CENTRE *for* ECONOMIC PERFORMANCE

CEP Discussion Paper No 928

May 2009

Risk Taking and Performance in Multistage Tournaments: Evidence from Weightlifting Competitions

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Abstract

We analyze the impact of interim ranking on the risk taking and performance behaviour of professional athletes participating in international weightlifting competitions. Weightlifting competitions are multistage tournaments with the unique characteristic that the athletes must announce in advance the amount they intend to lift at each stage, thus allowing quantification of the riskiness of their choices. We present two key findings. First, risk taking exhibits an inverted-U relationship with rank: risk taking increases up to rank six, but athletes then revert to safer strategies towards the bottom of the ranking. Second, athletes systematically underperform when ranked closer to the top, despite higher incentives to perform well. An athlete is more than 30 percent less likely to lift the announced weight when ranked first than tenth. Athletes also underperform in relatively more prestigious competitions, when the competition is more intense, and when the potential gain from a successful lift is higher. Taken together, these findings suggest that athletes may systematically "choke under pressure".

Keywords: Choking under pressure, incentives, performance, risk taking, tournaments
JEL Classifications: J24, L83, M52, Z13
Data: International weightlifting competitions

This paper was produced as part of the Centre's Productivity and Innovation Programme. The Centre for Economic Performance is financed by the Economic and Social Research Council.

Acknowledgements

We would like to thank the Economic and Social Research Council for financial support, Raj Chetty, Pascal Courty, Giovanni Mastrobuoni, Francesca Molinari, Tommaso Valletti, Jaume Ventura, John Van Reenen for useful comments. We would especially like to thank the former head coach of the Greek weightlifting team, Christos Iakovou, the vice president of the Hellenic Weightlifting Federation, Giorgos Paraskevopoulos, and the executive director of the Queensland Weightlifting Association for useful comments and advice. Grace Lee provided excellent research assistance. The opinions expressed in this paper and any remaining errors are those of the authors alone.

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Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

ISBN 978-0-85328-381-2

1. Introduction

Individuals competing in tournaments are rewarded on the basis of their relative, rather than absolute, performance. Many everyday fields of economic activity are characterized by such a tournament-like structure. Employees and managers in labor markets, for example, are often evaluated on the basis of their relative performance within a firm; in financial markets, mutual funds compete in attracting new funds on the basis of their relative performance; in product markets, companies compete in patent races to secure the rights to new products; and, of course, the majority of sporting events are organized as tournaments.

An extensive literature emphasizes the role of tournaments in realigning the incentives of the parties involved (Lazear and Rosen, 1981; Green and Stokey, 1983; Nalebuff and Stiglitz, 1983). For instance, in the labor market, a tournament among managers could provide incentive for improved effort resulting in higher performance, thus mitigating the typical inefficiencies caused by the conflicting objectives of managers and shareholders.

However, it is likely that tournaments affect not only choices concerning effort, but other aspects of individual behavior as well, including risk taking and performance under pressure. In addition, tournaments often require the same pool of competitors to interact repeatedly over time, and are typically organized in stages. Tournaments may thus have a different effect on competitors who are leading the competition and those lagging behind. Exactly how interim ranking affects agents' risk taking behavior and performance is still an open question, fundamental to our understanding of tournaments in labor, financial and product markets.

An important branch of research is devoted to understanding how the behavior of individuals is affected by tournaments (Ehrenberg and Bognanno, 1990; Knoeber and Thurman, 1994; Chevalier and Ellison, 1997) and other performance evaluation schemes (Oyer, 1998; Lazear, 2000; Courty and Marschke, 2004; Bandiera, Barankay and Rasul, 2007). However, there is little evidence on the actual impact of interim ranking in tournaments on risk taking and performance. One reason is that it is typically difficult to observe both the amount of risk chosen by competitors and their performance.

This paper is the first attempt to describe how both variables are simultaneously affected by interim rank position. It exploits an unusually rich panel dataset, with individual level information on professional athletes participating repeatedly in tournaments with very significant rewards. The data derives from weightlifting competitions. These are multistage tournaments with the unique characteristic that the athletes must publically announce in advance the amount they intend to lift at each stage. Access to these recorded announcements, together with information on whether the lift was successful or not, affords a unique opportunity to observe both the intentions and the performance of all participants.

Using a panel dataset containing round-by-round information from international championships (the Olympic Games, World Championships and European Championships) between 1990 and 2006, we semi-parametrically estimate the impact of interim ranking on the announced weights and the probability of a successful lift. Since what matters for the individual score is the amount successfully lifted (more details are given in Section 2), not the announced weight, higher announcements represent a riskier strategy, in the sense that they imply a larger difference between the outcome in case of success and failure. Therefore, the relation between rank and announcement is informative of athletes' risk-taking behavior.

The probability that an athlete will succeed in lifting the declared weight during a specific attempt is much less than one. Obviously, better athletes are more likely to succeed in lifting a given weight, but the outcome of a specific attempt is still unpredictable to a certain extent. Interim ranking within a competition is affected by this random component of performance and is very volatile. Even the best athletes may find themselves at the bottom of the ranking in a certain competition, due to a combination of their own bad luck and the success of their opponents. This variability of interim ranking during weightlifting competitions provides us with an ideal environment for observing how athletes react when in the lead or when tailing other competitors. The panel dimension of the data allows us to control for multiple sources of unobserved heterogeneity at the athlete, competition and year level. The multistage nature of the games even allows us to estimate specifications where we can control for joint athlete-competition-year fixed effects.

We present two key results. First, when lagging behind, competitors tend to take greater risks than those in the lead. However, risk-taking exhibits an inverted-U relationship with rank: announcements increase from first to sixth place, but decrease for further decreases in rank; after rank seventeen, athletes do not show significant differences relative to when ranked first. This implies that athletes initially choose riskier strategies for positions close enough to the top, reverting to progressively safer strategies when placed further down.

The magnitude of the impact of rank is significant. A shift from first to sixth place corresponds to an increase in announcement that is 28 percent of the average increase in announcement between two stages, or 51 percent of the average discretionary (not dictated by the rules of the game) increase in announcement (see Section 2 for a description of the rules). This implies that cumulatively, by the end of the competition, an athlete is announcing roughly 5Kg more, implying a drop in the likelihood of success of 9.1 percent.

Our second key result is that, on average, the probability of a successful lift (conditional on the chosen weight) significantly increases moving down in the ranking. An athlete in sixth place is 19 percent more likely to lift the declared weight than when he is ranked first. An athlete in tenth position is 30 percent more likely to do so. Overall, the effect of rank on performance is so large that a decrease in rank implies an overall increase in the probability of success, even after taking into account the possibility of higher announcements.

This effect of ranking is surprising. One possible explanation is that athletes exert less effort when ranked at the top. However, since rewards are decreasing at a decreasing rate going down in the ranking, one would generally expect athletes to be more motivated and to exert greater effort when ranked at the top, where the gain from an increase in rank is highest. Therefore, one would expect that the probability of lifting a given weight would increase, not decrease, when an athlete is ranked closer to the top.[4]

An alternative explanation for these results is that athletes perform badly under pressure, despite strong motivation and effort. This interpretation is consistent with anecdotal evidence that athletes' performance may deteriorate as the importance of a successful lift increases, or when there are strong expectations for an outstanding performance. This may be due to "choking under pressure", a phenomenon that has been analyzed extensively in the social psychology literature, but which has received little attention in economics (Ariely, Gneezy, Loewenstein and Mazar, 2005; Dohmen, 2008). Several sources of pressure have been proposed by social psychologists, including the magnitude of stakes or rewards to be gained (Baumeister, 1985), and the presence of other people, whether they are competitors or not (Zajonc, 1965; Baumeister, Hamilton and Tice, 1985).

The psychological literature suggests at least two reasons for why choking may occur in our setting. First, there may be an optimal level of arousal for performing a given task, beyond which increasing incentives may cause excessive motivation and result in poorer performance (Yerkes and Dodson, 1908). Second, increased pressure may make people unconsciously switch from automatic to controlled mental processes, in spite of the fact that automatic processes provide

[4] The positive relation between rewards, motivation and effort seems to be accepted in the literature (Prendergast 1999), although with some exceptions (Camerer, Babcock, Lowenstein and Thaler, 1997; Gneezy and Rustichini, 2000a and 2000b; Frey and Jegen, 2001; Heyman and Ariely, 2004).

higher performance for some types of highly rehearsed tasks (Baumeister, 1985). Sports – like weightlifting – involving repetition of the same actions are typical cases of such tasks.[5] These considerations directly apply to weightlifting, since the movements required to lift the bar (in both snatch and clean & jerk) are codified by the rules of the game, and athletes cannot change the technique used to lift the bar.

The fact that performance decreases for rank positions closer to the top is robust when estimated for different types of competitions, different subsets of athletes, or by using different estimation strategies (OLS, fixed effects logit, IV). It is also robust when we control for the intensity of competition during a game, or the potential gains from a successful lift. In line with the hypothesis that individuals perform badly under pressure, we show that the individual probability of failing to lift a given weight is higher in more prestigious competitions, such as the Olympic Games or the World Championships, than in the European Championships. This is in spite of the fact that more prestigious competitions provide larger rewards, and are therefore expected to provide incentives to exert more effort.[6] Second, performance decreases when the competition is more intense, in the sense that athletes have very similar interim scores, and when the potential gain in rank from a successful lift is higher. This is true although one would generally expect higher effort and higher performance when the potential gains from success are higher (Ehrenberg and Bognanno, 1990). We find no evidence that "experience" (having won a medal or participated enough times in international competitions) attenuates this effect.

Finally, we contribute to the broader debate on tournaments by measuring the impact of a counterfactual reward system, in which each athlete is rewarded at each stage in proportion to the amount successfully lifted. This counterfactual corresponds to the common situation in the labor

[5] Another example of a repetitive task is free-throw shooting in basketball. Dandy, Brewer, and Tottman (2001) provide some evidence that free-throw shooting performance among elite Australian basketball players was worse during games than during training.
[6] The higher rewards also affect risk taking behavior. Athletes in prestigious competitions take significantly more risks by announcing higher weights.

market in which workers are paid in proportion to their absolute performance (piece-rate contract). The tournament setting significantly increases risk taking: the announced weight increases by 18 percent, while the probability of a successful lift decreases by 39 percent. Compared with a linear reward system, the average amount successfully lifted during each attempt is substantially lower in the tournament.

Related literature

Our work is related to a growing empirical literature on tournaments. Ehrenberg and Bognanno (1990) and Becker and Huselid (1992) use data from golf tournaments and car racing respectively to study whether larger prizes lead to greater effort and therefore improve performance. Main, O'Reilly and Wade (1993), Eriksson (1996), and Conyon and Peck (1997) study corporate tournaments and executive compensation. Our research is also related to a small number of papers that examine agents' risk taking decisions in tournaments. Becker and Huselid (1992) show that drivers take more risks if prizes and prize spreads are large. Knoeber and Thurman (1994) document that broiler chicken farmers least likely to win the tournament in which they were involved displayed more volatile performance, which is consistent with lower-ranking competitors taking riskier strategies. Brown, Harlow and Starks (1996) and Chevalier and Ellison (1997) show that mutual funds with relatively low mid-year performance increase fund volatility, relative to the funds with relatively high mid-year performance. Finally, in a study of soccer matches, Grund and Gurtler (2005) find evidence that losing teams are more likely to make a risky substitution (e.g., replacing a defensive player with an offensive one).

Three key aspects distinguish our work from these earlier studies. First, our unique setting permits us to observe both the intentions and performance of athletes, letting us isolate risk taking from other factors affecting performance. Second, we focus on an explicit, multi-agent, multi-stage tournament to investigate how interim ranking affects both risk taking and performance. Third, we use an exceptionally rich panel dataset that allows us to control for unobserved heterogeneity in great detail.

The remainder of the paper is organized as follows. Section 2 briefly describes the structure and rules of weightlifting competitions and the data. Section 3 presents our identification strategy and the econometric framework. Section 4 reports our main results and robustness tests. Section 5 draws comparisons from a counterfactual reward system, and Section 6 concludes.

2. A brief overview of weight lifting competitions and the data

In weightlifting, competitors attempt to lift heavy weights mounted on steel bars.[7] Lifters perform two types of lifts - the snatch and the clean & jerk. In the snatch, they lift the bar to arm's length above their head in one movement. In the clean & jerk, they lift the bar to their shoulders, stand up straight, and then jerk the bar to arm's length above their head. Lifters are allowed six attempts, three for each type of lift.[8] The competition is therefore organized in six stages. Before each stage, athletes announce how much they intend to lift by publicly writing their name and announcement on a roster. Then, competitors attempt their announced lift in increasing order, from the lightest to the heaviest weight. If they are unsuccessful at a particular weight, the athletes have the option of reattempting the same lift or trying a heavier one in the following stage. At the end of the competition, the highest snatch and the highest clean & jerk successful lifts of each athlete are added to determine the final score. Athletes are then ranked by

[7] Weightlifting has a long history as an Olympic discipline. Men's weightlifting was on the program of the first modern Olympic Games in Athens in 1896, while the first contemporary World Championships took place in London in 1891.

[8] Two hours before the start of each game, competitors are weighed and assigned an official bodyweight. This then determines the weight category in which they will compete. There are eight categories for men and seven for women. Athletes may switch between different categories over the course of their athletic careers for both personal and strategic reasons (for example, if there are fewer competitors in a specific category). For this reason, our definition of a competitor throughout this paper is an athlete in a particular bodyweight category. An athlete's bodyweight also plays a role in the event of two athletes lifting exactly the same weight; in this case, the competitor with the lower bodyweight who wins.

score with the highest score corresponding to rank one. In addition, at the end of each stage, interim rankings are computed using the same procedure.[9]

The direct money prizes for weightlifting are awarded to the best athletes, with a convex relationship between rank and prizes particularly at the top. The first three athletes are awarded medals (gold, silver, bronze) and receive most of the media coverage. Gold medallists receive the lion's share of fame and recognition, and private sponsorships are offered mainly to medal-winners. In comparison to other sports (such as tennis or golf), the direct money prizes in weightlifting are small, even for the most prestigious competitions. However, national teams provide substantial monetary rewards and other benefits such as civil service jobs, or employment in the national sport federation to athletes winning medals in international competitions.[10]

In addition to such private rewards, the top twenty-five athletes receive points for their national teams' classification. The allocation of these points is non-linear for the top three positions (the first athlete receives twenty-eight points, the second twenty-five and the third twenty-three), after which it becomes linear. Overall, the coaches and players we interviewed concur that there is a very significant drop in rewards between getting a medal and not getting one. In addition, there is a consensus that rewards generally decrease at a decreasing rate moving down in the ranking. Only after rank twenty-five does the perception of significant differences in the return from a marginal change in rank wane.[11]

Comprehensive round-by-round performance data for all athletes that participated in the most well-known weightlifting competitions (the Olympic Games, World Championships and

[9] For the second and third stage, the interim rank is computed using only the best successful lift in snatch.

