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A METHOD FOR THE COMPARISON OF THE BOWLING PERFORMANCES OF BOWLERS IN A MATCH OR A SERIES OF MATCHES

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ABSTRACT

The combined bowling rate (CBR) has been developed (Lemmer, 2002) as a single measure to assess the bowling performance of a bowler. Its calculation makes use of O, the number of overs bowled, R, the number of runs conceded and W, the number of wickets taken. It was, however, mentioned that it might be desirable to weight the wickets of top order batsmen higher than those of lower order batsmen. This is especially important if one wants to compare the bowling performances of the bowlers in a single match because it is far more difficult to get a top quality batsman out than a tail-ender. Normally a bowler claiming the top three batsmen's wickets ought to get much more credit than one who gets the three tail-enders' wickets. This can be accomplished by giving weights to the wickets and replacing W, the number of wickets taken, in the CBR formula by W, the sum of the weights of the wickets taken by the bowler. This paper develops suitable weights and uses these to rate the bowlers who were involved in the 2003 npower Test series between South Africa and England. From the results the need is observed for a measure that is more sensitive to a bowler's ability to take wickets and this is resolved by means of a modification of CBR. The dynamic bowling rate (DBR) is defined and is used to give the final ratings.*

Key words: Bowlers; Bowling performance; Combined bowling rate; Cricket; Comparison of bowlers; Dynamic bowling rate; Weights in the calculation of CBR and DBR.

INTRODUCTION

In the development of the combined bowling rate (CBR), it was emphasised (Lemmer, 2002) that a bowler must have bowled a sufficient number of overs (say at least 100) before reasonable comparisons can be made. The rationale was that if a bowler has bowled a large number of overs and taken many wickets, he would have bowled against batsmen of various abilities (top and lower order batsmen) under a variety of circumstances on all kinds of pitches and in different countries. This would have resulted in a balancing-out effect of most factors determining the success of the bowler. But in the case of a small number of overs bowled, these arguments are not realistic. It is therefore necessary to weight the wickets taken by the bowler.

In the selection of a team it is not only useful to compare bowlers by means of measures such as CBR based on career figures, but it is also very important to take into account each bowler's recent form, i.e. how he has bowled in his last one or two matches. There is therefore a need to adjust CBR to be applicable after an individual match or a short series of matches.

The main purpose of this study is to provide a useful yet simple aid for selecting teams. The bowling measure must enable selectors to use simple match statistics. It must be easy to apply and make the use of complicated calculations unnecessary.

METHODS

In W, each wicket has a weight of one – one simply counts the number of wickets taken by the bowler. A method will be described to determine the weights of the different wickets. Weights will be allocated according to the batting positions of the batsmen. Theoretically, it would be desirable to attach a weight to each batsman individually, e.g. by making use of BP, a measure developed by Lemmer (2004) to assess the batting performance of a batsman, but this will make the procedure much too complicated for practical use. It will be much simpler to use BP to attach weights to batsmen according to their batting positions and use these weights regardless of the specific batsmen involved.

A pragmatic way to allocate weights could be to reason that the top four or five positions are occupied by specialist batsmen, the sixth to eighth positions by all-rounders and positions nine to eleven by specialist bowlers. It can thus be expected that the top four or five batsmen would be equally good and the rest would show a systematic decline in batting ability. If the top batsmen were equally good, it is fair to reason that the opening batsmen will not perform as well as those following them because the former have to face the new ball and fast bowlers who are still fresh. Although the two opening batsmen perform the same function in the team, batting statistics (shown later in Figures 1 and 2) indicate that the one who faces the first ball (occupying batting position one) does not perform as good than the other one. It would thus be natural that there will be a gradual increase in performance from the first until the fourth or fifth batsmen and then a gradual decline further down the batting order. To allocate weights, however, remains a problem and should rather be solved by making use of batting performance data.

