GENERAL

THE BEST BATSMEN AND BOWLERS IN ONE-DAY CRICKET

David Beaudoin and Tim Swartz[1]
Department of Statistics and Actuarial Science, Simon Fraser University,
8888 University Drive, Burnaby BC, Canada V5A1S6.

Key words: ODI cricket matches.

Summary: This paper proposes a new statistic for assessing the performance of batsmen and bowlers in one-day cricket. The statistic is the ratio of runs scored to resources consumed where resources are defined according to the Duckworth-Lewis method of resetting targets. A standard error is provided to help determine real differences in performance. Various comparisons are made with traditional measures of performance when applied to data obtained from one-day international cricket matches.

1. Introduction

It is not always easy to define sensible measures of performance in sport. Difficulties may include the collection of data on subjective components of a complex game, the assessment of the relative worth of various tasks, the comparison of teams and players of different eras, the comparison of players of different positions, the contribution of teammates, etc.

However, there have been recent efforts to define sensible measures by carefully assessing what it means to do well. White and Berry (2002) rank

[1] David Beaudoin is an MSc candidate and Tim Swartz is Professor at Simon Fraser University. Swartz was partially supported by a grant from the Natural Sciences and Engineering Research Council of Canada. The authors thank two referees whose comments led to an improvement in the manuscript.

STMA (2003) SUBJECT CLASSIFICATION: 14:045 (14:145)

quarterbacks in the National Football League (NFL) by assigning a measure of worth to each play. The measure of worth is based on historical scoring patterns in the NFL and the assessment of the value of field position. Simon and Simonoff (2002) address the question as to whether the 1996-2000 New York Yankees were the best Major League Baseball (MLB) team of all time. For this difficult problem, the authors use historical data to assess the impressiveness of the accomplishments of the Yankees. Briefly, the approach estimates probabilities of achieving certain milestones taking into account historical changes in MLB. Albert (2002) addresses the issue of "clutch" hitting in MLB. In doing so, he classifies and rates a batting performance according to one of 24 states where historical data is used to estimate the number of expected runs in each state.

In this paper, we propose a new statistic for assessing the performance of batsmen and bowlers in one-day cricket. Our approach attempts to use the same philosophy as White and Berry (2002), Simon and Simonoff (2002) and Albert (2002) by focusing on what is really important in batting and bowling.

Batting and bowling statistics have been previously studied in cricket. In test cricket, Clarke (1998) reviews the commonly reported statistics and offers criticisms of each of the approaches. Cohen (2002) takes a different approach by estimating the probability distribution of a batsman's scoring strokes whence the distribution can be used to assess the quality of the batsman. Lemmer and Nel (2001) and Barr and van den Honert (1997) investigate the consistency of batsmen.

One-day cricket differs from the more established game of test cricket. In particular, batting and bowling strategies differ, and this leads to different measures of performance. With respect to batting, there are two statistics that are widely reported, each of which purports excellence via large values and each of which suffers from serious drawbacks. The first statistic is the *batting average* which is calculated as the total number of runs scored by a batsman divided by the number of innings in which the batsman was dismissed. A problem with this statistic can be seen from the pathological case where a batsman scores a total of 100 runs during 100 innings but is dismissed only once. Such a batsman would have an incredibly high batting average of 100.0 yet would be a detriment to his side as he scores so few runs per innings. The second statistic is the batsman's *strike rate* which is calculated as the number of runs scored by a batsman per 100 balls. A problem with this statistic can be seen from the pathological case where a batsman always bats according to the pattern of scoring a six on the first ball and then being dismissed on the second ball. Such a batsman would have an incredibly high strike rate of 300.0 yet would be a detriment to his side as he uses up wickets so quickly. In summary, the batting average and the strike rate for batsmen do not adequately account for overs and wickets respectively.

Other batting measures pertaining to one-day cricket have been suggested and some of these are posted on the Cricinfo website (www.cricinfo.org). For example, Croucher (2000) proposed the *batting index* which is defined as the product of the batting average and the strike rate. The batting index attempts to alleviate the aforementioned shortcomings of both the batting average and the strike rate. Note that although Croucher's batting index is simple to calculate, it is not easily interpretable.

