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MODELLING HOME ADVANTAGE AND THE IMPORTANCE OF THE TOSS IN ONE-DAY CRICKET MATCHES

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I. INTRODUCTION

This paper examines evidence regarding home-field advantage in the English one-day county cricket league together with a particular focus on the importance of winning the pre-match toss of a coin to determine a team's strategic decision to bat first or second. Following a brief examination of the concept of, and evidence for, home advantage in professional team sports we describe the main features of limited overs cricket, as played during our study period, together with the components of our dataset. We then present our model and interpret the empirical results and their implications.

II. HOME ADVANTAGE IN TEAM SPORTS

Home-field advantage in team sports refers to the phenomenon that teams playing at home win significantly more often than chance would dictate. Specifically the concept may be defined as 'the consistent finding that home teams in sports competitions win over 50% of the games played under a balanced home and away schedule' (Courneya and Carron, 1992), with the implied home advantage higher the greater the percentage point excess above 50%.[1] Following the seminal work of Schwartz and Barsky (1977) and Edwards (1979) considerable descriptive evidence of significant home-field advantage has emerged for a range of team sports as, for example, listed in reviews by Courneya and Carron (1992) and Nevill and Holder (1999). While largely US based, and mainly covering American football, baseball, basketball and ice hockey, there are also specific studies relating to English and Scottish association football (soccer) by Pollard (1986), Clarke and Norman (1995)

and Nevill *et al.* (1996) and Australian Rules football by Stefani and Clarke (1992).[2] In general the evidence indicates clear, and historically stable, home-field advantage although its magnitude varies between sports and, to an extent, between different competitions and levels within a sport e.g. professional and college football in the US, English league soccer and European soccer competitions. Courneya and Carron (1992) present composite home advantage figures, involving a quantitative synthesis of studies that have examined home advantage in major team sports in terms of the win percentage of decided games, reporting baseball as 53.5%, football 57.3%, ice hockey 61.1%, basketball 64.4%, and soccer 69.0%.[3]

Basic explanations for the causes of home-field advantage and its effects have mainly approached the issue from the viewpoint of social psychology (e.g. Schwartz and Barsky, 1977; Edwards, 1979; Edwards and Archmbault, 1989). Accepting that different sports possess varying mixes of home advantage factors, which themselves interact, the major causal factors can be viewed as falling within four categories:

(i) *Learning/familiarity* associated with home and visiting teams' differing levels of intimacy with arena/ground facilities (e.g. Barnett and Hilditch, 1993).[4]

(ii) *Travel factors* based on the assumption that visiting teams experience greater fatigue and disruptions in preparation and routines contributing to an adverse effect on match performance (e.g. Pace and Carron, 1992).

(iii) *Rule factors* which may extend special privileges explicitly favouring the home team, such as the home team in baseball and softball always having the last 'bat' (Courneya and Carron, 1990).

(iv) *Crowd effects* in terms of size and/or density, based on the assumption that there are differences in psychological support extended to home and visiting teams, which

are affected both directly and indirectly via decisions by match officials. (e.g. Pollard (1986), Agnew and Carron (1994), Harville and Smith (1994), Nevill *et al.* (1996)) .[5] In addition, differing tactical approaches adopted by home and away teams during a match, which are themselves not unrelated to other factors, may be important (e.g. Carmichael and Thomas (2003), Dennis and Carron (1999)).

While the existence of home-field advantage has become increasingly well documented and interpreted, the systematic and empirical research of its nature and causes has been more limited. Due to the difficulties in controlling many home advantage variables, and several potential interactive effects, much work has been largely inferential. Apart from the problems of quantifying certain perceived, especially psychological, factors contributing to home-field advantage the issue is complicated by the fact that other factors impinge on results not least the relative quality and strengths of the two teams, in terms of abilities and skills of individual players, team cohesion and morale, and the coaching/management input, as well as the significance and/or position of a match in a league or tournament programme.[6] In general the empirical evidence suggests that effects of travel fatigue are minimal with the familiarity aspect unsubstantiated and the effects of rule factors largely ignored as are tactical issues. While most research has tended to focus on the specific, and interactive, aspects of crowd effects the results have been varied, failing to establish the precise nature of any relationship between crowd support and home advantage. Such research has treated the potential contrast between indoor sports, such as basketball and ice hockey, displaying close crowd-player inter-relations in more compressed and intense atmospheres which give particular resonance to sustained home audience support, and outdoor sports, such as American Football and baseball,

as well as the importance of home advantage in sports where facilities and playing conditions are less variable and more uniform.