[10] Based on the existing evidence on the money prizes offered to 2008 Olympic Games medallists, for example, the difference between prizes for third and fourth place was €70,000 for Greece and China (Grohmann, 2008) and €40,000 for Taiwan (official figures from the national sport federations). This includes only monetary rewards given by national institutions, leaving out any additional benefit (such as civil service jobs and free housing), which may also be offered by some countries, such as Greece, Italy and Russia, in addition to monetary rewards, or private sponsorships, which can be the main source of income for medallists.

[11] In the empirical section that follows, we do not attempt to directly measure the monetary gains from a change in rank. Instead, we take a nonparametric approach and estimate the impact of rank on announcements and performance.

European Championships) from 1990 to 2006 were obtained from the International Weightlifting Database, yielding a total of more than 39,000 individual stage-specific observations. This panel consists of 2,768 athletes of both genders from 139 countries, participating in 37 weight categories, in international competitions held in 20 different countries. The unit of observation includes the type of competition, date, location, gender, weight category, athlete's name, country of origin, bodyweight and detailed round-by-round attempts and outcomes, together with the overall rank at the end of the competition, as well as at the end of snatch and clean & jerk lifts.

Using this information, we reconstructed the ranking of all athletes at each stage of the competition.[12] Table 1 provides summary statistics on announcement and frequency of successful lifts. The average announcement increases from one stage to the next by roughly 3Kg.[13] The frequency of successful lifts correspondingly falls by around 20 percent. In general, higher weights can be lifted in the clean and jerk, as reflected in the higher average announcements.

3. Empirical Framework

We characterize each athlete's ability as a risk-reward frontier that describes the relationship between the announced weight and probability of success. For each athlete this frontier is downward sloping, since the probability of a successful lift naturally decreases as the announcement increases. Higher announcements increase the score difference between success and failure, and thus imply riskier strategies.[14]

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[12] Our algorithm to reconstruct ranking was based on the official rules of the International Weightlifting Federation. We verified the results from our algorithm against the ranking information at the end of both snatch and clean & jerk, as well as the final overall ranking.

[13] After a successful attempt, athletes are required to increase their announcements by 1 Kg.

[14] The interpretation of the results is the same if one considers the variance in outcomes, instead of the absolute difference. For realistic values of the announcement and the success probability, increases in announcement also correspond to increases in the (weighted) variance of outcomes.

Figure 1 plots the risk-reward frontiers for two hypothetical athletes of different abilities. The better athlete is characterized by the frontier on the right. Each competitor can improve the probability of a successful lift by increasing the quality and intensity of training before the competition, or by achieving greater concentration/determination during the game (i.e., by exerting more effort). Therefore, we can reinterpret the difference between the two curves as the impact of effort. Effort, however, is not the only potential explanation for shifts in the frontier. Any variable affecting performance, including psychological pressure, fear or emotions in general, may shift the frontier in the same way.

At each round, athletes choose their announcement, measured on the horizontal axis in Figure 1. This choice entails a fundamental trade-off between the gains from a higher successful lift and the costs of a higher probability of failing. In other words, for any given athlete, a higher announcement implies a higher probability of failure along with a higher reward for success, and a larger difference between the payoffs for success and failure. In this sense, for any given risk-reward frontier, a higher announcement implies that the athlete is pursuing a riskier strategy.

In the next section, we first estimate the impact of interim ranking on the choice of announcement and on how characteristics of the individual and the type of competition affect this choice. In terms of Figure 1, our estimates will demonstrate how ranking affects the choice of a point on each athlete's risk-reward frontier. We also estimate the risk-reward frontier, that is, the probability of a given individual successfully lifting the announced weight, and how this is affected by ranking and individual and competition characteristics. In terms of Figure 1, our estimates will demonstrate how ranking affects the location of each athlete's risk-reward frontier.

3.1. The Determinants of Announcements

We estimate models of the following general form:

$$\text{Announcement}_{itjs} = \alpha_0 + X_{itj}\,\beta + \Sigma_n\,\theta_n\,\text{Rank(n)}_{itjs} +$$

$$+ \alpha_1\,\text{Announcement}_{itj(s-1)} + \alpha_2\,\text{Success}_{itj(s-1)} + e_{itjs} \qquad (1)$$

where $\text{Announcement}_{itjs}$ is the announcement of athlete *i*, in year *t*, in competition type *j* (a competition is classified as Olympic Game, World or European Championship), at stage *s* of the game (s=2,3,5,6)[15]; X_{itj} is a vector that includes characteristics of the individual (bodyweight, binary indicators for country of origin and whether competing in the home country) and of the competition (number of competitors), Rank(n)_{itjs} is a binary indicator that takes the value of one if athlete *i*, in year *t*, in competition *j*, at stage *s* of the game is ranked n^{th} ; $\text{Success}_{itj(s-1)}$ is a binary indicator variable that takes the value of one if the previous attempt was successful; finally, the random variable e_{itjs} captures all of the unobserved determinants of an announcement. Our main interest is on parameters θ_n that describe the impact on athletes' announcement of being ranked n^{th}.

Cross-sectional estimates of (1) will likely produce biased estimates of all parameters, unless one is able to control for the athletes' ability. For example, the quality of each athlete's training may vary across years, or even for different competitions within the same year. Moreover, the organization of each competition may vary across years, and this may impact behavior. Hence, one needs to account for individual and competition-specific unobserved characteristics.

To mitigate these problems, we exploit the panel structure of our data and include a rich set of fixed effects to control for unobserved heterogeneity. The error term in (1) can be written as the sum of orthogonal athlete, year, competition, athlete-year, competition-year, athlete-competition,

[15] We consider only four stages. The first stage of snatch is dropped because the interim ranking is not defined for the first stage. The first stage of clean & jerk is also dropped because the impact of previous announcement and success may be very different during the transition from one type of lift to the other.

athlete-year-competition components, and an idiosyncratic error term, capturing measurement error or random mistakes in the announcement decision

$$e_{itjs} = \tau_i + \tau_t + \tau_j + \tau_s + \tau_{it} + \tau_{jt} + \tau_{ij} + \tau_{itj} + \varepsilon_{itjs} \qquad (2)$$

In the next section, we will report results from alternative fixed effects specifications that include different combinations of these controls. Most importantly, due to the multi-stage nature of weightlifting competitions, we can include athlete-year-competition (τ_{itj}) fixed effects. In this case, our main parameters of interest, θ_n, are estimated only by exploiting the variability of ranking across stages of the same competition for a given individual.

The variability of ranking, even for a given athlete within a given competition, is significant. On average, the difference between the maximum and minimum interim rank for a given individual within a competition is 6.4 positions, with the 25th percentile experiencing a change of 3 positions and the 75th percentile experiencing a change of 8 ranks. In other words, the variability in ranking is such that even the most consistent weightlifters may oscillate, for example, between getting a gold and getting no medal at all.

Our baseline specification includes a dummy for whether the previous announcement was successful or not, because the rules of the game dictate a minimum increase after a successful attempt. The level of the previous announcement is also included, as we want to allow for decreasing increments as the absolute level of the announced weight increases.[16]

Model (1) can be estimated by OLS under the assumption that $E(\varepsilon_{itjs} | X_{itj}, Rank(n)_{itjs}, Announcement_{itj(s-1)}, Success_{itj(s-1)}, \tau_{itj})=0$. This condition requires ε to be serially uncorrelated and that the control variables and fixed effects fully capture all strategic aspects of the game. The

[16] Including these two parameters means that the rank coefficients, θ_n, capture the impact of rank on athletes' discretionary incremental announcement. As the minimum increment after a successful attempt is 1 Kg, one could rewrite model (1) as follows:

$Announcement_{itjs} = [Announcement_{itj(s-1)} + Success_{itj(s-1)}] + [a_0 + X_{itj}\beta + \Sigma_n \theta_n Rank(n)_{itjs} + a_1 Announcement_{itj(s-1)} + a_2 Success_{itj(s-1)} + e_{itjs}]$,

where the first bracket is the automatic announcement, dictated by the rules of the game, and the second is the discretionary announcement, capturing athletes' risk taking behavior. The parameter α_1 and α_2 in model (1) capture the joint effect on both the automatic and the discretionary announcement ($\alpha_1=1+a_1$; $\alpha_2=1+a_2$).

concern, for example, could be that a higher concentration of athletes with very similar performance may affect an individual's behavior. Similarly, the absolute distance from the closest athletes (following or proceeding) in the ranking may also make a difference. Risk taking may be more rewarding if an athlete leads the closest trailer by a relatively substantial amount, but trails the closest leader by relatively little. We explore these issues in our robustness analysis. None of our benchmark results change in any fundamental way.

3.2. The Determinants of Performance

We estimate the risk-reward frontier using the following specification:

$$\text{Success}_{itjs} = X_{itj}\,\gamma + \Sigma_n\,\delta_n\,\text{Rank(n)}_{itjs} + \Sigma_s\,\lambda_s\,\text{Announcement}_{itjs} + u_{itjs} \quad (3)$$

where Success_{itjs} is a binary indicator that takes the value of one if athlete *i*, in year *t*, in competition *j*, at stage *s* (s =2,...,6) was successful in lifting the announced weight ($\text{Announcement}_{itjs}$), X_{itj} is the same vector of individual and competition characteristics as before, Rank(n)_{itjs} is the binary indicator for rank n, and u_{itjs} is the error term that captures all unobserved determinants of a successful lift. Our main interest is in parameters δ_n that describe the impact of being ranked n^{th} on the probability of success, controlling for announcement. Notice, that in terms of Figure 1, the parameters λ_s describe the average slope of athletes' risk-reward frontier, while δ_n capture the average impact of rank on its level.

We correct for unobserved heterogeneity by extensively controlling for fixed effects. In particular, the error term in (3) also can be decomposed as in (2):

$$u_{itjs} = \tau_i + \tau_t + \tau_j + \tau_s + \tau_{it} + \tau_{jt} + \tau_{ij} + \tau_{itj} + \eta_{itjs} \quad (4)$$

where η_{itjs} describe the random component of performance. This random component allows for random errors by the athletes, or for unforeseen circumstances affecting the performance of the athlete. We provide estimates of the parameters in (3) using a variety of fixed effects specifications, possibly including athlete-year-competition control variables.

Under the assumptions that $E(\eta_{itjs} \mid X_{itj}, Rank(n)_{itjs}, Announcement_{itjs}, \tau_{itj}) = 0$, and that η_{itjs} are not serially correlated, we estimate (3) using a linear probability and a conditional (fixed-effects) logit model. Both estimation methods lead to very similar results.

These assumptions imply that unobserved determinants of performance are not correlated with unobserved determinants for each announcement, $E(\eta_{itjs}|\varepsilon_{itjr})=0$, for s,r =2,…,6. The separation of the role of coaches and athletes, and the difference in timing of the announcements and actual lifts justify the validity of this assumption. Discussions with coaches and athletes indicated that athletes typically concentrate on successfully lifting the weight chosen by their coaches.[17] Although coaches and athletes do communicate during the game, it is unlikely that the coach incorporates in the announcement decision the idiosyncratic effects captured by the error term η_{itjs}. Moreover, the variables captured by η_{itjs} are likely to be realized only during – or just before – the attempt, so they are unlikely to affect the announcement, which is made at the beginning of the stage.

Variables such as individual physical and mental training before a given competition are captured by the athlete-competition fixed effects. The identity of competitors and the structure of rewards and any other variable which is fixed at the individual level, for a given competition, are also captured by these fixed effects. The shocks η_{itjs} may capture changes in the behavior of the public during the competition, or other events that occur during the competition and may affect the performance of the athletes. However, because of the separation of the role of the coach and the athlete, and because announcements are made well before the actual lifts, it is unlikely that in

[17] Perhaps the most famous example of such behavior was Pyrros Dimas, a three-time Olympic champion and one of the best weightlifters in history, who reportedly did not want to know how many kilos his coach was choosing for him in each attempt. His motto was: "I will lift as many kilos as you are going to choose for me".

practice such transitory variables could systematically affect the probability of success and the announcement.

3.3 The determinants of performance: Endogeneity of announcement and alternative estimation strategies

Instrumental Variable Estimation

Estimation of model (3) may lead to inconsistent results if shocks to success at each stage of the competition (η_{itjs}) that go unobserved by the econometrician affect the announcement decision at that stage ($Announcement_{itjs}$). Although it is highly unlikely that such shocks would systematically affect our estimates, we nevertheless also explore an instrumental variables approach that allows estimation of the parameters in (3) even if changes in the frontier impact the contemporaneous choice of the announcement, $E(\eta_{itjs}|\varepsilon_{itjs})\neq 0$. [18] As instruments for current announcement we use the announcement made in the previous attempt and the lagged indicator variable for success (within a given style). On the one hand, these two variables are correlated with the current announcement through (1), which can be used to test the power of the instrument (the estimated results for model (1) can be interpreted as the first stage regression results). On the other hand, there is no reason to believe that the previous announcement and success indicator may directly impact the probability of a successful lift in the current stage, after controlling for the current announcement. These considerations render the two variables valid instruments.

Alternative estimation strategies

We also provide two additional types of robustness results. First, we control for the announcement in model (3) using a less restrictive functional form. We divide the announcement into nine intervals based on the percentiles of its distribution and define a dummy for each

[18] We hold the assumption that η and ε are serially uncorrelated. Notice, however, that we allow for correlation across stages because of the individual-year-competition fixed effects (τ_{itj}).

bracket. We then interact them with each stage indicator variable. In other words, instead of controlling for the announcement using a single linear coefficient for each stage of the competition, we allow for a more flexible piecewise function.

Second, we explore the variability in ranking only for those athletes that reattempted to lift the same weight in two (or three) subsequent attempts. Remember that in case of a failed attempt, athletes can choose to reattempt the same weight. For those athletes, although their announcement is the same in two consecutive attempts, their interim ranking may decrease significantly as a result of their competitors' performance. The added value of this exercise is that we do not need to control for their announcement, since it is constant at the individual level and it is captured by the athlete-competition-year specific fixed effect.[19] Hence, results cannot be affected by assumptions on the functional form relating announcement to the probability of a successful lift.

4. Empirical Results

4.1 The Impact of Rank on Announcement

Table 2 reports our benchmark results for model (1), using alternative fixed effects specifications.[20] Column 1 provides the estimated coefficients when we control for athlete, year and competition fixed effects separately, whereas column 5 reports the estimates from our richest specification (including joint athlete-year-competition fixed effects). The omitted rank category throughout the table corresponds to the athlete ranked first, so all the rank coefficients measure the impact of being ranked n^{th} relative to being first.

[19] If, during the same competition, an athlete attempts to lift two different weights twice, we include two individual specific fixed effects.

[20] Only the first ten rank coefficients are reported in this table together with the rest of the estimated variables to ease exposition. The table is reported in full in the Appendix (Table A1). Throughout the paper, we report robust standard errors clustered by athlete.

