Managerial Decision Making under Uncertainty: the case of Twenty20 cricket

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Abstract

In this paper we consider managerial decision making by examining the impact of decisions taken by international cricket captains on match outcomes. In particular, we examine whether pressure from external commentators is associated with sub-optimal decision making by captains. Analysing Twenty20 (T20) cricket allows us to explore the evolution of decision making over time from the inception of this format of cricket. Applying a conditional logit model to a dataset comprising the full population of international T20 matches played between 2005 and 2011, we find little evidence that winning the toss improves the likelihood of winning, whether captains choose to bat or bowl first. Despite this, there is some evidence that over time captains have become more likely to follow the conventional wisdom and bat first on winning the toss. This finding is consistent with increasing social pressure constraining captains' decisions as the T20 format grows in importance.

Keywords: cricket, managerial decision making, uncertainty, conditional logit.

JEL codes: L83, D8, D83.

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1 Introduction

There is a growing literature on decision making under a type of uncertainty in which the decision maker is influenced by a lesser informed judge. Brandenburger and Polak (1996) show how managers can withhold private information from the lesser informed market because of short term concern for their company share price, while Cummins and Nyman (2005) demonstrate how inefficiencies can be endogenously created by very competitive environments in which one party is better informed than the other, such as when firms are better informed than their consumers but have to cater to their consumers' opinions. In this paper, we consider this particular type of decision making under uncertainty by examining decision making in professional cricket.

The use of professional sport as a testing ground for economic behaviour has a rich heritage, including Bhaskar (2009), who looks at decisions taken upon winning the toss in professional cricket matches by likening them to randomized trials, and Walker and Wooders (2001), who consider serving behaviour in professional tennis matches to investigate mixed strategy equilibria. Whilst experimental economists often use moderate financial incentives to try to induce rational behaviour amongst subjects in a laboratory setting (Camerer and Lowenstein, 2004), in contrast professional sportspersons tend to face very strong performance incentives because of the nature of their jobs, with considerable opportunities to learn over time. Further, data on professional sport often has the advantage of being detailed, comprehensive and accessible. The competitive nature of professional sport also means that decisions taken in these environments are particularly likely to help in furthering the understanding of decision making in other competitive environments.

Here we examine the batting order choices (the sequence in which the two teams "bat" and "bowl") of international cricket captains upon winning the random pre-match coin toss in light of concern about a widely held, though possibly incorrect belief regarding the optimal choice of batting order amongst the cricket media. The choice of batting order is a non-trivial decision because of the potential effects of the playing surface, called the pitch, and weather conditions on cricket match outcomes.

Boyle and Haynes (2009) and Whannel (2006) have commented on the increasing prominence of major professional sports in the mass media. This has consequently heightened the scrutiny on major sportspersons. Due to the heavy influence of the media on professional sport, media opinions serve as an external judgement on the decisions of international captains. Similar to the influence of the view of the external market on managers in the corporate world (Brandenburger and Polak, 1996), cricket captains are strongly aware of the critical opinions of the media.

Indeed, there exist further similarities between captains and corporate managers. Captains have a number of responsibilities with the ultimate goal of winning matches for their teams, just as managers of firms have the responsibility of managing their employees with the ultimate aim of maximizing profits for their companies. Also, captains are typically appointed for relatively short tenures. Whilst they are most likely to extend their tenures if they are successful in winning matches, given their short tenures captains may take decisions that benefit them rather than their teams. Narayanan (1985) shows that managers of companies who are appointed for longer tenures are less likely to take decisions that prioritize short term gains ahead of longer term profit maximization.

We present a model of captains' decision making in which a captain's decision making is constrained by social pressure. This social pressure is caused by a received wisdom amongst the cricket media that batting first is superior over the alternative of bowling first, also noted by Bhaskar (2009). This received wisdom has its origins in the early history of Test cricket, the oldest form of international cricket, where batting first was considered advantageous. Recent statistical analysis (Allsopp and Clarke, 2004) has offered little supporting evidence for this belief, but this received wisdom has persisted over time: captains who choose to bowl and lose in important Test and One Day International (ODI)[1] matches are subject to widespread criticism.

In contrast to previous work on this topic, we examine a relatively new format of the game called Twenty20 International (T20I) cricket, a second version of limited overs cricket. This allows us to observe decision making from the very inception of this format of the game and to test whether captains' decision making improves or worsens over time. We argue that social pressure to bat first is likely to be less prevalent early on in the history of T20I cricket due to the format being treated as experimental and early results being seen as of less importance than in other formats. Over time, the effect of social pressure may have risen because of the increasing popularity of T20I cricket. Further, social pressure is likely to be higher when playing at home due to greater media coverage and expectations from home crowds. Given this, in this study we test the effect of the toss on T20I match outcome over time. Although we argue that T20I cricket can provide insights that are of wider relevance

[1] ODI cricket is the first version of limited overs international cricket, beginning in 1971. It was initially played at 50, 55 or 60 overs a side, but has remained at 50 overs a side for the last two decades.

for decision making under uncertainty, the results of this study will also be of specific interest to cricket captains (and team managers) who wish to better understand the role of batting order choice in T20I performance, as well as cricket administrators who wish to understand the importance of the toss in the optimal design of tournaments.[2]

Applying a conditional logit model to a dataset comprising all T20Is played till the time of writing, we find that winning the toss and the choice of batting order upon winning the toss appear to be insignificant in influencing match outcomes over time. Despite this, we find some evidence that captains have become more likely to choose to bat first over time on winning the toss. This finding is consistent with increasing social pressure constraining captains' decisions as the T20 format gains popularity and media coverage.

