OBJECTIVE MEASURES OF PERFORMANCE IN THE WORLD CUP OF CRICKET.

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ABSTRACT

Since luck can play a big part in tournament success, team management should use more objective measures of performance. A Linear model is used to fit least squares ratings to margins of victory in the World Cup of cricket. The Duckworth/Lewis (D/L) rain interruption rules are applied to second innings victories to create a margin of victory in runs, equivalent to that for the team batting first. Results show that while the better teams progressed through the first round of the competition, some injustices occurred in the Super-Six round. Ordering teams by average margin of victory in runs gives similar results to the linear model, and its official publication and use as a tie breaker is suggested.

INTRODUCTION

The 1999 World Cup of (one-day) cricket was contested by 12 teams comprising the nine test match playing countries plus Scotland, Kenya and Bangladesh. These were 'seeded' and divided into two groups. Group A comprised Sri Lanka, India, South Africa, England, Zimbabwe and Kenya. Group B comprised Australia, West Indies, Pakistan, New Zealand, Bangladesh and Scotland. After the round robin group matches, the top three teams from Group A (South Africa, India and Zimbabwe) and Group B (Pakistan, Australia and New Zealand) progressed to the Super-Six, where they played each team from the other group. They also carried forward any points scored against the other qualifying teams in their group matches. This ensured the Super-Six round was effectively a round robin between the six teams. The top four teams at the end of the Super-Six phase, Pakistan, Australia, South Africa and New Zealand, played a seeded knockout tournament, which ultimately saw Australia defeat Pakistan in the final.

In this paper we use linear modeling techniques to rate the teams. To reward teams for strength of victory we use the winning margin as the dependant variable, rather than a 1-0 win loss variable. This requires rationalizing the two forms of winning margin currently used in cricket with an innovative use of the D/L rain interruption rules.

WINNING MARGIN USING THE D/L RAIN INTERRUPTION RULES

In test cricket different margins of victory are quoted depending on whether the team batting last wins or loses. Although inappropriate, these are also used in one-day cricket. If the team batting first wins, the margin of victory is recorded in runs as the difference between the two scores. If the team batting second wins, they do not complete their innings and the margin of victory is given as the number of wickets in hand. The margin can be quite misleading as to the superiority of the victory. For example, in a Super-Six match Australia defeated South Africa, by five wickets. While this appears to be convincing, Australia hit the winning runs with only two balls to spare, and was lucky to win one of the closest matches of the tournament.

Clarke (1998) suggested the D/L rain interruption rules could be used to provide a better method of declaring the winning margin in one-day matches. The statistically based method proposed by Duckworth and Lewis (1998; 1999) for declaring a winner in rain interrupted matches relies on formula based tables which show the available resources (balls to go and wickets in hand) a team has remaining at any stage of the game. When applied to a rain interruption, the D/L method calculates new target scores depending on the resources the team lost during the interruption. For our purposes, the D/L method can be used to project the score of the second innings at the time they passed the first innings score, to the score they could be expected to achieve if they completed the 50 overs. The resulting margin of victory is greater the more wickets and overs a second innings team has in hand, and can thus be given as a number of runs, the same as with first innings wins. Allsopp and Clarke (2000) explore this further.
ANALYSIS OF THE GROUP MATCHES PHASE

We model the margin of victory $w_{ij}$ of team $i$ batting first against team $j$ batting second as

$$w_{ij} = u_i + h - u_j + \epsilon_{ij}$$

(1)

where $u_i$ is a measure of the ability of team $i$, $h$ is the advantage (or disadvantage, if negative) of the team batting first and $\epsilon_{ij}$ is a zero mean random error. Since the $u_i$ are relative, we require an additional constraint, and here we choose they average 100. By defining indicator variables, PROC REG from SAS 6.12 can be used to fit model (1) to the margins of victory for Groups A and B. Since the group matches are independent, we need two restriction equations for the ratings, so we restrict the average ratings of the teams in each group to equal 100. We also assume any advantage in batting first is common to the two groups. The resulting ratings for Group B are given in Table 1.

<table>
<thead>
<tr>
<th>Team</th>
<th>Ratings</th>
<th>Model rank</th>
<th>Adjusted Ratings</th>
<th>Tournament rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paki</td>
<td>117</td>
<td>4</td>
<td>152</td>
<td>1</td>
</tr>
<tr>
<td>Aust</td>
<td>139</td>
<td>1</td>
<td>137</td>
<td>2</td>
</tr>
<tr>
<td>Wind</td>
<td>131</td>
<td>3</td>
<td>124</td>
<td>3</td>
</tr>
<tr>
<td>Bang</td>
<td>132</td>
<td>2</td>
<td>121</td>
<td>4</td>
</tr>
<tr>
<td>Scot</td>
<td>61</td>
<td>5</td>
<td>42</td>
<td>5</td>
</tr>
</tbody>
</table>

The analysis suggests that in the group matches phase of the tournament both England and the West Indies were unlucky to be eliminated. For example, in Group B, the West Indies are rated marginally ahead of New Zealand and 15 ahead of Pakistan. However, assuming each group is equal, the ratings also produce a ranking independent of group. This suggested four teams from Group B should have advanced, and only two from Group A. This would see the West Indies as the replacement for Zimbabwe in the Super-Six teams rather than England.

