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Forecasting outcomes in tennis matches using within-match betting markets

Stephen Easton*, Katherine Uylangco[1]

Newcastle Business School, University of Newcastle, Callaghan NSW 2308, Australia

Abstract

Klaassen and Magnus (2003) provide a model of the probability of a given player winning a tennis match, with the prediction updated on a point-by-point basis. This paper provides a point-by-point comparison of that model with the probability of a given player winning the match, as implied by betting odds. The predictions implied by the betting odds match the model predictions closely, with an extremely high correlation being found between the model and the betting market. The results for both men's and women's matches also suggest that there is a high level of efficiency in the betting market, demonstrating that betting markets are a good predictor of the outcomes of tennis matches. The significance of service breaks and service being held is anticipated up to four points prior to the end of the game. However, the tendency of players to lose more points than would be expected after conceding a break of service is not captured instantaneously in betting odds. In contrast, there is no evidence of a biased reaction to a player winning a game on service.
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1. Introduction

Traditional studies of the forecasts obtained from sports betting markets have been limited to examining bets placed before events begin. Such studies do not allow any updating of the predictions of outcomes during events. With the exception of Borghesi (2007), Easton and Uylangco (2007) and Gil and Levitt (2007), there has been little examination of within-match sports betting markets, that is, betting markets where betting continues during the event. The research literature has therefore failed to keep pace with betting markets where within-match betting has become increasingly important.

The absence of studies of within-match betting markets is unfortunate, as such an analysis is more in line with financial markets, where information becomes available throughout each day. In addition, highly liquid within-match betting markets avoid the complexities of financial markets, such as the diversity of information available to market participants, while

* Corresponding author. Tel.: +61 02 4921 5040; fax: +61 02 4921 7160.
E-mail addresses: Steve.Easton@newcastle.edu.au (S. Easton), Katherine.Uylangco@newcastle.edu.au (K. Uylangco).
[1] Tel.: +61 02 4921 5229; fax: +61 02 4921 7160.

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simultaneously avoiding the artificiality of experimental studies, as documented by Levitt and List (2007a,b).

This paper extends the analysis of within-match betting markets by comparing the ability of betting markets to predict outcomes in tennis matches with predictions made using the model developed by Klaassen and Magnus (2003). The study uses data collected from 49 matches played during the 2007 Australian Open Tennis Championship. Betting data were collected before and after each point on a continuous basis, with the final data set comprising data for 7404 points. Each of these points provides new information as to the outcomes of matches.

Such an analysis provides a far more comprehensive examination of market reactions to within-match information arrival than previous studies. By way of comparison, Gil and Levitt (2007) use the thinly-traded Intrade betting market (www.intrade.com) to examine reactions to each of the 122 goals scored in 50 soccer matches in the 2002 World Cup. Borghesi (2007) examines within-match betting for NFL football games and Easton and Uylangco (2007) examine within-match betting for cricket matches, but these studies are incomplete, as they are unable to compare the information arrival with a detailed model of match outcomes, as is provided by the Klaassen and Magnus (2003) tennis model.

The paper is organised as follows. Section 2 provides a discussion of the Klaassen and Magnus model and the data collection. The results are presented in Section 3, and Section 4 provides a summary.

2. Methodology and data

Klaassen and Magnus demonstrate that the probability of a given player winning a tennis match may be modelled using simple assumptions, with the prediction being updated on a point-by-point basis throughout the duration of the match. The mathematics behind the Klaassen and Magnus model are complex and require the incorporation of the complicated scoring system of points (including deuces and advantages to server or receiver), games, sets (including tie breaks) and matches that comprise the rules of tennis. The model is not formally derived in their paper. However, the intuition behind the model may be explained simply.

Firstly, if the probability of each player winning a point on service is known, then the probability of the match outcome may be determined by inputting those probabilities into the complex set of rules governing the game of tennis. Therefore, the probability of each player winning a point on service must be derived.

The derivation of these two probabilities requires two equations. The first of these equations is an estimate of the assumed (fixed) sum of the probabilities of each player winning their service points:

$$P_1 + P_2 = \gamma,$$

where P_1 = an estimate of the probability of Player 1 winning their service points;

P_2 = an estimate of the probability of Player 2 winning their service points; and

γ = an estimate of the sum of the probabilities of each player winning their service points.

The second equation is the equation of the match outcome (incorporating the rules of tennis). If the probabilities of each player winning the match are known at the beginning of the match, then possible values of P_1 and P_2 that provide those probabilities of the match outcomes may be derived.

With two equations and two unknowns, unique values of P_1 and P_2 may then be derived.[2] Therefore, the inputs required by the Klaassen and Magnus (2003) model are, firstly, the probabilities at the beginning of the match of each player winning the match, and, secondly, the assumed (fixed) sum of the probabilities of each player winning their service points. The probabilities at the beginning of the match of each player winning the match are derived from the betting market odds quoted immediately prior to the match. Klaassen and Magnus (2003) suggest the use of player rankings combined with subjective judgements of a player's ability prior to the start of the match. However, the literature on market efficiency suggests that pre-match betting odds should already incorporate this information. For example, Pennock, Lawrence, Nielsen, and Giles (2001) report that prediction markets are superior to experts at forecasting the box office success

[2] The model also assumes that points are independent and identically distributed (iid). While Klaassen and Magnus (2001) showed that points are neither independent nor identically distributed, they nevertheless found that the model provides a good approximation.

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