

Fairly Random: Impact of Winning the Toss on the Probability of Winning*

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In nearly all cricket matches, it is claimed that there is a clear advantage to either bowling or batting first. The advantage is pointed to by commentators, by the team captains in the pre-toss interview, and by the captain of the losing team in the post-match interview. And to wrest the said advantage, one merely needs to pick the side of the coin left facing the sky after the toss. And while this method of granting advantage is fair on average, the system isn't fair in any one game.

At first glance, the imbalance seems inevitable. After all, someone has to bat first. One can, however, devise a baseball like system in which short innings are interspersed. If that violates the nature of the game too much, one can easily create pitches that don't deteriorate appreciably over the course of a game. Or, one can come up with an estimate of the advantage, and adjust the scores accordingly, akin to an adjustment issued when matches are shortened due to rain.

None of this to say that there is actually an advantage in winning the toss, or that teams are able to successfully exploit any such advantage. For it may be impossible to predict well in advance the advantage of bowling or batting first. Or, it may be that teams squander the potential advantage by using bad heuristics to choose what they do.

To assess the net observed advantage of winning the toss, we exploit data from a novel dataset of over 43,000 first-class men's cricket matches — to our knowledge, the largest ever dataset assembled for the question, and nearly 50–100 times larger than used in prominent previous attempts (see, [Dawson et al., 2009](#); [De Silva and Swartz, 1998](#)). And in analyzing these data, we

*You can find the scripts used to scrape the data, the final data set, and scripts used for analysis at: <https://github.com/dwillis/cricket-stats>.

avoid a common but important pitfall that some other studies on the topic fall into. To avoid post-treatment bias (see [Acharya, Blackwell and Sen, 2015](#)), unlike [Dawson et al. \(2009\)](#); [Shafqat \(2015\)](#) etc., we do not condition on post coin-toss decisions. We find that winning the toss grants a small but significant advantage, but that advantage varies considerably and systematically.

Data

Data are from 43,185 first-class men’s cricket matches. It is a near census of the relevant population. We have data on all types of matches: domestic and international Twenty20s — T20s and T20Is respectively, domestic and international one-dayers — List A and One-Day Internationals (ODI) respectively, and domestic and international multi-day matches — First Class (FC) and Tests respectively.¹

Of these matches, we do not have data on the toss for 2,807, or roughly 7%, of the matches. The primary reason we don’t have data on these matches is because the match was abandoned without play. We exclude data from these matches.

In limited overs cricket, a minimum number of overs must be bowled to establish a result. In a one-day match, for instance, each side must bat at least 20 overs for a result to be declared. In 706 matches, or roughly 1.7% of the remaining matches, not enough overs were bowled to get a result. We again exclude these matches from our analysis. This leaves us with 39,672 matches. We analyze these data.

Analyses and Results

We assume that the outcome of a toss is random. Conditional on the outcome of a toss being random, the effect of winning the toss can be attributed to the toss itself. Before we exploit the design, we shed some light on the validity of the assumption. In particular, we assess whether the

¹There is a rich variety of first-class matches. In English county cricket, first-class matches last four days. Some first class matches last just a day. Others two days. Yet others three days. And till a particular point in history, a test match lasted as long as it was needed to finish a game. We elide over such differences.

coin toss is somehow rigged, with the home side enjoying the rub of the green more often. For this analysis, we only get to exploit international matches as establishing which of the teams is the home team in local matches is somewhat arduous. Of the 5,591 international matches, the home team won the toss in 2,860 matches, or about 51.15%. The probability that we will get as large a proportion by chance after tossing 5,591 coins is about 8.7%, low but not eyebrow-raisingly so. Thus, for now, we choose to trust that the tosses are random.