Figure 2 plots the estimated coefficients and confidence interval on the thirty-five rank binary indicators from our most restrictive specifications in column 5. When lagging behind, competitors tend to adopt riskier strategies than those in the lead. However, risk-taking exhibits an inverted-U relationship with rank: announcements increase from first to sixth place, but then decrease for further decreases in rank until seventeenth place, after which there is no significant effect. This implies that athletes choose riskier strategies moving down in the ranking until rank six, but then progressively revert to safer strategies when ranked further down.

An athlete ranked sixth would announce on average 0.825 Kg more than when ranked first, which is 28 percent of the average increase in announcement between two stages (see Table 1), or 51 percent of the average discretionary increase in announcement (not dictated by the rules of the game).[21] This implies that cumulatively, by the end of the competition, an athlete announces roughly 5 Kg more, which implies a drop in the likelihood of success of 9.1 percent.[22] This effect is substantial, given that the probability of a successful lift at the last attempt is just 32 percent (Table 1). In terms of Figure 1, athletes choose points further to the right on their risk-reward frontier, involving higher weights, but a lower probability of success. However, after rank six, individuals choose less risky strategies as they move down in the ranking. For example, the impact of going from rank six to eleven is 0.2 Kg. The relation between rank and announcement progressively flattens towards the bottom of the ranking.[23] The results are very robust to the way we control for unobserved heterogeneity in Table 2.[24]

Looking at the impact of athletes' individual characteristics, being heavier (within a given category) implies higher announcements. This confirms a well-known fact in weightlifting that a

[21] The average discretionary increase in announcement across all stages is 1.62Kg.
[22] The average impact of a 1 Kg increase in announcement on the probability of a successful lift is approximately 1.8 percent (see column 5, Table 3).
[23] The change in announcement between rank six and eighteen is 0.746Kg, but only 0.178Kg between rank nineteen and thirty-four (difference highly significant: F(19, 4047)=5.87, prob>F=0.015).
[24] A similar inverted-U relationship emerges in column 2, where we control for athlete and competition-year fixed effects, in column 3, where we control for year and athlete-competition fixed effects and in column 4, where we control for competition and athlete-year fixed effects. Figure A1 in the appendix plots the estimated rank coefficients from all specifications. Overall, unobserved heterogeneity does not significantly affect the impact of rank on announcement.

higher body mass allows athletes' to lift heavier weights. Playing at home does not seem to induce athletes to take greater risks, as the coefficient on $Home_{itj}$ is never significant. The number of competitors has a positive, but very small effect on announcement.[25] Finally, both the impact of the previous announcement and the success indicator are positive and significant as expected, as athletes cannot decrease their announcement and must increase it after a successful attempt.

4.2 Interpretation of the impact of rank on announcement

Conventional wisdom from sports competitions tells us that the trailing team may have a big incentive to adopt riskier strategies in an attempt to catch up with the leaders (Grund and Gurtler, 2005). Similarly, it has been argued that troubled firms and interim losers in corporate tournaments are more likely to take riskier strategies than market leaders (Bowman, 1982; Knoeber and Thurman, 1994; Brown, Harlow and Starks, 1996, Chevalier and Ellison, 1997).[26] The fact that the impact of rank is positive up to rank seventeen is broadly consistent with this literature.

The progressive flattening of the relation after the first six positions is also consistent with differences in risk taking behavior at different points in the ranking. Since rewards are decreasing at a decreasing rate going down in the ranking, the benefit from variability in rank is expected to decrease substantially towards the bottom of the ranking, where catching up with the leaders becomes progressively more unlikely.

Some additional details further support the link between the results in Figure 2 and differences in risk-taking behavior at different rank positions. If changes in attitude towards risk drives the results in Figure 2, then we expect to observe particularly large differences between

[25] Coefficients from columns 1 and 3 indicate that having ten additional participants implies an average increase of 0.06 Kg in announcements.

[26] This intuition has been formalized by Cabral (2003), Goriaev, Palomino and Prat (2003), and Anderson and Cabral (2007).

the announcements at ranks one and two. For while the leader has no gain from variability in rank, the second athlete may significantly gain from rank variability.[27] We also expect to observe large differences between rank 3 and 4. In fact, prizes in weightlifting competitions display a significant discontinuity between 3rd and 4th rank (see Section 2). This provides incentives to take riskier strategies when ranked 4th than when ranked 3rd.[28]

We find strong support for these hypotheses: the coefficient for rank two is statistically different from zero at conventional levels (Table 2, column 5), and so is the difference in coefficients between rank three and four ($F(1, 4047)=11.51$, prob>F=0.0007). Moreover, the differences between rank one and two (0.309 Kg), and three and four (0.237 Kg), are not statistically significant ($F(1, 4047)=0.43$, prob>F=0.5145) and they are larger than any other difference between adjacent ranks.

4.3 The Impact of Rank on the Probability of a Successful Lift

Table 3 reports our benchmark results for model (3), using alternative fixed effects specifications.[29] Figure 3 plots the estimated coefficients and confidence interval on the thirty-five rank binary indicators from our most restrictive (athlete-year-competition fixed effects) linear probability model specification in column 5 to ease exposition. The omitted rank category again corresponds to the athlete ranked first, so all the rank coefficients measure the impact of being ranked nth relative to being first.

Estimated coefficients reveal a significant positive relationship between ranking and the probability of a successful lift. Conditional on the announced weight, moving an athlete from the first to the sixth position implies a 19 percent increase in the probability of a successful lift, and a

[27] As discussed above, the relation between rewards and prizes is decreasing and convex.
[28] The discontinuity in rewards locally affects the concavity of the relation between rewards and rank, so that incentives to take risk are drastically different just above and below this threshold.
[29] To ease exposition, we report only the first ten rank coefficients. The table is reported in full in the Appendix (Table A2).

change from first to tenth implies a 32 percent increase. Overall, the effect of rank on performance is so large that a decrease in rank implies an overall increase in the probability of success, even after taking into account the possibility of higher announcements.

Columns 1-4 in Table 3 report the results from the different fixed effects specifications. In sharp contrast to model (1), controlling for more sources of unobserved heterogeneity has a large impact on the results. Figure A2 in the Appendix plots the estimated rank coefficients from the different specifications. As we move from column 5 to column 1 in Table 3, we progressively control for fewer sources of unobserved heterogeneity and as a result, the relationship becomes flatter and not significant. This is consistent with an omitted variable bias. Individuals with higher unobserved ability are likely to be ranked towards the top, and they also perform better on average. When we do not control for individual characteristics, the rank variable captures the unobserved differences in quality, so the performance at the top of the ranking is overestimated. The bias induced by the omitted variable tends to offset the true impact of changes in rank.

Results using the conditional (fixed-effects) logit model show the same positive relationship between rank and success. Column 6 of Table 3, reports the coefficients for our richest fixed effects specification. As in column 5, the impact of rank on the log-odds of a successful lift is significantly positive and increases as we move down in the ranking.

The remaining estimated coefficients in Table 3 are in line with expectations. Higher bodyweight increases the probability of successfully lifting the announced weight (i.e., the individual frontier shifts to the right when bodyweight increases). Playing at home seems to provide a small (7 percent) but significant advantage in performance. On the contrary, an increase in the number of competitors seems to slightly decrease the probability of a successful lift.[30] Finally, announcements at each stage have a negative and significant coefficient, as higher announcements generally lead to a lower probability of success.

IV regression results

Using our most restrictive (athlete-competition-year fixed effects) linear specification, we re-estimate model (3) using the lagged announcement and success indicator variable as instruments for the current announcement. Results are reported in Table 4. The first stage estimates of both instruments are positive and significant, confirming our previous results from model (1). Both the first stage R^2 and F tests indicate that we do not have a weak instrument problem (Stock and Yogo 2005). The rank coefficients exhibit the same positive pattern as before: conditional on the announcement, an athlete lifts with higher probability if he is further down in the ranking.

Alternative estimation strategies

Table A3 in the Appendix reports the estimated rank coefficients for our richest specification (athlete-year-competition fixed effects), controlling for announcement at each stage using a flexible piecewise function (as described in Section 3.3). The rank coefficients exhibit the same positive pattern as before.

Table A4 in the Appendix reports the results of model (3), only for those athletes that reattempted to lift the same weight in either style (as described in Section 3.3). We divide athletes into three categories: those who experienced a fall of up to two rank positions (56.03 percent of the sample), those who experienced a fall between three and six positions (30.11 percent) and those fell more than six ranks (13.85 percent). Using the first category as the base-line category, coefficients on the remaining two indicators reveal the same qualitative picture as before: for exactly the same announcement, the more rank places an athlete drops, the higher is the probability of a successful lift.

[30] We explore the effect of the intensity of competition extensively in the next section.

4.4 Interpretation of the impact of rank on performance

The results from model (3) imply that moving towards the top of the ranking decreases performance. There are two potential explanations for this surprising result. First, individuals exert less effort as they move towards the top of the ranking. Although the marginal increase in rewards from an increase in rank is higher at the top, one cannot exclude that effort might decrease. This could occur, for example, either because competition is systematically less intense at the top, or because the differences in interim score across athletes are higher, or because potential gains from a successful lift are lower.

A second potential explanation is what is known in the social psychology literature as "choking under pressure". Athletes' performance may deteriorate when the stakes are higher, or the importance of success is higher (Baumeister, 1985), or when there is more pressure from other individuals, either friendly or not (Zajonc, 1965). At the top of the ranking stakes are higher and so is the importance of a successful lift, and the potential pressure created by the public and the media. This suggests that athletes in weightlifting competitions may perform worse when ranked closer to the top. The coaches we interviewed reported that it is expected for athletes to perform systematically better in training sessions than in competitions, which suggests that psychological pressure may indeed be important.

The results in Figure 3 are consistent with both explanations. Ranking affects behavior, but one cannot identify whether the decrease in performance at the top comes from lower effort or choking under pressure, or a combination of both. However, there are circumstances in which the two theories make different predictions on the impact of ranking on performance and so we can try to explore the relative importance of the two possible explanations. In the remaining part of this section, we will first compare prestigious and non-prestigious competitions, and then situations in which athletes face more intense competition, or higher incentives to perform well.

Prestigious versus non-prestigious competitions

The literature on tournaments suggests that effort (and therefore performance) increases with the level of prizes (Ehrenberg and Bognanno, 1990; Becker and Huselid, 1992; Knoeber and Thurman, 1994). The literature on social psychology, however, argues that the psychological pressure caused by higher incentives (including monetary incentives), or the presence on an audience, may significantly decrease performance.

Prizes (both monetary and not) and media coverage are higher for the Olympic Games and World Championship than for the European Championship. Therefore, athletes should perform better in the Olympic Games or World championships than in the European Championships (they should lift any given weight with a higher probability). Finding the contrary would suggest that psychological pressure may indeed play a significant role.

To explore this hypothesis, we interact all explanatory variables (rank dummies, stage-specific announcements and stage dummies) in model (3) with an indicator that takes the value of one if the competition is less prestigious (European Championships) and zero otherwise.[31]

Table A5 in the Appendix reports the estimated rank coefficients for prestigious and non-prestigious events, controlling for athlete-year fixed effects, which is the most restrictive specification we can use. The omitted rank category corresponds to first place in a non-prestigious competition. In the first two columns of Table 5 we report the average impact of interim rank based on the estimated coefficients in Table A5, column 1, and the average announcements at each stage.[32] Figure 4 describes the differences in the impact of interim rank in prestigious and non-prestigious competitions.

[31] The European Championships takes place every year, whereas the World Championships alternate with the Olympic Games, taking place every four years. So there are many instances in which the same athlete can participate in both types of competitions during a single year. See table B1 in the Appendix for the exact chronology of competitions in our sample.

[32] Define the indicator variable P equal to one for prestigious competitions. Table 5 reports δ_n^P Rank(n) + $(1/5)\Sigma_s$ (λ_s^PAnnouncement$^*_s$+τ_s^P) for each rank n, both for prestigious (P=1) and non-prestigious competitions (P=0), where Announcement$^*_s$ is the average announcement for stage s and τ_s^P is the estimated stage-specific coefficient.

For a given announced weight, performance is significantly lower in more prestigious competitions (F(20, 4051)=206.48, P-value=0.0000). The average difference in the level of the two curves is 12 percent, whereas there is no statistically significant difference in the slope of the two curves. This is consistent with the impact of increased pressure dominating the increase in effort in important competitions. The fact that both curves in Figure 4 are upward sloping shows that our previous findings are robust. In both types of competitions the marginal impact of rank is essentially the same.

Although the European and World Championships (or Olympic Games) do not overlap within a year, one could possibly argue that the difference just identified is entirely driven by self-selection of good athletes to the more prestigious competitions. To control for this potential selection problem, we re-estimate the same model, this time restricting the sample to those athletes who participated in both competitions in the same year (Table A5, column 2).[33] The results are substantially unaffected (Table 5, columns 3 and 4), although the average distance between the two curves is slightly smaller (8 percent).[34]

The effect of intensity of competition

As argued above, if effort is lower when competition is less intense, and competition is systematically less intense at the top of the ranking, then performance may be decreasing moving towards the top of the ranking, even in the absence of psychological pressure. This hypothesis suggests carefully controlling for intensity of the competition in model (3).[35]

We construct a measure of the intensity of the competition which varies at the individual level within a competition. Given the interim score s_{itjs} of athlete i, in year t, competition j, and stage s,

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[33] None of the results changes in any fundamental way if we use a fixed effect logit model (columns 3 and 4 in Table A5).

[34] We also estimate the impact of ranking on risk taking, model (1) discussed above, interacting the prestigious binary indicator with all the explanatory variables (columns 5 and 6 in Table A5). The inverted U-shape relationship between risk taking and rank is not affected. However, announcements are higher overall in more prestigious competitions, particularly after rank 10, suggesting that when incentives are higher athletes tend to choose more risky strategies on average (total effects not reported here, available upon request).

[35] The literature suggests that effort (and therefore performance) may be affected by the intensity of competition (Ehrenberg and Bognanno, 1990).

we compute the fraction of other athletes $k \neq i$ with interim score s_{ktjs} such that $(s_{itjs}-10) \leq s_{ktjs} < (s_{itjs}+10)$.[36] The fraction of competitors within this interval varies across individuals and across stages of the same competition, because of differences in the distribution of interim scores. We then construct a binary indicator for tough competitions, which is equal to one when our measure of intensity of the competition is above 30 percent.[37]

We first estimated model (3) including this variable including athlete-year-competition fixed effects. The impact of this variable is negative and significant (coef. -0.262, s.e. 0.031), implying lower performance when competition is more intense. The impact of rank on performance is not affected, providing additional evidence that performance decreases when athletes are ranked closer to the top.

Second, we interact the binary indicator for tough competition with all the explanatory variables in model (3) while controlling for athlete-year-competition fixed effects. Table 6 presents the impact of interim rank based on these estimates and the average announcement at each stage (estimated coefficients are reported in Table A6 of the Appendix).[38] The omitted rank category now corresponds to rank one when the competition is not close. The probability of a successful lift is significantly lower when the competition is tough for any interim rank ($F(19, 4051)=3.39$, prob>F=0.0000).