The rest of this paper is structured as follows. In section 2, we discuss the relevance of managerial choice under uncertainty in the context of cricket captaincy and present a simple model of captains' batting order choices in professional cricket. In section 3, we discuss the empirical methodology and data used in this paper. In section 4, we present some descriptive statistics of the data and then report and comment on the multivariate regression results before closing with some concluding remarks in section 5.

2. Managerial decision making in professional cricket

2.1 Managerial choice under uncertainty

Baird (1989) suggests that "the best way to judge the competence of any executive…is by the quality of decisions made in complex situations when faced with uncertainty" (p.5). When making these decisions, managers may face uncertainty from various sources, such as the changing nature of demand for their goods, supply side changes and invention and innovation (Jones, 2004).

As mentioned, of primary interest to this study are decisions in which individuals are influenced by others' judgment of their actions, especially where such judgment by others has a financial payoff riding on it. Brandenburger and Polak (1996) constructed a model of managerial choice in stock markets in which they showed that managers were driven to withhold private information to keep share prices in line with market expectations instead of maximizing profits. Similarly, Narayanan (1985) demonstrated that when managers possess private information regarding a firm's decisions, they may take decisions that result in short term gains at the expense of shareholders, although the likelihood of these decisions is

[2] Several commentators have suggested abolishing the toss and allocating the choice of batting order to the away side on the grounds that this will improve the competitive balance of cricket matches.

inversely related to experience and length of contract. Narayanan (1985) suggested these decisions are driven by a manager's desire to enhance his reputation, especially if newly hired. Baker and Nyman (2009) looked at hiring decisions faced by employers, who typically have inferior information compared to their interviewees about their suitability for a job. Baker and Nyman (2009) pointed out that interviewees may not necessarily disclose whether they are suited to the job to their potential employers, with their decisions partially dependent on labour market conditions. Cummins and Nyman (2007) discussed the incentives created by rank order promotion tournaments within companies in which employees competing with each other may be forced to agree with their superiors' pre-conceived notions about investment decisions and projects in order to gain promotion, despite obtaining superior information contradicting their superiors' views. In each of these uncertain situations, individuals face incentives that leave them unwilling to make efficient use of the information available, as their choices are evaluated by those with inferior information. Indeed, as Cummins and Nyman (2005) suggest, it is the very competitiveness of these environments that drives such behaviour.

2.2 Roles of cricket captains

In professional cricket, the captain plays a key role in the running of his team. He bears several responsibilities, including formulating plans and strategies within matches and series; having a say in team and squad selections; acting as a team spokesperson during interactions with the media and maintaining team morale in a squad of up to sixteen other players. While the concept of a team coach has gained increasing currency in professional cricket over the last two decades, the captain of a cricket team still bears more responsibility than captains in other team sports. We focus on international professional cricket in our discussion, as it is the elite and most widely followed type of professional cricket.

In international cricket teams, the selection committee is akin to a principal and the captain to an agent. The selectors choose squads and appoint captains with the aim of winning matches and series, so cricket captains are accountable to their selectors (and in some countries, the administrators of their national governing body). Whilst the selectors can observe decisions taken by the captain, they are not privy to the captain's motivations. Given the level of competition; pressure faced from selectors and the fact that T20I cricket usually has only two outcomes, one might expect captains to care only about winning matches. However, there is a major source of external pressure on captains from the cricket media. International cricketers face scrutiny of their careers to a degree that has little parallel with most real world managerial jobs. Although, for example, major companies are also closely followed by the financial media, the constant, individual scrutiny on major cricketers is very different in nature. Andrew Strauss, the current captain of the English Test cricket team, provides some insight into the possible effect of this criticism on decision making by explaining that "…thoughts can go through your head in terms of how…decisions are going to…be received by the media" (Berry, 2010).

Previous studies on social pressure have noted such external influence on behaviour. For example, Bernheim (1994) constructed a model of social interaction in which an individual's utility function includes a need for social approval in addition to standard consumption utility. In this model, the social status of an individual is assumed to depend in part on the public perception of him or her.

2.3 The batting order decision

Batting order decision making provides a useful natural experiment of managerial choice under uncertainty. The captain, who is like a manager, chooses between two alternatives not knowing what the outcome will be, just as a manager might choose between two employees not knowing whether they will be productive for the company or between two investment choices not knowing what the return will be with certainty. While this decision is sometimes made in consultation with the team coach and other players, the captain bears responsibility for it. Further, in contrast to many other decisions, data are available on a specific performance measure (match outcome) that is directly associated with each decision.

Several international captains have faced extreme criticism after choosing to bowl first and losing in important matches. After receiving extensive criticism for bowling first and losing the second Test of the 2005 Ashes series, a series Australia subsequently lost, the former Australian captain Ricky Ponting never chose to bowl in a Test match. The former English captain Mike Denness was sacked after losing the first Test match of the 1975 Ashes series against Australia, partly because of his decision to bowl first. Another former English captain, Nasser Hussain, faced substantial criticism about his choice to bowl first in the opening Test match of the 2002-03 Ashes series, which England subsequently lost. After retirement, Hussain commented on the long standing criticism of that decision to bowl, saying "...it has...been labelled the biggest mistake I made as England captain" (John, 2006).