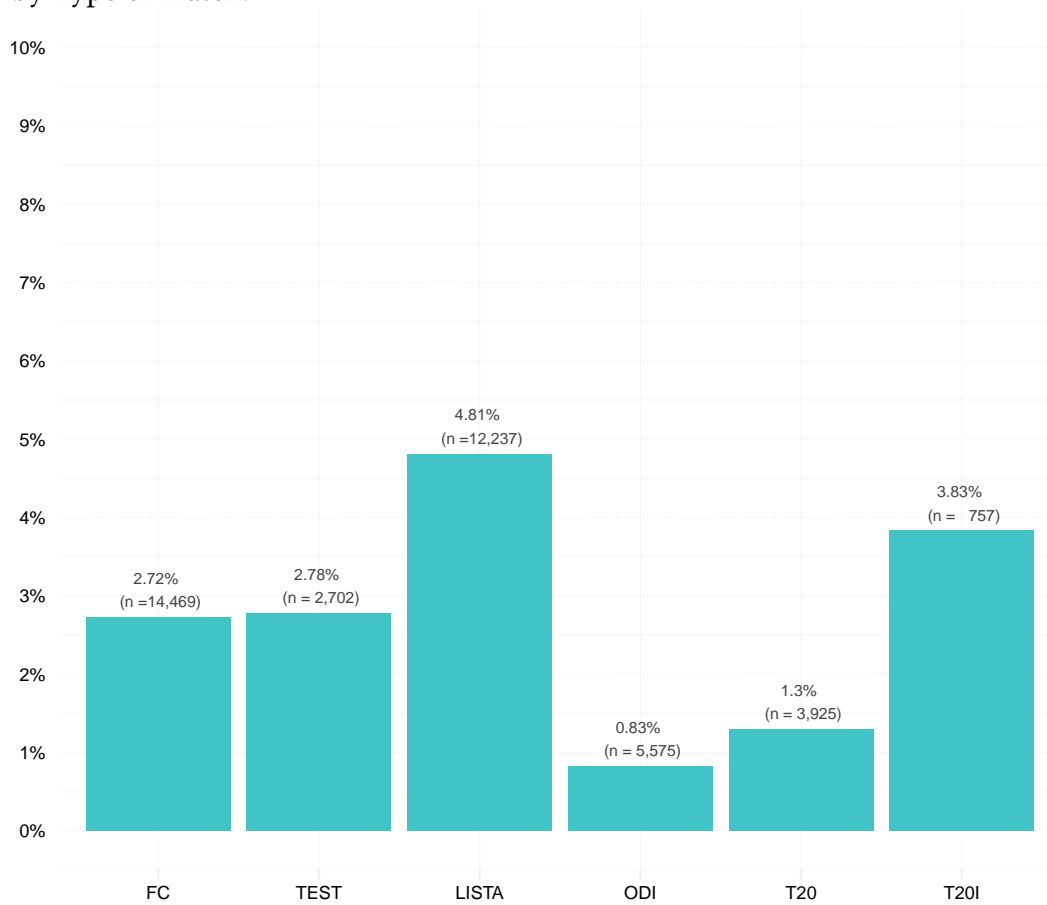
A caveat about interpretation before we report the results. As we discuss in the introduction, we cannot estimate the actual advantage of winning a toss. We can only estimate the net observed advantage, which is the extent to which the teams capitalize on the potential advantage. With that, the results.

The team that wins the toss wins the match 2.9% more often than the team that loses the toss. This is a reasonable sized advantage in a competitive sport — though likely much smaller than the number that most commentators carry in their heads. This advantage, however, varies by format, by conditions, by whether or not a particular formula was used to adjust scores when it rains, and how much better the team that won the toss is vis-à-vis the competing team. Some of the variability is expected, but as we will see, much of it is unanticipated.

The conventional wisdom among lay cricket followers is that toss grants the greatest advantage in multi-day affairs like tests and first class matches, followed by day long affairs, and Twenty20s. And there is good dose of common sense behind the conventional wisdom. Pitches invariably deteriorate over multiple days and batting last in a test match is often the most challenging time to bat. The pitch deteriorates far less over the course of the day, or in case of Twenty20s, a few hours. And indeed unlimited over matches provide the most consistent advantage — the average advantage over FC and test matches is north of 2.2% (see Figure 1). But the heftiest advantage is in domestic one-day matches (List A), approximately 4%. The number for ODIs, however, is a bit puzzling – there is a slight disadvantage to winning the toss. That can best be ascribed to choosing badly.