With respect to bowling in one-day cricket, there also exist statistics that attempt to measure excellence. Refer again to the Cricinfo website where various rankings are posted. There are three widely reported bowling statistics and we mention these here. The first is the *bowling average* which is defined as the total number of runs allowed by a bowler divided by the number of wickets obtained. The second is the *economy rate* which is defined as the total number of runs allowed by the bowler divided by the number of overs bowled. The third is the bowler's *strike rate* which is defined as the total number of balls bowled divided by the number of wickets obtained. Small values of each of these three statistics are deemed to be good. Like the common batting statistics, the bowling average, the economy rate and the strike rate for bowlers are individually deficient as they do not adequately account for overs, wickets and runs respectively.

When discussing individual performance measures in cricket, it is necessary to mention the PricewaterhouseCoopers (PwC) ratings. The PwC ratings range on a scale from 0 to 1000 where large values denote excellence. The ratings have evolved since 1987 and consist of complex formulae for evaluating batsmen, bowlers and all-rounders in both test and one-day settings. Perhaps due to proprietary reasons (Clarke, 1998) or perhaps due to their complexity, the PwC formulae are not explicitly stated on the PwC website (www.cricketratings.pwcglobal.com). However, it is known that the ratings depend on a number of factors including a 4% exponential decay curve which places more weight on recent form, penalties for missing matches, strength of opposition, whether a match was high-scoring, whether an individual's side won the match, bonuses for early runs in one-day matches, etc. Apart from the subjective choice of the factors, the PwC ratings may be criticized on a lack of interpretability. Nevertheless, the PwC ratings have stood the test of time and are considered by some to be the authoritative measures for ranking of individual performance.

We propose a new measure of batting and bowling prowess in one-day cricket that takes into account what is really important in winning a match.

What is really important to both batsmen and bowlers is the number of runs scored relative to the resources used during a cricketer's tenure as either a batsman or a bowler. The concept of resources was introduced by Duckworth and Lewis (1998) in the context of resetting targets in interrupted one-day cricket matches. The Duckworth-Lewis (D/L) method is now widely used and has been adopted by all major one-day cricket playing nations both domestically and in international matches. In particular, the D/L method has been adopted by the International Cricket Council (ICC) for all of its competitions. The good sense of the D/L method has led to applications beyond resetting targets and include the breaking of ties in tournaments and the ranking of ICC sides (de Silva, Pond and Swartz 2001).

In section 2, we briefly review the D/L approach and the concept of resources. Resources are used together with runs scored to define a new measure of batting and bowling excellence in one-day cricket. The new statistic is readily interpretable and it is applicable to both batting and bowling. In addition to the new statistic, a standard error is provided to help determine real differences in performance. In section 3, the new statistic is expanded upon in the context of batting. The statistic is calculated for a subset of batsmen based on data collected from one-day international (ODI) cricket matches. Rankings are produced and comparisons are made with traditional measures. In section 4, we carry out similar tasks as in section 3 with respect to bowling. We conclude with a short discussion in section 5.

2. Methodology

The D/L resource table (Table 1) was devised to improve "fairness" in interrupted one-day cricket matches. The resource table is based on the principle that resources are diminished in a shortened match and that targets should be reset according to the resources available. Duckworth and Lewis (1998) obtained the entries in the resource table using statistical methods based on historical match data.

Our problem is to quantify excellence for batsmen and bowlers in one-day cricket. Clearly, batsmen do well if they score runs at a high rate and bowlers do well if they allow runs at a low rate. The immediate question then is "what are the relevant units in determining the rate?" The answer is that the units should be a combination of the number of overs completed and the number of wickets taken during a cricketer's tenure as either a batsman or a bowler. The combination of overs used and wickets taken is viewed as a depletion of resources, and it is the depletion of resources which is the relevant measure that results in the termination of batting. Fortunately, the D/L resource table expresses resources remaining in a match as a function of both overs available and wickets lost. Therefore we propose a new statistic, the *runs per match* for a cricketer, defined as

$$\mathrm{RM} = 100 \cdot \left(\frac{\text{total number of runs}}{\text{total resources used}} \right) \tag{1}$$

where the totals are taken over all of the cricketer's appearances.

The statistic RM is appealing as it is applicable to both batsmen and bowlers. Moreover, it is interpretable as the average number of runs had the cricketer initiated batting/bowling for his side and was allowed to continue until all of the 50 overs or 10 wickets were used. Since the average number of runs scored in ODI matches from mid-1997 through early 2002 is 233.1 with standard error 3.0 (Duckworth and Lewis 2002), we have a standard for determining the excellence of batsmen and bowlers. Clearly, a good batsman has an RM value well above 233, and a good bowler has an RM value well below 233.