Such criticism has also been faced by captains choosing to bowl first in important ODI matches: for example, the former Indian captain Saurav Ganguly received considerable criticism after choosing to bowl first in the final of the 2003 ODI World Cup against

Australia, which India lost. Given this prevalent received wisdom and its often adverse implications for captains who have chosen to bowl first in Test and ODI cricket, we examine captains' decision making in the relatively new T20I format, first played in February 2005. This novelty of T20I cricket can potentially provide insights into learning over time. Specifically, in the early days of T20I cricket, the matches were treated less seriously by the media. As interest in the format has grown, decision making by captains has come under a similar level of scrutiny to other forms of cricket.

The frequent discussion of the effect of the toss and batting order choice on professional cricket match outcomes has made it a subject of some interest in the literature, with previous studies having looked at the effect of the toss on international and domestic match outcomes. de Silva and Swartz (1997) found that winning the toss offers no competitive advantage in ODI matches, while Allsopp and Clarke (2004) noted that winning the toss provides no real advantage in either Test or ODI cricket. Morley and Thomas (2005) looked at domestic English one day cricket and found the toss was slightly significant in influencing match outcome, but relative team strengths and home advantage were more notable determinants of victory. Dawson et al. (2009) investigated day/night ODI matches and found that winning the toss and batting first increased the chance of winning.

Plainly, the literature has not found a clear advantage from winning the toss on professional cricket match outcomes. There is some evidence that winning the toss raises the chance of winning in some international matches, notably day/night ODI matches, but the toss seemingly does not provide a real advantage in Test cricket or ODI cricket played in the day. Despite this, batting first continues to be considered a superior choice by the cricket media.

2.4 A model of the batting choice decision

On winning the toss, a captain is faced with the choice of batting or bowling first. Excluding ties, there are only two possible results in T20I cricket, a win or a loss, giving four possible decision and outcome combinations. One might expect captains to make the choice of batting order in a T20I match with the sole aim of winning, as it is safe to assume that winning is more pleasurable than losing. Further, successive losses increase pressure on captains from their panel of selectors. However, we propose that the pressure exerted by scrutiny from the media is also likely to influence their behaviour, in particular through the incorrect but entrenched received wisdom that batting first increases the chance of a team winning as compared to bowling first.

We present a model of captains' decision making in T20I cricket. We propose that a captain's decision making is affected by social pressure, so that he can only maximize his expected utility subject to a social pressure constraint, with financial rewards assumed as given. In this case, as the social pressure constraint tightens due to rising social pressure over time, captains will increasingly take sub-optimal decisions. The model is presented below. We first show a captain's expected utility function:

$$Expected\ Utility\ (EU) = f\ (outcome,\ batting\ order)$$

$$EU = pU_W + (1-p)U_L$$

$$EU = U_L + p(U_W - U_L) \quad \textbf{[1]}$$

where:

p = *probability of team winning*

U_W = *utility gained from winning match*

U_L = *utility gained from losing match*

Let $p=t+e$, where t is the increase or decrease in probability of winning from batting first, whilst e is everything else that can affect the probability of winning. As t increases, e decreases.

$$EU = U_L + [t(Bat)+e](U_W - U_L)$$

$$-1 < t < 1$$

$$-1 < e < 1$$

$$Max\ EU\ subject\ to\ S+E(t) > 0$$

where:

S = *social pressure*

$E(t)$ = *expected impact of batting first on the probability of winning*

Without social pressure, to maximize EU a captain will choose to bat $(Bat=1)$ if $E(t)>0$, meaning the expected impact of batting first on the chance of winning is positive. He will choose to bowl $(Bat=0)$ if $E(t)<0$, as the expected impact of batting on winning is negative. However, in this case, with $E(t)<0$ and bowling first being the correct choice, social pressure has an impact on the captain's decision. To illustrate this, let the constraint to bat first be binding if $S + E(t)>0$, meaning that social pressure to bat first is greater than the expected beneficial impact of bowling first on winning. Figure 1 shows how the social pressure constraint affects expected utility by plotting expected utility against the marginal change in the probability of winning from winning the toss. With no social pressure, as t approaches -1 (meaning the probability of losing after batting first approaches certainty), EU increases with bowling first, because it makes winning more likely. However, if constrained by social pressure, captains will take sub optimal decisions, choosing to bat even though it lowers expected utility.

In our empirical analysis, we will test for the effect of the toss and batting order choice over time on match outcome. Based on our previous discussion, we can identify some competing hypotheses. First, if greater knowledge of T20I cricket leads to better decision making, then the toss would be expected to have an increasing positive effect on winning over time; however, if social pressure increases over time, then the effect of the toss would be expected to decrease over time. Second, if knowledge of local conditions helps, the effect of the toss would be expected to be greater in home games, but if social pressure in home games is higher, then the effect of the toss would be expected to be lower in home games. We now go on to test for the effect of the toss on T20I match outcome considering the potentially conflicting effects of social pressure over time and home advantage.

