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Optimal Bonus Points in the Australian Football League[#]

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Abstract

Bonus point systems are a popular tournament design feature in some sports. We consider a bonus point system for the Australian Football League (AFL). In this paper, we utilise league points as a measure of team strength in a prediction model and choose the allocation of points to maximise prediction accuracy. For AFL data extending over seasons 1997-2008, we determine a bonus points system that does a better job at revealing strong teams than the current allocation of league points. We conclude that there is considerable scope for the introduction bonus points to improve tournament design in the AFL.

JEL Classification Number: C61, L83

Keywords: Sport, Predictions, Estimation, Tournament Design

1. Introduction

League points are awarded in sporting contests to rank teams. In the Australian Football League (AFL), the eight highest-ranked teams (out of sixteen) at the end of each regular season contest the finals series (playoffs). The format of the finals series favours higher-ranked teams at the expense of lower-ranked sides. The four highest-ranked teams have a 'life' in the first week of the finals series whereas the four lower-ranked sides do not. Additionally, home advantage (excluding the Grand Final) is awarded to the team that finished higher on the league table at the conclusion of the regular season. It is therefore desirable that criteria used to allocate league points accurately separates stronger teams from weaker teams. The possibility of one or both teams gaining a bonus point may also maintain spectator interest well after the likely winner of a match has emerged.

The current allocation of AFL league points awards a winning team four points, zero points to a losing team and two points to each team in the unusual event that a match is drawn (tied). Teams with equal league points are separated by comparing season for and against scoring percentages (points scored divided by points conceded). Such an allocation is not unusual in sporting contests. Football (soccer) tournaments are a notable exception, where in recent history teams participating in a drawn match are awarded less than half the number of points awarded for a win. A number of competitions include bonus points. For example, bonus points are awarded for scoring four or more tries and/or losing by seven points or less in most rugby union tournaments, including the Rugby World Cup. Bonus points are also used in the Cricket World Cup and the National Hockey League. Although several studies have examined the impact of tournament type (round robin, knockout, etc.) on the probability of the strongest team winning – see, for example, Clarke *et al.* (2008) and Scarf *et al.* (2008) – the optimal allocation of league points has hitherto received scant attention. Szymanski (2003) provides a comprehensive review of tournament design issues.

Following Winchester (2008), we determine whether including bonuses is better at revealing strong teams in the AFL than the current system (which does not award bonus points). We consider two bonus specifications. In one, similar to bonuses awarded in rugby union, bonuses are awarded for scoring more than a certain number of goals; and/or losing by less than a certain number of points. In the other, a fixed number of league points are awarded per game and bonuses are awarded for winning by a large or losing narrowly. Our approach uses league points to construct strength measures and chooses league points to maximise prediction accuracy. The method determines both optimal values for bonuses (relative to the number of points awarded for a win) and optimal partitions for each bonus (e.g., the minimum losing margin required to earn a narrow-loss bonus). Intuitively, maximising prediction accuracy determines the optimal allocation of league points as predictions using strength indices built on an allocation that is good at revealing strong teams will be more accurate than predictions based on an allocation that is not.

Strength is measured by weighting the average number of league points earned by a team in the previous and current seasons. The optimal allocation of league points is determined by estimating the model for a range of alternative bonus partitions and choosing values for each event attracting league points (e.g., winning, losing by a narrow margin, etc.) so as to maximise prediction accuracy. In addition to strength measures, our prediction model includes several variables designed to capture a number of home advantage and travel fatigue factors.

This paper has four further sections. Section 2 outlines the unique features of both Australian Rules Football and the AFL that suit our modelling approach. Section 3 sets out our modelling framework and details our data. Section 4 presents results from our modelling analysis and discusses rankings when optimal bonus points are included. Section 5 concludes.

2. The Australian Football League

Australian Rules football is an indigenous sport that originated in 1858, when the first game was played in Melbourne and the first club (Melbourne FC) was formed. Although it is a national competition, the AFL (until 1989 known as the Victorian Football League) is still highly recognisable from its inception in 1897 as a suburban competition. All eight founding teams still participate, although one has relocated and another merged. The popularity of the AFL in Australian society is well-established, with the 2007 average attendance of 38,113 the second-highest of any professional sports league worldwide, behind only the National Football League (American Football) in the US. The game is played with 18 outfield players and 4 interchange players per side on an oval-shaped playing surface of 135-185 metres long by 110-155 metres wide. There are four posts at each end. A goal (six points) is scored by kicking the ball between the two centre (goal) posts and a behind (one point) is registered by kicking the ball between one of the goal posts and the adjacent outer post. The winning team is almost always the team with the greater number of goals (or at least as many). Games are played over four quarters, each consisting of 20 minutes plus time added (typically another 7-10 minutes). See Booth (2004) for a succinct history of the AFL.

