BATTING AND BOWLING PERFORMANCE MEASURES FOR LIST-A AND FIRST CLASS CRICKET MATCHES

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ABSTRACT

It is always difficult to decide whether a batsman (or bowler) who performs well in domestic matches should replace a player in the national team. It is therefore necessary that a sound basis should be found for a comparison of players' performances on local and international levels. In this study the performance measures BPW for batsmen and CBPW for bowlers at international level are extended to include this situation. This is achieved by determining appropriate weights for runs scored by batsmen, and also for wickets taken and runs conceded by bowlers, in local matches. BPW and CBPW are applied to each player's complete set of one-day scores (local and international) and recommendations are made on which players should be considered for inclusion in the ODI team. The same is done in the case of unlimited overs matches in order to identify strong new candidates for the test team.

Key words: Cricket; Rankings; Weights for runs; Weights for wickets.

INTRODUCTION

In the case of one-day matches, List-A matches consist of ODIs (one-day internationals) on the one hand and various other types of matches, e.g. provincial or franchise matches, county matches, A-team matches, etc., on the other hand. In this study all the latter types of matches are treated similarly and are referred to as local matches. (Note that it would not have been feasible to treat the subclasses of the local matches separately because the vast majority of players had not played a sufficient number of each type of match.) The same procedure will be followed in the case of First Class matches.

In the determination of weights for runs scored in international matches (Lemmer, 2007) the approach was that some weights should be smaller and others larger than one in such a way that the average overall weight in the whole scheme is equal to one. In the case of List-A matches it is logical that the weights used for all ODI scores should be those referred to above. Weights for the other (local) scores have still to be determined. Reasoning that it is on average easier to score runs in local than international matches, it can be expected that a batsman's average for his ODI scores will be lower than his average for his local scores. In order to make his local scores comparable to his international scores, his local scores should be scaled down. Similarly, in the case of bowling, the number of wickets taken by a bowler in local matches should be scaled down and the number of runs conceded should be scaled up.

BATTING: WEIGHTS FOR RUNS SCORED

In order to determine the downscale factor for runs scored, a large database has been used. This consisted of all current ODI batsmen of all the test playing countries who had established themselves as ODI batsmen, i.e. who had batted in at least 50 ODIs and had averages over 20. The names were obtained from Cricinfo (2007). Their List-A scores were taken from Cricketarchive (2007) on 12 November 2007. The average ODI score and the average local score have been calculated for every batsman. If AVO denotes the average ODI score for all batsmen and AVL the average of the local scores, the weight of each local score is obtained from w = AVO/AVL. The average of a batsman's List-A scores is then obtained by calculating the average of all his weighted scores. For some batsmen in the data set the average ODI score exceeded the average ordinary score, which contradicts the expectation that it is easier to score runs in local than international matches. Upon further investigation it became clear that most of these batsmen had played many ODIs, e.g. Kallis, with 347 List-A scores with average = 43.43, had 260 ODI scores with ODI average = 45.22. It is understandable that a batsman who has established himself well at the international level will increase his average and if he ultimately plays mainly international matches, his ODI average may become greater than his average of local scores. Taking into account that the weighting scheme is intended to compare a young upcoming batsman with an established one to decide whether the former should replace the latter in the ODI team, it is logical that batsmen with ODI averages greater than local score averages should rather not be used when the weight is calculated. After deleting these batsmen it was found that for the remaining 47 batsmen AVO = 30.99 and AVL = 36.26, resulting in the downscale factor w_r = 0.855. This weight transforms a local score of 50, say, into an international equivalent of 42.75. This is a reasonable transformation. It was based on the batsmen's ordinary averages. A more sophisticated performance measure (e.g. BP in Lemmer, 2004) could have been used, but it is doubtful that it would have resulted in a very different downscale factor to merit the additional effort of calculating BP for local and international scores for each batsman. The weight w_r = 0.855 for runs scored in local matches can now be incorporated into the calculation of the batting performance measure BPW given in Lemmer (2007) – see the Appendix for details. It is now possible to compare the BPW values of batsmen in List-A matches, irrespective of the proportion of ODIs they had played. In table 1 BPW was used to rank twenty South African batsmen based on their List-A scores taken from Cricketarchive (2008) on 4 February 2008.