Despite a considerable data richness, covering both individual and team performance, the sport of cricket is relatively under-researched[7] and, apart from the reporting of a home advantage figure of 56% for English county championship cricket in Pollard's (1986) study of association football, there has been no explicit treatment of the home team effect.[7] This issue now becomes the specific focus of the remainder of the paper which examines evidence from the English one-day, limited overs league competition as played during the 1996 and 1997 seasons.

III. LIMITED OVERS CRICKET

During the study period eighteen county teams[8] competed in a single one-day cricket league, scheduled to play each other once during a season, weather permitting on the fixture date, stretching from end of April/early May to mid-September.[9] The league championship was won by the team accumulating the highest number of points over the fixture programme, with the placings of two or more teams equal on points being determined by the greatest number of match wins over the season or, if equal, by the highest net run rate throughout the season.

A game of limited overs cricket is played between two teams of eleven players overseen and directly refereed by two 'umpires'.[10] Each team comprises a balance of specialist 'batsmen' and 'bowlers', with some players combining the two roles as 'all-rounders', together with a specialist 'wicket-keeper' when 'fielding'. As played during the study seasons of 1996 and 1997 each side is allocated a maximum of 40 overs, of six balls each, in which to 'bat' for a single 'innings' while the other side bowls and fields, with each bowler allocated a maximum number of overs. The order of batting is determined by a team captain's choice following his successful call on a

toss of a coin prior to the game's commencement. Apart from wicket length, overall playing area dimensions and arena/stadium facilities are potentially more variable than those in other outdoor and, particularly, indoor sports, but a potentially more critical aspect refers to the state of the playing area, particularly when affected by recent and prevailing weather conditions, which can dramatically affect results by favouring batsmen or bowlers, of different kinds.

The win/loss result of a game is determined by a side scoring the most runs, accumulated in a variety of ways, whether losing all ten of its 'wickets' (to various forms of dismissals) or not and regardless of the number of batsmen used, during its over allocation. A first innings ends after all overs have been bowled or ten wickets have 'fallen' whichever occurs sooner, with the total runs scored by the team setting the target to be achieved by the team batting second. The innings of the second batting team can end in a similar fashion without reaching its target (resulting in a loss for that team), or when the run target is exceeded before overs are exhausted and all ten wickets lost (in which case that team wins). There is also the possibility of a 'tied' result where the two teams end the match having scored the same number of runs (with no account being taken of the number of wickets which have been lost). Four points are awarded to a winning team and nothing to the loser, with the teams obtaining two points each in the rare event of a tie. When matches are curtailed due to weather interruptions, prior to commencement or at any stage of either innings during a match, results can still be achieved, in contrived form, following modification of the rules and as long as each team has the opportunity to bat for a minimum of ten overs; but in the event of no, or insufficient and abandoned, play a 'no result' is declared (with no postponement allowed) with each team receiving two points. For the 1997 season a specially designed method of determining results in

weather affected matches was introduced in the form of the Duckworth-Lewis system, which was presented as a fairer method of producing results for such matches.[11]

Given the nature of the game a cricket team captain assumes considerable responsibility for tactics, particularly when his team is bowling and fielding, choosing and permutating his bowlers in response to the type and form of the batsman at the wicket and the stage and state of the game, and similarly arranging fielding positions which can be changed on a ball-by-ball basis. Some teams are better equipped to bat first and set a target to defend, while others prefer to chase targets depending, other things being equal, on their relative batting/bowling/fielding strengths in comparison with their opponents.[12] As such, the toss appears crucially important in enabling a team to decide on whether to bat first or second given their known strengths and strategic preference, the nature of their opponents, and their perception of the cricket pitch and weather conditions and their anticipated effects, in combination, on the conduct and progress of the match. While the winning of the toss involves a 50-50 probability, it may be assumed that the decision to bat first or second is more likely to be better informed when available to the home captain given his local knowledge of the playing area, together with anticipated weather and atmospheric changes during the course of the game.[13] It is also possible that team selection ahead of the match has been influenced by local knowledge, enabling an appropriate mix of specialist batsmen and different bowling styles. As such, winning the toss assumes greater significance than in those sports where the toss simply decides initial direction of play as, for example, for the first half of an association football or rugby football match, where choice might be influenced by wind conditions and/or any perceived advantage in playing towards a favoured end, where the team's support may be particularly concentrated. This, of course, is in direct contrast with the game of baseball, which

although played sequentially through nine innings with each team alternating their half-innings, does not involve choice of batting order determined by the toss with the rules stipulating that the visiting team always bats first with the home team having the opportunity to bat last.