3 Empirical Methodology and Data

3.1 Conditional logit model

Our core empirical approach is to estimate conditional logit models of the probability of winning. The data are organized with two observations for every match, representing the winning and losing team respectively. Due to the inherent dependence between teams in each match, some previous studies such as Duggan and Levitt (2002) clustered the standard errors for each match. Simply clustering the standard errors, however, does not control for the fact that the two observations for each match are correlated with each other by construction. For this reason, we follow Dawson et al. (2009) and use the conditional (fixed effects) logit model. Koop (2008) explains that conditional logit analysis can be employed when multiple alternatives exist with variance across alternatives for any individual. For comparison, we also report OLS estimates in which the dependent variable is the margin of victory (or loss) for each team.

We follow the notation of Dawson et al. (2009) in constructing a conditional logit model:

$$y^*_{mt} = x_{mt}\beta + \alpha_m + \varepsilon_{mt} \quad [2]$$

where y^*_{mt} (m refers to match and t to team) is an unobserved variable measuring team performance; x_{mt} is a vector of explanatory variables; β is a vector of unknown parameters; α_m is an idiosyncratic fixed effect associated with match i and ε_{mt} is a random error term accounting for discrepancies between observed responses and predicted outcomes.

y_{mt} can also be written as the binary response variable that measures the performance of the team:

$$y_{mt} = \begin{cases} 1 \text{ if the team wins} \\ 0 \text{ otherwise} \end{cases}$$

The probability of the team winning is given in Equation 3:

$$\Pr(Y_t = 1|x_{mt}, \alpha_m) = \frac{\exp(\alpha_m + \beta x_{mt})}{1 + \exp(\alpha_m + \beta x_{mt})} \quad [3]$$

3.2 Variables

The discussion above suggests a number of variables expected to influence T20I match outcome. This list of variables and their description is provided in Table 1. Data on the variables are available for every match in the sample. *Win* and *Margin* are used as the dependent variables when estimating the probability of winning and the margin of winning respectively. *Toss* is a binary variable which assumes the value 1 if the team wins the toss, 0 if it loses. The expected sign on *Toss* is positive, though previous studies have found mixed results on its effect on Test and ODI match outcomes.

We include *Toss*DecisionBat* and *Toss*DecisionBowl* as interaction terms that assume the value 1 if the team wins the toss and chooses to bat and the team wins the toss and chooses to bowl respectively, and 0 otherwise. These terms are included to assess the effect of the batting order choice upon winning the toss on match outcome. *Home* is a binary variable which assumes the value 1 if the team is playing at home, 0 otherwise. This variable is included because of the widely observed home field advantage in professional team sports (Nevill and Holder, 1999), with teams playing at home expected to better exploit knowledge of pitch and weather conditions and to benefit from crowd support. *Home* is thus expected to have a positive coefficient. We include a *Toss*Home* interaction term to examine the effect of winning the toss at home. *TeamStrengths* controls for the relative strengths of the two teams, defined as the difference in pre match T20I ratings between the team and its opponent. This variable is expected to have a positive coefficient, with the higher pre match rated team expected to win. *DayNight* is a binary variable indicating whether the match was played under floodlights. *Time* is the number of the T20I that the team is playing, so that, for example, the fourth T20I that Australia played has a *Time* value of 4, the fifth a *Time* value of 5 and so on for all seventeen teams in the sample. *Time* will be interacted with *Toss* to ascertain the effect of the toss over time. Finally, *Experience* shows the number of T20Is the captain of the team had led in prior to the game.

3.3 Data

The data comprises all 192 T20I matches played by the seventeen T20I teams[3] between February 2005 and July 2011, not including four matches that were abandoned due to poor weather conditions and five others that were tied. The data was obtained from the ESPNcricinfo web site. For each match our dataset includes the date; venue; competing teams; batting order; which team's captain won the toss; batting order decision taken by the captain who won the toss; match result; whether the game was played under floodlights; whether one team was playing at home; number of T20Is each team had played prior to the match and the number of T20Is each team's captain had led in prior to the match.

To measure relative team strengths in the absence of pre match betting odds and official International Cricket Council (ICC) ratings for T20I cricket, we construct a rating system for T20I matches based on the ICC's ODI cricket rating system.[4] Also, the result margin in runs for matches in which the team batting second won (where the result was achieved in terms of wickets and overs remaining, rather than runs) was obtained by converting the wickets and overs remaining into a runs value using the T20 scaled Duckworth-Lewis table for rain affected matches (Duckworth and Lewis, 1998).

4. Results

4.1 Descriptive Statistics

We present some descriptive statistics in Tables 2 to 4. In Table 2, we report summary statistics for each variable and also the mean win percentages in particular circumstances. The raw data suggest an apparent benefit from winning the toss, with the team that wins the toss winning about 57% of matches. Despite the fact that fewer than half the matches have

[3] These are, in order of playing T20Is: New Zealand, Australia, England, South Africa, West Indies, Sri Lanka, Pakistan, Bangladesh, Zimbabwe, India, Kenya, Scotland, Netherlands, Ireland, Canada, Bermuda and Afghanistan.
[4] There were two differences from the way the ODI rating system is calculated. Firstly, the ODI rating of the team at the time of its first T20I match was used as its initial T20I rating, with each team given, for points calculation purposes, a base number of ten matches. Secondly, the T20I ratings system did not contain matches played in the previous three years only as the ODI system does, because the volume of T20Is is less than of ODIs.

been won by the side that batted first, captains who won the toss chose to bat first 56% of the time.