In table 1, n denotes the number of List-A innings played, AVE the ordinary average and AVW the more realistic average based on weighted scores. In order to assess a batsman's latest form, an exponentially weighted average (EWA) of the weighted scores was calculated (see the Appendix) and its ratio relative to AVW is FR = EWA/AVW, the form ratio, indicating the latest form of the batsman. Boucher had FR = 1.398, which indicates that he was in exceptionally good form. Bosman was in very bad form with FR = 0.884 due to final scores of 50, 22, 6, 0, 31, 2, 15, 4, 2, 0, 8. The batting performance measure BPW (see the Appendix for details) is based on EWA, the consistency coefficient CC and the strike rate SR. The latter has been estimated from each player's last five seasons' figures. According to the batsmen ranking, if we assume that there is place for six specialist batsmen in the team, the selectors should choose Kallis, Smith, de Villiers, Boucher, Gibbs and Rudolph whilst taking note of the performances of Pollock (who was in the team firstly as a bowler but also as an all-rounder), van Wyk, Peterson,..., etc., who have produced batting performances worthy of mention.

TABLE 1. **RANKING OF SOUTH AFRICAN LIST-A BATSMEN ACCORDING TO BPW**

Rank	Name	n	AVE	AVW	EWA	FR	CC	SR	BPW
1	J Kallis	347	43.43	41.83	47.04	1.125	1.810	72.24	45.58
2	G Smith	179	41.79	39.56	39.81	1.006	1.888	87.06	44.17
3	AB de Villiers	81	39.97	37.30	41.16	1.104	1.824	84.48	43.46
4	M Boucher	251	28.72	27.60	38.59	1.398	1.873	89.02	42.95
5	H Gibbs	318	34.99	32.99	40.72	1.234	1.731	88.14	41.66
6	J Rudolph	116	45.68	40.76	39.75	0.975	1.973	70.05	41.35
7	S Pollock	296	26.71	25.31	34.19	1.351	1.883	94.78	39.47
8	M v Wyk	121	40.97	35.14	37.83	1.077	1.827	79.55	38.83
9	A Petersen	63	32.84	28.14	36.25	1.288	1.746	83.95	36.53
10	B Dippenaar	166	40.38	37.27	35.96	0.965	1.858	74.05	36.22
11	V v Jaarsveld	34	33.44	28.60	28.78	1.007	2.059	83.63	34.12
12	JP Duminy	55	33.77	30.39	34.44	1.133	1.775	76.41	33.66
13	A Prince	154	32.05	28.48	29.79	1.046	1.931	75.64	31.50
14	M v Jaarsveld	192	38.35	32.90	29.61	0.900	1.843	80.29	30.80
15	N McKenzie	169	36.34	32.20	31.94	0.992	1.795	71.06	30.44
16	A Puttick	74	33.36	28.52	30.77	1.079	1.815	66.05	28.59
17	H Amla	41	27.97	23.92	26.70	1.116	1.787	80.63	26.98
18	J Ontong	106	25.54	21.94	26.84	1.224	1.783	78.37	26.69
19	JA Morkel	80	25.87	22.32	22.39	1.003	1.748	111.7	26.05
20	L Bosman	113	29.56	25.41	22.45	0.884	1.873	75.09	22.95

In a rotational selection system it would then be useful to include batsmen ranked lower than six to expose more players to ODI's with a view to rotational, transformational and injury issues. The advantage of this study is that it can be seen that players like van Wyk and Petersen are good candidates for inclusion in the ODI team.