IV. DATA, MODEL AND RESULTS

The limited overs league was chosen as the study context in preference to other forms of cricket as (i) far more win/loss results are generated than by the first-class county championship format which has a high propensity for drawn or no result games, and (ii) it provides a more balanced and fuller schedule of regular fixtures and a greater number of observations than the other premier one day competitions involving the first-class cricketing counties, which are organised on a randomly drawn, knockout basis. Although the league structure in our study period did not generate a precise balance of scheduled home and away games during a single season (with 9 matches at home and 8 away (or vice versa) for any one team), this was achieved in aggregate over the two seasons. With the second season programme involving a reversal of the previous season's fixture list, all 18 teams were scheduled to play the same number of home and away games (17 each) although, due to the abandonment of a few matches due to weather conditions, not all matches produced a result.[14] For many teams not all home games were played at the same venue with some used on an occasional basis.[15]

Data

Our dataset contains 270 observations relating to all those scheduled matches during the 1996 and 1997 league seasons which generated a win/loss result, and excludes four tied results. Of these matches 45 were curtailed in some form or another and involved a contrived result. Apart from attendance and membership data supplied by

the England and Wales Cricket Board all match information was obtained from the *Wisden Cricketers Almanack*.

The dependent RESULT variable is defined dichotomously as 1 for home win and 0 for an away win, in this case the odds ratio is the ratio of the probability of a home win to the probability of an away win. Those matches curtailed by weather conditions have been dummied by a CURTMATCH variable. The rule aspects of a limited overs game are examined by specifying TOSS and ORDER as dichotomous variables coded 1,0 depending, respectively, on whether the home side won the toss or not and whether the home side batted first or second. While in the case of TOSS the expected influence on RESULT may be assumed to be positive, the expected sign on ORDER is not anticipated. Attempts to capture the crowd effect associated with home advantage, in terms of overall size and density of home support, involve the employment of a variable measuring total attendance at a match (ATTEN) together with another reflecting the tendency for match attendance to be dominated by home season ticket holding members (MEM%), calculated as the proportion of total attendance comprising of home team members. Both of these may, on the basis of the earlier discussion, be hypothesised to have a positive relationship with a home win result, although their importance may be assumed to be limited given the traditional nature and (somewhat restrained) behaviour of cricket spectators. The possibility that crowd atmosphere is more intensive, and pressure on players greater, in those matches which are more significant for championship determination, particularly as the end-of-season approaches, is allowed for by employing the well-established Jennett measure (Jennett, 1984)[16], HJENN and AJENN for home and away team significance respectively, while any particular intensity associated with a 'derby' match effect is also allowed for by a dummy variable (DERBY), basically defined in terms of

matches between counties whose traditional boundaries are contiguous, which may also indirectly, and inversely, capture any travel factors potentially disadvantaging an away team. Any particular crowd effects arising from bank holiday fixtures are dummied by a HOLIDAY variable.

While anticipating +ve and −ve relationships respectively between RESULT and HJENN and RESULT and AJENN, neither Jennett measure can be unambiguously assumed to have a particular directional relationship with RESULT, due to the variable effects of pressure on either or both teams, and the same can be similarly argued for any anticipated DERBY or HOLIDAY match effects. The occurrence of occasionally used home venues (defined as two or less over the study period) is dichotomously defined by a VENUE variable, in an attempt to capture any particular unfamiliarity of the away team with the nature and dimensions of the pitch and outfield and surrounding facilities assumed to positively favour a home win result. Finally, in order to allow for other factors which may impinge on match results, in addition to the home-field effect, the quality and strengths and overall form of the teams involved is incorporated in our model by variables relating to the accumulated seasonal points totals of the home and away teams respectively prior to a fixture expressed as a percentage of the maximum aggregated match points attainable; H%POINTS for the home team and A%POINTS for the away team.[17] The directional effect of the former on RESULT is assumed to be positive and the latter negative.