Teams choosing to bowl first upon winning the toss emerged victorious in about 58% of cases, compared to around 56% for teams choosing to bat first. In day/night games (played under floodlights), the winning percentage for teams winning the toss is much closer to 50%, suggesting that very little advantage is gained from winning the toss in such matches. The team batting first in day/night games won 57% of the time. Teams playing at home win almost 58% of the time, and further, teams winning the toss at home win nearly two thirds of the time, suggesting a major advantage from playing at home in T20I cricket.

Next, we split the sample into three chronological periods to investigate how the descriptive statistics change over time. This gives us an indication as to whether there is evidence of captains adapting their decisions in light of previous T20I matches. We report the percentage of matches in which the captain chose to bat after winning the toss, the percentage of teams that won after choosing to bat first and, finally, the percentage of teams that won after batting first regardless of which team win the toss, looking at how these proportions change over time. Examining changes over time is particularly interesting because early on, captains were unaware of optimal batting order choices, but over time, one would expect them to have learned these choices.

As there are 192 matches in our sample, the three splits are of 64 matches each. The results are reported in Table 3, including the standard errors. The split sample percentages show that in both the first and second third of T20Is, captains chose to bat between 53% and 55% of the time, but in the final third of T20Is, captains leant more strongly towards batting first, choosing to bat first in 61% of T20Is. However, because of the large standard errors, the changes are not necessarily strong evidence of a shift in decision making, possibly being variations caused by the small sample instead.

Even so, despite this possible shift towards batting first over time, the percentage of matches won by teams choosing to bat first has not risen substantially. Further, while the percentage of teams winning batting first regardless of whether they won the toss rose in the second third of T20Is (again, the standard errors are large), there was a decline in the final third, in contrast to the sharp increase in the proportion of captains batting first. If the data are capturing the true effect, rather than varying because of the small number of observations, this shift suggests that the decision making of captains could be driven by reasons other than winning alone, though not necessarily so.

Referring back to the theoretical model above, it is possible captains are responding to a conventional wisdom that constrains decisions. The sharp increase in the proportion of captains batting first is not necessarily caused by this received wisdom but is consistent with the effect of external judgment by those with inferior information, similar to Brandenburger and Polak's (1996) theory of managers behaving in line with how the lesser informed market expects. In international cricket, captains are better informed than the media in terms of knowledge of their team strengths, best strategies and pitch conditions, but may similarly take decisions in line with the lesser informed media's opinions because of the potential criticism from bowling and losing. By doing so, captains can partially control for adverse consequences from the outcomes of their decisions. As Bhaskar (2009, p.21) points out, the old management adage used to be that "no one got fired for buying IBM" (p.2) and similarly, by choosing to bat first, captains can reduce the criticism that could follow their decision making.

To further examine decision making by captains in T20Is, we consider decisions made by individual captains in T20Is. At the time of writing, there had been 56 captains of the seventeen T20I teams. Of these 56 captains, only 25% led their teams in ten or more T20Is, while 60% led in fewer than five T20Is. In Table 4, we report the proportion of decisions to bat first by captains based on the experience of captains. Interestingly, captains who led in more than ten games batted first more often than those who led in fewer than ten games. However, these statistics, being cumulative, do not show how captains' decision making evolved over time. As mentioned, Narayanan (1985) demonstrated that managers with more experience were less likely to be influenced by market opinion and put short term benefits first. It is interesting to consider if captains' batting order choices evolve similarly.

The descriptive statistics make clear that any influence of the toss on win probabilities is moderated by other factors. For this reason, we now move on to a multivariate regression analysis.

4.2 Conditional logit estimation

We report the conditional logit estimates in Table 5. Using this method, we estimate two observations per match but incorporate match fixed effects.

We begin by including *Toss, TeamStrengths* and *Home* as explanatory variables in the first regression. *Toss* and *Home* both have positive coefficients as expected, but are statistically insignificant. However, *TeamStrengths* is very significant, at the 1% level of confidence. The coefficient on *Toss* was positive and statistically significant prior to the inclusion of *TeamStrengths*. However, once *TeamStrengths* was included, the coefficient was no longer significant, suggesting the effect of the toss recedes once the relative strength of the team to its opponent is controlled for. To interpret the coefficient on *TeamStrengths*, we convert the coefficient into its marginal effect, showing the partial derivative of the probability of winning with respect to *TeamStrengths*. The marginal effect is 0.002, implying that a 1% increase in the pre-match ratings point difference is likely to raise the probability of winning a T20I by 0.2%. In the second specification, we separate the batting order choice taken upon winning the toss by considering *Toss*DecisionBat* and *Toss*DecisionBowl* separately. Interestingly, the marginal effect of winning the toss and bowling on winning the match is one and a half times as much as winning the toss and batting, suggesting winning the toss and bowling is more successful than winning the toss and batting. Despite this, captains are still shifting towards batting first over time, as shown earlier. However, the two interaction terms are statistically insignificant, as is *Home*.