For First Class matches the names of the current test players were obtained from Cricinfo (2007). Their First Class scores were taken from Cricketarchive (2007) on 12 November 2007. Their test scores were separated from the rest (local scores) and exactly the same procedure as before was followed. It was found that the average test score for the 37 batsmen who qualified was 37.99 and the average ordinary score 43.93, which gave $w_r = 0.865$. The formula of BPW (see the Appendix for details) for test matches can now be extended to include this weight for runs scored in local matches and the formula then used for First Class matches. BPW was used to rank twenty South African batsmen based on their First Class scores taken from Cricketarchive (2008) on 4 February 2008.

TABLE 2. **RANKING OF SOUTH AFRICAN FIRST CLASS BATSMEN ACCORDING TO BPW**

Rank	Name	n	AVE	AVW	EWA	FR	CC	SR	BPW
1	J Kallis	328	54.79	51.36	68.75	1.339	1.857	51.93	72.85
2	JP Duminy	71	52.46	45.37	46.40	1.023	1.831	57.09	50.74
3	JA Morkel	78	41.89	36.24	42.72	1.179	1.743	71.39	49.47
4	G Smith	168	48.55	45.68	41.20	0.902	1.789	68.68	48.07
5	A Prince	210	42.25	38.05	45.61	1.199	1.807	44.99	43.90
6	N McKenzie	260	43.27	38.57	44.26	1.148	1.781	46.65	42.74
7	J Rudolph	214	42.30	37.89	41.01	1.083	1.791	52.68	42.21
8	J Ontong	170	38.05	32.99	38.32	1.161	1.812	57.81	41.71
9	AB de Villiers	99	40.32	37.87	36.28	0.958	1.840	54.09	38.83
10	S Pollock	267	33.12	31.06	32.44	1.044	1.852	65.34	38.26
11	B Dippenaar	226	42.99	38.12	38.35	1.006	1.749	50.01	37.59
12	M v Jaarsveld	313	44.75	38.93	36.89	0.948	1.701	53.86	36.44
13	H Amla	150	44.08	38.96	36.94	0.948	1.749	49.09	35.90
14	V v Jaarsveld	55	37.39	32.34	32.30	0.999	1.685	65.57	34.72
15	M Boucher	243	33.76	31.61	29.23	0.925	1.867	50.84	30.83
16	H Gibbs	319	42.73	39.59	27.98	0.707	1.823	57.92	30.67
17	A Puttick	132	39.81	34.43	30.76	0.893	1.770	45.34	29.12
18	M v Wyk	156	36.09	31.22	27.01	0.865	1.724	55.53	27.44
19	L Bosman	154	28.79	24.90	23.35	0.938	1.869	56.18	25.86
20	A Petersen	126	32.22	27.87	22.77	0.817	1.711	55.15	22.88

Table 2 shows that Duminy and Morkel deserve their recently acquired places in the test team, with Ontong a strong competitor for inclusion. The regular batsmen are Kallis, Smith, Prince, McKenzie and de Villiers with Boucher as wicket keeper. The question might be asked why Rudolph, Dippenaar and M van Jaarsveld have been left aside prematurely.

BOWLING: WEIGHTS FOR WICKETS TAKEN AND RUNS CONCEDED

In the case of bowling in one-day matches the performance of each bowler is measured by means of his CBR value (see the Appendix) defined in Lemmer (2002). This is calculated separately for his ODI matches and for the rest. All current ODI bowlers (taken from Cricinfo (2007) on 12 November 2007) who had bowled at least 400 overs in ODIs have been included in the database. Their List-A statistics have been obtained from Cricketarchive (2007). Seven of the fifty qualifying bowlers had CBR values for local matches larger than for ODIs,

signifying better bowling in ODIs than in local matches. As in the case of batsmen performing better in ODIs than locally, they were deleted from the data set. Denote the average CBR value in ODIs of all remaining bowlers by CBRO and the average CBR value of all local matches by CBRL, then the number of wickets taken in local matches is weighted by w_w = CBRL/CBRO = 9.81/10.92 = 0.898. Similarly, the number of runs conceded in local matches is multiplied by w_r = CBRO/CBRL = 1.113. These weights for ordinary matches were incorporated into CBPW (see the Appendix), which already contained the weights of international matches, for use in List-A matches. CBPW was used to rank eighteen South African bowlers based on their List-A scores taken from Cricketarchive (2008) on 4 February 2008.