Processing the data shows that the home-field effect is confirmed by the fact that 57% of all matches resulting in a definite result are won by the home team, with the percentage increasing slightly to 58% when the results of curtailed matches are excluded. Although overall the team winning the toss won the match in 51% of cases, the statistics show that the home team went on to win the match in 56% of those

fixtures where they won the toss to chose batting order (52% of the time), while in contrast the away team only won 43% of the matches in which they won the toss. Overall 54% of games were won by teams batting second, slightly lower than the respective figure for the home team and slightly higher than that for the away team. This contrasts with the appreciable difference in home/away team experiences relating to batting first with the home team winning 54% of those games in which it batted first compared with only 40% for the away team, with the overall figure calculated as 46%. The average attendance at all matches in our dataset was 2,937, small when compared with an average attendance figure of 3,354 in the bottom division of the English Football League during the 1996-1997 season (and 28,434 for the English Premier League), while the average figure for the home members component of match attendance was 66.5%.

Model and results

Our model may be viewed in three parts, with our estimated results reported in columns 1 to 4 of Table 1. The first stage specifications specifically investigate strategic issues relating to the importance of winning the toss and the order of batting on the likelihood of a home team victory (columns 1 and 2), in combination with the familiarity aspects associated with venue location. The next formulation contains those variables that attempt to capture the home-field effect in terms of the crowd size and intensity, venue and match significance, together with the quality of the two teams (column). Our final specification involved a stepwise procedure to produce the most parsimonious specification. All the specifications were estimated using a logistic model in which the dependent variable is RESULT, which has the value of 1 for a home win and 0 for a home loss. In all cases results are reported for the whole dataset, with curtailed matches dummied, including log-likelihoods and pseudo-R^2

figures indicating the percentage of correctly predicted outcomes. The four estimated

equations are as follows:

1)   RESULT $= f_1$ (TOSS, VENUE, CURTMATCH)

2)   RESULT $= f_2$ (TOSS, ORDER, VENUE, CURTMATCH)

3)   RESULT $= f_3$ (VENUE, HJENN, AJENN, H%POINTS, A%POINTS, MEM%, ATTEN, DERBY, HOLIDAY, CURTMATCH, TOSS, ORDER)

4)   RESULT $= f_4$ (, HJENN, AJENN, H%POINTS,)

In the first estimation (column 1) TOSS is positively significant at the 5% level,

whereas VENUE and CURTMATCH are insignificant, but when ORDER is

accounted for (column 2) TOSS becomes insignificant, with ORDER also

insignificant. These results indicate that winning the toss increases the probability of

winning the game, in home team terms, due to the better informed choice available to

the home team (as previously explained). The insignificance of order in which the

teams bat reflects the fact that this appears to dominated by the ability to choose

whether to bat first or second, on winning the toss, reflecting on the home team's

local knowledge of playing conditions and its team selection relative to that of its

opponents. The addition of the dummy variables for the curtailed matches has no

significant effect on the result indicating that the mechanisms for deciding the

outcome of such matches produce the same expected result as if the game had

produced a 'normal' conclusion. This latter result would seem to deny the popular

view regarding the 'lottery' nature of curtailed matches.[18]

In the third set of results (column 3) all the variables are incorporated into the

model, with AJENN being significant at the 5% level indicating that the significance

of the game, in terms of its championship importance and the pressure involved, is an

important influence on the probability of a home win.[19] In the fourth set of results we

have produced the most parsimonious model, in which HJENN and AJENN are significant, along with H%POINTS. The non-significance of A%POINTS may be explained by the subsumation of the away team's strength into the home-field effect.[20] In equation 3 those variables employed to proxy the direct and indirect crowd effects, ATTEN and MEM% are, not surprisingly, found to be insignificant, reflecting the nature of crowds at English one-day league matches where the atmosphere is generally less compressed and intensive than that found in other professional team sports, particularly those played in more enclosed and confined indoor stadiums. The lack of a indirect crowd effect seems to be further confirmed in equation 3 with the insignificance of DERBY and HOLIDAY.[21] In addition the insignificance of the VENUE variable suggests the irrelevance of occasional venues in determining match results with their effect subsumed within the general home team effect. The addition of the TOSS variable to the complete model covering home-field aspects and team quality sees it becoming insignificant indicating that, while winning the toss is an important aspect of a one-day cricket match, the other factors involved tend to dominate in determining the result.[22] Our results accord with Pollard's (1986) conclusion that hypothesized factors interact in producing home advantage[23], particularly emphasising the operation of more complex psychological factors which include the possibility of a self-fulfilling effect that 'the very acceptance of the existence of home advantage may itself create a vicious circle which contributes to its cause' with respect to both the home team and the away team.