These findings show that controlling for intensity of the competition does not eliminate the positive impact of rank on performance, and that performance is overall lower when competition is more intense. Therefore, we cannot exclude that the negative effect of increased psychological pressure may dominate any positive effect of higher effort when competition is more intense.

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[36] As discussed above, interim scores are computed as the sum of the maximum successful lift in snatch and clean & jerk up to that stage.

[37] On average, the fraction of competitors within the 10Kg interval is twenty-six percent, with a median of twenty-four percent. So the thirty percent cut-off level captures the behaviour of athletes facing relatively high concentrations of competitors around them. Results are robust to changes in either the radius around an athlete or the cut-off level that we use.

[38] Define the indicator variable T_{itjs} if competition is tough for individual i, in year t, competition j and stage s. Table 6 reports δ_n^T Rank(n) + $(1/5)\Sigma_s (\lambda_s^T \text{Announcement}^*_s + \tau_s^T)$ for each rank n, when the competition is tough (T=1) and non-tough (T=0), where Announcement^*_s is the average announcement for stage s, and τ_s^T is the estimated stage-specific coefficient.

The potential gains from a successful lift

Finally, one could argue that the impact of rank in Figure 3 is due to higher potential gains from success at the bottom of the ranking. In other words, for a given announcement, the potential gain in rank from a successful lift may increase moving towards the bottom of the ranking.

For each announcement in the dataset, we compute the potential improvement in rank position in case of success, given the observed performance of all the other competitors. While there is a slight increase in potential gains as one moves towards the bottom of the ranking, the potential gain in rank is on average small (1.6 rank positions). At rank 10, for example, the average gain in case of success is less than 1, at rank 20 it is 3.4, while at rank 35 it is 10.3 rank positions. This implies that, on average, individuals at the bottom of the interim ranking are extremely unlikely to reach the top positions, and be awarded significant prizes.

When we include our measure of potential gains in model (3), the results on the impact of rank on performance are not affected. The impact of this additional variable is negative and significant (coef. -0.016, s.e. 0.002), suggesting that performance is lower when the potential gain from success is higher. We also interact potential gain with all the rank dummies, so that we can estimate the local impact of potential gain for each rank position. Our main results are not affected, and the impact of potential gain is either negative or not statistically significant for all rank positions.[39]

5. The impact of tournament incentives relative to a linear reward scheme

Based on our results, we now consider the counterfactual scenario in which prizes are assigned stage-by-stage, as a linear function of the weight lifted at each stage, with no rewards

[39] Results not reported here, available upon request. Note that since these effects are local, the fact that we do not observe the exact money prizes for each rank position is not a significant limitation.

based on relative performance. This counterfactual scenario provides a useful benchmark for our tournament setting, as it corresponds to a simple piece-rate contract as is commonly used by firms to reward employees, especially when the tasks involved are simple and repetitive.[40]

The linear reward scheme applied in our setting implies that a risk neutral athlete would attempt to maximize the expected weight successfully lifted at each stage. In this scenario, given the individual risk-reward frontier, athletes would make announcements such that the elasticity of the probability of a successful lift to the announcement is equal to one.

Given the estimated risk reward frontier in model (3), we find that the elasticity implied by the data (measured at the averages) varies between -3 and -10, as reported in Table 7.[41] This implies that, by decreasing the announcement by one percent, athletes would increase the probability of a successful lift between 3 and 10 percent. Doing so would significantly increase their counterfactual payment on average. In particular, in order to maximize the expected weight successfully lifted at each stage, athletes would make 15 to 21 percent smaller announcements, implying an increase in the probability of a successful lift between 12 and 60 percent.

Figure 5 describes the counterfactual choice of announcement for a hypothetical individual with average announcement (154.8 Kg) and an average probability of a successful lift (0.56), in the second clean & jerk attempt. Under the counterfactual system, our hypothetical athlete would announce only 131.4 Kg and move up on his frontier, increasing the probability of a successful lift to 0.92 (point B in Figure 7).

Note that our counterfactual analysis illustrates only part of the possible impact of moving from a tournament to a linear reward system. If the linear compensation scheme puts less pressure on participants, average performance may further increase in the linear reward system.

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[40] This is also the benchmark case used by Lazear and Rosen (1981) to discuss the impact of tournaments.
[41] The elasticity is computed as [dPr(Successful lift)/dAnnouncement]/[Average Announcement/Average Pr(Successful lift)].

6. Additional results and discussion

We present four additional results. We first discuss the impact of (i) prestige and (ii) intensity of the competition on risk taking behavior. Then, we show that (iii) tiredness cannot reasonably explain the observed relation between rank and performance, and finally that (iv) this relation is not significantly affected by athletes' experience.

Risk taking and absolute distance from competitors

The results in Figure 2 are not affected when we control for the difference in score between each competitor and the competitor just above and below in the interim ranking. We would expect athletes to take more risks and increase their announcement in an attempt to overtake their competitor, if they are relatively close to the athlete just above them, but relatively far from the competitor just below in the interim rank. On the contrary, we would expect athletes to reduce risk taking and try to defend their position if they are relatively far from the competitor just above, but close to the competitor below in the interim rank.

We compute for each observation the score distance between each athlete and the athletes ranked just above and below. We then classify each observation in one of four categories and define four corresponding indicator variables: FF when a given athlete is far from both the athletes leading and following (1.17 percent of the observations); FC when a given athlete is far from the athlete following but close to the athlete leading (5.64 percent); CF in the opposite case (4.46 percent); and finally CC when both are close (88.72 percent).[42] We then use CC as the base line category, and include the remaining three indicators in model (1). Results are reported in Table A7 of the Appendix. Announcement is 0.2 kg higher in the FC case relative to the baseline category, 0.2 Kg lower in the CF case, and not significantly different in the FF case. The impact of distance from the competitor on announcement is in line with the incentives to take risk

[42] We classify two athletes being far if their interim scores' distance is higher than the ninety-fifth percentile of the distribution of distances in that particular stage. We also experimented using the ninetieth or the seventy-fifth percentile as the cut-off. Our results qualitatively remain the same.

discussed in the literature (Bronars and Oettinger, 2001). This further supports the relation between announcement decision and risk taking behavior.

Risk taking and intensity of competition

One concern could be that a higher concentration of athletes with similar performance might affect individuals' risk attitude. Table A8 in the Appendix reports the results from model (1) when we add the binary indicator for close competitions described in Section 4.4. Its coefficient is negative but not significant, and the results in Figure 2 are not affected.[43]

The impact of tiredness on performance

An alternative explanation for the positive relationship between rank and performance in Figure 3 is tiredness. One may argue that athletes at the top of the ranking may be more fatigued, having successfully lifted heavier weights, and so their performance may decrease in subsequent attempts.

We find this explanation unsatisfactory for a number of reasons. First, it is not obvious that a failed attempt is more tiring than a successful one. So it is not necessarily true that athletes are more tired when ranked at the top (since an athlete may be ranked at the bottom after a series of ambitious- yet unsuccessful- attempts). Second, we estimate model (3) using athlete-year-competition fixed effects and controlling for the cumulative weight attempted up to that stage in the competition. The impact of cumulative weight is negative but very small, and statistically insignificant.[44] The results in Figure 3 are virtually unchanged. Finally, tiredness cannot possibly explain why the same positive relationship between rank and success exists when we restrict our sample to athletes reattempting the same weight. By definition athletes are more tired in their

[43] We also experimented by interacting the tough competition indicator with all the rank dummies and the rest of variables in model (1). The results were unchanged. Both sets of rank coefficients exhibited the inverted-U relationship and were statistically indistinguishable.

[44] The point estimate is. -0.00010, with s.e. 0.0006. This implies that a 10 Kg increase in weight affects the probability of a successful lift by just 0.1 percent.

second attempt (and their interim ranking cannot be higher), but performance significantly increases.

Experience and the impact of rank on performance

We finally investigate whether experience attenuates the impact of rank on performance. Experience has been shown to mitigate the endowment effect in field experiments (List, 2003). In laboratory experiments on the ultimatum game, Slonim and Roth (1998) find that experience attenuates the tendency of experimental subjects to reject low offers, and increases the frequency of low proposals. To the extent that the results in Figure 3 may be related to psychological pressure, it is interesting to see if experience attenuates the impact of rank.

To measure "experience" in our setting, we construct a binary indicator that takes the value of one if an athlete has previously won a medal in an international competition. This definition captures the fact that winning a medal may provide a learning opportunity about what it takes to perform under pressure. We then interact this indicator with all the explanatory variables in model (3) while controlling for athlete-year-competition fixed effects. Table 8 reports the estimated coefficients. The relationship between rank and performance is upward sloping for both experienced and inexperienced athletes, and the two curves are not significantly different. Results are qualitatively the same if we use alternative definitions for experience, such as the times an athlete has participated in a given competition (or in any competition).[45]

7. Conclusions

Professional athletes participating in international weightlifting competitions seem to take more risks when ranked "close enough" to the first athlete (the first seventeen positions), but

[45] List (2003) defines an individual as experienced if the number of previous market transactions is above a given threshold. In our case, a similar definition is whether an athlete has previously participated in at least n competitions, where n is some percentile of the distribution of the number of competitions in which athletes participated. Results not reported here, available upon request.

then revert to safer strategies when ranked lower. This result is in line with the intuition that laggards may increase risk taking in an effort to catch up with the leaders. However, conditional on the weight chosen, the probability of success decreases as we get closer to the top. This result is quite surprising and cannot be explained by unobserved heterogeneity (across competitors or competitions), variability in the intensity of the competition, or differences in the return to effort, and is robust across a number of alternative specifications and estimation strategies. We provide some evidence suggesting that this effect could be the result of psychological pressure. This may explain why coping with pressure is often mentioned as an important skill for managers in large organizations, or why contractual agreements can provide a safety net for individuals with relatively low performance. How significant "choking" is in other environments and precisely through which channels it affects performance remain to be explored.

Finally, we demonstrate that the tournament setting significantly increases risk-taking, leading to higher risk and lower average performance relative to a counterfactual piece-rate contract. Although this is likely to be optimal in a sporting contest, where spectators seek excitement and breathtaking performances, it may not be so desirable within firms. If firm profitability is affected more by average performance than by the rare exceptional performance of a few individuals, then tournament-like incentives may reduce overall performance and profitability. On the other hand, in industries in which research and development are fundamental, tournaments may provide workers with the optimal incentives to take risk. This may partly explain why contracts based on relative performance are common but not ubiquitous, and why they are not uniformly distributed across different types of workers, firms or industries.

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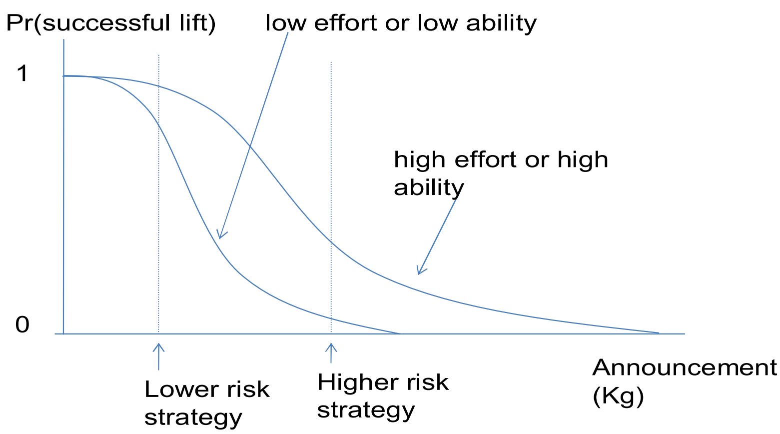
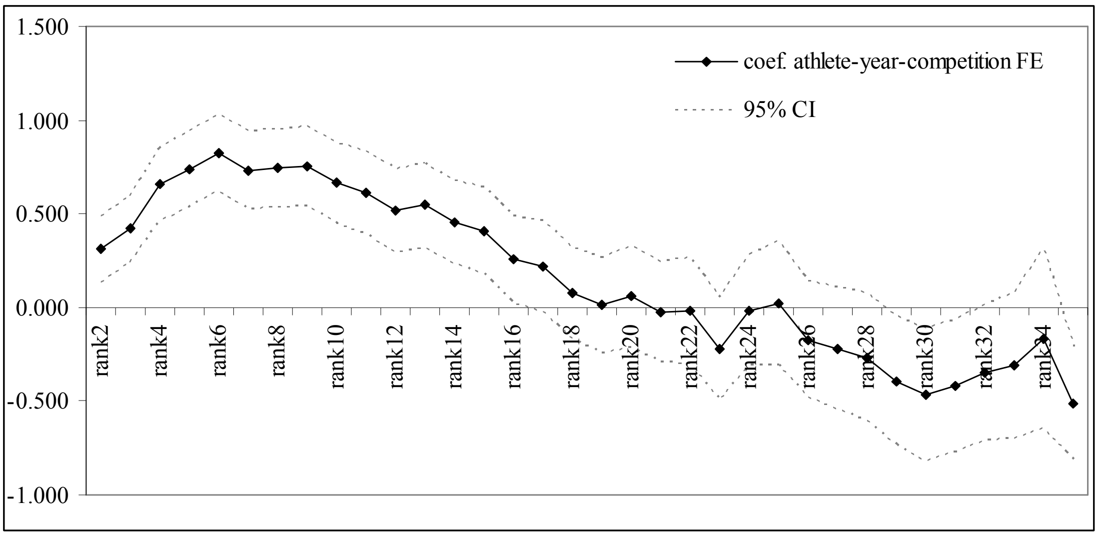
FIGURE 1 – THE ATHLETES' RISK-REWARD FRONTIER



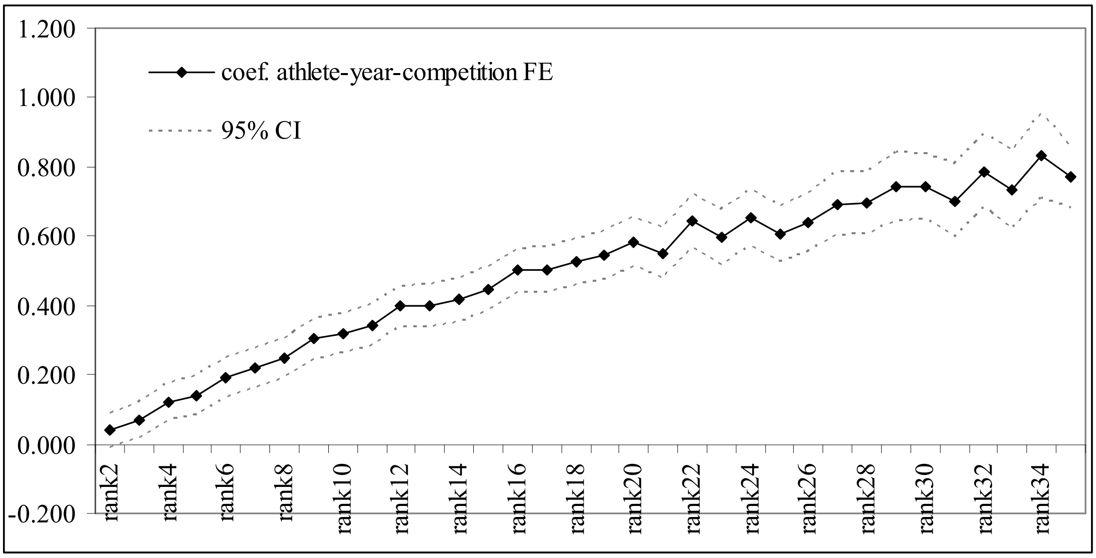
Notes: The figure describes the risk-reward frontiers for two hypothetical athletes of different ability. The better athlete is characterized by the frontier located to the right. Each competitor can improve the probability of a successful lift by increasing the quality and intensity of training before the competition, or by having more concentration/determination during the game (i.e., by exerting more effort).