A data set consisting of the batting statistics of all the current one-day international (ODI) players was taken from Cricinfo (2003a) on 23 July 2003. Those who have batted in at least 20 ODI innings each – a requirement for the calculation of BP – were taken from the data set. For each of these 142 players, the following statistics were calculated: the average batting position (AVEPOS), the median batting position (MEDPOS), the modal batting position (MODPOS) and the batting performance (BP). These statistics were used to calculate weights for the different batting positions.

CALCULATION OF WEIGHTS

For each player the average, median and mode were calculated for his batting position. Due to the fact that the mode is always an integer and the median almost always (it is sometimes a value halfway between two integers), it was not surprising to find that for the vast majority of players, MEDPOS and MODPOS were equal and AVEPOS close to this joint value. Plots of BP against each of these measures yielded very similar results. From a statistical point of view (Kenney & Keeping,1954: 53), the average is the best measure to use. It was then decided to pursue the work on AVEPOS only.

By looking at a plot of BP against AVEPOS, it was difficult to judge the functional form underlying the relationship between BP and AVEPOS. By making use of distance-weighted least squares in Statistica, a curve was fitted to the data. In this method a polynomial (second-order) regression is calculated for each value on the X variable scale to determine the corresponding Y value such that the influence of the individual data points on the regression decreases with their distance from the particular X value. This method has been developed in three-dimensional space where the height of a surface is given at a number of points. The points are assumed to be completely arbitrary and not arranged on a rectangular or other mesh. The interpolation method uses a weighting technique with weights depending on the distances of the data points; however the weights do not determine the height directly, but are used with a least squares fit to find the coefficients of a quadratic polynomial to act as an approximation to the surface. For a detailed description see McLain (1974). Looking at the curve in Figure 1, it appears as if there is an almost linear relation from positions one to four and again from positions five to eleven. Due to its construction, however, no explicit formula can be given for this curve.

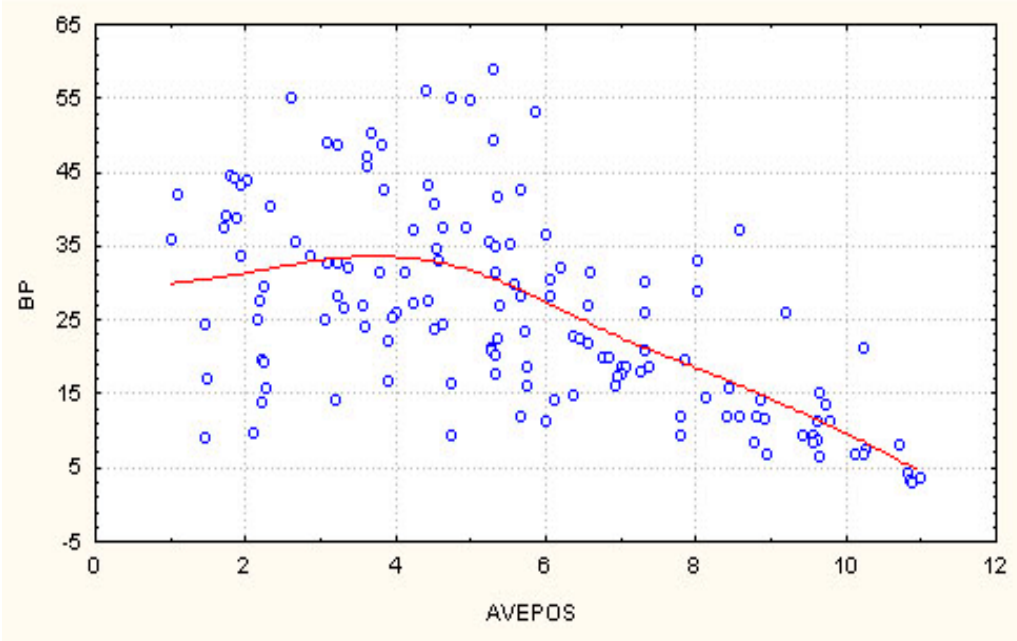

FIGURE 1. **RELATIONSHIP BETWEEN BP AND AVEPOS IN THE CASE OF ONE-DAY INTERNATIONALS**

Various mathematical functions have also been fitted to the data, e.g. a second, third, fourth and fifth degree polynomial and an exponential curve. None yielded satisfactory results. The third, fourth and fifth degree polynomials gave vastly different weights to the two opening batsmen. The second-degree polynomial gave a very low weight to batsman eleven – less than one fifth of the weight allocated to batsman number ten. From all the figures drawn, it was