Now, although statistics are rampant in sport, we cannot think of many (any?) instances where standard errors are routinely reported. Standard errors are important as they provide context for making comparisons. In the case of the runs per match statistic RM, consider a cricketer (either a batsman or a bowler) for whom x_i runs and r_i resources are recorded in the i-th appearance, $i = 1, \ldots, n$. Then using the approximate distribution

$$\begin{pmatrix} \frac{1}{n}\sum_{i=1}^{n} x_i \\ \frac{1}{n}\sum_{i=1}^{n} r_i \end{pmatrix} \sim \text{Normal}_2 \left[\begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix}, \frac{1}{n} \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix} \right]$$

as suggested by the multivariate central limit theorem, an application of the delta method gives

$$\begin{aligned} \sigma_{\text{RM}}^2 &= \text{Var(RM)} = \text{Var}\left(100 \cdot \frac{\frac{1}{n}\sum_{i=1}^{n} x_i}{\frac{1}{n}\sum_{i=1}^{n} r_i}\right) \\ &\approx \frac{100^2}{n} \left(\frac{1}{\mu_2} \; \frac{-\mu_1}{\mu_2^2}\right) \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix} \begin{pmatrix} \frac{1}{\mu_2} \\ \frac{-\mu_1}{\mu_2^2} \end{pmatrix} \end{aligned}$$

whereby standard errors $\hat{\sigma}_{\text{RM}}$ for RM can be obtained using the consistent estimators

$$\begin{aligned} \hat{\mu}_1 &= \tfrac{1}{n}\textstyle\sum_{i=1}^{n} x_i \\ \hat{\mu}_2 &= \tfrac{1}{n}\textstyle\sum_{i=1}^{n} r_i \\ \hat{\sigma}_1^2 &= \tfrac{1}{n}\textstyle\sum_{i=1}^{n} (x_i - \hat{\mu}_1)^2 \\ \hat{\sigma}_2^2 &= \tfrac{1}{n}\textstyle\sum_{i=1}^{n} (r_i - \hat{\mu}_2)^2 \\ \hat{\sigma}_{12} &= \tfrac{1}{n}\textstyle\sum_{i=1}^{n} (x_i - \hat{\mu}_1)(r_i - \hat{\mu}_2). \end{aligned}$$

Perhaps one of the reasons why standard errors are not routinely produced for sporting statistics is that standard errors are not widely understood by the sporting public.

Before turning to the analysis of ODI data, we comment on the upper right hand entries of the D/L resource table. In many instances, as one goes down the columns, the number of resources remaining in a match does not change. The implication of this for the RM statistic (1) is that a cricketer can accumulate runs in the numerator with no resources being added in the denominator. Although this is clearly not sensible, in practice, there are not many matches where the upper right hand section of the table is relevant. Moreover, when the upper right hand portion of the table is relevant, there tends to be very few runs recorded as the resources decrease slowly while batting.

3. Batsmen

In the context of batting, the runs per match statistic (1) translates to the total number of runs scored by a batsman divided by the total number of resources used by the batsman taken over all matches. Although the numerator is easily obtained, the calculation of the denominator is problematic.

Ideally, one would calculate the denominator of the RM statistic in the following way. Prior to the delivery of every ball, the status of the game dictates the current number of resources remaining according to the D/L table. After the ball is bowled, the number of resources changes according to the reduction in overs remaining and whether the batsman is dismissed. The difference in resources between the two states forms a "by ball" contribution to the denominator. Note that although Table 1 does not provide a ball by ball reduction in resources, a ball by ball table is available in Duckworth and Lewis (1999). Since ball by ball results in one-day matches are not generally available, this approach cannot currently be pursued. In cases where ball by ball results are available (see recent ODI matches at www.cricinfo.org), the data are presented in the format of commentary which is inconvenient for calculation.