FIGURE 2 – THE IMPACT OF RANK ON ANNOUNCEMENT



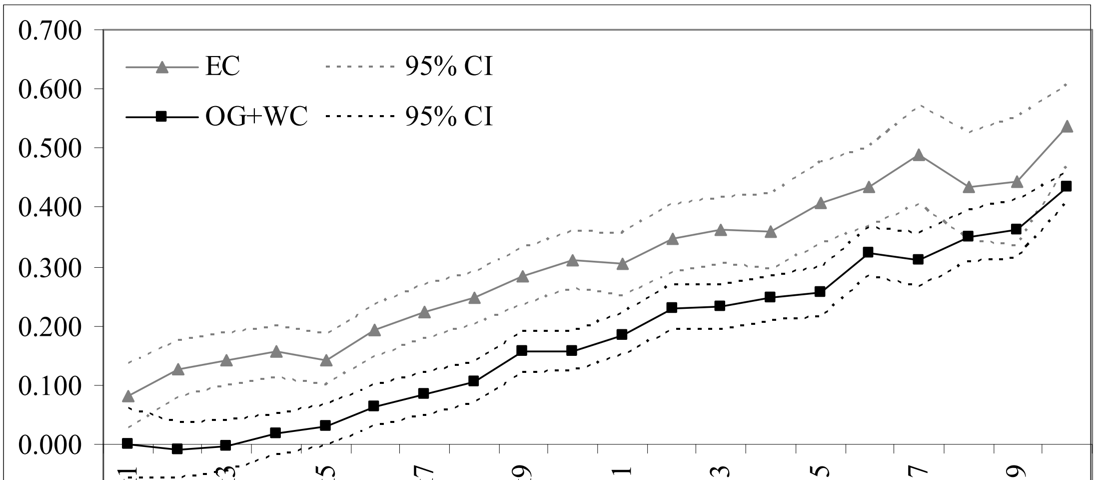
Notes: The figure reports the estimated coefficients (and the 95% confidence interval) of the binary indicators for athletes' rank position in model (1). The specification includes athlete-year-competition specific fixed effects, country of origin, and stage of the competition fixed effects. Results are also reported in Table 2, column 5.

FIGURE 3 – THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT



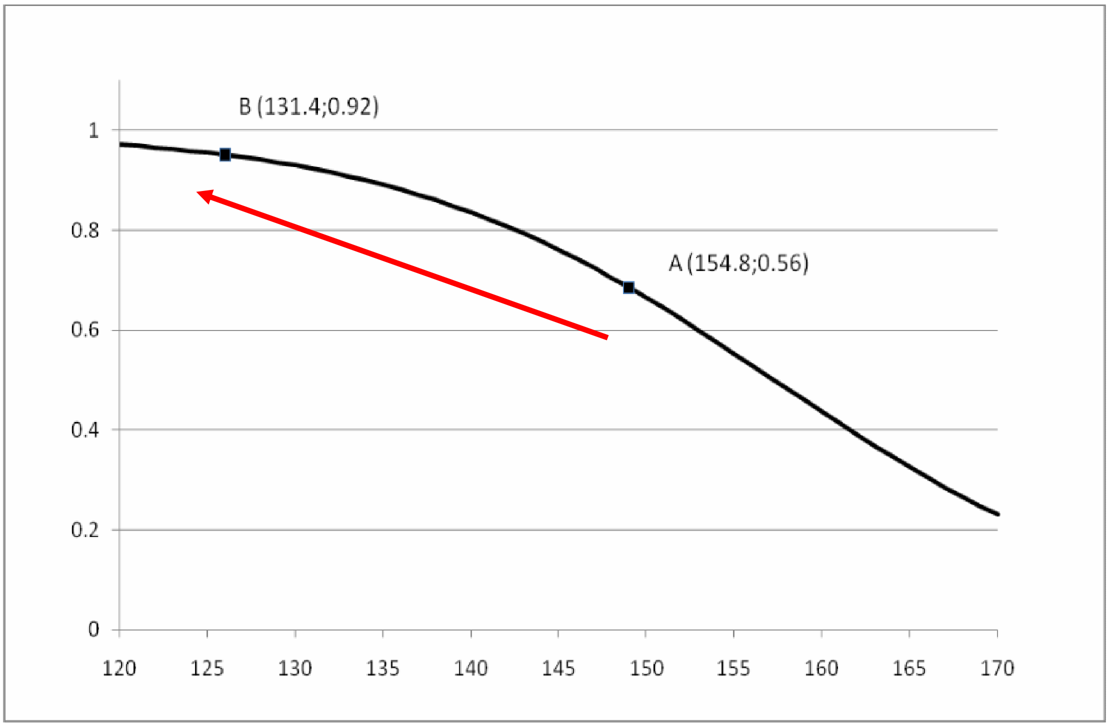
Notes: The figure reports the estimated coefficients (and the 95% confidence interval) of the binary indicators for athletes' rank position in model (3). The specification includes athlete-year-competition specific fixed effects and stage of the competition fixed effects. Results are also reported in Table 3, column 5.

FIGURE 4 – THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT IN PRESTIGIOUS AND NON-PRESTIGIOUS COMPETITIONS



Notes: The figure describes the differences in the impact of rank on the probability of a successful lift for prestigious and non-prestigious competitions (and the 95% confidence interval). The impact of rank one in prestigious competitions is normalized to zero. The results are also reported in Table 5 (columns 1 and 2).

FIGURE 5 – COUNTERFACTUAL ANALYSIS OF A LINEAR REWARD SCHEME



Notes: The figure describes the risk-reward frontier for a hypothetical athlete with average announcement and average probability of a successful lift in the second clean & jerk attempt (point A), based on the coefficients of the logit model in Table 3 and the average announcement reported in Table 1. Point B describes the optimal counterfactual announcement -and the corresponding probability of success- if prizes were assigned stage-by-stage, as a linear function of the weight lifted, with no rewards based on relative performance (see Section 5).

TABLE 1 - DESCRIPTIVE STATISTICS

	Snatch			Clean & Jerk		
	stage 1	stage 2	stage 3	stage 4	stage 5	stage 6
Announcement	122.404	125.953	128.013	150.570	154.808	156.752
	36.860	*37.205*	*37.450*	*44.057*	*44.503*	*44.840*
Prob. of Success	0.732	0.570	0.397	0.806	0.557	0.317
	0.443	*0.495*	*0.489*	*0.406*	*0.497*	*0.465*

Notes: The table provides the average and standard deviation (in italics) of the announcement and the probability of success at each stage.

TABLE 2 - THE IMPACT OF RANK ON ANNOUNCEMENT

	(1)	(2)	(3)	(4)	(5)
Estimation method	OLS	OLS	OLS	OLS	OLS
Dependent variable	$Announcement_{itjs}$	$Announcement_{itjs}$	$Announcement_{itjs}$	$Announcement_{itjs}$	$Announcement_{itjs}$
Rank 2	0.252***	0.255***	0.258***	0.254***	0.309***
	(0.072)	(0.072)	(0.079)	(0.081)	(0.090)
Rank 3	0.226***	0.234***	0.266***	0.367***	0.420***
	(0.065)	(0.065)	(0.072)	(0.079)	(0.090)
Rank 4	0.512***	0.522***	0.560***	0.616***	0.657***
	(0.073)	(0.072)	(0.081)	(0.088)	(0.099)
Rank 5	0.569***	0.581***	0.625***	0.691***	0.738***
	(0.073)	(0.073)	(0.083)	(0.090)	(0.104)
Rank 6	0.656***	0.670***	0.720***	0.786***	0.825***
	(0.074)	(0.074)	(0.086)	(0.091)	(0.105)
Rank 7	0.567***	0.584***	0.635***	0.690***	0.733***
	(0.074)	(0.073)	(0.085)	(0.091)	(0.106)
Rank 8	0.539***	0.558***	0.628***	0.697***	0.744***
	(0.075)	(0.074)	(0.085)	(0.093)	(0.107)
Rank 9	0.588***	0.605***	0.635***	0.727***	0.754***
	(0.077)	(0.077)	(0.089)	(0.095)	(0.109)
Rank 10	0.521***	0.538***	0.558***	0.641***	0.666***
	(0.078)	(0.077)	(0.089)	(0.096)	(0.111)
$Announcement_{itj(s-1)}$ announcement in previous attempt	0.978***	0.978***	0.979***	0.976***	0.977***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
$Success_{itj(s-1)}$	4.167***	4.167***	4.177***	4.216***	4.212***
success in previous attempt	(0.030)	(0.030)	(0.031)	(0.033)	(0.034)
$Bodyweight_{itj}$	0.016***	0.016***	0.018***		
athlete's bodyweight in Kg	(0.006)	(0.006)	(0.007)		
$Home_{itj}$	-0.002	-0.002	-0.017		
competing in home country	(0.057)	(0.057)	(0.080)		
Number of $Competitors_{itjs}$	0.006**	0.002	0.007**		
competitors at each stage	(0.002)	(0.003)	(0.003)		
Observations	29593	29593	29593	29605	29605
Clusters	4052	4052	4052	4052	4052
Athlete FE	yes	yes			
Competition FE	yes			yes	
Year FE	yes		yes		
Competition-Year FE		yes			
Athlete-Competition FE			yes		
Athlete-Year FE				yes	
Athlete-Year-Competition FE					yes

Notes: The dependent variable is the announcement by athlete *i* , in year *t* , in competition *j* , at stage *s* of the game. All equations include stage of the competition binary indicators. The first three columns also inlude country of origin binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 3 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	OLS	OLS	OLS	OLS	OLS	Logit (MLE)
Dependent variable	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$
Rank 2	-0.039**	-0.040**	-0.035	0.016	0.039	0.248*
	(0.020)	(0.020)	(0.022)	(0.024)	(0.025)	(0.127)
Rank 3	-0.062***	-0.064***	-0.050**	0.027	0.067**	0.391***
	(0.021)	(0.020)	(0.023)	(0.025)	(0.027)	(0.137)
Rank 4	-0.079***	-0.082***	-0.051**	0.043	0.121***	0.738***
	(0.021)	(0.021)	(0.023)	(0.026)	(0.027)	(0.147)
Rank 5	-0.098***	-0.101***	-0.067***	0.045*	0.138***	0.857***
	(0.022)	(0.022)	(0.025)	(0.026)	(0.029)	(0.157)
Rank 6	-0.079***	-0.081***	-0.036	0.084***	0.190***	1.130***
	(0.023)	(0.023)	(0.025)	(0.028)	(0.029)	(0.161)
Rank 7	-0.067***	-0.070***	-0.017	0.109***	0.220***	1.296***
	(0.023)	(0.023)	(0.026)	(0.028)	(0.029)	(0.164)
Rank 8	-0.053**	-0.057**	-0.007	0.130***	0.248***	1.454***
	(0.023)	(0.023)	(0.026)	(0.028)	(0.030)	(0.167)
Rank 9	-0.030	-0.034	0.028	0.177***	0.303***	1.747***
	(0.023)	(0.023)	(0.026)	(0.029)	(0.030)	(0.167)
Rank 10	-0.026	-0.029	0.034	0.185***	0.319***	1.836***
	(0.023)	(0.023)	(0.026)	(0.029)	(0.030)	(0.168)
Announce-stage1	-0.013***	-0.013***	-0.014***	-0.019***	-0.020***	-0.111***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)
Announce-stage2	-0.013***	-0.013***	-0.013***	-0.019***	-0.020***	-0.109***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)
Announce-stage3	-0.011***	-0.011***	-0.012***	-0.017***	-0.017***	-0.094***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.006)
Announce-stage4	-0.011***	-0.011***	-0.012***	-0.017***	-0.017***	-0.094***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.005)
Announce-stage5	-0.011***	-0.011***	-0.012***	-0.016***	-0.017***	-0.093***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.005)
Bodyweight $_{itj}$	0.008***	0.008***	0.009**			
athlete's bodyweight in Kg	(0.003)	(0.003)	(0.004)			
Home $_{itj}$	0.060***	0.059***	0.072***			
competing at home country	(0.018)	(0.018)	(0.024)			
Number of Competitors $_{itjs}$	-0.003***	-0.004***	-0.005***			
competitors at each stage	(0.001)	(0.001)	(0.001)			
Observations	36901	36901	36901	36915	36915	33556
Clusters	4052	4052	4052	4052	4052	3741
Athlete FE	yes	yes				
Competition FE	yes			yes		
Year FE	yes		yes			
Competition-Year FE		yes				
Athlete-Competition FE			yes			
Athlete-Year FE				yes		
Athlete-Year-Competition FE					yes	yes

Notes: The dependent variable is a binary indicator that takes the value one if the attempt by athlete i, in year t, in competition j, at stage s of the game, was successful. All equations include stage of the competition binary indicators. The first three columns also inlude country of origin binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 4 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT - IV ESTIMATION

Estimation method	IV
Dependent variable	Pr(success) $_{itjs}$
Rank 2	0.036
	(0.026)
Rank 3	0.061**
	(0.027)
Rank 4	0.109***
	(0.028)
Rank 5	0.114***
	(0.030)
Rank 6	0.163***
	(0.030)
Rank 7	0.183***
	(0.030)
Rank 8	0.204***
	(0.031)
Rank 9	0.250***
	(0.031)
Rank 10	0.259***
	(0.031)
Rank 11	0.282***
	(0.031)
Rank 12	0.333***
	(0.032)
Rank 13	0.335***
	(0.032)
Rank 14	0.344***
	(0.032)
Rank 15	0.356***
	(0.033)
Rank 16	0.414***
	(0.033)
Rank 17	0.420***
	(0.034)
Rank 18	0.434***
	(0.035)
Rank 19	0.441***
	(0.037)
Rank 20	0.522***
	(0.030)
Announcement $_{itjs}$	-0.010***
announced weight to lift	(0.001)
1st Stage Coef.-Announcement $_{itjs-1}$	0.978***
announcement in previous attempt	(0.003)
1st Stage Coef.-Success $_{itjs-1}$	4.231***
success in previous attempt	(0.029)
1st Stage R^2	0.934
1st Stage F-test	76731.31***
	[0.000]
Observations	29572
Clusters	4036
Athlete-Year-Competition FE	yes