There are currently 16 teams in the AFL. Brisbane and Sydney each have one team, Adelaide and Perth two each, and ten teams are based in (or just outside) Melbourne. Current AFL teams and their domiciles are listed in Table 1. A total of 176 regular season games are played prior to the finals series playoffs each season (22 for each team). The current AFL schedule is unbalanced, with each team playing seven other teams twice and eight other teams once throughout the course of the season (see Weiss, 1986; and Lenten, 2008, for concerns regarding unbalanced schedules).

Using the AFL to examine the impact of bonuses on revealing strong teams has two advantages relative to other competitions. First, the introduction of bonus points is unlikely to change player behaviour, since AFL players always aim to score a goal and a behind is consolation for a near miss. In contrast, in sports such as rugby, players must choose between alternative scoring modes and the allocation of league points may influence participants' choices. Second, unlike the Super Rugby competition analysed by Winchester (2008), bonuses are not currently awarded in the AFL. This characteristic ensures that the match data being used to estimate an optimal 'theoretical' bonus point system is uncontaminated by incentives induced by existing bonus points.

A key feature of the AFL is that some teams play home matches at more than one ground, rather than the traditional model of each team having its own home stadium. This recent phenomenon is not so salient for non-Victorian teams, with only two grounds being used in both Perth (Subiaco and WACA) and Sydney (SCG and Olympic Stadium) in recent years, and only one each in Adelaide (Football Park) and Brisbane (Wollongabba). However, when incentives to retain suburban grounds (such as Princes Park, Victoria Park and Western Oval) in Melbourne declined, the Melbourne teams aggregated to a smaller number of larger grounds – a phenomenon that accelerated when gate-revenue sharing was abolished in 2000. Also, Waverley Park was abandoned in favour of the then newly-constructed Docklands in the same year. Following the final game at Princes Park in 2005, only two grounds are now used for all matches played in Melbourne (MCG and Docklands). Even Geelong (about 75 kilometres from Melbourne) now plays some home games in Melbourne.

More interestingly, due to changing incentives, a number of smaller-market Melbourne teams have played an increasing number of home matches outside of Melbourne in regional centres, such as Darwin (Western Bulldogs), Canberra (North Melbourne and Western Bulldogs), Launceston (Hawthorn and St. Kilda) and the Gold Coast (North Melbourne and Hawthorn). In other cases, teams have given away home advantage, electing to play home games at the opposition team's home ground, such as Melbourne (to Brisbane) and Western Bulldogs and North Melbourne (both to Sydney). The reasons include the expectation of higher net (of match costs) gate receipts, external financial inducements, and the opportunity to build new regional fan markets and increase their membership base. See Booth (2006) for a more detailed discussion.

In terms of geography, away teams have to travel the largest distances when an 'East' team plays a 'West' team. Away disadvantage for these contests is also enlarged by the two-hour time difference between the two regions. Scientific literature on 'circadian dysrythmia' (jet lag) suggests that away disadvantage is greater when travel is longitudinal as opposed to latitudinal. See, for example, Waterhouse *et al*. (1997), Balmer *et al*. (2001), and Richmond *et al*. (2001). Interestingly, the latter examined the sleep patterns of AFL players representing West Coast.

3. Modelling Framework

We consider two bonus specifications. In the first, following the allocation of bonuses in rugby union, bonuses are awarded for scoring a large number of goals and/or losing by a small margin. Bonuses are awarded for winning by a large margin or losing by a small margin in our second specification. We determine optimal bonus points by specifying a prediction model that includes bonuses as endogenous variables. We use our prediction model to determine optimal values for bonuses and optimal bonus thresholds (e.g., the minimum losing margin required to earn a narrow-loss bonus).

As is common in prediction models, such as that employed by Clarke (1993), we use the home team's winning margin (points scored by the home team minus points scored by the away team) to characterise the outcome of a match. Determinants of match outcomes include home advantage and the strength of the two opponents. Previous research indicates that home advantage can be modelled without including separate home advantages for each team against each opponent (Clarke, 1993; and Winchester, 2008) or distinct home advantages for each team (Clarke, 2005; and Harville and Smith, 1994). Following the two latter studies, we group teams and include separate home advantages for each group.

We identify two broad groups: teams from the East (Adelaide, Brisbane, Melbourne and Sydney) and teams from the West (Perth). This allows us to capture the impact of travel and the time difference between Australia's Eastern and Western seaboards. Scientific evidence suggests that the impact of travel across time zones may vary with the direction of travel. For example, Recht *et al*. (1995) and Worthen and Wade (1999) find that it is easier for teams to travel westward than eastward, while Steenland and Deddens (1997) reach the contrary conclusion. For this reason, we include separate East v West and West v East home advantages. We also allow home advantage for matches between two East sides from different states to differ from home advantage for matches involving teams from the same state.