In practice, we approximate the denominator of the RM statistic using the following procedure. For each partnership in which a batsman is involved, we approximate the number of resources used by the batsman and this forms a "by partnership" contribution to the denominator. With only standard match summaries available, how should this be done? As a first step, we obtain the number of resources remaining at the beginning of a partnership according to the D/L table. We then obtain the number of resources remaining one ball prior to the end of the partnership (i.e. when one of the batsmen is dismissed or the match terminates). The difference in resources between the two states describes the resources lost during the partnership up to but not including the final ball. We then scale this difference by the proportion of balls faced by the batsman between the two states where the scale factor is obtained from standard match summaries. Finally, to this quantity we add the number of resources lost by the batsman on the final ball. We note that the batsman is not responsible for resources lost when his partner is dismissed. Although the procedure is seemingly complex, once the data is extracted in a convenient form, programming the approximation is straightforward.

We now consider the analysis of batting data obtained from the Cricinfo website. The data consist of all ODI matches from October 1998 through the completion of the World Cup in March 2003. We were unable to go further back in time as the commentary log, essential for data extraction, is unavailable.

In 1998, there were only nine nations belonging to the ICC. If we think of each nation as having five key batsmen with sufficient international experience, this results in a pool of roughly 45 batsmen of interest. For our analysis, we considered batsmen listed in the top 50 according to their career batting average. From that list, we chose 12 active batsmen who have batted in a minimum of 100 ODI matches. For context, we supplemented this group with three active batsmen (A. Razzaq, W. Akram and S.M. Pollock) who are generally regarded as proficient all-rounders. We emphasize that the comparisons we make concern only these 15 batsmen; there may be batsmen who are ranked highly on other criteria yet have been omitted due to their non-stellar career batting averages. For example, S. Jayasuriya of Sri Lanka is not included in our study.

In Table 2, we present the batting average, the strike rate and the runs per match statistic for the 15 batsmen based on the 1998-2003 data. We also include the PwC rating for each batsman based on their entire career up to March 2003 where we note that the PwC rating for G. Kirsten is unavailable. The batsmen are listed from best to worst according to their batting average. For the runs per match statistic, we also include standard errors. The RM statistic suggests that S.R. Tendulkar and L. Klusener are the best active ODI batsmen in the study. Klusener is particularly interesting in that his PwC rating does not adequately reflect his value as a batsman. Without knowing the precise details of the PwC formulae, one can only speculate on the reason for the discrepancy. Moreover, Klusener has a large standard error associated with RM; this highlights his tendency to have exceptionally dominant performances together with notably lesser performances. After Tendulkar and Klusener, the divisions are less clear. One might next group R.T. Ponting by himself, and then place B.C. Lara, S.C. Ganguly, M.G. Bevan, J.H. Kallis, G. Kirsten, R.P. Arnold, N.V. Knight and M.S. Atapattu in the third group. In the final rankings, one might group Y. Youhana and W. Akram, followed by A. Razzaq who is then followed by S.M. Pollock. These somewhat subjective groupings are summarized in Table 6. Note that the bottom five ranked batsmen have RM values less than the ODI average of 233 runs. In particular, it may appear strange that Youhana and Atapattu, batsmen with exceptional career batting averages, have RM values slightly below average. Apart from the fact that the RM statistic is different from the batting average, this might be explained by keeping in mind that only a small subset of ODI batsmen do most of the batting. As argued previously, suppose that there are 45 active ODI batsmen who do most of the batting. Then it is not so surprising that when looking at the top 12 active batsmen that two of them have RM values slightly below average since 12 is not that far away from 23 (i.e. the middle value of $1, \ldots, 45$). Finally, it seems that both Bevan and Youhana may be slightly over-rated with respect to some of the traditional measures. This may be explained by noting that each of these batsmen have relatively low dismissal rates.

In Table 3, we present the correlation coefficients between each pair of the four statistics taken over the relevant batsmen. We observe that the batting average correlates most highly with the runs per match. Given that the runs per match statistic has a sound theoretical basis yet is currently difficult to calculate, this suggests that batting average might be the preferred batting statistic at this point in time. This coincides with prevailing wisdom that tends to prefer batting average as a measure of batting proficiency. Quoting David Mar in his explanation of cricket posted on the Cricinfo website, “Over a single player’s career, the two most important statistics are ... batting average and bowling average”. We also note that the PwC rating correlates reasonably well with the runs per match statistic in the context of batting.

4. Bowlers

In the context of bowling, the runs per match statistic (1) translates to the total number of runs allowed by a bowler divided by the total number of resources used while bowling, taken over all matches.