But type of matches cover only major source of variation and theorizing about the advantage

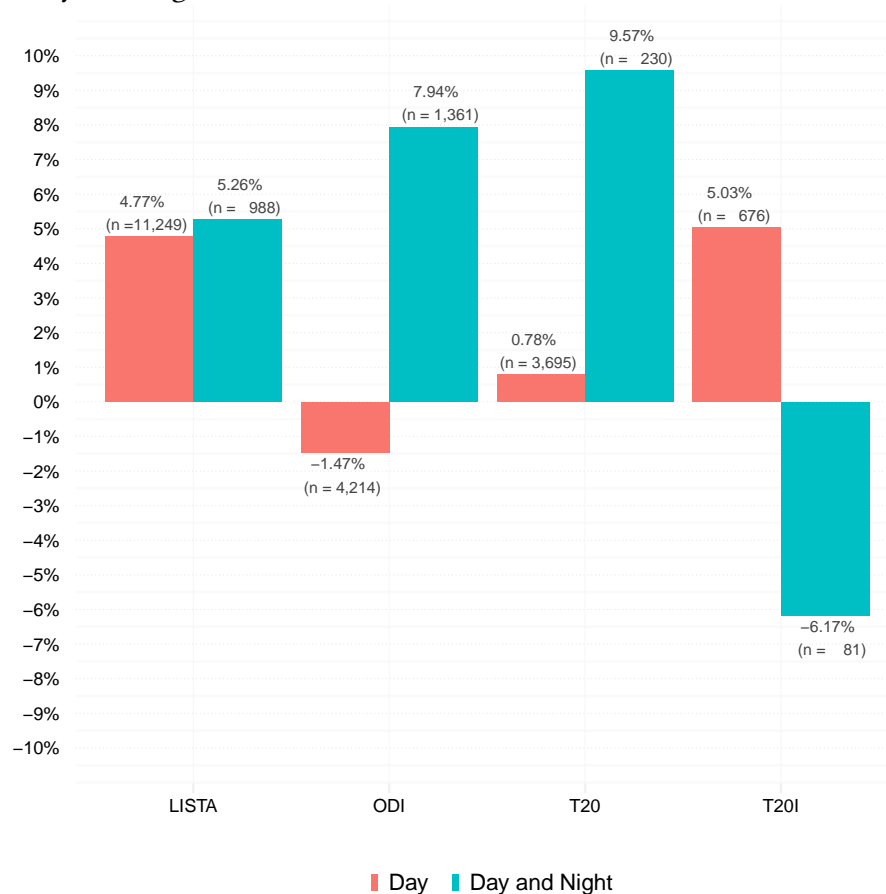
Figure 1: Difference in Winning Percentages of Teams that Won the Toss and Teams that Lost the Toss by Type of Match.



Note: n refers to the number of matches.

granted by the toss. It is often claimed that the toss is more crucial in day and night matches. Due to dew – it is thought to make bowling hard, and lower visibility of the white ball under lights – it allegedly makes catching hard, it is thought that the team that fields second is disadvantaged. It turns out that the conventional wisdom is largely vindicated, except in the case of Twenty20 Internationals (see Figure 2). In each, domestic one-day and Twenty20 matches, and one-day internationals, the advantage of winning the toss is at least 3%, and in case of one-day internationals, nearly 8%.