Although Pakistan is only ranked fourth in Table 1, they, finished first in Group B. There were two preliminary matches in Group B that warrant further examination. When Bangladesh beat the previously unbeaten Pakistan by 62 runs in the second last match, Pakistan was assured of top place in Group A by virtue of its unbeaten record, and Bangladesh was guaranteed to finish fifth in the group. Thus the match was immaterial to progress in the World Cup, and only team pride was at stake. The match result may not be a true reflection of the team abilities and should be ignored. In the Australia versus West Indies match it was reported in The Age (1/6/99) that Australia blatantly manipulated the match and from over 28 purposely adopted a 'go-slow' approach to ensure that the West Indies, rather than New Zealand qualified for the Super-Six. The D/L model can be used to determine what Australia would have achieved if they had not adopted a 'go-slow' approach. If we repeat the analysis with the consequent adjustment to the margin of victory and the omission of the Pakistan versus Bangladesh match we obtain the adjusted ratings displayed in Table 1. In this case the ratings are in the same order as the tournament rankings.

SUPER-SIX AND FINALS MATCHES

The ratings resulting from including all Super-Six and finals matches are given in Table 2. As the Australian go-slow was well documented in the press and admitted by the Australian captain, the Australia - West Indies match has been adjusted as outlined above. As reasons for Pakistan's poor showing against Bangladesh were conjecture, this result has been allowed to stand. However, it could be argued that in the following analysis Pakistan's true ability is somewhat higher than the actual rating.

Overall, the team batting first gained an advantage of 9 runs, which is not statistically significant ($p = 0.48$). While the tournament has ultimately given the World Title to the team the model rates the best, only two of the top four teams
made the semi-finals, and the second best team failed to reach the final. Many of the differences in the two results can be traced back to the carrying forward of match results from the group matches to the Super-Six rounds. The two teams most disadvantaged by this were India and Australia, who carried no points through (or alternatively, their only two losses were counted twice). While Australia overcame this handicap, they were on the point of elimination throughout the super-six rounds. The teams most advantaged were Pakistan and Zimbabwe, who both carried two wins through to the Super-Six. During the Super-Six Zimbabwe had no wins, and Pakistan's only win was over Zimbabwe.

### TABLE 2

<table>
<thead>
<tr>
<th>Team</th>
<th>Aust</th>
<th>SthAf</th>
<th>Wesl</th>
<th>India</th>
<th>NewZ</th>
<th>Paki</th>
<th>Engl</th>
<th>Zimb</th>
<th>Bang</th>
<th>Sril</th>
<th>Keny</th>
<th>Scot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>164</td>
<td>147</td>
<td>136</td>
<td>130</td>
<td>124</td>
<td>100</td>
<td>79</td>
<td>71</td>
<td>59</td>
<td>32</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Mean margin of victory</td>
<td>51</td>
<td>37</td>
<td>27</td>
<td>30</td>
<td>13</td>
<td>9</td>
<td>1</td>
<td>-29</td>
<td>-37</td>
<td>-40</td>
<td>-69</td>
<td>-92</td>
</tr>
<tr>
<td>Actual final rank</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

Although Model I correctly allows for quality of opponent in rating performance, in many tournaments this averages out. In these cases an average margin of victory may be an acceptable measure of rating teams. Table 2 also gives the average margins of victory for each team. The subsequent rankings are in exact agreement with those given by the linear model. This suggests the average follower could arrive at reasonable conclusions by working with the average (unsigned) margin of victory, and that margin of victory could be used as a tie breaker. Margin of victory is a natural measure, similar to goal difference used in soccer, and is easy to manipulate. However, its use requires the official bodies to publish the calculated D/L figure in second innings victories.

### CONCLUSIONS

It is apparent the D/L method is useful not just for dealing with rain-interrupted matches but for predicting a second innings team's score when they have won a match. This could be used to give a margin of victory in runs that is equivalent to the quoted margin for a first innings victory. Were this figure quoted regularly, fans could better judge the winners superiority. When investigating topics such as cricket ratings, home advantage, advantage of winning the toss, etc it provides a more sensitive measure than win or loss.

While the linear regression method demonstrated would probably be too much of a 'black box' for cricket administrators, reasonable results might be obtained by using average margin of victory. While such a method downgrades the importance of winning, it would always encourage attacking play by both teams, as they are rewarded for runs and wickets. One-day cricket is designed to be entertaining, and methods that encourage bright cricket are to be encouraged. The use of average margin of victory should at least be investigated for breaking ties. This is a simple statistic that is easily calculated and understood provided the margin of victory is published for each match.

While the format adopted by the World Cup organizers was successful in crowning the top team, there were some anomalies in the final rankings. The rules chosen by tournament organizers are not the only means of measuring achievement. Other more objective and fairer measures of achievement may be appropriate.

### REFERENCES


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