Notes: The dependent variable is a binary indicator that takes the value one if the attempt by athlete i, in year t, in competition j, at stage s of the game, was successful. The regression includes stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 5 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT IN PRESTIGIOUS AND NON-PRESTIGIOUS COMPETITIONS

	Calculated Total Effects			
	All athletes		**Athletes participating in both types of competitions**	
	(1)	(2)	(3)	(4)
	Non-prestigious	Prestigious	Non-prestigious	Prestigious
Rank 1	0.398***	0.316***	0.613***	0.583***
	(0.028)	(0.030)	(0.034)	(0.057)
Rank 2	0.441***	0.306***	0.660***	0.576***
	(0.025)	(0.024)	(0.030)	(0.043)
Rank 3	0.459***	0.312***	0.632***	0.563***
	(0.022)	(0.022)	(0.029)	(0.042)
Rank 4	0.471***	0.332***	0.634***	0.500***
	(0.021)	(0.018)	(0.028)	(0.039)
Rank 5	0.457***	0.347***	0.621***	0.531***
	(0.021)	(0.018)	(0.029)	(0.035)
Rank 6	0.508***	0.380***	0.662***	0.500***
	(0.022)	(0.017)	(0.030)	(0.037)
Rank 7	0.539***	0.399***	0.698***	0.563***
	(0.023)	(0.018)	(0.036)	(0.040)
Rank 8	0.562***	0.421***	0.677***	0.595***
	(0.023)	(0.018)	(0.034)	(0.039)
Rank 9	0.600***	0.472***	0.717***	0.614***
	(0.024)	(0.018)	(0.036)	(0.040)
Rank 10	0.627***	0.474***	0.677***	0.654***
	(0.025)	(0.017)	(0.039)	(0.037)
Rank 11	0.620***	0.501***	0.733***	0.613***
	(0.027)	(0.018)	(0.045)	(0.040)
Rank 12	0.663***	0.546***	0.704***	0.734***
	(0.029)	(0.019)	(0.055)	(0.041)
Rank 13	0.677***	0.547***	0.728***	0.671***
	(0.029)	(0.019)	(0.052)	(0.041)
Rank 14	0.675***	0.562***	0.732***	0.665***
	(0.033)	(0.020)	(0.062)	(0.046)
Rank 15	0.723***	0.572***	0.765***	0.637***
	(0.035)	(0.021)	(0.068)	(0.054)
Rank 16	0.751***	0.640***	0.819***	0.707***
	(0.034)	(0.021)	(0.060)	(0.049)
Rank 17	0.804***	0.626***	0.851***	0.661***
	(0.042)	(0.023)	(0.066)	(0.053)
Rank 18	0.750***	0.667***	0.745***	0.748***
	(0.046)	(0.023)	(0.093)	(0.059)
Rank 19	0.759***	0.679***	0.628***	0.745***
	(0.056)	(0.025)	(0.106)	(0.067)
Rank 20	0.853***	0.749***	0.863***	0.714***
	(0.035)	(0.013)	(0.053)	(0.026)

Notes: The table reports the impact of interim rank on the probability of a successful lift for the average announcement: $\delta_n^P \text{Rank}(n) + (1/5)\Sigma_s (\lambda_s^P \text{Announcement}^*_s + \tau_s^P)$ for each rank n, both for prestigious (P=1) and non-prestigious competitions (P=0), where Announcement^*_s is the average announcement for stage s, and τ_s^P is the estimated stage-specific coefficient. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 6 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT IN CLOSE AND NON-CLOSE COMPETITIONS

	Calculated Total Effects	
	NON-CLOSE	CLOSE
Rank 1	0.222***	0.218***
	(0.026)	(0.033)
Rank 2	0.262***	0.253***
	(0.020)	(0.032)
Rank 3	0.283***	0.277***
	(0.019)	(0.026)
Rank 4	0.352***	0.318***
	(0.018)	(0.021)
Rank 5	0.360***	0.340***
	(0.019)	(0.020)
Rank 6	0.440***	0.371***
	(0.019)	(0.020)
Rank 7	0.438***	0.426***
	(0.019)	(0.019)
Rank 8	0.495***	0.429***
	(0.020)	(0.020)
Rank 9	0.535***	0.495***
	(0.020)	(0.020)
Rank 10	0.573***	0.489***
	(0.019)	(0.020)
Rank 11	0.576***	0.536***
	(0.020)	(0.022)
Rank 12	0.646***	0.564***
	(0.021)	(0.023)
Rank 13	0.640***	0.574***
	(0.021)	(0.024)
Rank 14	0.668***	0.578***
	(0.021)	(0.026)
Rank 15	0.678***	0.644***
	(0.023)	(0.026)
Rank 16	0.723***	0.709***
	(0.022)	(0.031)
Rank 17	0.756***	0.656***
	(0.024)	(0.034)
Rank 18	0.782***	0.683***
	(0.026)	(0.034)
Rank 19	0.799***	0.691***
	(0.027)	(0.036)
Rank 20	0.882***	0.763***
	(0.014)	(0.020)

Notes: The table reports the impact of interim rank on the probability of a successful lift for the average announcement: $\delta_n^C \text{Rank}(n) + (1/5)\Sigma_s (\lambda_s^C \text{Announcement*}_s + \tau_s^C)$ for each rank n, both for close (C=1) and non-close competitions (C=0), where Announcement*$_s$ is the average announcement for stage s, and τ_s^C is the estimated stage-specific coefficient. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 7 - COUNTERFACTUAL LINEAR REWARD SCHEME

	Observed values		**Estimated Counterfactual values**		
	Average Announcement	Pr(successful lift)	Elasticity	Announcement	Pr(successful lift)
	(1)	(2)	(3)	(4)	(5)
stage 1	126.0	0.57	-5.95	107.0	0.92
stage 2	128.0	0.40	-8.41	102.9	0.91
stage 3	150.6	0.81	-2.74	139.2	0.92
stage 4	154.8	0.56	-6.44	131.4	0.92
stage 5	156.8	0.32	-9.95	123.3	0.91

Notes: Columns 1 and 2 report the average observed announcement and probability of a successful lift at each stage. Column 3 reports the estimated elasticity of the probability of a successful lift to the announcement, computed at the average values (see Section 5 for details). Column 4 and 5 report the counterfactual announcement such that the elasticity is equal to one, and the corresponding probability of a successful lift.

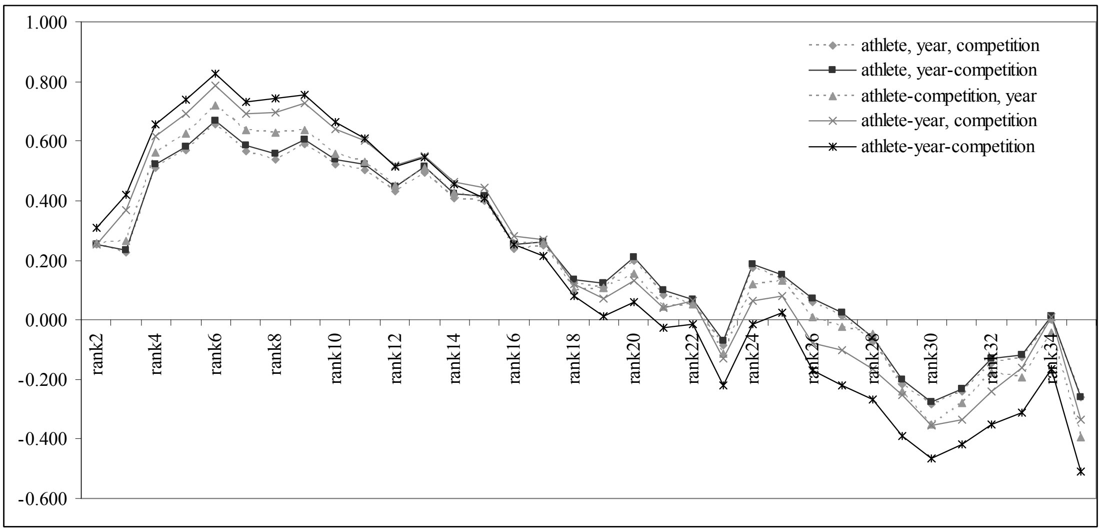
TABLE 8 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT FOR EXPERIENCED AND NON-EXPERIENCED ATHLETES

Estimation method	OLS	
Dependent variable	Pr(success) $_{itjs}$	
	Non-experienced	Experienced
Rank 2	-0.032	0.086***
	(0.038)	(0.031)
Rank 3	0.015	0.106***
	(0.041)	(0.034)
Rank 4	0.061	0.178***
	(0.044)	(0.034)
Rank 5	0.082*	0.201***
	(0.045)	(0.036)
Rank 6	0.138***	0.252***
	(0.045)	(0.041)
Rank 7	0.162***	0.315***
	(0.046)	(0.040)
Rank 8	0.193***	0.343***
	(0.046)	(0.047)
Rank 9	0.253***	0.390***
	(0.046)	(0.049)
Rank 10	0.270***	0.404***
	(0.046)	(0.049)
Rank 11	0.293***	0.492***
	(0.047)	(0.052)
Rank 12	0.360***	0.422***
	(0.047)	(0.059)
Rank 13	0.356***	0.505***
	(0.047)	(0.058)
Rank 14	0.385***	0.403***
	(0.048)	(0.065)
Rank 15	0.412***	0.529***
	(0.049)	(0.066)
Rank 16	0.471***	0.565***
	(0.048)	(0.065)
Rank 17	0.491***	0.388***
	(0.050)	(0.067)
Rank 18	0.503***	0.570***
	(0.050)	(0.080)
Rank 19	0.532***	0.471***
	(0.051)	(0.089)
Rank 20	0.615***	0.615***
	(0.048)	(0.043)
Observations	36915	
Clusters	4052	
Athlete-Year-Competition FE	yes	

Notes: The dependent variable is a binary indicator that takes the value one if the attempt by athlete i, in year t, in competition j, at stage s of the game, was successful. The regression includes stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

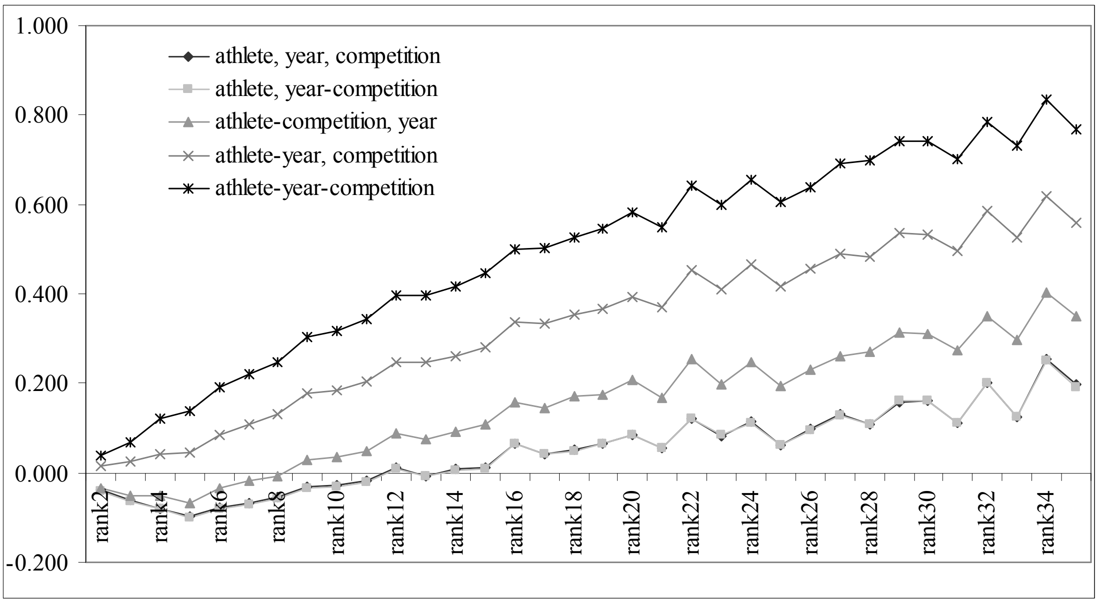
APPENDIX

FIGURE A1 – THE IMPACT OF RANK ON ANNOUNCEMENT



Notes: Figure plots the estimated coefficients on the binary indicators for the rank position of athletes from Table A1. The different lines on the graph correspond to the different column of Table A1, where we control for more sources of unobserved heterogeneity.

FIGURE A2 – THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT



Notes: Figure plots the estimated coefficients on the binary indicators for the rank position of athletes from Table A2. The different lines on the graph correspond to the different column (1-5) of Table A2, where we control for more sources of unobserved heterogeneity.