In the third regression, we consider the effect of winning the toss over time by interacting *Toss* with *Time*. The interaction term is statistically insignificant, suggesting the effect of the toss is not significant over time. Surprisingly, the coefficient is negative, implying the probability of winning a T20I after winning the toss is lessening over time. In the fourth regression, we consider the effect of playing at home and winning the toss at home to assess the importance of home advantage in T20Is. The sum of the coefficients on *Toss* and *Toss*Home* is around 0.55, but both variables are insignificant.

In the fifth regression, we consider the effect of winning the toss in day/night games. The interaction term has a negative coefficient, implying that winning the toss in a day/night game reduces a team's chances of winning, though it is insignificant. *Toss* is slightly significant, though the sum of the coefficients on *Toss* and the *Toss*DayNight* interaction term is negative. In the sixth regression, we consider the effect of captaincy experience and also interact captaincy experience with winning the toss to see how this evolves with time. *Experience* is not significant, but *Toss*Experience* is only slightly insignificant at the 10% level. The sum of the coefficients on *Toss* and *Toss*Experience* is positive, which suggests that as individual captains gain experience of T20I cricket, the probability of winning the match if they win the toss increases, though increasing captaincy experience is in itself reflective of some intrinsic captaincy skill. Nonetheless, this finding is similar to Narayanan's (1985) suggestion that more experienced managers face fewer incentives to prioritize short term gains at the expense of shareholders, as in both cases social pressure lessens with experience.[5]

Clearly, the conditional logit estimates suggest relative team strength is the only statistically significant explanation of T20I match outcome, robust to a number of specifications. Notably, the effect of the toss is statistically insignificant, as is the choice of batting order, with two exceptions: the toss is significant when considering day/night matches and captaincy experience.

4.3 OLS estimation

As comparison, we report the OLS estimates in Table 6, using margin in runs as the dependent variable. In the first regression, a point increase in *TeamStrengths* raises the margin of victory by just under 0.46 runs. The average margin of victory in runs in T20Is is almost 32 runs. The coefficient on *TeamStrengths* implies that, if all other variables are held constant, an increase in twenty points in pre-match ratings would raise the margin of victory by over 9 runs, which is over 28% of the average margin of victory. This suggests that widening gaps in relative team strengths tend to considerably raise the margin of victory in favour of the higher rated team.

Winning the toss raises the margin of victory by over 7 runs, holding all other variables constant. All other things being equal, playing at home raises the margin of victory by nearly 13 runs, suggesting playing at home raises the average margin of victory by almost twice as much as winning the toss does. The *Toss*Time* interaction term has an insignificant coefficient. The coefficients on the *Toss*DecisionBat* and *Toss*DecisionBowl* interaction terms are again insignificant, suggesting the choice of batting order is not significant in raising the margin of victory. *Experience* and *Toss*Experience* are both significant, with a positive sum of coefficients between *Toss* and *Toss*Experience*, suggesting that with increasing experience, on average captains are likely to win by higher margins on winning the toss.

Evidently, similar to the conditional logit estimates, the OLS results show a very significant effect of relative team strengths on the margins of victories in T20Is, with the larger the difference, the more likely the higher rated team is to win by a big margin. Strikingly, the effect of the toss is statistically significant in influencing the margin of victory,

[5] *TeamStrengths* was interacted with *Time* but was very insignificant. This is not reported.

as is playing at home, in contrast to the conditional logit estimates. However, the effect of the toss on match outcomes over time is again insignificant.

So, how do our results compare with previous literature? Earlier studies have looked at the effect of the toss on Test matches and ODIs rather than T20Is, so the comparison with our results has to be considered firstly in light of the differences in formats and secondly the time needed for captains and players to adapt to a new version of the game, though our results partially control for time and experience. The high significance of relative team strengths is similar to Allsopp and Clarke's (2004) finding that higher rated teams were more successful in Test and ODI matches. The lack of significance for the toss is similar to both de Silva and Swartz's (1997) result for ODI cricket and Allsopp and Clarke's (2004) result for Test and ODI cricket. However, the insignificance of playing at home is in contrast to the results obtained by Morley and Thomas (2005) and Allsopp and Clarke (2004), who considered home field advantage in English domestic and international one day cricket respectively. The insignificance of batting order choice contrasts with Dawson et al. (2009), who found a very significant and positive effect of batting first in day/night ODI matches. The shorter length of T20I matches means that conditions do not change as markedly between innings as they do in day/night ODIs, though the toss was nonetheless significant in day/night T20Is.

5 Concluding Remarks

We derive a simple model to illustrate the possibility in which cricket captains maximize the probability of winning subject to a social pressure constraint. Our model is consistent with the literature on uncertainty in which the decision maker is evaluated by a lesser informed judge. As the decision maker responds to what the less informed judge expects, sub-optimality results. One example is found in Brandenburger and Polak (1996), who suggest managers "…often complain that they feel pressured to make the decisions the stock market thinks is correct rather than the decisions they believe to be in the best interests of their firms" (p.524). Similarly, our model proposes that external pressure can lead to sub-optimal decisions that do not maximize the team's probability of winning.