TABLE 3. **RANKING OF SOUTH AFRICAN LIST-A BOWLERS ACCORDING TO CBPW**

Rank	Name	n	A	E	S	CBR	WCBR	FR	BC	CBPW
1	S Pollock	421	22.84	3.65	37.57	8.66	7.92	1.094	0.213	13.68
2	D Steyn	52	24.47	4.65	31.60	11.30	11.59	0.975	0.257	10.42
3	J Kallis	312	30.33	4.70	38.75	10.83	10.76	1.007	0.191	9.44
4	A Hall	228	26.80	4.49	35.78	11.14	10.99	1.014	0.191	9.26
5	M Ntini	219	24.53	4.43	33.22	10.10	10.91	0.926	0.187	9.20
6	A Nel	178	25.05	4.26	35.29	10.48	11.06	0.948	0.180	8.89
7	M Morkel	23	23.44	4.64	30.33	12.46	12.38	1.006	0.218	8.87
8	R Peterson	101	31.68	4.44	42.78	11.55	11.63	0.993	0.193	8.79
9	J Botha	66	40.98	4.49	54.75	11.90	11.71	1.016	0.195	8.78
10	C Langeveldt	149	24.66	4.61	32.13	11.38	11.55	0.986	0.184	8.62
11	V Philander	34	34.91	4.76	43.97	13.11	12.51	1.048	0.192	8.14
12	G Kruger	93	24.85	4.78	31.21	11.92	12.67	0.941	0.184	7.86
13	T Tshabalala	43	28.11	4.79	35.21	12.51	13.21	0.947	0.196	7.81
14	JA Morkel	107	29.08	4.72	36.98	12.37	12.53	0.988	0.179	7.80
15	J Louw	88	24.63	4.82	30.68	12.07	12.96	0.932	0.182	7.63
16	Telemachus	162	26.08	4.50	34.77	10.89	12.47	0.874	0.171	7.63
17	M Zondeki	61	28.68	4.90	35.10	12.68	13.46	0.942	0.152	6.62
18	P Harris	28	32.07	4.56	42.20	12.32	12.06	1.022	0.116	6.32

In table 3, n denotes the number of innings in which the bowler has bowled and A, E and S are the ordinary bowling measures (without weights). All the other measures used the weighted runs and wickets. CBR is the career combined bowling rate and WCBR an exponentially weighted bowling rate (see Lemmer, 2006: 98 and the Appendix) where recent performances have higher weights than those further back in time. FR = CBR/CBRW is the form ratio, BC

the bowling consistency and CBPW the current bowling performance measure. If four specialist bowlers and two all-rounders are required, Pollock and Kallis can fulfil the latter role with Steyn, Hall, Ntini and Nel the specialist bowlers. Pollock was by far the best bowler and ended his career in good form. The table shows that J Botha (as a spinner) and M Morkel deserved their recent inclusion in the ODI team, but also raises the question why R Peterson was not given another opportunity.

In the case of First Class matches (the names of the current test batsmen were taken from Cricinfo (2007) and their bowling data from Cricketarchive (2007) on 12 November 2007), the dynamic bowling rate DBR (see the Appendix) was calculated for each bowler's test and local scores separately and hence the averages DBRT (for test matches) and DBRL (for local matches). For the 41 bowlers whose test DBR values were greater than their local DBR values, DBRT = 15.67 and DBRL = 13.83. This gave w_w = 13.83/15.67 = 0.882 as downscale factor for wickets and w_r = 1.134 for runs conceded. These weights have been incorporated into the formula of CBPW for test matches, which can now be used as a measure of current bowling performance in First Class matches. CBPW was used to rank eighteen South African bowlers based on their First Class scores taken from Cricketarchive (2008) on 4 February 2008.