When calculating RM for bowlers, we consider every bowling appearance that a bowler makes and note that a bowler can make several appearances in a match. The contribution to the numerator for each appearance is readily available from standard match summaries. The calculation of the denominator is also straightforward. Prior to each appearance, the status of the game dictates the current number of resources remaining according to the D/L table. After the appearance, the number of resources changes according to the reduction in overs remaining and whether any wickets were taken. The difference in resources between the two states forms a "by appearance" contribution to the denominator of the RM statistic. We therefore observe that although the calculation of the RM statistic for bowlers is straightforward, data extraction may be time consuming due to the potential of multiple appearances by a bowler during a match.

We now consider the analysis of bowling data obtained from the Cricinfo website. The data consist of all ODI matches from October 1998 through the completion of the World Cup in March 2003. Again, we were unable to go further back in time as the commentary log, essential for data extraction, is unavailable.

For our analysis, we considered bowlers in a similar manner to batsmen. We first looked at a list of the top 50 ODI bowlers ranked according to career bowling average. From that list, we chose 12 active bowlers. We made sure that each bowler had sufficient ODI experience. This resulted in a subset of bowlers who had each bowled in at least 34 ODI matches. For context, we supplemented this group with two active bowlers (J.H. Kallis and L. Klusener) who are currently (March 2003) the number 1 and number 5 all-rounders according to the PwC ratings. As with batsmen, our list may omit some bowlers who are ranked highly on other criteria but who do not have stellar career bowling averages.

In Table 4, we present the bowling average, the economy rate, the strike rate and the runs per match statistic for the 14 bowlers based on the 1998-2003 data. We also include the PwC rating for each bowler based on their entire career up to March 2003 where we note that the PwC ratings for A.A. Donald and S.K. Warne are unavailable. The bowlers are listed from best to worst according to their bowling average. For the runs per match statistic, we also include standard errors. We first observe that the standard errors of the RM statistic may be slightly smaller for bowlers than for batsmen. The RM statistic suggests that M. Muralitharan and G.D. McGrath are clearly the best ODI bowlers in the study. This is not always demonstrated when other statistics are considered such as the strike rate which ranks S. Akhtar and W. Younis ahead of both Muralitharan and McGrath. According to the RM statistic, S.M. Pollock, Akhtar, Donald and perhaps W. Akram seem to be in the second group. D. Gough might then be next by himself followed by a group including Z. Khan, W. Younis, S.K. Warne, A. Razzaq, J.H. Kallis and S. Mushtaq. L. Klusener appears to be isolated by himself at the bottom. These somewhat subjective groupings are summarized in Table 6. Of the 14 listed bowlers, all of them have better RM values than the ODI average corresponding to 233 runs. We also observe that S.M. Pollock is the best bowler according the PwC rating yet does not distinguish himself in the same way under any of the other statistics. Finally, we suggest that there is a simple explanation as to the discrepancy between the RM statistic and the strike rate in the case of Younis. Younis is an example of a bowler who, when he is not taking wickets, is giving up many runs.

In Table 5, we present the correlation coefficients between each pair of the five statistics taken over the relevant bowlers. Recall that a strong negative correlation between PwC and any of the other four statistics indicates good agreement. We observe that bowling average correlates most highly with the runs per match statistic. Given that the runs per match statistic has a sound theoretical basis yet is currently difficult to calculate, this suggests that bowling average might be the preferred bowling statistic at this point in time. We also note that the PwC rating agrees reasonably well with the runs per match statistic in the context of bowling. The strike rate has the poorest agreement with the other statistics.

5. Discussion

The paper has proposed a new statistic RM (runs per match) used to assess the performance of batsmen and bowlers in one-day cricket. We have argued that the statistic is readily interpretable and has a symmetry that is applicable to both batting and bowling. Moreover, the statistic takes into account what is really important for batsmen and bowlers in winning a match. The statistic also yields a standard error and agrees reasonably well with some of the traditional measures including the PwC ratings.

In future work, one might consider whether the RM statistic can be applied to assess the performance of all-rounders. A simple idea is to subtract a cricketer's RM bowling statistic from his RM batting statistic. The resultant value can be interpreted as the average magnitude of victory in runs for the cricketer's side had he been the only batsman and the only bowler. This approach, however, assigns equal weight to batting and bowling, and one may prefer to devise alternative weighting schemes.

