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Teams as Superstars: Effort and Risk Taking in Rank-Order Tournaments for Women and Men

by

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Teams as Superstars: Effort and Risk Taking in Rank-Order Tournaments for Women and Men

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Abstract

This article analyzes top-level basketball competitions and measures the effect of superstar presence on effort provision in rank-order tournaments. I extend the previous literature to team competitions for male and female teams, as well as different institutional settings over a long period of time. In addition, I analyze risk-taking behavior in the context of superstar effects. The results of the empirical analysis suggests that the level of superstar dominance is crucial for the observed effects. While there is an significant and sizeable effort reducing superstar effect, less (little) dominance by the superstar seems to be result in a positive peer effects.

JEL Classification: D70, M51, J01

Keywords: superstar effects, rank-order tournaments, incentives, effort, risk-taking

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1 Introduction

Economic decision making regularly involves strategic interactions within groups of heterogenous contestants. For example, workers face decision environments (e.g. promotion tournaments) with incentive systems that involve strategic decisions about effort provision or risk-taking. The reactions of contestants to incentives, contest design and contestants' heterogeneity has been a central focus of the theoretical literature (Lazear and Rosen, 1981; Baik, 1994; Stracke et al., 2015). In the majority of contests competitors are heterogenous in terms of ability or status. In the extreme case one contestant stands out and represents a superstar among relatively inferior contestants. In a seminal article, the term superstar was defined by Rosen (1981, p. 845) as

> [...] relatively small numbers of people earn enormous amounts of money and dominate the activities in which they engage [...]

In general, superstars are usually interpreted as single competitors who have a disproportionately larger chance to win a contest or tournament due to their relatively large ability. A substantial part of the literature on the superstar phenomenon has dealt with the share of total wages that are allocated top superstars (Lucifora and Simmons, 2003) or the general environment where superstars are usually observed (Fort and Quirk, 1995). Malmendier and Tate (2009) analyze the performance of firms who are led by superstar CEOs and find that those firms exhibit lower performance levels after the CEO achieved superstar status. A particular interest in sports economics is the effect of superstar presence on fan or media attendance (Hausman and Leonard, 1997; Krueger, 2005; Brandes et al., 2008; Kuethe and Motamed, 2010).

Sporting competitions represent an ideal environment to empirically analyze superstar effects on decision making of individual competitors and teams. Data on financial incentives (i.e. the prize structure), wages as well as very good measures for relative ability are frequently available. Additionally, sports contest feature a multitude of competitive settings with clearly defined incentive structures and prizes (Szymanski, 2003).

In this article I extend the previous empirical literature on the superstar effect in sports competitions (e.g. Brown (2011) or Hill (2014)). Along the definition of Rosen (1981), I define a superstar as a team of professional basketball players competing in a dynamic tournament of multiple stages. As shown by Kocher and Sutter (2005) or Charness and Sutter (2012), it is highly plausible that teams or groups of individuals are even better (i.e. more efficient) decision makers than individuals. In particular, I will analyze if teams who are in direct competition with a superstar-team in a rank-order tournament will exert more or less effort than without the superstar. In a second step, I will shift the focus to risk taking behavior.

Superstar effects in group-wise rank-order competitions are relevant for a wide array of settings. Promotion tournaments in firms are often designed similar to a round-robin rank-order tournament. The ultimate goal is to find the job candidate with the highest ability while maximizing total effort of all contestants throughout the competition. Superstar effects are also relevant when incentive payments are introduced and enforced according to a performance ranking. Another obvious example are patent races or competitive innovation processes (Boudreau, Lacetera and Lakhani, 2011). A similar setting to teams competing in sports contests is found in politics. Electoral contests are more often observed between parties or interest groups rather than individual candidates. More general, any competition among firms could be influenced by the vast superiority of one firm, which could lead to undesirable and inefficient outcomes (Chan, Li and Pierce, 2014). Undeniably, the designers of sports contests have to consider superstar effects in order to maintain a certain level of overall competitiveness (Jane, 2014).