clear that the distance-weighted least squares curve was the best one to use. Then a program was written to fit a straight line up to a change-point at 4.5 and a second straight line thereafter, i.e. two straight lines with a change-point. This yielded much more satisfactory results. According to the coefficient of determination r^2 this line gave a better fit than all the other curves and also lead to weights in accordance with the pragmatic approach mentioned before. Although $r^2 = 0.41$ does not indicate a very good fit, this comprehensive method is obviously better than simply calculating averages per batting position. The weights allocated were found by scaling down the estimated BP values obtained from the curve such that the weights add up to eleven, as shown in the first three columns of Table 1.

TEST MATCHES

The same procedure was followed for a data set consisting of all the current Test players taken on 23 July 2003 from Cricinfo (2003b). Players from India, Pakistan and Sri Lanka could not be included because their BP values could not be calculated due to the unavailability of their strike rates. The data set consisted of 90 players who had played at least 20 test innings each.

The distance-weighted least squares curve of BP against AVEPOS is given in Figure 2. This curve again appeared to provide the best description. The polynomial fits again yielded unacceptable results, including negative weights allocated to some low order batsmen!

TABLE 1. **WEIGHTS OF WICKETS ACCORDING TO THE BATTING POSITION**

Batting Position	One-Day Internationals		Test Matches	
	Estimated BP value	Weight	Estimated BP value	Weight
1	30.1621	1.30	33.2701	1.20
2	31.3295	1.35	36.3794	1.31
3	32.4969	1.40	39.4886	1.42
4	33.6643	1.45	42.5979	1.53
5	31.9607	1.38	40.9890	1.47
6	27.3861	1.18	34.6621	1.25
7	22.8115	0.98	28.3352	1.02
8	18.2369	0.79	22.0082	0.79
9	13.6623	0.59	15.6813	0.56
10	9.0877	0.39	9.3544	0.34
11	4.5131	0.19	3.0275	0.11
Total	255.3111	11.00	305.7936	11.00