APPENDIX A1 - THE IMPACT OF RANK ON ANNOUNCEMENT

	(1)	(2)	(3)	(4)	(5)
Estimation method	OLS	OLS	OLS	OLS	OLS
Dependent variable	$Announcement_{itjs}$	$Announcement_{itjs}$	$Announcement_{itjs}$	$Announcement_{itjs}$	$Announcement_{itjs}$
Rank 2	0.252***	0.255***	0.258***	0.254***	0.309***
	(0.072)	(0.072)	(0.079)	(0.081)	(0.090)
Rank 3	0.226***	0.234***	0.266***	0.367***	0.420***
	(0.065)	(0.065)	(0.072)	(0.079)	(0.090)
Rank 4	0.512***	0.522***	0.560***	0.616***	0.657***
	(0.073)	(0.072)	(0.081)	(0.088)	(0.099)
Rank 5	0.569***	0.581***	0.625***	0.691***	0.738***
	(0.073)	(0.073)	(0.083)	(0.090)	(0.104)
Rank 6	0.656***	0.670***	0.720***	0.786***	0.825***
	(0.074)	(0.074)	(0.086)	(0.091)	(0.105)
Rank 7	0.567***	0.584***	0.635***	0.690***	0.733***
	(0.074)	(0.073)	(0.085)	(0.091)	(0.106)
Rank 8	0.539***	0.558***	0.628***	0.697***	0.744***
	(0.075)	(0.074)	(0.085)	(0.093)	(0.107)
Rank 9	0.588***	0.605***	0.635***	0.727***	0.754***
	(0.077)	(0.077)	(0.089)	(0.095)	(0.109)
Rank 10	0.521***	0.538***	0.558***	0.641***	0.666***
	(0.078)	(0.077)	(0.089)	(0.096)	(0.111)
Rank 11	0.504***	0.522***	0.531***	0.602***	0.610***
	(0.080)	(0.080)	(0.090)	(0.098)	(0.112)
Rank 12	0.430***	0.449***	0.453***	0.520***	0.516***
	(0.081)	(0.080)	(0.092)	(0.101)	(0.114)
Rank 13	0.493***	0.513***	0.509***	0.551***	0.546***
	(0.082)	(0.081)	(0.094)	(0.102)	(0.115)
Rank 14	0.407***	0.424***	0.429***	0.463***	0.453***
	(0.081)	(0.081)	(0.092)	(0.100)	(0.113)
Rank 15	0.398***	0.414***	0.409***	0.442***	0.409***
	(0.087)	(0.086)	(0.098)	(0.105)	(0.118)
Rank 16	0.238***	0.254***	0.256***	0.281***	0.255**
	(0.085)	(0.085)	(0.097)	(0.104)	(0.118)
Rank 17	0.248***	0.262***	0.258**	0.270**	0.216*
	(0.092)	(0.092)	(0.103)	(0.112)	(0.125)
Rank 18	0.123	0.137	0.101	0.120	0.079
	(0.090)	(0.089)	(0.102)	(0.113)	(0.125)
Rank 19	0.108	0.123	0.106	0.071	0.012
	(0.096)	(0.096)	(0.108)	(0.118)	(0.129)
Rank 20	0.199*	0.211**	0.155	0.132	0.058
	(0.106)	(0.106)	(0.118)	(0.128)	(0.140)
Rank 21	0.082	0.099	0.042	0.042	-0.028
	(0.101)	(0.100)	(0.115)	(0.123)	(0.137)
Rank 22	0.053	0.068	0.051	0.063	-0.016
	(0.109)	(0.109)	(0.121)	(0.130)	(0.143)
Rank 23	-0.085	-0.071	-0.113	-0.129	-0.221
	(0.112)	(0.112)	(0.122)	(0.131)	(0.142)
Rank 24	0.176	0.187	0.121	0.065	-0.013
	(0.118)	(0.118)	(0.132)	(0.139)	(0.150)
Rank 25	0.138	0.152	0.131	0.079	0.024

	(0.136)	(0.136)	(0.149)	(0.156)	(0.169)
Rank 26	0.058	0.072	0.007	-0.078	-0.171
	(0.120)	(0.120)	(0.137)	(0.145)	(0.157)
Rank 27	0.013	0.026	-0.025	-0.101	-0.219
	(0.138)	(0.138)	(0.149)	(0.152)	(0.166)
Rank 28	-0.073	-0.057	-0.049	-0.164	-0.267
	(0.137)	(0.136)	(0.147)	(0.165)	(0.174)
Rank 29	-0.215	-0.203	-0.239	-0.254	-0.392**
	(0.134)	(0.134)	(0.149)	(0.161)	(0.173)
Rank 30	-0.285**	-0.276**	-0.350**	-0.353**	-0.467***
	(0.133)	(0.134)	(0.155)	(0.165)	(0.180)
Rank 31	-0.242	-0.232	-0.280*	-0.337**	-0.418**
	(0.154)	(0.154)	(0.170)	(0.167)	(0.180)
Rank 32	-0.144	-0.132	-0.179	-0.239	-0.350*
	(0.145)	(0.146)	(0.156)	(0.171)	(0.185)
Rank 33	-0.124	-0.116	-0.195	-0.163	-0.311
	(0.168)	(0.167)	(0.180)	(0.195)	(0.198)
Rank 34	0.001	0.011	-0.043	0.010	-0.166
	(0.197)	(0.197)	(0.216)	(0.220)	(0.244)
Rank 35	-0.261**	-0.260**	-0.396***	-0.337**	-0.510***
	(0.115)	(0.115)	(0.126)	(0.135)	(0.154)
Announcement$_{itj(s-1)}$	0.978***	0.978***	0.979***	0.976***	0.977***
announcement in previous attempt	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Success$_{itj(s-1)}$	4.167***	4.167***	4.177***	4.216***	4.212***
success in previous attempt	(0.030)	(0.030)	(0.031)	(0.033)	(0.034)
Bodyweight$_{itj}$	0.016***	0.016***	0.018***		
athlete's bodyweight in Kg	(0.006)	(0.006)	(0.007)		
Home$_{itj}$	-0.002	-0.002	-0.017		
competing in home country	(0.057)	(0.057)	(0.080)		
Number of Competitors$_{itjs}$	0.006**	0.002	0.007**		
competitors at each stage	(0.002)	(0.003)	(0.003)		
Observations	29593	29593	29593	29605	29605
Clusters	4048	4048	4048	4048	4048
Athlete FE	yes	yes			
Competition FE	yes			yes	
Year FE	yes		yes		
Competition-Year FE		yes			
Athlete-Competition FE			yes		
Athlete-Year FE				yes	
Athlete-Year-Competition FE					yes

Notes: The dependent variable is the announcement by athlete *i*, in year *t*, in competition *j*, at stage *s* of the game. All equations include country of origin and stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX A2 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	OLS	OLS	OLS	OLS	OLS	Logit (MLE)
Dependent variable	$Pr(success)_{itjs}$	$Pr(success)_{itjs}$	$Pr(success)_{itjs}$	$Pr(success)_{itjs}$	$Pr(success)_{itjs}$	$Pr(success)_{itjs}$
Rank 2	-0.039**	-0.040**	-0.035	0.016	0.039	0.248*
	(0.020)	(0.020)	(0.022)	(0.024)	(0.025)	(0.127)
Rank 3	-0.062***	-0.064***	-0.050**	0.027	0.067**	0.391***
	(0.021)	(0.020)	(0.023)	(0.025)	(0.027)	(0.137)
Rank 4	-0.079***	-0.082***	-0.051**	0.043	0.121***	0.738***
	(0.021)	(0.021)	(0.023)	(0.026)	(0.027)	(0.147)
Rank 5	-0.098***	-0.101***	-0.067***	0.045*	0.138***	0.857***
	(0.022)	(0.022)	(0.025)	(0.026)	(0.029)	(0.157)
Rank 6	-0.079***	-0.081***	-0.036	0.084***	0.190***	1.130***
	(0.023)	(0.023)	(0.025)	(0.028)	(0.029)	(0.161)
Rank 7	-0.067***	-0.070***	-0.017	0.109***	0.220***	1.296***
	(0.023)	(0.023)	(0.026)	(0.028)	(0.029)	(0.164)
Rank 8	-0.053**	-0.057**	-0.007	0.130***	0.248***	1.454***
	(0.023)	(0.023)	(0.026)	(0.028)	(0.030)	(0.167)
Rank 9	-0.030	-0.034	0.028	0.177***	0.303***	1.747***
	(0.023)	(0.023)	(0.026)	(0.029)	(0.030)	(0.167)
Rank 10	-0.026	-0.029	0.034	0.185***	0.319***	1.836***
	(0.023)	(0.023)	(0.026)	(0.029)	(0.030)	(0.168)
Rank 11	-0.017	-0.020	0.049*	0.203***	0.344***	1.950***
	(0.024)	(0.024)	(0.027)	(0.029)	(0.031)	(0.171)
Rank 12	0.011	0.009	0.088***	0.248***	0.396***	2.239***
	(0.025)	(0.025)	(0.027)	(0.030)	(0.031)	(0.173)
Rank 13	-0.006	-0.008	0.075***	0.248***	0.397***	2.259***
	(0.025)	(0.025)	(0.028)	(0.030)	(0.031)	(0.175)
Rank 14	0.008	0.006	0.091***	0.260***	0.415***	2.364***
	(0.025)	(0.025)	(0.028)	(0.031)	(0.032)	(0.179)
Rank 15	0.011	0.010	0.108***	0.280***	0.446***	2.503***
	(0.026)	(0.026)	(0.029)	(0.032)	(0.033)	(0.181)
Rank 16	0.066**	0.064**	0.158***	0.336***	0.501***	2.812***
	(0.026)	(0.026)	(0.029)	(0.031)	(0.032)	(0.183)
Rank 17	0.043	0.043	0.146***	0.335***	0.502***	2.857***
	(0.028)	(0.028)	(0.031)	(0.033)	(0.034)	(0.193)
Rank 18	0.051*	0.050*	0.170***	0.355***	0.527***	3.008***
	(0.029)	(0.029)	(0.031)	(0.033)	(0.034)	(0.195)
Rank 19	0.065**	0.065**	0.174***	0.365***	0.545***	3.094***
	(0.030)	(0.030)	(0.032)	(0.035)	(0.035)	(0.201)
Rank 20	0.087***	0.085***	0.209***	0.393***	0.582***	3.296***
	(0.032)	(0.031)	(0.034)	(0.037)	(0.037)	(0.209)
Rank 21	0.054*	0.054*	0.169***	0.370***	0.551***	3.181***
	(0.031)	(0.031)	(0.033)	(0.035)	(0.037)	(0.214)
Rank 22	0.121***	0.122***	0.253***	0.455***	0.642***	3.660***
	(0.032)	(0.032)	(0.035)	(0.037)	(0.039)	(0.221)
Rank 23	0.082**	0.084**	0.199***	0.410***	0.598***	3.417***
	(0.035)	(0.035)	(0.037)	(0.040)	(0.041)	(0.233)
Rank 24	0.114***	0.113***	0.247***	0.467***	0.654***	3.732***
	(0.036)	(0.036)	(0.039)	(0.041)	(0.042)	(0.232)

Rank 25	0.061	0.061	0.195***	0.417***	0.607***	3.494***
	(0.037)	(0.037)	(0.040)	(0.041)	(0.041)	(0.239)
Rank 26	0.098**	0.096**	0.230***	0.455***	0.639***	3.658***
	(0.039)	(0.038)	(0.042)	(0.043)	(0.044)	(0.244)
Rank 27	0.130***	0.130***	0.262***	0.489***	0.693***	4.057***
	(0.042)	(0.042)	(0.044)	(0.046)	(0.047)	(0.266)
Rank 28	0.108***	0.109***	0.270***	0.484***	0.697***	3.993***
	(0.039)	(0.039)	(0.041)	(0.045)	(0.045)	(0.261)
Rank 29	0.159***	0.161***	0.313***	0.537***	0.743***	4.239***
	(0.044)	(0.044)	(0.047)	(0.049)	(0.051)	(0.280)
Rank 30	0.161***	0.161***	0.309***	0.534***	0.742***	4.351***
	(0.043)	(0.043)	(0.046)	(0.048)	(0.048)	(0.289)
Rank 31	0.111**	0.112**	0.274***	0.496***	0.702***	4.048***
	(0.048)	(0.048)	(0.050)	(0.053)	(0.054)	(0.312)
Rank 32	0.201***	0.201***	0.350***	0.584***	0.786***	4.667***
	(0.050)	(0.049)	(0.053)	(0.053)	(0.054)	(0.323)
Rank 33	0.123**	0.124**	0.297***	0.524***	0.733***	4.250***
	(0.049)	(0.049)	(0.055)	(0.055)	(0.059)	(0.343)
Rank 34	0.254***	0.252***	0.403***	0.620***	0.833***	4.925***
	(0.054)	(0.054)	(0.059)	(0.063)	(0.063)	(0.387)
Rank 35	0.197***	0.192***	0.350***	0.560***	0.769***	4.701***
	(0.036)	(0.036)	(0.039)	(0.042)	(0.044)	(0.287)
Announce-stage1	-0.013***	-0.013***	-0.014***	-0.019***	-0.020***	-0.111***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)
Announce-stage2	-0.013***	-0.013***	-0.013***	-0.019***	-0.020***	-0.109***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)
Announce-stage3	-0.011***	-0.011***	-0.012***	-0.017***	-0.017***	-0.094***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.006)
Announce-stage4	-0.011***	-0.011***	-0.012***	-0.017***	-0.017***	-0.094***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.005)
Announce-stage5	-0.011***	-0.011***	-0.012***	-0.016***	-0.017***	-0.093***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.005)
Bodyweight$_{itj}$	0.008***	0.008***	0.009**			
athlete's bodyweight in Kg	(0.003)	(0.003)	(0.004)			
Home$_{itj}$	0.060***	0.059***	0.072***			
competing at home country	(0.018)	(0.018)	(0.024)			
Number of Competitors$_{itjs}$	-0.003***	-0.004***	-0.005***			
competitors at each stage	(0.001)	(0.001)	(0.001)			
Observations	36901	36901	36901	36915	36915	33556
Clusters	4052	4052	4052	4052	4052	3741
Athlete FE	yes	yes				
Competition FE	yes			yes		
Year FE	yes		yes			
Competition-Year FE		yes				
Athlete-Competition FE			yes			
Athlete-Year FE				yes		
Athlete-Year-Competition FE					yes	yes

Notes: The dependent variable is a binary indicator that takes the value one if the attempt to lift a given weight, by athlete i, in year t, in competition j, at stage s of the game, was successful. All equations include country of origin and stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX A3 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT - FLEXIBLE FUNCTIONAL FORM

Estimation method	OLS
Dependent variable	Pr(success) $_{itjs}$
Rank 2	0.041*
	(0.025)
Rank 3	0.074***
	(0.027)
Rank 4	0.128***
	(0.027)
Rank 5	0.145***
	(0.029)
Rank 6	0.198***
	(0.029)
Rank 7	0.227***
	(0.029)
Rank 8	0.255***
	(0.030)
Rank 9	0.309***
	(0.030)
Rank 10	0.323***
	(0.030)
Rank 11	0.351***
	(0.030)
Rank 12	0.401***
	(0.031)
Rank 13	0.404***
	(0.031)
Rank 14	0.425***
	(0.031)
Rank 15	0.456***
	(0.033)
Rank 16	0.513***
	(0.032)
Rank 17	0.518***
	(0.034)
Rank 18	0.543***
	(0.034)
Rank 19	0.561***
	(0.035)
Rank 20	0.648***
	(0.030)
Observations	36915
Clusters	4052
Athlete-Year-Competition FE	yes

Notes: The dependent variable is a binary indicator that takes the value one if the attempt by athlete i, in year t, in competition j, at stage s of the game, was successful. Regression includes stage of the competition binary indicators. We define an indicator variable for each decile of the distribution of announcement. Each indictor variable is then interacted with stage specific dummies. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses below coefficients: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX A4 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT- ATHLETES REATTEMPTING THE SAME WEIGHT

Estimation method	OLS
Dependent variable	Pr(success) $_{itjs}$
RankChange 2	0.131**
Athletes that fell between three and six rank positions	(0.057)
RankChange 3	0.209***
Athletes that fell more than six rank positions	(0.048)
Observations	13754
Clusters	3146
Athlete-Year-Competition-Type of lift FE	yes

Notes: The dependent variable is a binary indicator that takes the value one if the attempt by athlete i , in year t , in competition j , at stage s of the game, was successful. We include in the sample only athletes reattempting the same weight (see Section 3.3). Regression includes stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX A5 - RISK TAKING AND PERFORMANCE IN PRESTIGIOUS AND NON-PRESTIGIOUS COMPETITIONS