In table 4 A, E and S are the ordinary bowling measures (without weights). All the other measures used the weighted runs and wickets. Table 4 shows that Pollock and Kallis can again be considered the all-rounders with specialist bowlers Philander, Steyn, Harris and Ntini. Harris ranks higher than the other spinners in First Class matches and deserves his place. Philander must be a strong candidate for a regular place in the test team.

TABLE 4. **RANKING OF SOUTH AFRICAN FIRST CLASS BOWLERS ACCORDING TO CBPW**

Rank	Name	n	A	E	S	DBR	WDBR	FR	BC	CBPW
1	J Kallis	310	30.48	2.77	65.94	14.26	12.17	1.171	0.232	9.07
2	V Philander	58	21.75	2.55	51.27	14.38	13.81	1.041	0.281	8.87
3	S Pollock	346	23.25	2.38	58.57	11.98	11.29	1.061	0.186	8.68
4	D Steyn	102	24.77	3.38	43.98	15.79	12.55	1.258	0.196	8.04
5	P Harris	116	28.66	2.65	64.98	15.23	13.30	1.145	0.218	8.04
6	M Ntini	269	29.00	3.30	52.81	15.63	13.31	1.174	0.186	7.37
7	A Hall	226	26.16	2.83	55.52	15.41	16.26	0.947	0.235	6.83
8	J Louw	164	32.32	3.16	61.31	18.21	15.24	1.195	0.177	6.27
9	A Nel	189	26.66	2.84	56.38	14.78	15.48	0.955	0.181	6.24
10	C Langeveldt	129	29.94	2.98	60.30	16.80	17.64	0.952	0.201	5.79
11	R Peterson	135	35.31	3.05	69.46	18.10	17.26	1.049	0.180	5.58
12	J Botha	75	29.54	2.99	59.37	16.98	17.00	0.999	0.158	5.28
13	M Morkel	36	29.35	3.50	50.34	18.33	17.83	1.028	0.169	5.22

14	M Zondeki	122	28.23	3.18	53.26	17.48	15.93	1.097	0.133	5.14
15	JA Morkel	96	30.47	3.07	59.62	17.60	17.98	0.979	0.165	5.11
16	G Kruger	138	29.28	3.38	52.01	18.32	17.90	1.024	0.162	5.09
17	T Tshabalala	57	31.99	3.73	51.51	19.79	19.04	1.039	0.170	4.90
18	Telemachus	137	28.14	3.15	53.61	17.45	21.08	0.828	0.186	4.64

CONCLUSION

The rankings of batsmen and bowlers given in the tables, which are based on sophisticated performance criteria, can help the selectors in the selection of a team, or a 15 man squad for a specific series. The number of specialist batsmen, specialist bowlers, specialist fielders, specialist all-rounders, etc., for a given series or match, depends on many factors which can change from match to match. This is left for the selectors to decide on. The reader is, however, referred to an interesting paper by Gerber and Sharp (2006) which addresses the problem of selecting an ODI squad.

By using the weights given in this study it is possible to measure a player's performance based on all his scores without concern about his proportion of local or international scores. This should simplify the selectors' task because they no longer have to compare two sets of scores (local and international). The most important achievement of this study lies in the fact that the measures BPW and CBPW are completely objective and provide unique rankings of all the players considered.