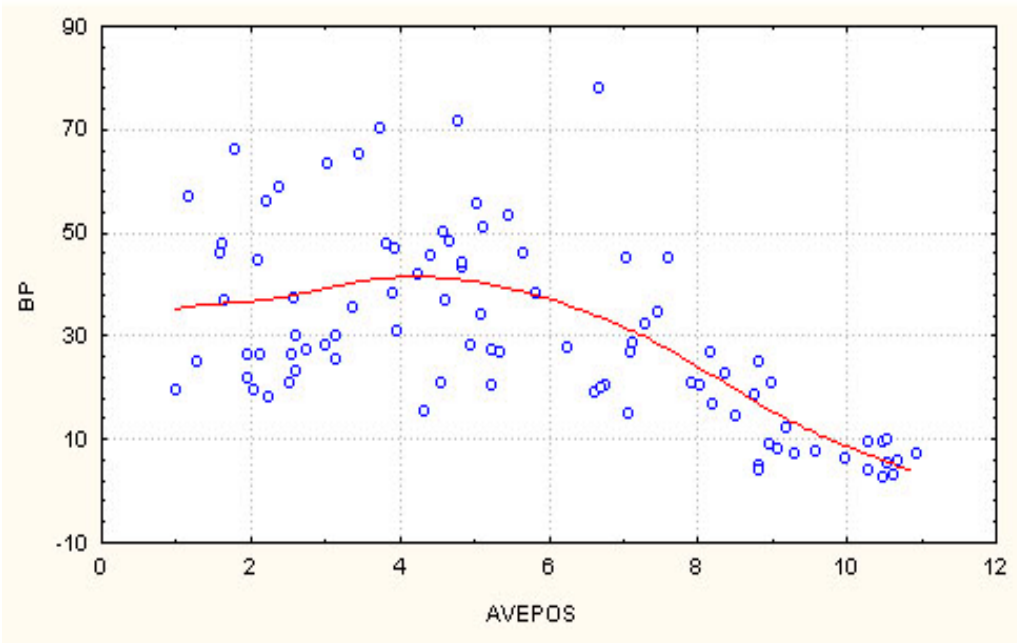

FIGURE 2. **RELATIONSHIP BETWEEN BP AND AVEPOS IN THE CASE OF TESTS**

A change-point straight line fit was again used with a change-point at 4.5 (using a change-point at 5.5 gives batsman number ten a weight more than ten times that of batsman number eleven!). The weights allocated are given in Table 1.

APPLICATION

The bowling results of the npower Test series between South Africa and England played in July, August and September 2003 has been used to examine the effect of the weights proposed in this article.

In the formula of

$$CBR = 3R/(W + O + W.R/B)$$

where $B = 6 \times O$, the legitimate number of balls bowled, the number of wickets taken is denoted by W and now the total weight of those wickets is denoted by W*. The combined bowling rate based on these weights is given by

$$CBR^* = 3R/(W^* + O + W^*.R/B)$$

The bowlers of both teams have been ranked according to CBR* in every individual Test match played. Despite the desirable results obtained from the use of the weights, it was found that CBR* still gave ratings very similar (but not necessarily identical) to the economy rate E, as was the case with CBR. In personal communication with cricket experts, including Andrew Samson, official statistician of the United Cricket Board of South Africa, it was agreed that a modified version of CBR would be useful (Samson, 2003).

In the construction of CBR the approach was that the average, A=R/W, the economy rate, E=R/O, and the strike rate, S=6 x O/W, were equally important and should therefore have equal weights (before going through the process of standardisation described in Lemmer, 2002). Using weights in the ratio 1:1:1 for the standardised values of A, E and S it has been shown (Lemmer, 2002: 39-40) that CBR is a weighted average between A, E and S:

$$CBR = (W.A + O.E + T.S)/(W + O + T)$$

with T = W.R/B. In order to get a measure that would be less sensitive to E but more sensitive to S, it was decided (after very extensive investigations) that E should be scaled down by 50% and the weight of S should be doubled, resulting in weights 2:1:4 for the standardised values of A, E and S. Define

$$DBR = (2W.A + O.E + 4T.S)/(2W + O + 4T)$$

$$= 7R/(2W + O + 4W.R/B)$$

which will be called the dynamic bowling rate, and

$$DBR^* = 7R/(2W^* + O + 4W^*.R/B)$$

for use in the case of fewer than one hundred overs bowled per bowler. In the case of Test matches a bowler's ability to take wickets is very important because a match can only be won if all the opponent's wickets are taken. Therefore the dynamic bowling rate is a better measure to use than CBR. In the case of limited overs matches, however, CBR could be used because then the number of runs conceded must be kept low even though not all wickets are taken.

ILLUSTRATIVE EXAMPLES

The first Test match was played at Edgbaston, Birmingham from 24 to 28 July 2003 and ended in a draw. The bowling results obtained from Cricinfo (2003c) are given in Table 2. For each bowler, the number of wickets taken is given under W, the position numbers of the batsmen claimed by the bowler are given under 'wickets' and the total weight of those wickets is given under W*. The combined bowling rate based on these weights is given by CBR* and the dynamic bowling rate by DBR*. The economy rate of each bowler is given under E. All the bowlers who had bowled are included in the comparison, but those who had bowled fewer than twenty overs in a test are not included in the ranking, which is done according to DBR*. The requirement of at least twenty overs bowled is intended to exclude from the ranking those bowlers who had bowled very few overs compared to the rest.