At this time, the main obstacle in using the statistic is the difficulty of calculation. The calculation is not difficult in a mathematical or computational sense. Rather, the difficulty arises from the form in which one-day cricket data are recorded. It was an enormous effort on the part of the authors to search the Cricinfo website and extract the necessary ODI data for the analyses of sections 3 and 4. What is called for is a new standard in the collection of one-day cricket data. In the case of ODI matches, it would be desirable to conveniently record ball by ball results on every match. Since there are only a finite number of possible outcomes for each ball and a finite number of balls, one could imagine the data presented in matrix form where rows of the matrix correspond to balls in the match. This does not seem far-fetched as all ODI matches are carefully covered by international media. This would not only open up the possibility of the widespread use of the RM statistic but permit deeper analyses of many aspects of ODI cricket. We remark that ball by ball results are currently recorded in a convenient form for all matches in the Australian Open (tennis).

References

ALBERT, J. (2002). Hitting with runners in scoring position. *Chance*, **15** (4), 8–16.

BARR, G.D.I. and VAN DEN HONERT, R. (1997). Evaluating batsmen's scores in test cricket. *South African Statistical Journal*, **32**, 169–183.

CLARKE, S.R. (1998). *Test statistics.* In: Statistics in Sport. J. Bennett (editor), Arnold, London, 83–103.

CROUCHER, J.S. (2000). *Player ratings in one-day cricket.* In: Mathematics and Computers in Sport. G. Cohen and T. Langtry (editors), University of Technology, Sydney, Australia, 95–106.

COHEN, G.L. (2002). *Cricketing chances.* In: Mathematics and Computers in Sport. G. Cohen and T. Langtry (editors), Bond University, Queensland, Australia, 1–13.

DE SILVA, B.M., POND, G.R. and SWARTZ, T.B. (2001). Estimation of the magnitude of victory in one-day cricket matches. *The Australian and New Zealand Journal of Statistics*. **43** (3), 259–268.

DUCKWORTH, F.C. and LEWIS, A.J. (1998). A fair method for resetting the target in one-day cricket matches. *Journal of the Operational Research Society*, **49**, 220–227.

DUCKWORTH, F.C. and LEWIS, A.J. (1999). *Your comprehensive guide to the Duckworth/Lewis Method*. University of the West of England, Bristol.

DUCKWORTH, F.C. and LEWIS, A.J. (2002). *Review of the application of the Duckworth/Lewis method of target resetting in one-day cricket*. In: Mathematics and Computers in Sport. G. Cohen and T. Langtry (editors), Bond University, Queensland, Australia, 127–140.

LEMMER, H.H. and NEL, J. (2001). A classification scheme for the consistency of batsmen. *South African Statistical Journal*, **35**, 147–173.

SIMON, G.A. and SIMONOFF, J.S. (2002). Were the 1996–2000 Yankees the best baseball team ever? *Chance*, **15** (1), 23–29.

WHITE, C. and BERRY, S.M. (2002). Tiered polychotomous regression: ranking NFL quarterbacks. *The American Statistician*, **56** (1), 10–21.

Manuscript received, 2003.02; revised, 2003.05; accepted, 2003.06.

Table 1. The Duckworth-Lewis resource table obtained from Appendix 1 of Duckworth and Lewis (2002) where the percentage of resources remaining is given as a function of the number of wickets lost and the number of overs available