ACKNOWLEDGEMENTS

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APPENDIX: **LIST OF FORMULAE**

Batting

Let $x_1,\ldots,x_n$ denote the scores in chronological order of a batsman. The traditional average of a batsman is given by $\text{AVE} = \sum_{i=1}^{n} x_i / m$ where m denotes the number of 'out' scores. In Lemmer (2004) it was reasoned that a weighted average reflects a batsman's performance better if the last scores have higher weights than scores earlier in his career. In the exponentially weighted average (EWA), if the last score has a weight a, the second last has a weight 0.96a, the third last a weight 0.96^2a, etc.:

$$\text{EWA} = \sum_{i=1}^{n} x_i (1-\alpha)^{n-i} / \sum_{i=1}^{n} (1-\alpha)^{n-i} \text{Ind}(x_i \text{ an out score})$$

with $\alpha = 0.04$ and Ind(.) the indicator function: Ind(A) = 1 if A is true and Ind(A) = 0 otherwise. A batsman's present form can be quantified by calculating the form ratio FR = EWA/AVE. If FR > 1 it means that his form was good. A batsman's consistency is also important. It is defined by CC = AVE/SD where

$$\text{SD}^2 = \sum_{i=1}^{n} (x_i - \text{AVE})^2 \text{Ind}(x_i \leq \text{AVE } \& \ x_i \text{ an out score})/(n-1).$$

The third important measure is SR, the batsman's strike rate. The measure of batting performance defined in Lemmer (2004) has recently been updated to

$$\text{BP} = \text{EWA}.(\text{CC}/1.8313).(\text{SR}/75.1745)^{0.50}.$$

The weights given in Lemmer (2007) have also been updated. Note that when BP is calculated by using weighted scores, BP is denoted by BPW.

In the case of Test and other First Class matches the formula becomes

$$\text{BP} = \text{EWA}.(\text{CC}/1.7771).(\text{SR}/50.4219)^{0.478}.$$

Bowling

Let O = number of overs bowled, R = number of runs conceded, W = number of wickets taken and B = number of balls bowled. The traditional measures are the average A = R/W, the economy rate E = R/O and the strike rate S = B/W. The combined bowling rate

CBR = 3R/(W + O + W.R/B) has been defined in Lemmer (2002) for use in one-day matches and the dynamic bowling rate DBR = 7R/(2W + O + 4W.R/B) in Lemmer (2005) for unlimited overs matches.

Indicate the value of CBR in the i-th innings by CBR_i and the career CBR up to the i-th innings by $CCBR_i$ for i = 1, 2,...,n where n denotes the number of innings in which the bowler has bowled. In Lemmer (2006) the bowling consistency BC was defined as follows. Let

$BC = S_n/CCBR_n$ where

$$S_j^2 = [\sum_{i=1}^{j} (CBR_i - CCBR_j)^2 \, Ind\{CBR_i < CCBR_j \}$$

$$- \sum_{i=1}^{j} (CBR_i - CCBR_j) \, Ind\{CBR_i > CCBR_j \}]/(j-1).$$

In practical applications it was found that if a bowler had bowled a very small number of overs, his BC–curve can have an unrealistically large change. If he had bowled a few balls and had not conceded any runs, then $CBR_i = 0$, which causes a large jump. The definition of S_j was adjusted in the case of a bowler who had bowled up to two overs in an ODI (or four overs in a test match) and obtained a very small or large CBR_i –value, the contribution to S_j was scaled down linearly in order to minimise this effect. A weighted CBR, called WCBR, has been defined to accentuate recent scores. WCBR is calculated using the formula of CBR after weighting the bowling figrues as follows: If the most recent set of figures O, R, B and W has weight ω, the second last set has a weight $\beta \omega$, the third last set a weight $\beta^2 \omega$, etc., where β = 0.94. The ratio FR = CBR/WCBR can be used to reflect the present form of a bowler. The measure of the current bowling performance defined in Lemmer (2006) has been updated and is

CBP = 100B/WCBR where $B = (BC/0.1858)^{0.58}$ for one-day matches.

Note that when CBP is applied to weighted scores, it is denoted by CBPW.

In the case of Test and other First Class matches

CBP = 100B/WDBR where $B = (BC/0.1931)^{0.54}$

with WDBR the weighted DBR value and where the consistency coefficient BC is calculated from the innings by innings values DBR_i exactly as in the case of BC for one-day matches.

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