TABLE 2. **COMPARISON OF BOWLERS IN FIRST TEST MATCH**

Rank	Name	O	R	W	Wickets	W*	CBR*	DBR*	E
1	Pollock	34.4	57	2	4,8	2.32	4.58	9.59	1.66
2	Peterson	35	90	1	2	1.31	7.32	15.80	2.57
3	Willoughby	20	46	0	-	0	6.90	16.10	2.30
4	Pretorius	35	135	4	2,5,6,7	5.05	9.35	16.27	3.86
5	Giles	50	198	4	1,1,3,5	5.29	10.11	18.59	3.96
6	Gough	25	88	1	4	1.53	9.63	19.46	3.52
7	Harmison	33	138	2	3,5	2.89	10.92	20.63	4.18
8	Ntini	32	152	4	1,3,9,10	3.52	11.90	21.20	4.75
9	Anderson	26	129	1	2	1.31	13.63	27.40	4.96
10	Flintoff	27	113	0	-	0	12.56	29.30	4.19
Too few overs	Vaughan	8	26	1	2	1.31	7.79	13.52	3.25
Too few overs	Butcher	2	15	0	-	0	22.5	52.50	7.5

The reader might be surprised that Ntini is down in position eight. Compare him with Pretorius, who also took four wickets with a weight of 5.05 compared to Ntini's 3.52. Furthermore, Pretorius was more economical than Ntini – he conceded fewer runs than Ntini despite bowling more overs. In all respects, Pretorius bowled better than Ntini. Pollock, on the other hand, was extremely economical and although he took only two wickets, he was ranked first among all the bowlers. Economy is his main strength. If he bowls from one side and Ntini from the other, cricket commentators have repeatedly pointed out that the batsmen are restricted from scoring by Pollock and then try to score from Ntini, which often leads to risky shots that claim their wickets. Ntini's strength is his strike rate, which is very good and compensates to some extent for his high economy rate.

The second Test match was played at Lord's, London from 31 July to 3 August 2003 and was won by South Africa by an innings and 92 runs. The bowling results obtained from Cricinfo (2003c) are given in Table 3.

Ntini shared the Man of the Match award with Graeme Smith because he took 10 wickets albeit at the expense of an economy rate of 4.58 runs per over. Had the ranking been done according to CBR*, Ntini would have been in position six, which could not be seen as very realistic. This was part of the motivation in favour of DBR*. Andrew Hall did exceptionally well by taking five wickets at an economy rate of 2.47. According to DBR* he performed even better than Ntini. That this conclusion is fully justified can be seen by also looking at the other two individual measures. Let A*=R/W* denote the adjusted average and S*=6 **x** O/W* the adjusted strike rate. Then A*=12.88 for Hall, which is much better than A*=21.51 for Ntini, while S*=31.29 for Hall is nearly as good as Ntini's S*=28.15. This and other similar comparisons give convincing evidence that DBR* has the desired effect of giving sufficient prominence to strike bowlers without distorting the balance between A, E and S.

The third Test match was played at Trent Bridge, Nottingham from 14 to 18 August 2003 and was won by England by 70 runs. The bowling results obtained from Cricinfo (2003c) are given in Table 4.

TABLE 3. **COMPARISON OF BOWLERS IN SECOND TEST MATCH**

Rank	Name	O	R	W	Wickets	W*	CBR*	DBR*	E
1	Hall	34	84	5	2,3,4,5,8	6.52	5.83	10.18	2.47
2	Ntini	48	220	10	1,4,6,8,10,1,2,6,7,10	10.23	9.99	15.44	4.58
3	Pollock	43.4	133	4	5,9,3,9	4.01	8.07	15.62	3.06
4	Anderson	27	90	2	1,6	2.45	8.76	16.87	3.33
5	Flintoff	40	115	1	5	1.47	8.18	17.59	2.88
6	Giles	43	142	1	4	1.53	9.39	20.11	3.30
7	Adams	23.1	93	1	7	1.02	11.25	23.35	4.03
8	Harmison	22	103	1	2	1.31	12.70	25.11	4.68
9	Gough	28	127	0	-	0	13.61	31.75	4.54
Too few overs	McGrath	11	40	1	3	1.42	9.04	16.20	3.64
Too few overs	Butcher	6	19	0	-	0	9.50	22.17	3.17
Too few overs	Pretorius	7	36	0	-	0	15.43	36.00	5.14