As noted previously, the AFL schedule creates a number of challenges when modelling home advantage. Special cases requiring attention include 'neutral' and 'flip' matches. We classify contests with no obvious home team as neutral matches. In most cases, neutral matches involve two Melbourne teams playing each other (excluding Geelong's home games at Kardinia Park), Adelaide playing Port Adelaide, or West Coast playing Fremantle (as the two Adelaide and Perth teams share their respective venues). Additionally, we include home matches for Melbourne-based teams played in centres that are not home to an AFL franchise (described previously) as neutral matches. However, there are several within-Melbourne games where we believe discernable home ground advantage existed due to 'territorial' advantage associated with ground familiarity.[1] These cases include Carlton home games at Princes Park and Hawthorn and St. Kilda home games (not against each other) at Waverley Park (until 1999). Matches whereby home advantage was effectively

[1] Pollard (2002) finds for data from three major US pro-sports leagues that home-ground advantage diminishes by approximately one-quarter when a team initially relocates to a new stadium, demonstrating that 'territorial' familiarity is important.

handed to the opposition are designated flip matches, and we reorganise the schedule to account for these matches.

We estimate a team's strength by calculating wins, draws, narrow losses, and the number of times the large number of goals was scored, all on a per-game basis. We then determine the number of league points to award for each event and bonus thresholds to maximise prediction accuracy. Following Winchester (2008), we calculate strength as a time-varying weighted average of league points earned per game in the previous and current seasons. At the start of each season, strength measures are based on league points earned in the previous season and the weight on current season performances increases as the season progresses. We advance Winchester's (2008) specification by allowing the data to determine optimal across-season weights rather than specifying weights exogenously.

To formalise our approach, let i denote the home team, j denote the away team, k index weeks and y index years. We specify the following equation:

$$M_{ij,k,y} = \alpha^{H} D^{H}_{ij,k,y} + \alpha^{S} D^{S}_{ij,k,y} + \alpha^{EW} D^{EW}_{ij,k,y} + \alpha^{WE} D^{WE}_{ij,k,y} + \beta\left(S_{i,k-1,y} - S_{j,k-1,y}\right) + \varepsilon_{ij,k,y} \qquad (1)$$

where $M_{ij,k,y}$ is home team i's winning margin against away team j, in week k of year y; α^{H} is home advantage applying to all (non-neutral) matches; D^{H}_{ij} is a binary variable equal to one if the match is not played at a neutral venue; α^{S} is additional home advantage for interstate (but intra-region) contests; D^{S}_{ij} is a binary variable equal to one if i and j are both East teams but from different states; α^{EW} is additional home advantage when an East team hosts a West team; D^{EW}_{ij} is a binary variable equal to one if i is an East team and j is a West team; α^{WE} and D^{WE}_{ij} capture home advantage when a West team hosts an East team; β captures the influence of strength differences on the home team's winning margin; S_i is the strength of team *i*; and ε is an error term, representing the stochastic or 'on the day' component of the match result.

Our strength measure is a function of league points. League points are awarded for winning, drawing, scoring more than a certain number of goals, and losing by a narrow margin. As there is small number of draws in our sample, we value a draw as half a win instead of estimating the value of a draw. League points earned by team *i* at the completion of week *k* of year *y*, $\overline{P}_{i,k,y}$, are:

$$\overline{P}_{i,k,y} = \theta^W \overline{W}_{i,k,y} + 0.5\theta^W \overline{T}_{i,k,y} + \theta^G \overline{G}_{i,k,y} + \theta^L \overline{L}_{i,k,y} \tag{2}$$

where θ^W, θ^G and θ^L are league points awarded for, respectively, winning, scoring more than a certain number of goals, and losing by less than a certain number of points; and $\overline{W}_{i,k,y}$, $\overline{T}_{i,k,y}$, $\overline{G}_{i,k,y}$ and $\overline{L}_{i,k,y}$ denote, respectively, the number of wins, draws, goal and narrow-loss bonuses earned per game by team *i* in year *y* at the completion of week *k*.

Strength measures are a time-varying weighted average of league points in the previous and current seasons:

$$S_{i,k,y} = \left(1 - \lambda_{i,k,y}\right)\overline{P}_{i,k-1,y} + \lambda_{i,k,y}\overline{P}_{i,22,y-1} \tag{3}$$

where $\lambda_{i,k,y}$ is the weight on league points earned in the previous season.