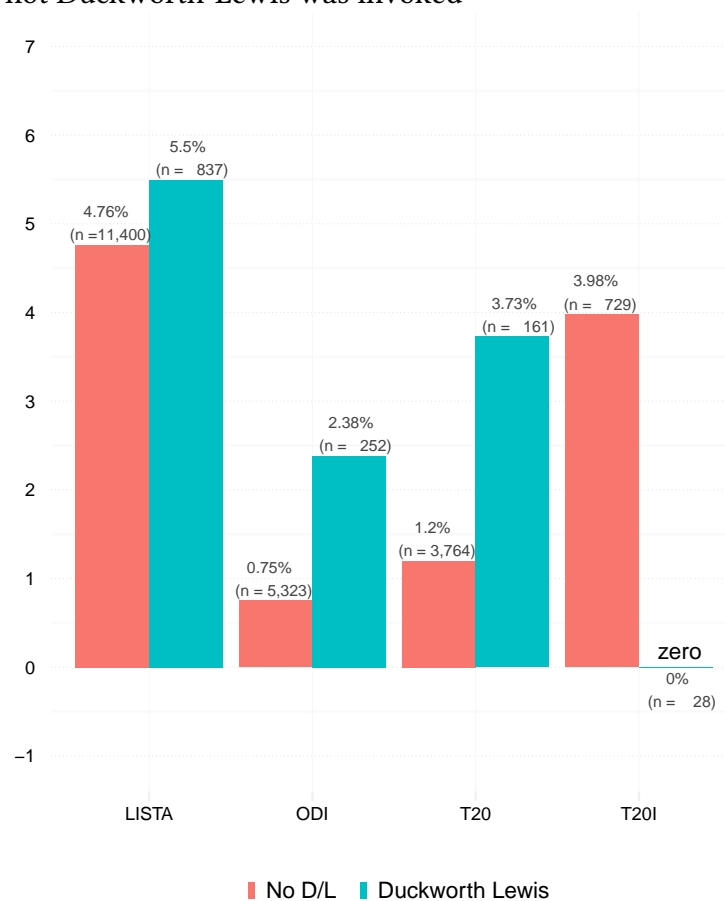
Figure 2: Difference in Winning Percentages of Teams that Won the Toss and Teams that Lost the Toss by Day or Day and Night



In limited over matches sometimes weather intervenes significantly after the match has already begun. After certain loss of time, the match is generally curtailed and the scores adjusted using a method invented by Duckworth and Lewis (see Duckworth and Lewis, 1998). We can use

the random nature of who wins the toss to see if winning percentages are strongly conditioned by matches that use Duckworth-Lewis and matches that don't. We find scant differences except in the case of international Twenty20s (see Figure 3).