TABLE 4. **COMPARISON OF BOWLERS IN THIRD TEST MATCH**

Rank	Name	O	R	W	Wickets	W*	CBR*	DBR*	E
1	Pollock	53.4	104	8	2,4,1,2,4,7,8,11	8.8	4.80	8.83	1.95
2	Kirtley	47.2	114	8	3,5,1,3,6,7,9,10	8.68	5.76	10.16	2.42
3	Adams	26.3	46	2	6,10	1.59	4.87	10.28	1.75
4	Anderson	39.5	119	7	4,6,8,9,10,4,5	7.47	7.04	12.00	3.01
5	Hall	30	94	5	1,7,8,3,5	5.9	7.23	12.16	3.13
6	Harmison	28	66	2	2,2	2.62	6.26	12.37	2.36
7	Flintoff	50	145	3	1,7,8	3.01	7.99	16.41	2.90
8	Kallis	37	128	2	5,6	2.72	9.30	18.39	3.46
9	Ntini	46	165	3	3,9,9	2.54	9.89	20.21	3.59
Too few overs	Vaughan	1	0	0	-	0	0	0	0
Too few overs	Giles	10	24	0	-	0	7.20	16.80	2.40

Kirtley was awarded Man of the Match. The only logical explanation could be that he performed well in his first test match. He took eight wickets (weight = 8.68) but Pollock also

took eight wickets with a weight of 8.8. Pollock bowled more overs than Kirtley but conceded fewer runs. Kirtley's strike rate was better than Pollock's, but according to every other bowling criterion, Pollock did better than Kirtley.

The fourth Test match was played at Headingley, Leeds, from 21 to 25 August 2003 and was won by South Africa by 191 runs. The bowling statistics obtained from Cricinfo (2003c) are given in Table 5.

TABLE 5. **COMPARISON OF BOWLERS IN FOURTH TEST MATCH**

Rank	Name	O	R	W	Wickets	W*	CBR*	DBR*	E
1	Kallis	37.1	92	9	1,3,5,2,3,4,7,8,9	10.72	5.282	8.44	2.48
2	Ntini	31.2	102	5	2,7,8,1,6	5.57	7.687	13.11	3.27
3	Bicknell	49	125	4	2,4,1,9	4.6	6.750	13.25	2.55
4	Flintoff	40	118	4	7,8,5,7	4.3	7.627	14.48	2.95
5	Kirtley	51.3	145	5	1,11,2,4,11	4.26	7.556	14.96	2.83
6	Ali	36	136	5	3,5,6,3,10	5.9	8.944	15.19	3.78
7	Hall	45.4	141	4	9,10,5, 10	2.71	8.543	17.49	3.11
8	Anderson	34	119	2	9,6	1.81	9.684	19.91	3.50
9	Pretorius	28	127	1	6	1.25	12.618	25.93	4.54
Too few overs	Rudolph	2	1	1	4	1.53	0.820	1.26	0.50
Too few overs	Vaughan	5	13	0	-	0	7.8	18.20	2.60
Too few overs	Zondeki	1.5	10	0	-	0	20	46.47	6.67

Kallis bowled extremely well and took nine wickets with a weight of 10.72. According to all the bowling criteria, he was by far the best bowler. Note, however, that Rudolph had a DBR* value of 1.26, which was the best, but this was obtained after only two overs. Obviously it would not be fair to compare his figure with those of bowlers who had bowled more than 40 or 50 overs.

The fifth and final Test match was played at the Oval in London from 4 to 8 September 2003 and was won by England by nine wickets. The series was drawn with two each. For the bowling statistics obtained from Cricinfo (2003c), see Table 6.

Harmison and Bicknell were responsible for getting the South Africans out cheaply in their second innings by taking four wickets each. Although Bicknell took six wickets in the match compared to four by Harmison, the latter was so much more economical that he ranked first compared to Bicknell's second place. In this match, Ntini's aggressive bowling resulted in a very bad economy rate and he could get only one wicket.