In the first game of each season, the weight on league points from the previous season is one. This weight decreases by a constant fraction each game until the number of games played in the current season equals or exceeds the number of games included in strength calculations. Once this happens, strength measures only include outcomes from the current season. Formally, if *N* is the number of games included in strength calculations, and $g_{i,k,y}$ is the number of games played by team *i* in year *y* at the completion of week *k*, the weight on league points earned in the previous season $(\lambda_{i,k,y})$ is:

$$\lambda_{i,k,y} = \begin{cases} (N - g_{i,k,y})/N & \text{if } g_{i,k,y} \leq N \\ 0 & \text{if } g_{i,k,y} > N \end{cases} \tag{4}$$

If $g_{i,k,y} \leq N$, per game wins, draws, and goal and narrow-loss bonus averages are calculated using all games played by team *i* in year *y*, otherwise *i*'s most recent *N* games are used to calculate averages.

Substitution of (2) and (3) into (1) yields:

$$\begin{aligned} M_{ij,k,y} &= \alpha^H D^H_{ij,k,y} + \alpha^S D^S_{ij,k,y} + \alpha^{EW} D^{EW}_{ij,k,y} + \alpha^{WE} D^{WE}_{ij,k,y} \\ &+ \beta.\theta^W \left(\lambda_{i,k,y} \overline{W}_{i,22,y-1} + (1-\lambda_{i,k,y})\overline{W}_{i,k-1,y} - \lambda_{j,k,y} \overline{W}_{j,22,y-1} - (1-\lambda_{j,k,y})\overline{W}_{j,k-1,y}\right) \\ &+ 0.5\beta.\theta^W \left(\lambda_{i,k,y} \overline{T}_{i,22,y-1} + (1-\lambda_{i,k,y})\overline{T}_{i,k-1,y} - \lambda_{j,k,y} \overline{T}_{j,22,y-1} - (1-\lambda_{j,k,y})\overline{T}_{j,k-1,y}\right) \\ &+ \beta.\theta^G \left(\lambda_{i,k,y} \overline{G}_{i,22,y-1} + (1-\lambda_{i,k,y})\overline{G}_{i,k-1,y} - \lambda_{j,k,y} \overline{G}_{j,22,y-1} - (1-\lambda_{j,k,y})\overline{G}_{j,k-1,y}\right) \\ &+ \beta.\theta^L \left(\lambda_{i,k,y} \overline{L}_{i,22,y-1} + (1-\lambda_{i,k,y})\overline{L}_{i,k-1,y} - \lambda_{j,k,y} \overline{L}_{j,22,y-1} - (1-\lambda_{j,k,y})\overline{L}_{j,k-1,y}\right) \\ &+ \varepsilon_{ij,k,y} \end{aligned} \tag{5}$$

As an allocation of league points is invariant to multiplication by a positive scalar, we normalise league points with respect to θ^W. That is, we set $\theta^W = 1$ and express values for θ^G and θ^L relative to the number of league points awarded for a win. Parameters to be estimated include α^H, α^S, α^{EW}, α^{WE}, β, θ^G and θ^L. We estimate the model using non-linear least squares (NLS). When estimating (5), we vary the number of games included in strength calculations (N) from 1 to 22, the goal partition from 1 to 25, and the loss partition from 1 to 35. Optimal values for N and goal and loss partitions are those that minimise the sum of squared prediction errors.

The total number of league points awarded (to both teams) can differ across matches under the bonus point system above. Accordingly, we also consider a bonus allocation where the total number of league points awarded per match is constant. There is a single bonus in this specification, which we term a margin bonus. If the winning team wins by more than a certain number of points, the bonus is awarded to the winning team. If not, the losing team collects the bonus. If a match is drawn, the two teams share both the bonus and the points awarded for a win. Under this specification, the number of league points earned per game by team i at the completion of week k of year y is:

$$\overline{P}_{i,k,y} = \theta^{W}\overline{W}_{i,k,y} + \theta^{M}(\overline{A}_{i,k,y} + \overline{L}_{i,k,y}) + 0.5(\theta^{W} + \theta^{M})\overline{T}_{i,k,y} \quad (6)$$

where θ^{M} is the value of the margin bonus and $\overline{A}_{i,k,y}$ is the per-game number of large wins accumulated by i at the completion of week k of year y. Substitution of (6) and (3) into (1) yields a model similar to (5), which is estimated using identical ranges for N and the margin bonus threshold as above, however, this time we estimate the parameter θ^{M} in place of θ^{G} and θ^{L}.

