



## Testing the effect of serve order in tennis tiebreak

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### ABSTRACT

The order of actions in contests may generate different psychological effects which, in turn, may influence contestants' probabilities to win. The Prouhet-Thue-Morse sequence in which the first 'n' moves is the exact mirror image of the next 'n' moves should theoretically terminate any advantage to any of the contestants in a sequential pair-wise contest. The tennis tiebreak sequence of serves is the closest to the Prouhet-Thue-Morse sequence that one can find in real tournament settings. In a tiebreak between two players, A and B, the order of the first two serves (AB) is a mirror image of the next two serves (BA), such that the sequence of the first four serves is ABBA. Then, this sequence is repeated until one player wins the tiebreak. This sequence has been used not only in tennis, but also recently in the US TV presidential debates. In this study we analyse 1701 men's and 920 women's tiebreak games from top-tier tournaments between the years 2012 to 2015. Using several different strategies to disentangle the effect of serving first from the effect of selection, we find that, for both genders, serving first does not have any significant effect on the winning probabilities of the two players. Thus, it might be useful for other sports, and contests in general, to consider adopting the ABBA sequence.

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### 1. Introduction

In recent decades, economists have started to pay increased attention to the effect of the order of actions on performance in sequential contests. The importance of this issue is threefold. First, sequential contests have many real-life applications, including R&D races (Harris and Vickers, 1987); job promotions (Rosen, 1986); political campaigns (Klump and Polborn, 2006); sports (Szymanski, 2003); and music competitions (Ginsburgh and van Ours, 2003). Second, behavioral insights regarding the effects of psychological motives on players in a competitive environment can be derived from the consequences of the order of actions (Apestequia and Palacios-Huerta, 2010; González-Díaz and Palacios-Huerta, 2016; Cohen-Zada et al., 2017a). Third, an order of actions that provides an ex-post advantage to one of the contestants may harm efficiency by reducing the probability of the 'better' contestant to win. This can result in an inefficient economy that operates below the production-possibility frontier.

Many studies have shown that contests with a sequential order of moves may produce a systematic advantage that stems from higher psychological pressure on one of the players. For example, in the pioneering study of Apestequia and Palacios-Huerta (2010), it was found that in soccer penalty shootouts, the team that kicked first had a significant margin

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of 21 percentage points over the second team. This finding was reproduced in Palacios-Huerta (2014) using a significantly larger sample size. More recently, González-Díaz and Palacios-Huerta (2016) obtained a similar result in a multi-stage chess contest (chess matches) between two players, and found that the player playing with the white pieces in the odd games was much more likely to win the match than the player playing with the white pieces in the even games. Similarly, Magnus and Klaassen (1999) showed that serving first is associated with a higher probability of winning in the first set of a tennis match (see also Kingston, 1976; Anderson, 1977).<sup>1</sup>

In an attempt to find a contest design in which the order of moves may not provide a psychological advantage to any of the players, Palacios-Huerta (2012) proposed using the so-called Prouhet-Thue-Morse sequence described in Thue (1912).<sup>2</sup> In this sequence, the order of the first  $n$  moves is the exact mirror image of the next  $n$  moves. Put more simply, if the order between players  $A$  and  $B$  (assume order  $AB$ ) provides any kind of advantage to either player, then reversing the order in the next two rounds will mitigate and may even terminate this advantage. An order close to the Prouhet-Thue-Morse sequence is the order of serves in tennis tiebreak in which one of the players serves once and then the service alternates every two points between the players. Thus, the order of the first two serves is a mirror image of the next two serves, such that the sequence of the first four serves is  $ABBA$ , where players  $A$  and  $B$  are denoted by  $A$  and  $B$ , respectively.<sup>3</sup> In support of this argument, a recent theoretical study by Brams and Ismail (2017) showed that the  $ABBA$  sequence does not provide an advantage to any of the players.