TABLE 6. **COMPARISON OF BOWLERS IN FIFTH TEST MATCH**

Rank	Name	O	R	W	Wickets	W*	CBR*	DBR*	E
1	Harmison	46.2	106	4	3,4,8,11	3.85	6.172	12.41	2.29
2	Bicknell	44	155	6	6,7,1,6,7,9	6.3	8.611	15.20	3.52
3	Pollock	45	126	3	2,6,9	3.12	7.625	15.46	2.8
4	Hall	35	111	2	3,5	2.89	8.448	16.57	3.17
5	Kallis	39.2	142	3	4,8,2	3.63	9.462	18.00	3.62
6	Giles	39	138	2	2,3	2.73	9.552	18.98	3.54
7	Anderson	35	141	3	5,11,2	2.89	10.620	20.33	4.03
8	Flintoff	25	101	2	9,5	2.03	10.670	20.48	4.04
9	Ntini	39	175	1	1	1.2	12.775	27.23	4.49
10	Adams	20	99	1	7	1.02	13.586	27.28	4.95
Too few overs	Rudolph	6	28	0	-	0	14.000	32.67	4.67
Too few overs	Vaughan	5	24	0	-	0	14.400	33.60	4.8
Too few overs	Butcher	3	18	0	-	0	18.000	42.00	6

TABLE 7. **TEST SERIES: RANKING ACCORDING TO ADJUSTED AVERAGE**

Rank	Name	O	R	W	W*	A*	E	S*
1	Kirtley	98.5	259	13	12.94	20.02	2.63	45.67
2	Kallis	113.3	362	14	17.07	21.21	3.20	39.82
3	Pollock	176.2	420	17	18.25	23.01	2.38	57.93
4	Hall	144.4	430	16	18.02	23.86	2.98	48.08
5	Bicknell	93	280	10	10.9	25.69	3.01	51.19
6	Ntini	196.2	814	23	23.06	35.30	4.15	51.05
7	Anderson	161.5	598	10	15.93	37.54	3.70	60.83
8	Harmison	129.2	413	9	10.67	38.71	3.20	72.65
9	Pretorius	70	298	5	6.3	47.30	4.26	66.67
10	Giles	142	502	7	9.55	52.57	3.54	89.21
11	Flintoff	182	592	10	10.81	54.76	3.25	101.02
12	Adams	69.4	238	4	3.63	65.56	3.43	114.71
13	Gough	53	215	1	1.53	140.52	4.06	207.84

Finally, the bowling figures of all five Test matches are combined in order to compare the performances of the bowlers in the series as a whole. The three bowling criteria used by cricket authorities are shown firstly, but instead of using W, the number of wickets taken, the adjusted number of wickets, W*, is used.

Who was the best bowler in the series? Was it Ntini, who took the most wickets - 23? What about the bowlers who did not play in all the test matches, like Kirtley who only played in two test matches and took 13 wickets? In a comparison like this, one should be more sophisticated

and base one's decision on rational criteria. This study will provide rankings according to the three customary bowling criteria separately, and finally according to the dynamic bowling rate, DBR*, which will be the final answer.

Firstly, the bowlers are ranked according to the adjusted average, A* = R/W* – see Table 7.

Kirtley comes out best, followed by Kallis, Pollock, Hall, Bicknell, Ntini, Harmison, Pretorius, Giles, Flintoff, Anderson, Adams and Gough.

The economy rate E = R/O needs no adjustment because it does not depend on W* and is also given in the table. The ranking according to E is: Pollock, Kirtley, Hall, Bicknell, Kallis, Harmison, Flintoff, Adams, Giles, Anderson, Gough, Ntini, Pretorius.

The adjusted strike rate S* = 6 **x** O/W* is also given in Table 7. According to S* the order is Kallis, Kirtley, Hall, Ntini, Bicknell, Pollock, Pretorius, Harmison, Giles, Anderson, Flintoff, Adams, Gough.