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	OLS	OLS	Logit (MLE)	Logit (MLE)	OLS	OLS
Dependent variable	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$	Pr(success) $_{itjs}$	Announcement $_{itjs}$	Announcement $_{itjs}$
Rank 2 * EC	0.042	0.047	0.171	0.197	0.058	0.035
	(0.032)	(0.038)	(0.159)	(0.186)	(0.114)	(0.134)
Rank 3 * EC	0.062*	0.019	0.291*	0.052	0.295***	0.317**
	(0.033)	(0.038)	(0.160)	(0.182)	(0.109)	(0.125)
Rank 4 * EC	0.074**	0.023	0.307*	0.025	0.527***	0.601***
	(0.034)	(0.039)	(0.164)	(0.189)	(0.121)	(0.144)
Rank 5 * EC	0.060*	0.010	0.225	-0.029	0.590***	0.525***
	(0.035)	(0.043)	(0.172)	(0.204)	(0.122)	(0.146)
Rank 6 * EC	0.107***	0.046	0.438**	0.104	0.740***	0.711***
	(0.037)	(0.045)	(0.179)	(0.217)	(0.121)	(0.142)
Rank 7 * EC	0.141***	0.086*	0.634***	0.328	0.587***	0.585***
	(0.037)	(0.049)	(0.183)	(0.235)	(0.121)	(0.148)
Rank 8 * EC	0.163***	0.063	0.726***	0.152	0.612***	0.601***
	(0.037)	(0.049)	(0.181)	(0.228)	(0.126)	(0.163)
Rank 9 * EC	0.202***	0.104**	0.945***	0.375	0.599***	0.540***
	(0.038)	(0.049)	(0.187)	(0.237)	(0.126)	(0.162)
Rank 10 * EC	0.227***	0.064	1.034***	0.142	0.479***	0.729***
	(0.039)	(0.052)	(0.187)	(0.249)	(0.139)	(0.201)
Rank 11 * EC	0.223***	0.120**	1.041***	0.437	0.337**	0.377**
	(0.040)	(0.057)	(0.192)	(0.279)	(0.133)	(0.181)
Rank 12 * EC	0.266***	0.091	1.253***	0.316	0.138	0.089
	(0.040)	(0.063)	(0.195)	(0.293)	(0.142)	(0.189)
Rank 13 * EC	0.278***	0.115*	1.337***	0.463	0.268*	0.008
	(0.041)	(0.063)	(0.199)	(0.296)	(0.141)	(0.202)
Rank 14 * EC	0.275***	0.119*	1.280***	0.441	0.162	0.117
	(0.044)	(0.071)	(0.211)	(0.333)	(0.148)	(0.243)
Rank 15 * EC	0.328***	0.152**	1.511***	0.605*	0.040	-0.039
	(0.046)	(0.076)	(0.220)	(0.339)	(0.152)	(0.207)
Rank 16 * EC	0.353***	0.206***	1.708***	0.908***	-0.100	-0.185
	(0.045)	(0.069)	(0.220)	(0.341)	(0.148)	(0.192)
Rank 17 * EC	0.406***	0.238***	2.024***	1.125***	-0.126	-0.082
	(0.051)	(0.073)	(0.258)	(0.366)	(0.174)	(0.260)
Rank 18 * EC	0.352***	0.132	1.682***	0.516	-0.414**	-0.480*
	(0.054)	(0.099)	(0.269)	(0.462)	(0.176)	(0.252)
Rank 19 * EC	0.361***	0.015	1.716***	-0.105	-0.414**	-0.700**
	(0.063)	(0.113)	(0.307)	(0.519)	(0.190)	(0.271)
Rank 20 * EC	0.455***	0.250***	2.216***	1.084***	-0.463***	-0.443*
	(0.046)	(0.064)	(0.239)	(0.311)	(0.165)	(0.228)
Rank 1 * no EC	-0.272***	-0.222**	-1.368***	-0.977**	-0.095	-0.122
	(0.070)	(0.098)	(0.331)	(0.442)	(0.191)	(0.234)
Rank 2 * no EC	-0.278***	-0.228**	-1.418***	-1.039**	0.326*	0.134
	(0.070)	(0.100)	(0.327)	(0.447)	(0.179)	(0.210)
Rank 3 * no EC	-0.275***	-0.240**	-1.425***	-1.131***	0.350**	0.150
	(0.068)	(0.095)	(0.318)	(0.423)	(0.174)	(0.195)

Rank 4 * no EC	-0.256***	-0.306***	-1.282***	-1.427***	0.624***	0.739***
	(0.068)	(0.096)	(0.316)	(0.426)	(0.173)	(0.206)
Rank 5 * no EC	-0.240***	-0.273***	-1.200***	-1.272***	0.711***	0.665***
	(0.067)	(0.092)	(0.312)	(0.408)	(0.170)	(0.200)
Rank 6 * no EC	-0.207***	-0.303***	-1.048***	-1.423***	0.775***	0.778***
	(0.068)	(0.097)	(0.314)	(0.432)	(0.171)	(0.205)
Rank 7 * no EC	-0.188***	-0.247**	-0.956***	-1.155***	0.713***	0.708***
	(0.068)	(0.096)	(0.312)	(0.423)	(0.175)	(0.202)
Rank 8 * no EC	-0.166**	-0.208**	-0.823***	-0.998**	0.707***	0.682***
	(0.068)	(0.096)	(0.316)	(0.428)	(0.170)	(0.198)
Rank 9 * no EC	-0.113*	-0.191*	-0.588*	-0.934**	0.760***	0.617***
	(0.068)	(0.097)	(0.314)	(0.432)	(0.171)	(0.199)
Rank 10 * no EC	-0.116*	-0.153	-0.602*	-0.717*	0.690***	0.576***
	(0.068)	(0.096)	(0.312)	(0.427)	(0.170)	(0.201)
Rank 11 * no EC	-0.084	-0.192*	-0.461	-0.955**	0.706***	0.713***
	(0.068)	(0.099)	(0.316)	(0.439)	(0.172)	(0.215)
Rank 12 * no EC	-0.039	-0.068	-0.233	-0.350	0.675***	0.584***
	(0.069)	(0.101)	(0.320)	(0.450)	(0.171)	(0.217)
Rank 13 * no EC	-0.043	-0.134	-0.250	-0.662	0.654***	0.703***
	(0.069)	(0.102)	(0.319)	(0.448)	(0.172)	(0.225)
Rank 14 * no EC	-0.023	-0.139	-0.126	-0.706	0.570***	0.529**
	(0.069)	(0.100)	(0.318)	(0.445)	(0.169)	(0.206)
Rank 15 * no EC	-0.016	-0.166	-0.127	-0.844*	0.585***	0.597**
	(0.070)	(0.108)	(0.322)	(0.482)	(0.171)	(0.252)
Rank 16 * no EC	0.054	-0.104	0.216	-0.518	0.408**	0.210
	(0.070)	(0.106)	(0.322)	(0.472)	(0.173)	(0.251)
Rank 17 * no EC	0.038	-0.139	0.178	-0.690	0.394**	0.419*
	(0.070)	(0.106)	(0.323)	(0.474)	(0.176)	(0.243)
Rank 18 * no EC	0.081	-0.057	0.389	-0.311	0.272	0.304
	(0.070)	(0.105)	(0.326)	(0.473)	(0.183)	(0.246)
Rank 19 * no EC	0.092	-0.060	0.429	-0.294	0.206	0.562**
	(0.071)	(0.112)	(0.330)	(0.494)	(0.183)	(0.260)
Rank 20 * no EC	0.163**	-0.091	0.783**	-0.483	0.077	0.165
	(0.067)	(0.093)	(0.312)	(0.412)	(0.164)	(0.184)
Observations	36915	8374	34293	8289	29605	6716
Clusters	4052	584	3741	576	4048	584
Athlete-Year FE	yes	yes	yes	yes	yes	yes

Notes: The dependent variable in the first four columns is a binary indicator that takes the value one if the attempt by athlete i, in year t, in competition j, at stage s of the game, was successful. The dependent variable in the last two columns is the announcement by athlete i, in year t, in competition j, at stage s of the game. All equations include stage of the competition binary indicators. In columns 2, 4 and 6, the sample includes athletes who participated in the EC Championships and the World Championships (or the Olympic Games) in the same year. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX A6 - THE IMPACT OF RANK ON THE PROBABILITY OF A SUCCESSFUL LIFT IN CLOSE AND NON-CLOSE COMPETITIONS

Estimation method	OLS	
Dependent variable	Pr(success) $_{itjs}$	
	NON-CLOSE	CLOSE
Rank 1		0.073
		(0.056)
Rank 2	0.042	0.097
	(0.027)	(0.061)
Rank 3	0.064**	0.142**
	(0.030)	(0.058)
Rank 4	0.133***	0.170***
	(0.031)	(0.058)
Rank 5	0.141***	0.201***
	(0.033)	(0.058)
Rank 6	0.220***	0.228***
	(0.033)	(0.059)
Rank 7	0.220***	0.286***
	(0.033)	(0.059)
Rank 8	0.276***	0.287***
	(0.034)	(0.059)
Rank 9	0.315***	0.354***
	(0.034)	(0.058)
Rank 10	0.354***	0.346***
	(0.034)	(0.059)
Rank 11	0.358***	0.393***
	(0.035)	(0.060)
Rank 12	0.427***	0.424***
	(0.035)	(0.061)
Rank 13	0.421***	0.431***
	(0.035)	(0.061)
Rank 14	0.447***	0.434***
	(0.036)	(0.062)
Rank 15	0.459***	0.499***
	(0.037)	(0.063)
Rank 16	0.506***	0.567***
	(0.036)	(0.064)
Rank 17	0.535***	0.519***
	(0.038)	(0.066)
Rank 18	0.563***	0.533***
	(0.038)	(0.066)
Rank 19	0.580***	0.554***
	(0.040)	(0.067)
Rank 20	0.663***	0.621***
	(0.032)	(0.060)
Observations	36915	
Clusters	4052	
Athlete-Year-Competition FE	yes	

Notes: The dependent variable is a binary indicator that takes the value one if the attempt by athlete i, in year t, in competition j, at stage s of the game, was successful. The regression includes stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX A7 - THE IMPACT OF RANK ON ANNOUNCEMENT

Estimation method	OLS
Dependent variable	$Announcement_{itjs}$
CF	0.212***
the competitor in front is close, the competitor behind is far	(0.067)
FC	-0.219***
the competitor in front is far, the competitor behind close	(0.064)
FF	0.192
the competitor in front is far, the competitor behind is far	(0.207)
Rank 2	0.313***
	(0.090)
Rank 3	0.425***
	(0.091)
Rank 4	0.671***
	(0.100)
Rank 5	0.762***
	(0.105)
Rank 6	0.843***
	(0.106)
Rank 7	0.758***
	(0.106)
Rank 8	0.773***
	(0.107)
Rank 9	0.782***
	(0.110)
Rank 10	0.696***
	(0.111)
Rank 11	0.655***
	(0.113)
Rank 12	0.562***
	(0.115)
Rank 13	0.585***
	(0.115)
Rank 14	0.491***
	(0.114)
Rank 15	0.453***
	(0.119)
Rank 16	0.299**
	(0.119)
Rank 17	0.262**
	(0.125)
Rank 18	0.121
	(0.126)
Rank 19	0.054
	(0.130)
Rank 20	0.108

	(0.141)
Rank 21	0.020
	(0.138)
Rank 22	0.024
	(0.144)
Rank 23	-0.186
	(0.143)
Rank 24	0.055
	(0.151)
Rank 25	0.056
	(0.171)
Rank 26	-0.147
	(0.157)
Rank 27	-0.194
	(0.167)
Rank 28	-0.252
	(0.174)
Rank 29	-0.321*
	(0.173)
Rank 30	-0.418**
	(0.180)
Rank 31	-0.382**
	(0.182)
Rank 32	-0.325*
	(0.186)
Rank 33	-0.269
	(0.198)
Rank 34	-0.101
	(0.250)
Rank 35	-0.478***
	(0.154)
Announcement$_{itj(s-1)}$	0.977***
announcement in previous attempt	(0.003)
Success$_{itj(s-1)}$	4.204***
success in previous attempt	(0.034)
Observations	29605
Clusters	4048
Athlete-Year-Competition FE	yes

Notes: The dependent variable is the announcement by athlete *i* , in year *t* , in competition *j* , at stage *s* of the game. The regression includes stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX A8 - THE IMPACT OF RANK ON ANNOUNCEMENT IN CLOSE AND NON-CLOSE COMPETITIONS

	(5)
Estimation method	OLS
Dependent variable	Announcement $_{itjs}$
Close Competition	-0.040
Dummy = 1 if at least 30 percent of the competitors have an interim score that is not more than 10 points above or below athlete *i*	(0.029)
Rank 2	0.305***
	(0.090)
Rank 3	0.419***
	(0.090)
Rank 4	0.658***
	(0.099)
Rank 5	0.742***
	(0.104)
Rank 6	0.829***
	(0.106)
Rank 7	0.739***
	(0.106)
Rank 8	0.750***
	(0.107)
Rank 9	0.758***
	(0.110)
Rank 10	0.671***
	(0.111)
Rank 11	0.614***
	(0.113)
Rank 12	0.520***
	(0.115)
Rank 13	0.549***
	(0.115)
Rank 14	0.456***
	(0.113)
Rank 15	0.412***
	(0.119)
Rank 16	0.257**
	(0.118)
Rank 17	0.218*
	(0.125)
Rank 18	0.082
	(0.125)
Rank 19	0.014
	(0.129)
Rank 20	0.060

	(0.140)
Rank 21	-0.026
	(0.137)
Rank 22	-0.015
	(0.143)
Rank 23	-0.222
	(0.142)
Rank 24	-0.013
	(0.150)
Rank 25	0.024
	(0.169)
Rank 26	-0.170
	(0.157)
Rank 27	-0.219
	(0.166)
Rank 28	-0.269
	(0.173)
Rank 29	-0.395**
	(0.173)
Rank 30	-0.470***
	(0.179)
Rank 31	-0.424**
	(0.179)
Rank 32	-0.355*
	(0.184)
Rank 33	-0.315
	(0.198)
Rank 34	-0.170
	(0.243)
Rank 35	-0.513***
	(0.154)
Announcement$_{itj(s-1)}$	0.977***
announcement in previous attempt	(0.003)
Success$_{itj(s-1)}$	4.214***
success in previous attempt	(0.034)
Observations	29605
Clusters	4048
Athlete-Year-Competition FE	yes

Notes: The dependent variable is the announcement by athlete i, in year t, in competition j, at stage s of the game. All equations include country of origin and stage of the competition binary indicators. Standard errors adjusted for heteroskedasticity and autocorrelation of unknown form and clustered by athlete are reported in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.

APPENDIX B1 - CHRONOLOGY OF THE COMPETITIONS IN THE SAMPLE

MEN			WOMEN		
EC	WC	OG	EC	WC	OG
	1990				
	1991			1991	
		1992			
	1993			1993	
	1994			1994	
	1995		1995	1995	
1996		1996	1996		
1997	1997		1997	1997	
1998	1998		1998	1998	
1999	1999		1999	1999	
2000		2000	2000		2000
2001	2001		2001	2001	
2002	2002		2002	2002	
2003	2003		2003	2003	
2004		2004	2004		2004
2005	2005		2005	2005	
2006	2006		2006	2006	

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