Since Basketball was included in the Olympic Games, the teams from the United States were highly successful. During the games from 1936 (Berlin) to 2012 (London) the US Men Team has won a total of 130 games with only 5 losses (3,7%). Women's Basketball was a later addition to the Olympic program in 1976 (Montreal), but the US team had similar success than their male counterpart. Up to the most resent games in 2012 the US Women's team has won 58 games to go along with 3 lost games (4.2%). With the exception of the 1980 games in Moscow[1] it was a highly rational expectation to expect the US basketball teams to win every single match as well as the overall Olympic tournament. Consequently, I will identify the male and female US basketball team as a superstar.

2 Related literature

Since the pioneering work by Lazear and Rosen (1981) and Rosen (1986), heterogeneity among contestants was one of the focuses of the literature on performance and effort decisions in tournaments. Recent theoretical as well as empirical contributions by Sunde (2009), Stracke and Sunde (2014), Stracke et al. (2015) and Brown and Minor (2014) show that current (as well as future) heterogeneity influences effort provision of contestants in dynamic elimination contests. Berger and Nieken (2014) as well as Deutscher et al. (2013)

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[1] The US–along with other nations–boycotted the 1980 Olympic Games due to political tensions at the heights of the cold war.

use data from round-robin tournaments to measure the effect of contestant heterogeneity on effort in rank-order contests.

A specific and very pronounced form of heterogeneity in competitions is observed in the presence of a superstar. The consequences of such superstar presence are a well described and vividly discussed phenomenon in sports (Jane, 2014). Few empirical contributions, however, focus on the causal effect of superstar presence in competitions on effort provision of contestants. In a seminal paper Brown (2011) shows that the presence of a superstar has negative effects on the performance of the other contestants in golf tournaments. The presence of Tiger Woods as the dominating player yields lower overall performance levels of all other players in professional golf contests. This decline in overall performance is interpreted as a negative superstar effect on performance of Wood's competitors. This detrimental effect on effort provision was smaller in competitions when Woods was experiencing a span of lower productivity, indicating that the different degrees of superstar dominance lead to different shifts in competitors' performance.

Using a three heterogenous contestant model, Brown (2011) shows that effort decreases as heterogeneity of contestants increases. The more able the single superstar in the competition is relatively to the other contestants, the lower will be effort of other (non-superstar) competitors. An important factor is the existence of a second prize, with the superstar effect being more pronounced as the share of the total purse that is going to the winner.[2]

Jane (2014) analyze data from swimming contests and find no detrimental effect of superstar presence, but rather a positive peer effect. The performance levels of heats with a potentially dominant swimmer increase compared to heats without such a superstar swimmer. Hill (2012), Emerson and Hill (2014) as well as Hill (2014) presents a similar result for 100 meter sprinters a top-level competitions, confirming that the negative effect of superstar presence is not a unanimous empirical result. This contrary finding could potentially be due to the fact that no clear superstar is identified in the analyzed athletic competitions.

This article expands the previous literature on the superstar effects in round-robin tournaments to the analysis of team behavior and compares different levels of superstar dominance. The focus will be on effort and risk-taking. In addition, I will establish a causal effect by using an exogenous rule change and measure how it changed potential superstar effects on effort and risk-taking.

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[2] While my empirical analysis cannot take (monetary) prizes into account, it is not problematic, as the only (observed) reward or prize available in round-robin stages of basketball tournaments is the advancement to the next level of the competition.

3 Data and Institutional Background

I use a unique data set from all Olympic and FIBA World Cup basketball tournaments from 1960 through 2014. Both tournament formats represent the highest level of international basketball with the worlds best players competing. The data consist of 28 men's and 18 women's tournaments, for both genders evenly distributed among Olympics and World Cups[3], covering 363 games played by female and 768 games by male teams. All games are first-round round-robin games. All data are collected from box scores provided by the Federation Internationale de Basketball (FIBA)[4], the governing organization of international basketball competitions. The data cover information on the final score, the number of personal fouls and the duration of the game. Additionally, detailed information on the date, time and group of the game is available. For some tournaments in the data, the box scores also provide information on 2- and 3-point attempts.

The 1992 Olympic Games in Barcelona mark an important point of change in international basketball. The Soviet Union as well as Yugoslavia–the two main competitors of team USA–dissolved into various different states, all competing separately with much lower levels of player talent. This left the US as the single dominant basketball nation.