*TABLE 8***. TEST SERIES: RANKING ACCORDING TO DBR***

Rank	Name	O	R	W	W*	DBR*	DBR
1	Pollock	176.2	420	17	18.25	12.16	12.39
2	Kirtley	98.5	259	13	12.94	12.33	12.31
3	Kallis	113.3	362	14	17.07	13.79	14.81
4	Hall	144.4	430	16	18.02	13.92	14.46
5	Bicknell	93	280	10	10.9	14.34	14.73
6	Harmison	129.2	413	9	10.67	16.68	17.38
7	Anderson	161.5	598	10	15.93	17.99	20.30
8	Flintoff	182	592	10	10.81	18.25	18.53
9	Ntini	196.2	814	23	23.06	18.61	18.63
10	Giles	142	502	7	9.55	19.14	20.37
11	Adams	69.4	238	4	3.63	19.61	19.25
12	Pretorius	70	298	5	6.3	20.76	22.15
13	Gough	53	215	1	1.53	25.00	26.08
Too few overs bowled							
	Rudolph	8	29	1	1.53	13.76	16.35
	Ali	36	136	5	5.9	15.19	16.25
	Peterson	35	90	1	1.31	15.80	16.27
	Willoughby	20	46	0	0	16.10	16.10
	McGrath	11	40	1	1.42	16.20	18.15
	Vaughan	19	63	1	1.31	17.99	19.00
	Butcher	11	52	0	0	33.09	33.09
	Zondeki	1.5	10	0	0	46.67	46.67

Who was the best bowler? According to the present study, the answer is given in Table 8.

The requirement for bowlers in this comparison is that they should have bowled at least 50 overs. This number seemed reasonable taking into account that some bowlers had bowled close to 200 overs. For comparison purposes, the ordinary DBR is also given. DBR* should be used for a small or moderate number of overs bowled, but for more than 200 overs the much simpler DBR can be used. The top bowlers were Pollock, Kirtley, Kallis, Hall and Bicknell. Each one took 10 or more wickets. Ntini (rated eighth) took the most wickets, but he conceded by far the most runs.

In the case of ODI's the procedure is exactly the same except that the weights in column 3 (instead of 5) of Table 1 are used. A bowler may only bowl 10 overs per match. CBR* or DBR* can be calculated for every bowler irrespective of the number of overs bowled, but it is up to the reader to decide whether to include one who had bowled fewer than two or three overs in a ranking.

CONCLUSIONS

Ideally speaking, weights should be allocated to individual batsmen instead of to the positions in which they bat. This would, however, in every application require the calculation of BP for each batsman – a value based on all his scores and his strike rate - and then the calculation of suitable weights for the different batsmen. This could be done, but would require the availability of a very extensive and up to date data set. Secondly, for players who had not played at international level before, the values of BP are not available, and for those who had played fewer than twenty innings at this level, the BP values are not reliable. Furthermore, for players from India, Pakistan and Sri Lanka the test match strike rates are not readily available, which means that their BP values cannot be calculated. Therefore, it was decided to allocate weights to batting positions, thereby keeping the calculations simple enough for selectors and coaches – those for whom this measure was intended in the first place.

In order to standardise the procedure, the position of a batsman will be determined by the order in which he goes out to bat, as also reflected in the score card. Selectors may, however, for their own purposes use their discretion when comparing their team's bowlers if a player has batted out of his normal batting position, as in the case of a night-watchman.

DBR* and CBR* can be very useful criteria to measure the performance of a bowler in a single match or a short series of matches because they take into account the weights of the wickets taken by the bowler.

The argument mentioned in Lemmer (2002) that the use of weights was unnecessary in the case of large numbers of overs bowled was confirmed by the fact that the values of CBR* and CBR (not shown here) were very similar. The values of DBR and DBR* were also very similar (see Table 8) in the case of bowlers who had bowled more than 150 overs.

DBR* has the desired effect of giving more prominence to bowlers' wicket taking abilities than CBR*. It is suggested that DBR*/DBR should be used in the case of unlimited overs matches, where wicket taking is very important, while CBR*/CBR should be used in limited overs matches, where economy is very important.

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