3.1 Data

Our sample extends from 1997 to 2008, comprising a total of 2,112 regular season matches (excluding finals matches). The sample commences in 1997 as two teams merged (Fitzroy and Brisbane) and one was added (Port Adelaide) to the AFL following the 1996 season, hence the same 16 teams competed throughout our sample. Of the matches, 1,246 (59.0 per cent) were won by the (scheduled) home team, 848 (40.1 per cent) were won by the away team, and 18 matches (0.9 per cent) were drawn. Table 2 displays average home winning margins for alternative classifications of neutral and flip games. The average home net score is 8.4 points (9.2 per cent of the average away team score) for all matches as scheduled, but increases to 13.2 points after appropriately accounting for neutral and flip matches.

More detailed data regarding home advantage is displayed in Table 3. The data breaks down home advantage by city pairing (though with Sydney and Brisbane aggregated). Melbourne teams enjoy the smallest home advantage on average (and a negative home advantage against the Brisbane-Sydney combination). Adelaide teams and Brisbane-Sydney enjoy the greatest home advantage. The data also reveals that Perth teams do not tend to travel very well, even relative to Melbourne-based teams, providing support for the presence of asymmetry in the time-zone travel effect. This asymmetry is even more evident when all East teams are aggregated (and 'Perth' is relabelled 'West'), as shown in Table 4. A crude estimate suggests that directional travel asymmetry is approximately two goals or 12 points (21.9 – 9.9) in favour of teams from the East.

4. Modelling Results

Although our sample begins in 1997, we estimate (5) for the 1998-2008 seasons as our strength measures require data lagged up to one season. We consider three specifications. In specification (a), we estimate (5) subject to the constraint $\theta^G = \theta^L = 0$, so that strength measures are built on the allocation of league points currently used in the AFL. Specification (b) considers narrow loss and goal bonuses and involves estimation of (5) without constraints. The optimal value of the margin bonus is determined in specification (c).

Results are reported in Table 5. Twenty-two games are included in strength calculations in specification (a). Also in this specification, base home advantage $\left(\alpha^H\right)$ is a significant determinant of match outcomes at a 1 per cent significance level and is equal to 10 points. Additional interstate (but within region) home advantage $\left(\alpha^S\right)$ is not significantly different from zero. Estimates for α^{EW} and α^{WE} indicate that additional inter-region home advantage depends on the direction of travel. Specifically, East home advantage against West teams is approximately 10 points (over base home advantage) and is significant at a 1 per cent level, whereas West home advantage against East teams is insignificant. Thus, our results indicate that travelling eastward is more difficult than travelling westward. Results for home advantage parameters are similar across specifications, so we do not discuss these parameters elsewhere. The estimate for β indicates that the net number of wins is strongly correlated with match outcome and suggests that in a neutral match, a team that always wins will beat a team that always loses by around 68 points. Specification (a) is able to explain about 20 per cent of the variation in net scores and correctly selects the winning team in 1,255 matches (64.8 per cent).

Results for specification (b) show a small increase in the R^2 and the number of correct predictions from the inclusion of bonus points.[2] The data suggest that a goal bonus should be awarded if a team scores 20 or more goals and a narrow-loss bonus granted

[2] Although specification (b) generates only seven additional correct predictions relative to specification (a), the inclusion of bonuses produces an additional 18 correct predictions when goal and narrow-loss partitions are selected to maximise the number of correct predictions.

for losing by 27 points or less. The goal threshold is approximately equal to the average number of goals scored per team per game plus one standard deviation. Significantly, both bonus estimates are significantly different from zero at a five per cent significance level, and the narrow-loss coefficient is different from zero at one per cent significance. Point estimates indicate that a goal bonus should attract around one-third of the points awarded for a win, and a narrow-loss is equivalent to about half a win. To make the allocation of goal and loss bonuses more usable, we impose the restriction $\theta^G = \theta^L = 1/3$. The p-value for the joint test of this constraint is 0.13, which indicates that the data cannot reject the restriction. After scaling so that values for league points are integers, our preferred allocation of AFL league points awards six points for a win, three for a draw, two for scoring 20 or more goals, and two for losing by 27 points or less.

The R^2 increases but the number of correct predictions decreases in specification (c) relative to (b).[3] In (c), the margin bonus is awarded to the losing team if the margin of victory is 26 points or less. The estimate for θ^M is 0.61 and is different from zero at one per cent significance, indicating that the margin bonus is a significant determinant of strength. We determine a practical margin specification by testing the constraints θ^M =1/3 and θ^M = 1/2. The tests produce p-values of 0.02 and 0.36 respectively. Therefore, the data indicate that the margin bonus is worth more than one-third of a win, but is not statistically different from 1/2 at conventional significance levels. After scaling appropriately, our preferred margin-bonus specification awards four points for

[3] Indeed, there is one less correct prediction when there is a margin bonus than when bonuses are excluded. However, there are 15 additional correct predictions in (c) than in (a) when the margin threshold is chosen to maximise the number of correct predictions.

a win, three for a draw, two points for winning by 27 or more, and two points for losing by 26 or less.