V. CONCLUDING REMARKS

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Despite the proliferating research on home-field advantage in team sports much still remains to be learned regarding the complex mechanisms that contribute to its relevance in determining a match result. In this context, our investigation of English one-day county cricket provides some additional evidence with our results indicating that, as would be expected, the crowd effect, with all its inferred manifestations is not significant[24]. While the toss has a significant effect on the result in the basic model, the effect is nullified when team quality and match significance are added to the specification. With particular reference to rule factors the implication of such a result is that a simple, but often mooted, rule change involving the abandonment of the toss and allowing the visiting team to automatically choose order of batting, to reduce any familiarity advantage to the home team, would not effect the outcome in terms of reduced probability of the home team winning. However, while this conclusion may apply to the limited overs form of cricket examined in this study, further evidence is required regarding the implications of the toss and choice of batting order for other forms of cricket. This applies to other variants of one-day, limited overs cricket of both domestic knockout form and at international level, where matches often are of longer duration with early morning batting the norm, as well as for 'first-class' county cricket and Test Match cricket, of two-innings a side and unlimited overs played over a number of consecutive days. In the latter case the significance of the home team winning the toss may be great with the possibility of pitch preparation (or doctoring) 'sympathetic' to the home team being a regular source of controversy and debate. Finally it may be noted that the implications of winning the toss in determining the order of batting may also be particularly relevant in limited overs matches played on a day-night basis, where the side batting second under artificial lighting may be disadvantaged. While, at the time of writing, this appears a particularly controversial

issue during the 2003 Cricket World Cup in South Africa[25], a meaningful empirical

investigation awaits an appropriate accumulation of such games.

NOTES

1.Whereas this technically applies to competitions where all games are played to a win/loss finish with tied/drawn games not permitted, home advantage can also be calculated by omitting tied/drawn matches or as the number of match points gained at home expressed as a percentage of total points gained over the season.

2.Other interesting studies of home-advantage, at an individual level, include Gayton and Langevin's (1992) reference to wrestling, Bray and Carron's (1993) study of alpine skiing and Nevill *et al*'s (1997) study of international tennis and golf tournaments. See also Balmer *et al*'s (2001) study of the Winter Olympic Games.

3.These figures are typical of those quoted in a variety of surveys and individual studies, including Stefani and Clarke's (1992) study of Australian Rules Football which reports a figure of 58%.

4.See Pollard (2002) for evidence regarding reduced home advantage when teams move to new stadiums, with data relating to teams involved in US baseball, basketball, football and ice hockey. See also Moore and Brylinski (1995).

5.There is some, limited and tenuous, evidence of home-field disadvantage, particularly relating to pressure and expectation of the home crowd in critical games, usually near the end of season, e.g. Benjafield *et al.* (1989).

6.The contribution of chance and skill to sports' match outcomes is considered by Goldstein (1979).

7.See Schofield (1982) for an economic analysis of the development of first-class county cricket in England. The earliest academic research on cricket matches and scores may be dated back to Elderton (1945) and Wood (1945), with more recent statistical studies by Clarke (1988), Kimber and Hansford (1993), and Preston and Thomas (2000). For other work on cricket see the production function studies of Schofield (1988) for England and Bairam *et al.* (1990a, 1990b) for Australia and New Zealand*,* as well as Schofield's (1983) attendance demand functions for limited overs county cricket in England and Hynds and Smith's (1994) estimation of a demand function for international Test Match cricket.

8.The eighteen county teams are geographically dispersed throughout England and, in the case of one (Glamorgan), Wales.

9.Fixtures were almost exclusively scheduled for Sunday afternoons with a normal duration of some five hours. Over the two seasons a small number of matches were rescheduled for midweek when either team were otherwise engaged on the original date, due to playing in a knockout cup final. Additionally, during the 1997 season three day-night matches, partly played under floodlights, were experimented with.