It is of interest that the  $ABBA$  sequence is not only applicable to sports competitions. To illustrate, the three 2016 US presidential election debates between Donald Trump and Hillary Clinton, organized by the Commission on Presidential Debates, also followed the  $ABBA$  structure. In each of the three debates each segment started with a two-minute speech by one candidate followed by a two-minute speech by the other candidate, after which there was an open discussion for the rest of each segment. The identity of the first speaker in the first segment was determined according to a coin toss and then, similarly to the sequence in tennis tiebreak, in each segment the order of the first two speeches was reversed. For example, in the final TV debates the order of the two-minute speeches was as follows: Clinton, Trump, Trump, Clinton, Clinton, Trump, and so on.<sup>4</sup>

Obviously, examining whether the  $ABBA$  sequence provides any advantage based on data from presidential TV debates is unfeasible, mainly because the outcome of any specific debate is ambiguous and mostly unobserved. Also, the number of observations is far from sufficient. However, since a similar order is also played in tennis competitions, where both the outcome and the players' characteristics are perfectly observed, it is only natural to exploit this setting in order to empirically test whether the  $ABBA$  order of serves in tennis tiebreak affects the players' probability to win. This is the purpose of this study.

Applying data from professional sports where contestants have strong incentives to win has several advantages. First, it eliminates any possible scepticism about applying behavioral insights obtained in a laboratory to real-life situations (Hart, 2005; Palacios-Huerta and Volij, 2009). Second, sports contests involve high-stake decisions that are familiar to agents. Third, it provides a unique opportunity to observe and measure performance as a function of variables such as heterogeneity in abilities and prizes. Indeed, as Kahn (2000) argues, sports data are very unique in that they embody a large amount of detailed information that can be applied for research purposes.

In this paper we utilize data on all the tiebreaks in the first sets of all four top-tier tournaments in professional tennis that took place between the years 2012 to 2015 (in the data section we justify why we concentrate only on the first set of each match). Based on the analysis of 1701 men's and 920 women's tiebreak games from 72 men's and 135 women's tournaments, we find no significant effect of the order of serves. This finding is obtained for both genders. In other words, a player who serves first in a tiebreak has the same probability to win as his opponent does. As expected, the most important factor that affects the probability to win is a player's ability, as measured by his or her world rankings or betting odds. This result is in line with González-Díaz et al. (2012), who showed that higher ranked players perform better in the most important points of the match.

Since the order of serves in tiebreak games is not determined randomly, we use several different strategies to disentangle the effect of serving first from the effect of selection. First, to control for unobserved factors that may affect the probability to win a tiebreak, we gathered data on the betting odds of the players. These odds capture many factors that are unobserved for researchers. The second strategy is based on a study by Oster (2016) which assesses the size of the selection bias and the bias-adjusted treatment effect under the assumption that the relationship between the treatment and the unobservables

<sup>1</sup> Based on their analysis of other multi-stage contests with sequential moves, Genakos and Pagliero (2012) and Genakos, Pagliero and Garbi (2015) found consistent evidence that professional weightlifters and divers underperform if they are close to the top of the interim ranking. There is also a large amount of evidence showing that in contests in which participants perform one after the other, the contestants who performed later in the contest had a higher probability to win. Such an advantage was documented for the prestigious Queen Elizabeth music contests (Ginsburgh and van Ours, 2003), the popular *Idol* series Page and Page (2010), the Eurovision song contests and the World and European figure skating championships De Bruin (2005).

<sup>2</sup> See Allouche and Shallit (1999) for a survey on implications of the Prouhet-Thue-Morse sequence.

<sup>3</sup> This order remains until the end of the tiebreak such that this is also the sequence of serves 5–8, 9–12 and so on.

<sup>4</sup> Full transcripts of the three debates can be found on: [https://www.washingtonpost.com/news/the-fix/wp/2016/09/26/the-first-trump-clinton-presidential-debate-transcript-annotated/?utm\\_term=.86b72435f17f](https://www.washingtonpost.com/news/the-fix/wp/2016/09/26/the-first-trump-clinton-presidential-debate-transcript-annotated/?utm_term=.86b72435f17f), <http://fortune.com/2016/10/09/presidential-debate-read-transcript-donald-trump-hillary-clinton/> and [https://www.washingtonpost.com/news/the-fix/wp/2016/10/19/the-final-trump-clinton-debate-transcript-annotated/?utm\\_term=.11a8d5572ec8](https://www.washingtonpost.com/news/the-fix/wp/2016/10/19/the-final-trump-clinton-debate-transcript-annotated/?utm_term=.11a8d5572ec8). Last accessed on 16/12/2016.

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