In comparing the two bonus allocations, we prefer a margin bonus to goal and narrow loss bonuses for several reasons. First, (c) fits the data slightly better than (b) in terms of explained sum of squares. Second, the inclusion of goal and narrow loss bonuses can result in peculiar outcomes. Specifically, the total number of league points awarded per game ranges from six to 10 and there are 16 possible pairwise allocations of league points per game in (b). In contrast, the total number of league points is fixed and there are only five possible pairwise allocations of league points in (c). Third, the goal bonus rewards attacking ability without considering defensive performance, while a margin bonus considers both attacking and defensive capabilities. Fourth, the bonus allocation in (b) closely follows that used in rugby union, where teams must make genuine choices between alternative modes of scoring. However, as noted above, teams always attempt to score a goal in Australian Rules football. As such, the goal bonus in (b) essentially rewards large wins and we believe a margin bonus is a more suitable way of rewarding large wins than a goal bonus.

The margin threshold in (c) is an important element of our bonus specification. We display R^2 values (shaded bars) and the number of correct predictions (connected dots) when $\theta^M = 1/2$ for alternative margin thresholds in Figure 1. Specifications are ranked in descending order of R^2 values. There is strong support for a margin threshold in the mid-to-high twenties. The results also indicate scope for administrators to choose a convenient threshold. For example, a ‘round’ threshold of 25 may be preferred to simplify the specification.

4.1 Alternative League Rankings

End-of-season league points determine both which teams qualify for the playoffs, and the difficulty of each qualifier's playoff schedule. As noted above, the top eight sides at the end of the each regular series contest the finals and the schedule favours teams seeded one to four relative to teams seeded five to eight. Rankings at the bottom of the league are also important, as the lowest ranked team receives the first draft pick in the following season.

We evaluate the impact of including a margin bonus on AFL standings by identifying four classifications and evaluating whether or not the inclusion of a margin bonus altered a team's classification. Our classification identifies: (i) first to fourth seeds (q^*); (ii) fifth to eighth seeds (q); (iii) ninth to fifteenth seeds (n); and (iv) the sixteenth seed (b). Rankings when a margin bonus is included are determined by replacing the number of wins with league points. Cases where the ranking methods produced different classifications are reported in Table 6. The first letter in each cell denotes the classification using a conventional system and the second reports the classification when a margin bonus is included. Wins, draws, large wins, narrow losses and league points (in parentheses) are displayed below classification change indicators. For example, in 1997, Brisbane was seeded in the five to eight bracket but would not have qualified for the playoffs if a bonus was included. Brisbane also accumulated ten wins, one draw, six large wins and five narrow losses for a total of 65 league points.

Teams with less wins can be ranked higher than a team with more wins when bonuses are included. The largest ranking reversals occur in the 2002 season. Sydney and the

Western Bulldogs finished eleventh and twelfth, respectively, in this season. However, the two teams would have qualified for the playoffs, as fifth and sixth seeds respectively, if a margin bonus was included. North Melbourne fail to qualify for the playoffs when our alternative allocation of league points is employed, even though both Sydney and the Western Bulldogs recorded three less wins (but one more draw) than North Melbourne. This is because a large percentage of North Melbourne's wins (losses) were by narrow (large) margins. Elsewhere, it is not uncommon for a team with two less wins to rank higher than a team with two more wins. Interestingly, Collingwood fares best under a bonus point system overall during this period, climbing a classification in five seasons, while falling a classification only once.

On average, relative to the status quo, the inclusion of a margin bonus results in one exchange between first to fourth seeds and fifth to eighth seeds each year, one exchange between fifth to eighth seeds and non-qualifiers every two years, and an alternative bottom-placed team every three years. These changes do not represent significant changes to league rankings. Nevertheless, ranking teams with less wins ahead of teams with more wins is likely to be controversial. In defence of our alternative allocation of league points, National Football League bookmaker data, which is readily available, shows that the favourite is the team with less wins in the current season or the away team if two opponents have the same number of wins in around one-fifth of matches.

5. Conclusions

We used a prediction model to test the efficiency of tournament design of the AFL with respect to the allocation of league points. We determined the allocation of league points that is best at revealing strong teams by using league points to measure strength and choosing league points to maximise prediction accuracy. Two alternative allocations of league points were considered. One awarded bonuses for scoring a large number of goals and losing by a narrow margin. The other awarded a bonus for winning by a large margin or losing by a narrow margin. We found that bonuses were significant determinants of strength in both specifications, concurring with the results of Winchester (2008) for Super Rugby. Our preferred allocation of league points awarded four points for a win, three points for a draw, two points for winning by 27 or more, and two points for losing by 26 or less.