10.Full details regarding the rules and regulations determining the conduct of the game can be obtained from the England and Wales Cricket Board (ECB). Introduced in 1969, as the John Player Sunday League of 17 teams, the one-day, limited overs format was designed as a product variant of the traditional, and long established, three

day county championship tournament suffering from the inherent product weakness associated with traditional cricket, namely the high propensity for drawn matches (weather interrupted or not) and relative lack of concentrated and continuous action. The league has undergone many sponsorship and name changes over its existence, including the Axa Equity and Law League during the study period, and in 2000 the competition, currently named the Norwich Union League, was restructured to form two divisions linked by a system of relegation and promotion. The initial commitment to Sunday fixtures has been abandoned with fixtures played on any day with an increasing, though still limited, number of day-night matches part played under floodlights. Over the years other attempts to make league matches more attractive and spectator friendly have variously involved changing the regulations regarding the maximum number of overs to be bowled (currently 45) and introducing fielding restrictions and over rate penalties, as well as attempting to increase the theatricality of the occasion with coloured clothing (replacing the traditional all white kit) and more emblematic names to identify teams.

11.Generally recognised (though not necessarily fully understood by spectators, players or administrators!) as a fairer method than others to determine the result of interrupted matches the Duckworth-Lewis system involves a method of setting (and resetting) revised target scores for the team batting second when a limited overs match is forcibly shortened at any time after the match has commenced. The technicalities involved are described by the inventors themselves in Duckworth and Lewis (1998).

12.The nature of a limited overs cricket match makes it a prime candidate for analysing within-match strategies by batting and bowling teams, which can vary between innings as well as within innings, basically involving trade-offs between aggressive batting run rates and wicket loss, and between aggressive/defensive bowling and wicket taking and/or conceding runs. The question of optimum batting strategies has been explicitly treated by Clarke (1988) and Preston and Thomas (2000) The question of attacking/defensive play is noted in Schofield's (1988) study of English county cricket which identifies defensive bowling, in terms of restricting the opponents run scoring, as assuming greater importance than attacking bowling in the one-day county cricket league, together with aggressive batting shown to be more rewarding than mere run accumulation. Bairam *et al's* (1990a, 1990b) production function studies of Australian and New Zealand cricket also identify the strategic aspects generally employed in those countries' cricket competitions. Specifically they conclude that in the New Zealand case bowling performance is generally viewed as more important in the one-day game than in the unlimited overs counterpart. On a separate issue, cricket enthusiasts may also be interested in Kimber and Hansford's (1993) statistical approach to calculating a more refined measure of player batting averages.

13.Apart from producing curtailments it should be noted that weather conditions, particularly in the form of dampness and humidity, can influence the course of a game by affecting the state of the pitch and atmospheric conditions as well as the behaviour of the ball, with differing implications for batsmen, bowlers and fielders.

14.Over the two seasons 32 matches were abandoned with no result.

15.For example, during the 1997 season Derbyshire had six of their eight home fixtures scheduled for their regular county ground headquarters at Derby, with the remainder played at a different venue.

16.In his model of attendance demand for association football in Scotland, Jennett (1984) attempts to establish the *ex ante* significance of each league game by an *ex post* assessment of the number of points required to win the championship, in terms of the actual points eventually accumulated by the championship winner. As the season progresses and clubs drop out of contention, the games of those remaining take an ever greater significance. On this basis Jennett suggests a measure of outcome uncertainty based on the number of matches required to be won to win the league. For example, "taking the reciprocal of 'required' matches while teams remain in the championship race, implies a significance value of 0.1 where a team requires ten victories to win the league, but a value of 1.0 where the team requires to win merely the final championship deciding game" with a value of 0 indicating no significance. While the Jennett measure is not without its problems and critics it has become accepted, and regularly applied, as a standard proxy for match significance in terms of seasonal uncertainty of outcome.

17.This is chosen in preference to the more simplistic approach recording league positions of the two teams prior to a match.

18.As far as the second season (1997) data is concerned this would seem to support the Duckworth-Lewis claim that their method provides an appropriate system for determining the results of interrupted matches. See fn. 11.

19.We also experimented with other specifications of the match significance variable, including dummies for matches which were significant (on the Jennett measure) to both teams, to neither team, to the home team only, and to the away team only. All were found to be insignificant.

20.We also experimented with variables relating to results of previous home and away matches by the observed home and away teams respectively. Both were found to be insignificant. This may not be surprising given the more irregular fixture schedule in one-day cricket compared with the English football leagues which, together with the occurrence of cancelled and abandoned matches, means that there may be a considerable length of time between the relevant matches. In the case of the home team it should also be noted that two successive home matches might not be played at the same venue.