Using the entire population of T20Is, this paper tests some implications of this model. Our findings suggest that, controlling for relative team strengths and home advantage, winning the toss does not have a meaningful impact on the outcome of the match, irrespective of the choice to bat or to bowl first. Furthermore, the impact of the toss does not significantly change over time. Despite this, we find some evidence of a shift towards batting first by T20I captains over time, which is consistent with our hypothesis that increasing social pressure over time is affecting captains' decision making. Specifically, captains could possibly be making batting order choices that shield them from media criticism. Our empirical analysis finds some tentative evidence that captains are opting to bat first more frequently over time, though there is little to suggest that this shift in decision making is successful.

Of course, unlike corporate managers, captains are not accountable to shareholders. But should they compromise the team's optimal winning chances due to being constrained by social pressure, their decision making can contribute to declining fan interest and revenues for their board in the longer term. Given this, the possibility of international sports captains making sub-optimal decisions is of considerable interest.

Our research adds to the literature by suggesting how this decision making behaviour can occur even in a highly competitive and scrutinized environment like Twenty20 international cricket, reinforcing Cummins and Nyman's (2005) suggestion that competition can drive inefficient behaviour. If international cricket was less competitive and thus less scrutinized, captains would possibly be less concerned by external opinions and so face less pressure to take incorrect decisions.

The finding that the toss is not apparently important in T20Is can also be of interest to the ICC in terms of the debate over the fairness of day night matches in major tournaments, as discussed by Dawson et al. (2009). Although Test matches and ODIs played in the day do not apparently provide the team winning the toss with a major advantage, day/night ODIs give the team batting first after winning the toss an advantage, raising issues about their presence in major ODI tournaments. Contrary to the perception that the shorter duration of T20I matches makes them more chance than skill driven as compared to ODI cricket and especially Test cricket, our results suggest that T20I cricket matches, like Test and ODI matches, are generally won by the stronger team, and the toss is seemingly not very important, though the sample of T20Is considered in this study is small. While this suggests T20I cricket is a very fair contest with the toss giving no advantage, the low chance of an upset may reduce spectator and TV viewer demand for T20I cricket. Apart from its strategic implications, the toss is an integral part of the entertainment provided by professional cricket matches and as such, removing it could lower fan interest by reducing the spectacle of a professional cricket match.

This dataset used in this study comprises every T20I match played to date. The format, however, is still in a relatively early period of development. As more matches are played, future research might usefully explore further the evolution of learning and adjustment to decision-making trends. Comparisons with domestic Twenty20 competitions, and in particular the Indian Premier League, are also likely to be instructive.

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Table 1: Variables and Definitions[6]

Variable	Definition
Win	1 if the team won the match, 0 if it lost
Margin	Margin of the result for the team, in runs
Toss	1 if the team won the toss, 0 if it lost
Bat	1 if team batted first; 0 otherwise
Bowl	1 if the team bowled first, 0 otherwise
*Toss*DecisionBat*	1 if the team won the toss and chose to bat first, 0 if not
*Toss*DecisionBowl*	1 if the team won the toss and chose to bowl first, 0 if not
Home	1 if the team played at home, 0 if not
*Toss*Home*	1 if the team played at home and won the toss, 0 if not
TeamStrengths	Difference in pre match T20I rating between team and opposition
DayNight	1 if the match was played under lights, 0 if not
Time	The number of T20Is the team had played
Experience	The number of T20Is the captain had led prior to the match

Table 2: Summary statistics

Variable	Mean (SE)
Margin	**31.5 (2.17)**
TeamStrengths	**27.4 (2.31)**
Bat | *toss* = 1	**56.3 (3.58)**
Bowl | *toss* = 1	**43.8 (3.58)**
Win % if:	
Toss = 1	**56.8 (3.57)**
Bat = 1	**48.4 (3.61)**
*Toss*DecisionBat* = 1	**55.6 (4.78)**
*Toss*DecisionBowl* = 1	**58.3 (3.58)**
Home = 1	**57.6 (5.15)**
*Toss*Home* = 1	**65.4 (6.60)**
*Toss*DayNight* = 1	**50.7 (5.85)**
*Bat*DayNight* = 1	**57.5 (5.79)**
N	**192**

[6] We also included a binary variable for a foreign coach which assumed the value 1 if the team coach was foreign, 0 if not. It was later dropped as it was very insignificant and added little explanatory power, with limited justification to include it based on previous literature.

Table 3: Decision making and winning over time

	Split 1 (SE)	N	Split 2 (SE)	N	Split 3 (SE)	N
Choosing to bat after winning the toss	**53.12 (6.24)**	**34/64**	**54.68 (6.22)**	**35/64**	**60.93 (6.10)**	**39/64**
Teams winning after choosing to bat	**55.88 (8.52)**	**19/34**	**54.29 (8.42)**	**19/35**	**56.41 (7.94)**	**22/39**
Teams winning after batting first	**43.75 (6.21)**	**28/64**	**51.56 (6.25)**	**33/64**	**50.00 (6.25)**	**32/64**

Notes:
(i) *Split 1* refers to the first 64 T20Is; *Split 2* to the next 64 T20Is and *Split 3* to the most recent 64 T20Is.
(ii) Standard errors in brackets.

Table 4: Decision making by individual captains

Number of matches	Tosses won	Bat first percentage (SE)
More than 10 games	**129**	**58.91 (4.33)**
10 games or less	**63**	**42.86 (6.23)**

Note:
Standard errors in brackets.