In addition to more accurately revealing strong teams, the inclusion of bonuses may increase spectator interest in matches where an obvious winner emerges prior to match completion. For these reasons, the AFL Commission may wish to amend the allocation of league points currently used in Australian Rules football. Introducing bonuses to AFL standings may cause controversy as a team with less wins may qualify for the playoffs at the expense of a team with more wins. Nevertheless, our optimal bonus point system is based on an objective analysis and breaking the one-to-one mapping between league wins and league rankings is supported by bookmakers' actions. We hope that bonus points are not overlooked due to the 'tyranny of the status quo'.

We note two caveats to our analysis before closing. First, the introduction of bonuses may alter team behaviour. For example, a team with a comfortable lead late in a game will be less likely to substitute key players when a margin bonus is included than under the current system. We do not account for changes in team behaviour induced by bonuses. However, as highlighted above, the introduction of bonuses is likely to have a smaller impact on team behaviour in the AFL than in other competitions.

Second, bonuses may be included for entertainment purposes. For example, the try bonus in rugby union was introduced to encourage teams to adopt attacking tactics. A more comprehensive analysis of bonuses may optimise a function of entertainment and accurate rankings. Undertaking such a study is complicated by the fact that spectators derive entertainment from watching the strongest teams contest the playoffs, so entertainment may be a function of accurate rankings. Our approach could be used to select the design of a bonus point system motivated by entertainment purposes that minimises distortions to league rankings.

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Table 1: Regional Breakdown of AFL Teams

Team	Base City	Base State
Adelaide	Adelaide	South Australia
Brisbane	Brisbane	Queensland
Carlton	Melbourne	Victoria
Collingwood	Melbourne	Victoria
Essendon	Melbourne	Victoria
Fremantle	Perth	Western Australia
Geelong	Geelong	Victoria
Hawthorn	Melbourne	Victoria
Melbourne	Melbourne	Victoria
North Melbourne	Melbourne	Victoria
Port Adelaide	Adelaide	South Australia
Richmond	Melbourne	Victoria
St. Kilda	Melbourne	Victoria
Sydney	Sydney	New South Wales
West Coast	Perth	Western Australia
Western Bulldogs	Melbourne	Victoria

Table 2: Average Scores, Goals and Net Home Winning Margin, 1997-2008

	Home	Away	Net
	All Games as Scheduled		
Points	99.7	91.3	8.4
Goals	14.5	13.3	1.2
	Accounting for Neutral and 'Flip' Games		
Points	100.8	87.6	13.2
Goals	14.7	12.7	2.0

Table 3: Average Inter-Regional (and Intra-Melbourne) Net Home Winning Margins

	Away City			
Home City	Melbourne	Adelaide	Perth	Sydney-Brisbane
Melbourne	9.9	3.1	20.2	-0.9
Adelaide	22.2	N/A	25.9	4.5
Perth	11.1	5.8	N/A	8.8
Sydney-Brisbane	21.9	13.1	25.2	8.1

Note: Neutral matches are excluded from calculations and flip matches are appropriately re-ordered.

Table 4: Average Inter-Region Net Home Winning Margins

	Away Team	
Home Team	East	West
East	12.2	21.9
West	9.9	N/A

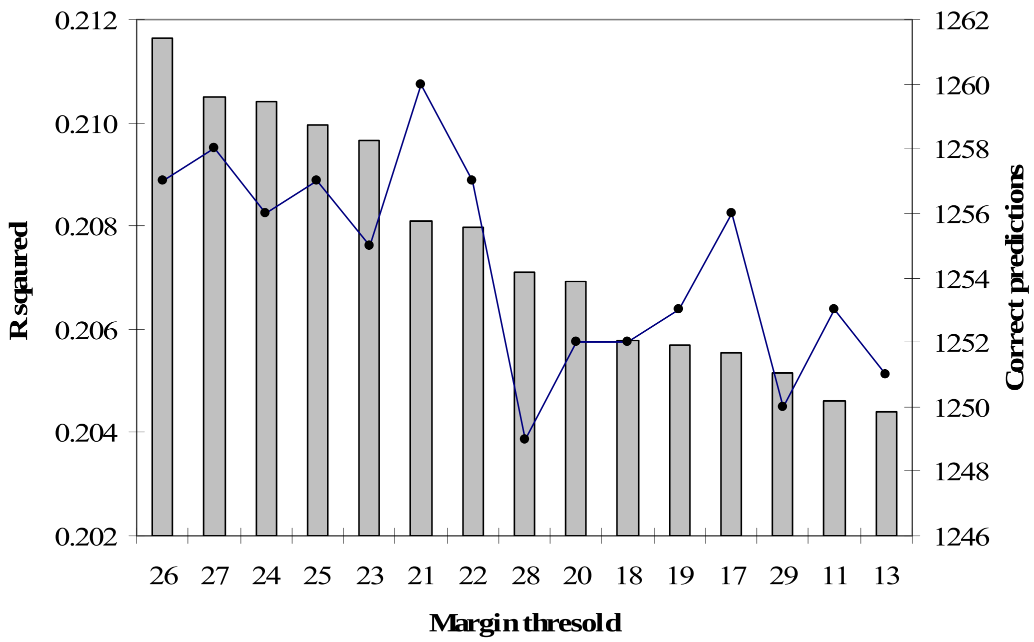
Note: Neutral matches excluded from calculations and flip matches appropriately re-ordered.