	Wickets Lost									
Overs Left	0	1	2	3	4	5	6	7	8	9
50	100.0	92.4	83.8	73.8	62.4	49.5	37.6	26.5	16.4	7.6
49	99.2	91.8	83.3	73.5	62.2	49.4	37.6	26.5	16.4	7.6
48	98.3	91.1	82.7	73.1	62.0	49.3	37.6	26.5	16.4	7.6
47	97.4	90.3	82.2	72.7	61.8	49.2	37.6	26.5	16.4	7.6
46	96.5	89.6	81.6	72.3	61.5	49.1	37.5	26.5	16.4	7.6
45	95.5	88.8	81.0	71.9	61.3	49.0	37.5	26.4	16.4	7.6
44	94.6	88.0	80.4	71.5	61.0	48.9	37.5	26.4	16.4	7.6
43	93.6	87.2	79.7	71.0	60.7	48.7	37.4	26.4	16.4	7.6
42	92.5	86.3	79.0	70.5	60.4	48.6	37.4	26.4	16.4	7.6
41	91.4	85.4	78.3	70.0	60.1	48.4	37.3	26.4	16.4	7.6
40	90.3	84.5	77.6	69.4	59.8	48.3	37.3	26.4	16.4	7.6
39	89.2	83.5	76.8	68.9	59.4	48.1	37.2	26.4	16.4	7.6
38	88.0	82.5	76.0	68.3	59.0	47.9	37.1	26.4	16.4	7.6
37	86.8	81.5	75.2	67.6	58.6	47.7	37.1	26.4	16.4	7.6
36	85.5	80.4	74.3	67.0	58.2	47.5	37.0	26.4	16.4	7.6
35	84.2	79.3	73.4	66.3	57.7	47.2	36.9	26.3	16.4	7.6
34	82.9	78.1	72.4	65.6	57.2	47.0	36.8	26.3	16.4	7.6
33	81.5	76.9	71.4	64.8	56.7	46.7	36.6	26.3	16.4	7.6
32	80.1	75.7	70.4	64.0	56.1	46.4	36.5	26.3	16.4	7.6
31	78.6	74.4	69.3	63.2	55.5	46.0	36.4	26.2	16.4	7.6
30	77.1	73.1	68.2	62.3	54.9	45.7	36.2	26.2	16.4	7.6
29	75.5	71.7	67.0	61.3	54.3	45.3	36.2	26.1	16.4	7.6
28	73.9	70.2	65.8	60.4	53.5	44.9	35.8	26.1	16.4	7.6
27	72.2	68.8	64.5	59.3	52.8	44.4	35.6	26.0	16.4	7.6
26	70.5	67.2	63.2	58.3	52.0	43.9	35.4	25.9	16.4	7.6
25	68.7	65.6	61.8	57.1	51.2	43.4	35.1	25.9	16.4	7.6
24	66.9	64.0	60.4	55.9	50.3	42.8	34.8	25.8	16.3	7.6
23	65.0	62.3	58.9	54.7	49.3	42.3	34.4	25.6	16.3	7.6
22	63.0	60.5	57.3	53.4	48.3	41.5	34.1	25.5	16.3	7.6
21	61.0	58.6	55.7	52.0	47.2	40.8	33.7	25.3	16.3	7.6
20	58.9	56.7	54.0	50.6	46.1	40.0	33.2	25.2	16.3	7.6
19	56.8	54.8	52.2	49.0	44.8	39.1	32.7	24.9	16.2	7.6
18	54.6	52.7	50.4	47.4	43.5	38.2	32.1	24.7	16.2	7.6
17	52.3	50.6	48.5	45.8	42.2	37.2	31.5	24.4	16.1	7.6
16	49.9	48.4	46.5	40.0	40.7	36.1	30.8	24.1	16.1	7.6
15	47.5	46.1	44.4	42.1	39.1	35.0	30.0	23.7	16.0	7.6
14	45.0	43.7	42.2	40.2	37.5	33.7	29.1	23.2	15.8	7.6
13	42.4	41.3	39.9	38.1	35.7	32.3	28.2	22.7	15.7	7.6
12	39.7	38.8	37.6	36.0	33.9	30.8	27.1	22.1	15.5	7.6
11	36.9	36.1	35.1	33.7	31.9	29.2	25.9	21.4	15.3	7.5
10	34.1	33.4	32.5	31.4	29.8	27.5	24.6	20.6	14.9	7.5
9	31.1	30.6	29.8	28.9	27.6	25.6	23.1	19.6	14.5	7.5
8	28.1	27.6	27.0	26.3	25.2	23.6	21.5	18.5	14.0	7.5
7	25.0	24.6	24.1	23.5	22.7	21.4	19.7	17.2	13.4	7.4
6	21.7	21.4	21.1	20.6	20.0	19.0	17.7	15.7	12.6	7.2
5	18.4	18.2	17.9	17.6	17.1	16.4	15.5	14.0	11.5	7.0
4	14.9	14.8	14.6	14.4	14.1	13.6	13.0	11.9	10.2	6.6
3	11.4	11.3	11.2	11.1	10.9	10.6	10.2	9.6	8.5	6.0
2	7.7	7.7	7.6	7.6	7.5	7.4	7.2	6.9	6.3	4.9
1	3.9	3.9	3.9	3.9	3.9	3.8	3.8	3.7	3.5	3.1
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Reprinted with the permission of Messrs. Duckworth and Lewis

