004</b>	630.41	-66.74	-0.2180	962.47	201.12	-0.0129	859.96	141.82	0.0080	693.72	160.35	0.0257
<b>2005</b>	729.81	-78.50	-0.1932	925.10	109.30	0.0143	815.96	157.16	0.0450	630.39	4.42	0.0222
<b>2006</b>	697.32	15.67	-0.1552	874.42	42.27	0.0199	771.27	56.94	0.0496	651.98	-58.35	0.0040
<b>2007</b>	695.86	128.60	-0.1042	1048.70	115.63	0.0348	998.55	86.47	0.0559	790.70	-46.59	-0.0064

Note: All results are out-of-sample. The data set begins in round 1 of 1998 and is updated and the models rerun for each round after round 1 of 2001. The explanatory variables in the four specifications are as follows:

1. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst.
2. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst dummy\_home neutral.
3. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst dummy\_home neutral clinch\_1 elim\_1.
4. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst dummy\_home neutral clinch\_1 elim\_1 winpct\_1.

**Table 3 Betting Simulation Results for the Conditional Logit Model**

Conditional Logit Model												
Year	<i>Specification 1</i>			<i>Specification 2</i>			<i>Specification 3</i>			<i>Specification 4</i>		
	Amount Bet	Profit	Cumulative Rate of Return	Amount Bet	Profit	Cumulative Rate of Return	Amount Bet	Profit	Cumulative Rate of Return	Amount Bet	Profit	Cumulative Rate of Return
<b>2001</b>	600.33	-19.34	-0.0322	1140.25	-113.58	-0.0996	1196.29	-110.77	-0.0926	1452.08	-132.37	-0.0912
<b>2002</b>	691.04	-236.53	-0.1981	1227.98	-133.46	-0.1043	1258.29	-29.10	-0.0570	1553.14	-30.41	-0.0542
<b>2003</b>	635.70	-154.73	-0.2131	1218.07	-33.07	-0.0781	1255.14	3.95	-0.0366	1455.73	-100.87	-0.0591
<b>2004</b>	623.62	-56.17	-0.1830	1356.41	285.58	0.0011	1398.86	200.18	0.0126	1645.70	173.83	-0.0147
<b>2005</b>	811.18	-21.51	-0.1452	1348.01	109.39	0.0183	1349.55	133.48	0.0306	1616.62	-34.45	-0.0161
<b>2006</b>	702.27	0.84	-0.1199	1270.09	-54.40	0.0080	1403.86	-34.61	0.0207	1646.53	-176.82	-0.0321
<b>2007</b>	743.36	85.11	-0.0837	1382.04	135.57	0.0219	1385.57	38.61	0.0218	1841.62	-50.39	-0.0314

Note: All results are out-of-sample. The data set begins in round 1 of 1998 and is updated and the models rerun for each round after round 1 of 2001. The explanatory variables in the four specifications are as follows:

1. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst.
2. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst dummy\_home.
3. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst dummy\_home clinch\_1 elim\_1.
4. kicks marks handballs tackles clangers rebound50s hitouts clearances freesfor freesagainst dummy\_home clinch\_1 elim\_1 winpct\_1.



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