Table 5: Modelling Results

	(a) No Bonuses	(b) Goal and Loss Bonuses	(c) Margin bonus
Goal Partition	-	20	-
Narrow-Loss Partition	-	27	26
Games in Strength Calcs. (N)	22	20	20
Home Advantage (α^{H})	10.00**	9.64**	8.56**
	(2.84)	(2.85)	(2.85)
Interstate Home Adv. (α^{S})	1.03	1.31	2.31
	(3.03)	(3.04)	(3.03)
East v West Home Adv. (α^{EW})	10.34**	9.33**	10.36**
	(3.59)	(3.59)	(3.56)
West v East Home Adv. (α^{WE})	0.35	2.34	3.45
	(3.90)	(3.91)	(3.91)
Net Strength (β)	68.21**	71.47**	53.85**
	(3.85)	(5.28)	(4.09)
Goal Bonus (θ^{G})		0.27*	
		(0.14)	
Narrow-Loss Bonus (θ^{L})		0.50**	
		(0.09)	
Margin bonus (θ^{M})			0.61**
			(0.12)
R^2	0.195	0.206	0.212
Correct Predictions	1,255	1,262	1,254

Note: ** and * denote significance at the one and five per cent significance level, respectively. Robust standard errors are reported in parentheses. Sample size = 1,936.

Figure 1: R^2 and Correct Predictions for Alternative Margin Thresholds in Specification (c), θ^M= 1/2



Note: R^2 values are shown by shaded bars. Correct predictions are shown by connected dots.

Table 6: Changes in Ranking Classifications, 1997-2008

	1997	1998	1999	2000	2001	2002	2003	2005	2006	2007	2008
Adelaide		q → q* 13-0-8-8 (84)			q → n 12-0-5-4 (66)		q → q* 13-0-9-8 (86)				
Brisbane	q → n 10-1-6-5 (65)			q → q* 12-0-11-6 (82)							
Carlton					q → q* 14-0-10-6 (88)		n → b 4-0-0-4 (24)	b → n 14-0-10-4 (84)		n → b 4-0-1-9 (36)	
Collingwood	n → q 10-0-7-9 (72)		b → n 4-0-3-8 (38)		n → q 11-0-6-9 (74)			n → b 5-0-2-7 (38)	q → q* 14-0-10-4 (84)		q → q* 12-0-8-6 (76)
Fremantle			n → b 5-0-3-6 (38)						q* → q 15-0-8-3 (82)		
Hawthorn				q → n 12-0-7-1 (64)						q → q* 13-0-8-6 (80)	
N. Melbourne				q* → q 14-0-7-3 (76)		q → n 12-0-3-5 (64)				q* → q 14-0-4-4 (72)	
Melbourne		q* → q 14-0-6-2 (72)									
Port Adelaide			q → n 12-0-3-2 (58)					q → n 11-1-5-4 (65)			
Richmond					q* → q 15-0-8-0 (76)					b → n 3-1-2-10 (39)	
St. Kilda			n → q 10-0-6-7 (66)								q* → q 13-0-8-4 (76)
Sydney	q → q* 12-0-9-6 (78)	q* → q 14-0-7-4 (78)		n → q 10-0-5-8 (66)		n → q 9-1-6-9 (69)	q* → q 14-0-8-5 (82)			q → q* 12-1-9-9 (87)	
W. Bulldogs	q* → q 14-0-5-4 (74)					n → q 9-1-7-8 (69)	b → n 3-1-1-7 (31)	n → q 11-0-7-6 (70)			
West Coast		q → q* 12-0-5-10 (78)				q → n 11-0-6-3 (62)				q* → q 15-0-6-2 (76)	

Note: q* denotes seeded in the top four, q denotes seeded five to eight, n denotes seeded nine to 15, b denotes seeded 16. Numbers below classification change indicators convey wins-draws-large wins-narrow losses and league points (in parentheses). Ranking classifications for excluded teams and years are unaffected by the inclusion of bonuses.