21.The insignificance of the DERBY variable also conforms with other evidence regarding the minimal effect of travel fatigue on the away team. See Courneya and Carron (1992).

22.In the only other study explicitly treating rule factors, Courneya and Carron (1990) investigate 'slo-pitch' softball where the rules involve the home team batting last, with their results indicating that there were no significant differences in the number of games won when batting first compared with last. The form of softball involved in their study, played at neutral venues, in local, municipal leagues allowed for control of a number of factors believed to contribute to home advantage. Crowds were small,

travel was limited and, crucially, both teams notionally alternated home/away status and the related batting order over two fixtures during a season.

23. Interaction dummy variables were also considered, such as a toss/order dummy variable, however they did not have a significant effect.

24. While crowd effects may be limited in domestic cricket this may not be the case in international Test Match cricket often, though not always, played in vast arenas with large, vociferous and intimidating crowds. The associated pressure on umpires in such circumstances (see Sumner and Mobley, 1981) has led to the relatively recent introduction of 'neutral' country umpires. A fuller study of pressure on officials could involve a detailed investigation of match-play statistics focusing on decisions requiring an explicit umpiring decision, in particular the contentious issue of L.B.W. However, while all dismissals are recorded for each match there is no record of 'not out' decisions given in favour of the batsmen in response to appeals, whether reasonable or unreasonable, from the fielding side.

25. See, for example, *'India demand semi switch'* (Guardian Unlimited, 6/3/03), which refers to India's official approach to the International Cricket Council requesting that the second World Cup semi-final be changed from a day-nighter into a day game, on the grounds that they fear that 'the toss could have a huge influence on the result'.
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Table 1. *Variable definitions*

Variable	Definition
RESULT	1 for home win, 0 for away win
TOSS	1 for home team winning toss, 0 otherwise.
ORDER	1 for home team batting first, 0 otherwise.
VENUE	1 for occasionally used home venue, 0 otherwise.
CURTMATCH	1 if match curtailed by weather conditions, 0 otherwise.
HJENN	Jennett measure of match significance for home team.*
AJENN	Jennett measure of match significance for away team.*
H%POINTS	Accumulated seasonal points total of home team from all matches prior to observed fixture as a percentage of maximum aggregated match points possible from those matches.
A%POINTS	Accumulated seasonal points total of away team from all matches prior to observed fixture as a percentage of maximum aggregated match points possible from those matches.
MEM%	Percentage of attendance at match comprising of home team members.
ATTEN	Total attendance at match.
DERBY	1 if derby match, 0 otherwise.
HOLIDAY	1 if match played on bank holiday, 0 otherwise.

Notes:
* See fn. 6.

Table 2. *Logit results for home advantage in limited overs cricket*
Dependent Variable is Result

Variable	1	2	3	4
Toss	0.337**	0.380*	-0.182	
	(1.671)	(1.982)	(0.686)	
Order	0.143		-0.164	
	(0.690)		(0.602)	
Venue	-0.311	-0.260	-0.297	
	(0.983)	(0.844)	(0.859)	
Curt	0.018	0.046	-0.073	
	(0.056)	(0.144)	(0.198)	
Hjenn			1.524	2.403**
			(1.086)	(1.711)
Ajenn			-3.081*	-3.596*
			(2.190)	(2.730)
Hpoints			0.486	0.691*
			(0.832)	(2.065)
Apoints			-0.729	
			(1.279)	
Mem			0.534	
			(0.931)	
Atten			0.123	
			(1.256)	
Derby			0.387	
			(1.110)	
Holiday			-0.458	
			(0.988)	
LL	-184.552	-184.790	-161.033	-164.572
R^2	54%	53%	62%	63%

Notes:
See text for variable definitions.
T-statistics are in parentheses.
**denotes significance at 5%, * at 10%.
LL is the Log Likelihood function.
R^2 is the percentage of correctly predicted outcomes, sometimes termed the pseudo-R^2.
n = 270 for estimations 1 and 2, and n = 250 for estimations 3, 4 and 5 due to the absence of observations for H%POINTS and A%POINTS for the first seasonal match for a team.

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[23] Interaction dummy variables were also considered, such as a toss/order variable, however they did not have a significant effect.
[24]