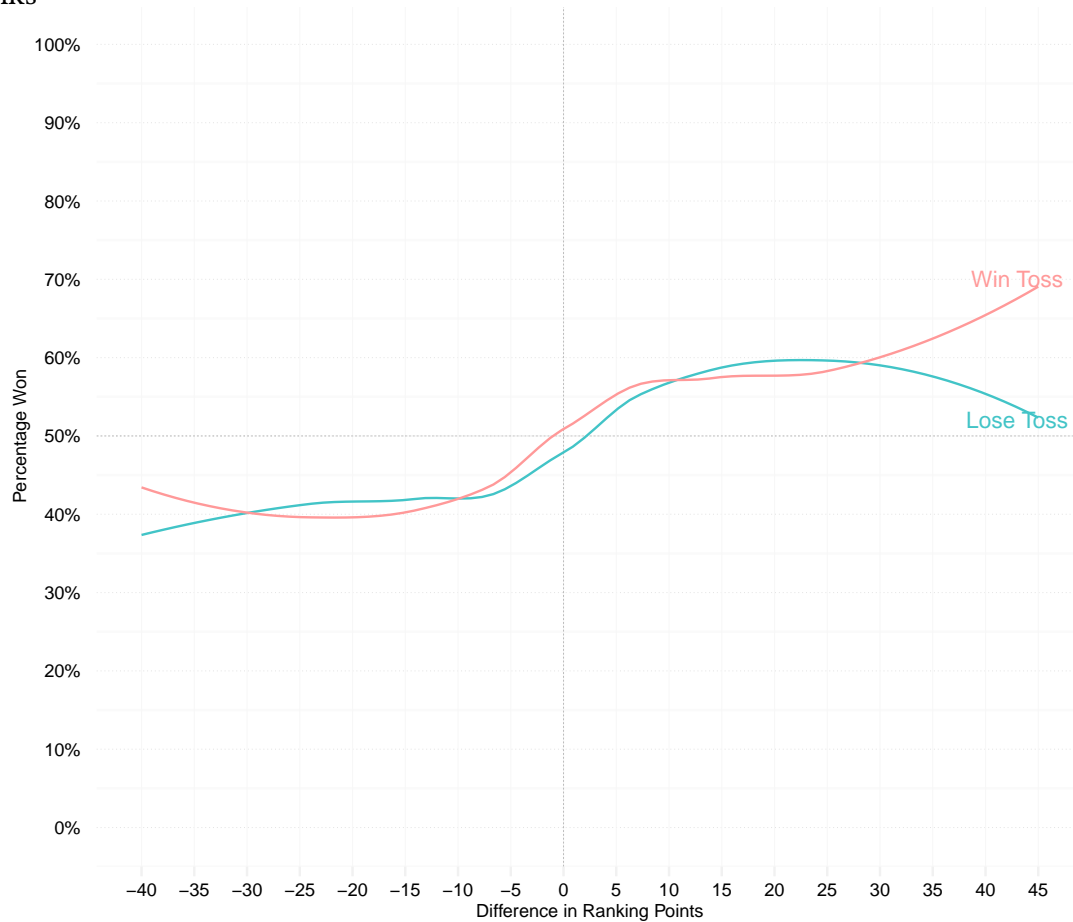
Figure 3: Difference in Winning Percentages of Teams that Won the Toss and Teams that Lost the Toss by Whether or not Duckworth-Lewis was invoked



Lastly, winning a toss ought to matter the most when two closely matched teams are playing. What good would winning the toss do if you are matched with a team you have no chance beating. To study this, we collected ranking data. The ranking data are only available for international teams. And for reasons to do with convenience, we limited ourselves to collecting data on one-day internationals and tests between the earliest starting point and 2013. (These ranking data are updated monthly.) We measure how closely matched the teams are by simply subtracting the ranking points of team that lost the toss from the team that won it. The results are

expected but new. As Figure 4, there is a sharp curve around 0. When closely matched teams win, the winning ratio is strongly affected by who wins the toss.

Figure 4: Percentage of Matches Won Minus Matches Lost After Winning the Toss by Difference in Ranks



This isn't a comprehensive inventory of analyses that one could do on the topic. But neither is it meant to be. There are some simple questions that still unanswered. For one, how does the toss advantage vary over time? Have teams become smarter? How the advantage vary by country – are some countries better than others? Other more nuanced but commonly thought questions also remain. For one, students of the game suspect that the advantage of winning a toss in early English season is especially great. We propose to investigate these questions in a follow-up piece.

References

- Acharya, Avidit, Matthew Blackwell and Maya Sen. 2015. "Explaining Causal Findings Without Bias: Detecting and Assessing Direct Effects."
- Dawson, Peter, Bruce Morley, David Paton and Dennis Thomas. 2009. "To bat or not to bat: An examination of match outcomes in day-night limited overs cricket." *Journal of the Operational Research Society* 60(12):1786–1793.
- De Silva, Basil M and Tim B Swartz. 1998. "Winning the coin toss and the home team advantage in one-day international cricket matches."
- Duckworth, Frank C and Anthony J Lewis. 1998. "A fair method for resetting the target in interrupted one-day cricket matches." *Journal of the Operational Research Society* 49(3):220–227.
- Shafqat, Saad. 2015. "Analysis: How many ODIs are decided by the toss of a coin?"
[http://www.telegraph.co.uk/sport/cricket/9163738/
Analysis-How-many-ODIs-are-decided-by-the-toss-of-a-coin.
html](http://www.telegraph.co.uk/sport/cricket/9163738/Analysis-How-many-ODIs-are-decided-by-the-toss-of-a-coin.html).