

IS THERE A TRADE-OFF BETWEEN SKIING AND SHOOTING PERFORMANCE IN PROFESSIONAL BIATHLON RACES? EMPIRICAL EVIDENCE FROM THE OLYMPIC GAMES 2006

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INTRODUCTION

In recent years a growing number of sports economics papers have analyzed the determinants of individual performance of professional sportsmen. Surprisingly however, many of these studies are primarily taken from sports that either pay attention to athletes endurance (Frick & Klaeren, 1997; Lynch & Zax, 2000) aspects or to skills affecting individual precision and concentration (Ehrenberg & Bognano, 1990; Becker & Huselid, 1992). Although there are other sports including different legs (triathlon, decathlon), biathlon is not only a winter sport, it rather combines the intense physical demands of cross-country skiing with the precision of rifle marksmanship. Although the incompatible combination of high physical exertion and the precision of shooting is responsible for the high popularity of this sport among European and in particular German-TV watchers, biathlon contests have been subjected to limited quantity and breath of research due to a lack of adequate data.

The purpose of this study is to analyze empirically whether there is a possible trade-off between the two conflicting disciplines of biathlon. During the individual contest athletes have to conduct four periods of shooting, which are preceded and followed by the running discipline. Shooting changes from round to round between the prone and the standing position but at each period athletes have to deliver five shots on five targets, while a missed target is penalized by an extra penalty minute. Since income-maximizing athletes who are usually familiar with the abilities of their competitors know that winning requires good skiing and good shooting performance, they will choose their individual level of effort so that the marginal utility of clean shooting or reduced missed targets equals the marginal costs of decreasing skiing velocity over the last 200 m before approaching the firing line. The assumption that athletes constantly compare the costs and benefits of an additional unit of hit targets can be proven by looking at individual behaviour during a race: Biathletes reduce their skiing intensity when entering the stadium in hopes of a better shooting performance. Although this seems to be a plausible optimization technique for being successful, the indoor laboratory study conducted by Hoffman et al. 1992 concluded that overall shooting performance is only marginally influenced by the intensity of the preceding skiing discipline.

Despite the fact that success in biathlon involves skiing fast and shooting accurately the latter is particularly important since most of the international competitions are determined by strong shooting results. Given however the mixed evidence described above it is a priori still uncertain in how far the effort level of the preceding cross-country discipline influences the shooting performance in a real outdoor competition.

METHODS

Using data from the 2006 Olympic Games in Turin from the men and the women individual competition races it is now possible to test the effect of the skiing intensity on an athlete's shooting performance outside the laboratory. In doing so the underlying study is based on almost all biathletes that finished the individual 20k men and the individual 15k female races.

The database is drawn from the official International Biathlon Union homepage (www.biathlonworld.com) and it provides relevant athletes' characteristics and biathletes performance statistics. Although the most important variable proxying an individual athletes skiing intensity – heart rate data – (Hoffman & Street, 1992) is (understandably) not available, the database offers other detailed information to measure an athlete's

skiing effort put forth, by computing each biathlete's course time deviation from his mean course time over the five skiing laps analyzed. Apart from this key determinant our empirical model also controls for some other important individual characteristics influencing an athlete's success, such as physical strengths/fitness, human capital variables (age and experience), current standing of the World Cup competition, nationality, starting order and weather conditions.

Since our obtained results would be inefficient when using the traditional OLS technique, we apply a poisson regression model because our dependent variable evaluates the rate of an outcome event (shooting error) in a sample that is followed through time. Overall, we analyze the shooting performance of 90 men and 65 women over four periods of shooting, resulting in $N = 360$ (observations) for men and $N = 260$ for women.

RESULTS

While the findings from both genders report an average shooting error rate of 1.2 mistakes per lap, men need on average somewhat more than 11 minutes (11min; 39sec) to cover the 4k skiing session. Taking into account the increasing fatigue when approaching the end of the competition our findings form a "real" biathlon contest do not support the evidence outlined by Hoffman et al. 1992. The coefficient estimates of our intensity measure clearly indicate that the results from the laboratory cannot be transferred to a competition where factors such as weather conditions and the performance of direct rivals play a significant role. Controlling for other significant variables such as nationality and human capital the implication from this study is that biathletes should either slow down when approaching the firing lane or relax to some extent while preparing for shooting.

DISCUSSION

Although we analyze for the first time the potential trade-off between skiing intensity and shooting performance under race conditions, the findings from the paper must be interpreted with some caution. First of all, the main drawback is the absence of any real intensity measure such as individual heart rates, which would certainly provide additional information about the robustness of our results. Moreover, wind conditions are not necessarily the same for each participant, some of them might simply be lucky others are not, a factor that will definitely bias the findings. Further studies especially for assessing skiing intensity more precisely are needed and the new feature of live stream heart rates monitors shown on TV will certainly reduce this deficit.

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