Table 2. Batting statistics for 15 of the best active batsmen in ODI cricket listed in order of their batting average (BA). The strike rate (SR), the PwC rating and the runs per match (RM) are also provided along with a standard error for RM

Batsman		BA	SR	PwC	RM (std. error)
S.R. Tendulkar	India	50.7	88.6	793	282.2 (13.1)
M.G. Bevan	Australia	49.4	71.4	741	241.6 (12.9)
L. Klusener	South Africa	46.5	91.1	646	279.5 (19.7)
J.H. Kallis	South Africa	45.5	69.6	665	239.5 (10.0)
R.T. Ponting	Australia	42.0	81.1	767	252.3 (12.9)
Y. Youhana	Pakistan	41.0	72.7	716	227.9 (12.2)
S.C. Ganguly	India	40.1	76.9	628	242.0 (10.7)
G. Kirsten	South Africa	39.0	70.8	na	235.6 (12.8)
M.S. Atapattu	Sri Lanka	38.6	68.5	744	231.7 (11.1)
N.V. Knight	England	38.2	71.5	644	233.6 (13.8)
B.C. Lara	West Indies	37.5	79.0	674	242.4 (20.3)
R.P. Arnold	Sri Lanka	36.4	71.1	551	234.6 (12.0)
A. Razzaq	Pakistan	29.6	71.9	541	211.7 (15.2)
W. Akram	Pakistan	19.6	87.2	436	225.1 (21.7)
S.M. Pollock	South Africa	18.4	81.0	468	195.9 (21.5)

Table 3. Sample correlation coefficients for the batting average (BA), strike rate (SR), PwC rating and runs per match (RM)

	BA	SR	PwC	RM
BA		–0.08	0.87	0.79
SR			–0.12	0.49
PwC				0.63

Table 4. Bowling statistics for 14 of the best active bowlers in ODI cricket listed in order of their bowling average (BA). The economy rate (ER), the strike rate (SR), the PwC rating and the runs per match (RM) are also provided along with a standard error for RM

Bowler		BA	ER	SR	PwC	RM (std. error)
M. Muralitharan	Sri Lanka	18.0	3.35	32.2	895	154.7 (7.4)
G.D. McGrath	Australia	19.2	3.77	30.3	905	158.8 (9.7)
A.A. Donald	South Africa	22.1	4.29	30.9	na	191.7 (13.4)
S. Akhtar	Pakistan	22.6	4.58	27.2	635	186.9 (13.2)
S.M. Pollock	South Africa	22.7	3.70	36.7	909	183.6 (8.7)
W. Younis	Pakistan	24.7	4.91	30.2	641	218.8 (13.4)
D. Gough	England	25.4	4.37	34.9	639	207.0 (12.1)
Z. Khan	India	25.5	4.71	32.5	715	218.0 (13.7)
A. Razzaq	Pakistan	25.6	4.38	35.0	569	221.0 (12.3)
W. Akram	Pakistan	25.9	4.03	35.8	769	197.8 (10.9)
S. Mushtaq	Pakistan	27.0	4.44	36.5	649	225.7 (13.1)
J.H. Kallis	South Africa	28.4	4.54	37.5	651	223.5 (11.2)
S.K. Warne	Australia	29.0	4.35	40.1	na	220.8 (12.1)
L. Klusener	South Africa	30.1	4.51	40.0	528	232.8 (11.3)

Table 5. Sample correlation coefficients for the bowling average (BA), economy rate (ER), strike rate (SR), PwC rating and runs per match (RM)

	BA	ER	SR	PwC	RM
BA		0.65	0.73	–0.79	0.93
ER			–0.02	–0.82	0.80
SR				–0.25	0.55
PwC					–0.85

Table 6. Rankings of our cohort of ODI batsmen and bowlers according to the runs per match statistic

Batsmen (rank)	Bowlers (rank)
Tendulkar (1)	Muralitharan (1)
Klusener (1)	McGrath (1)
Ponting (2)	Pollock (2)
Lara (3)	Akhtar (2)
Ganguly (3)	Donald (2)
Bevan (3)	Akram (2)
Kallis (3)	Gough (3)
Kirsten (3)	Khan (4)
Arnold (3)	Younis (4)
Knight (3)	Warne (4)
Atapattu (3)	Razzaq (4)
Youhana (4)	Kallis (4)
Akram (4)	Mushtaq (4)
Razzaq (5)	Klusener (5)
Pollock (6)	