A Doping and Anti-doping Game: The Rational Choices of Cheater and Catcher under Asymmetric Information

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Doping in sport has been evident since the third century BC at the ancient Olympic Games (Eber, 2007). Presently, doping occurs at all levels and all kinds of sports. Anti-doping policy is often legitimized by concerns over protecting athletes’ health and ensuring fair competition (Hemphill, 2009). However, these justifications have been criticized. For example, Lippi, Banfi, Franchini & Guidi (2008) argue that if safeguarding athletes’ health is the primary purpose of policy then efforts should be directed towards this rather than focusing on detecting cheaters. Rushall and Jones (2007) also challenge the issue of fair play by questioning the extent of doping in sport. They argue that doping policies are based on the belief of epidemic doping use, rather than evidence. An additional problem with detection-based policies is that the continual advances in biochemical and pharmacological technology, along with the rigorous testing procedure requirements, makes it difficult to detect new doping agents. The issue of whether a doping problem exists coupled with limitations on detection capability raises the question of whether sport organizations should employ doping tests. This problem is especially onerous at lower levels of sport, such as high school sport. Recently several states added mandatory random doping tests for high school sport and subsequently canceled these programs, or reduced their budget due to the low number of positive tests. The sport organizations that administer these tests face financial and logistical limitations, particularly when compared to higher levels of sport (e.g., the Olympic Games). Considering the incentives to dope and the limitations of detection the sport manager is faced with the dilemma of what approach should be taken with doping policy. One way to examine this issue is via economic analysis, since it is widely agreed that economic incentives form the primary motivation for doping (Haugen, 2004). The purpose of this study was therefore to investigate the rational approach to doping policy at different levels of sport with particular emphasis placed on sport organizations with limited resources and detection capabilities.

Game theory is the primary tool used by economists to approach these issues due to its advantage in capturing individual behavior under strategic situations (Eber, 2007). Typically, economic studies assume that athletes are rational players intending to maximize their own utilities based on other players’ choices. Eber and Thepot (1999) found that reward differences between winner and loser, the frequency of the events, the possibility of being caught, and the cost of doping would influence the athletes’ decision to use doping. Berentsen (2002) and Haugen (2004) discussed the ways in which Nash equilibria force players to use drugs. Haugen (2004) also argued that doping tests should differentiate between sports that require single ability and combined ability. While research on doping usage using game theory has provided us with valuable knowledge on athletes’ behavior, most of these studies have relied upon the classic prisoners’ dilemma involving two or more athletes. The role of testing authorities (i.e., the sport organization) however appears missing from the economic enquiry. Whereas athletes may choose their own behavior strategies based on their competitors, simultaneously they must also factor in the doping test authorities, arguably a powerful player within the game, who determine the probability that they will be caught. While the doping test authorities have knowledge of their detection capability, athletes may not know this information. Due to this asymmetric information, athletes may not precisely discern the detecting capability of the test. Instead, athletes’ belief in the efficacy of the doping test rather than the reality will impact on their doping decision. Moreover, testing authorities could use the informational asymmetries to influence the perception of efficacy of the test to detect athletes who dope. As an extension to the current debate, this study will include both testing authorities and athletes into the game model to 1) examine how athletes’ belief of testing efficacy and factors including prize incentives, penalty severity, health concerns, and personal achievement influence their doping decision; and 2) to explore the power of doping policy to influence doping behaviors. Based on the model equilibria, the policy implications and strategies that could be utilized by sport organizations will be discussed.

In the proposed model there are two types of testing authorities. Type 1 has sufficient budget and high detecting capability (T1). Type 2 has insufficient budget and low detecting capability (T2). Both of these authorities have two policy choices: implement doping test or not. Athletes do not have enough information to precisely identify the type of testing authorities. They observe the authorities’ policy and update their beliefs on the authorities’ type, then
choose whether or not to dope and this decision will jointly affect the utility of the authorities and themselves. The model is analyzed in three steps. In the first step, the model is simplified with T1 having perfect detecting capability and T2 having no detecting capability. If dopers are subjected to the test done by T1, they will definitely be caught, but if they are subjected to the test done by T2 they will not be caught. Only one perfect Bayesian equilibrium was found under this extreme situation, in which regardless of their test efficacy, T1 and T2 will both implement a testing policy. This strategy will effectively influence the athlete not to dope when they perceive that there is higher possibility that the testing authorities belong to T1. In the second step, a more realistic model where T1 has a high (but not perfect) capability to detect and T2 has a low (but not zero) capability to detect was analyzed. Two perfect Bayesian equilibria emerged from this model. Once again, regardless of their types, T1 and T2 will both adopt the testing policy. However, the model predicts that athletes engage in a probability analysis of whether the testing authorities belong to T1 or T2. This analysis, along with other factors included in the model yield a threshold belief point. If this threshold belief point is exceeded then the equilibrium will result in athletes not doping. Conversely, if the threshold belief point is not exceeded then the other equilibrium will end up with athletes doping regardless of the type of testing authority. The third step involves applying the model to a real situation. For this step a state high school governing body currently engaged in drug testing has been identified. This is a typical T2 authority discussed in the second step. Information is currently being collected from this organization, and will subsequently be included into the model to determine the factors they may influence athletes’ doping choices.

To summarize, this study adds to the current literature on economic analysis of doping behavior by factoring in the role and detection capabilities of the sport organization. Preliminary results from the proposed model demonstrates that having a doping test is the rational choice for sport organizations and will be adopted regardless of the detection capability. This helps to explain why doping tests are used at different levels of sports, even though the detection capability of authorities may be questionable. Moreover, the model is currently being applied to determine the factors that may influence athletes’ decision to dope. The results from this analysis will be particularly meaningful to the anti-doping movement at the high school level. While the authorities at this level lack adequate resources, understanding the factors that contribute to athletes’ decision making and their belief of the testing authorities detection capabilities may be instrumental in developing doping policy at the high-school level.