The second – probably even more important – change was that the FIBA allowed professional players from the NBA to compete in the Olympic and World Cup tournaments. Before 1992, only non-professional players were allowed to compete, which resulted in team USA consisting of collegiate players only. During a special session of the FIBA in 1991, the delegates voted with great majority in favor of allowing professional athletes–most importantly players under contract and competing in the National Basketball Association (NBA)–to compete at international competitions like the Olympics or FIBA World Cups. As a result, there were no age or contract limitations imposed from 1992 onwards. This reform substantially enforced the dominant position of the US national team, as the strongest opponent seized to exist, while the own talent experienced a dramatic surge. Table 1 plots the cumulative point-differentials for all teams in the data set that participated during the Olympics tournaments (upper panel) and World Cups (lower panel) from 1960–2014.

Since 1960, the men's team USA has won the gold medal in all but three Olympic basketball tournaments: 1972 (Munich, GER), 1988 (Seoul, KOR) and 2004 (Athens, GRE). A somewhat different picture arises when looking at FIBA World Cups: the US men's team

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[3] FIBA has changed the official name of this second most important international basketball event over time. In some years it is named FIBA World Championships, while in other years it is officially named FIBA World Cup. In this article I will use FIBA World Cup.

[4] All schedules, results and box scores for Olympic and World Cups basketball tournaments are available at `www.fiba.com`

only finished 4 out of 13 Cups in first place. Extending this analysis, one should look at the level of domination in more detail. Before the allowance of NBA players to participate, there were two distinctively well performing men teams in the Olympic basketball tournaments: the USA and the Soviet Union. While there were obviously two rather similar superstars before 1992, the US dominated most of the competition from the Barcelona games in 1992 onwards. Concerning FIBA World Cups, there is a similar, however less pronounced pattern. The Soviet Union, USA and Yugoslavia dominated before the 1992 reform, after 1992 the US team outperformed all other teams with the Spanish team in a close second place, denying them a clear position as the sole superstar.

Further evidence is provided by Figure 3, which plots the average winning margin for the Soviet Union, the USA and all other teams for all Olympic tournaments and FIBA World Cups from 1960 through 2014 for all first-round round-robin stage games. For all years before 1992, team USA had strong contestants in the Soviet Union and Yugoslavia, but all three teams were distinctively outperforming the rest. During this period they won their games–on average–much more decisively. In 1992 the Soviet Union as well as Yugoslavia dissolved. This substantial political change weakened their respective basketball teams, as it would now be drawn from a significantly smaller talent pool. While Yugoslavia made a final run at the 1996 and 2000 Olympics (no participation in 1992), the Soviet team competed for the last time in 1988. Not only did the two main competitors of the US team disappear, but the 1992 reform enforced the dominance of team USA, which shows in the increasing average point margin. With the exception of the 2004 Olympics, which were the worst performance of any US team in the history of international basketball, this is more pronounced in the Olympics than World Cups.

For women's competitions, cumulative point differentials are plotted in Table 2. After 1992 the US Women's basketball team was dominating Olympic tournaments (upper panel). However, team Australia was also dominant compared to all remaining teams. Similarly, the US women's team dominated the FIBA World Cups with Australia being a second powerful competitor after 1992.

Due to the fact that the olympic games of 1972 and 1976 were affected by within-competition boycotts and withdrawals[5], the Olympic Games in Munich and Montreal are not suitable for the empirical analysis. Consequently, all observations for the period from 1970 through 1979 were not used for the subsequent empirical analysis. The main results presented below in section 4 are robust to the inclusion of competitions within this period.