Table 5: Conditional Logit (Fixed Effects) Estimates

Dependent Variable	WIN					
Variable	1	2	3	4	5	6
Toss	0.197 (0.16)		0.423 (0.28)	0.041 (0.22)	0.390 (0.20)**	0.568 (0.26)**
TeamStrengths	0.010 (0.002)***	0.010 (0.002)***	0.010 (0.002)***	0.010 (0.002)***	0.010 (0.002)***	0.010 (0.002)***
Home	0.337 (0.22)	0.330 (0.23)		0.035 (0.41)		
*Toss*DayNight*					-0.432 (0.32)	
*Toss*Home*				0.633 (0.63)		
*Toss*DecisionBat*		0.160 (0.21)				
*Toss*DecisionBowl*		0.247 (0.24)				
*Toss*Time*			-0.0126 (0.014)			
Experience						0.017 (0.025)
*Toss*Experience*						-0.048 (0.029)
Pseudo R squared	0.10	0.10	0.093	0.103	0.097	0.102
Log likelihood	-119.876	-119.838	-120.654	-119.360	-120.124	-119.537
N=384						

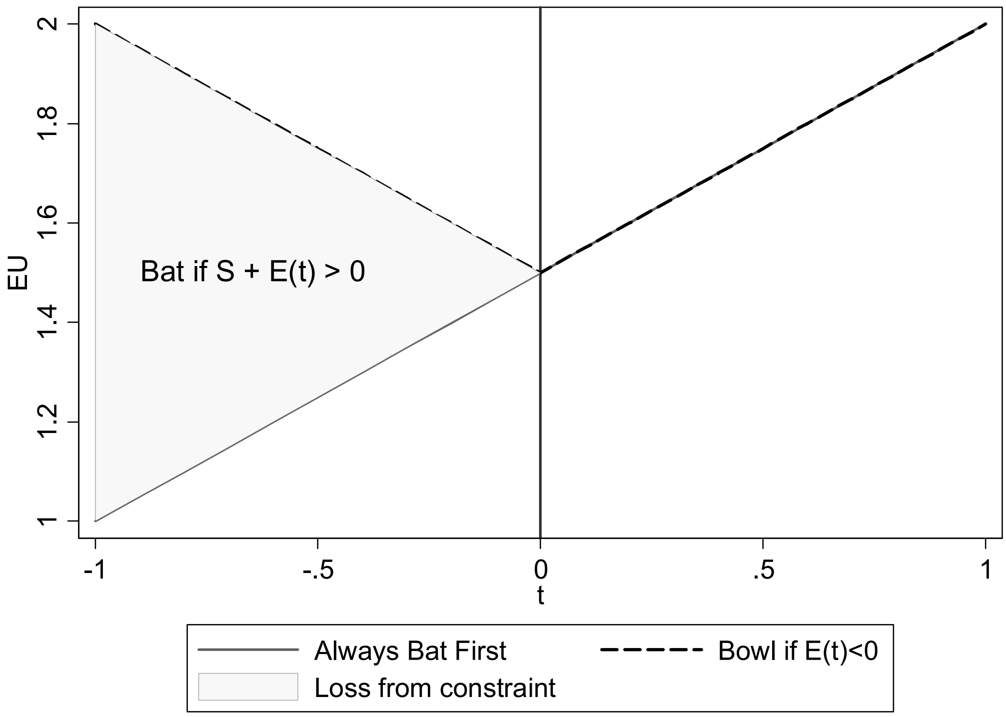
Notes:
(i) Robust standard errors used.
(ii) *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 6: OLS estimates

Dependent Variable	MARGIN					
Variable	1	2	3	4	5	6
Toss	7.556 (5.87)		12.595 (7.61)*	6.186 (5.83)	10.966 (6.03)*	16.267 (8.09)**
TeamStrengths	0.484 (0.08)***	0.484 (0.08)***	0.490 (0.08)***	0.485 (0.08)***	0.482 (0.08)***	0.480 (0.08)***
Home	12.962 (5.90)***	12.967 (5.87)**		9.917 (7.69)		
*Toss*DayNight*					-6.783 (6.14)	
*Toss*Home*				5.607 (7.83)		
*Toss*DecisionBat*		7.636 (6.33)				
*Toss*DecisionBowl*		7.454 (6.77)				
*Toss*Time*			-0.269 (0.27)			
Experience						0.742 (0.38)*
*Toss*Experience*						-1.105 (0.55)*
R squared	0.228	0.228	0.215	0.229	0.215	0.214
N=384						

Notes:
(i) Robust standard errors used, clustered by match.
(ii) * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Figure 1: Loss of Utility from Social Pressure Constraint



Notes:
(i) Figure 1 shows the utility loss arising from the social pressure constraint, with values of *EU* = 2 for a win and *EU*= 1 for a loss. *t* represents the impact of the toss on the probability of winning. When *t*=0, the toss has no impact on the probability of winning, *p*=0.5 and *EU*=1.5. When *t* is negative, bowling first is preferable and so if the captain is forced to bat first due to social pressure, the loss in utility is illustrated by the shaded area. As *t* approaches – 1, the loss in EU increases, but the level of social pressure required overturn the decision to bowl also increases.