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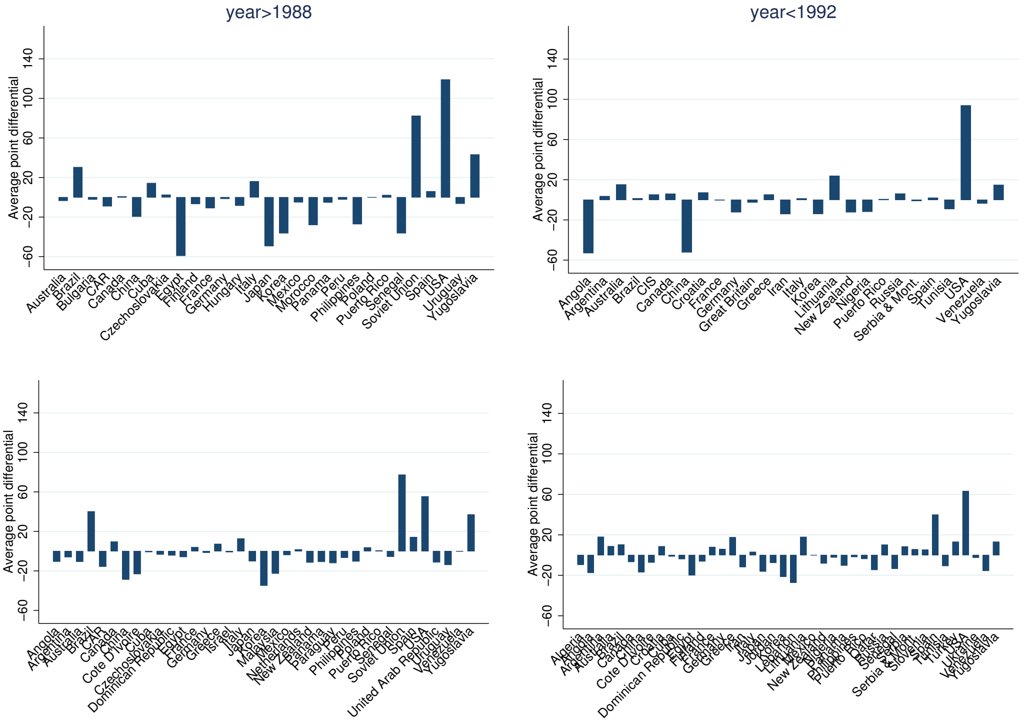
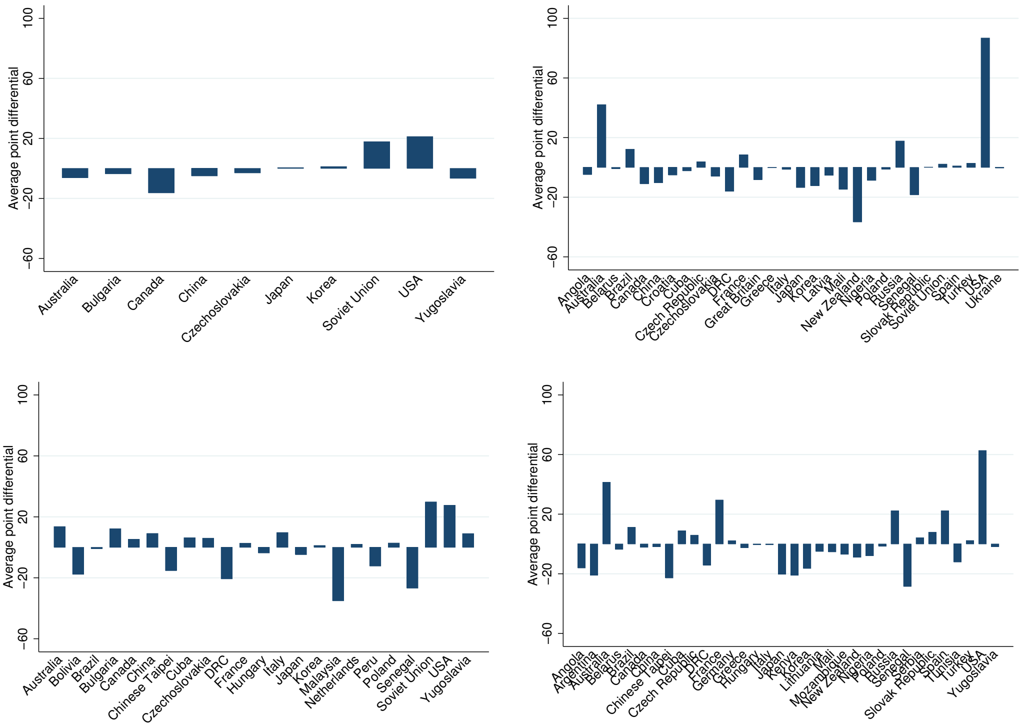
[5] The Olympic Games of 1972 were hit by a severe terror attack. The Olympic basketball tournament of the 1976 Olympic Games was affected by the team representing Egypt after only one match, which resulted in the cancelation of all games with Egypt participating.

Figure 1: Cumulative point differentials and number of games: Men 1960–2012.



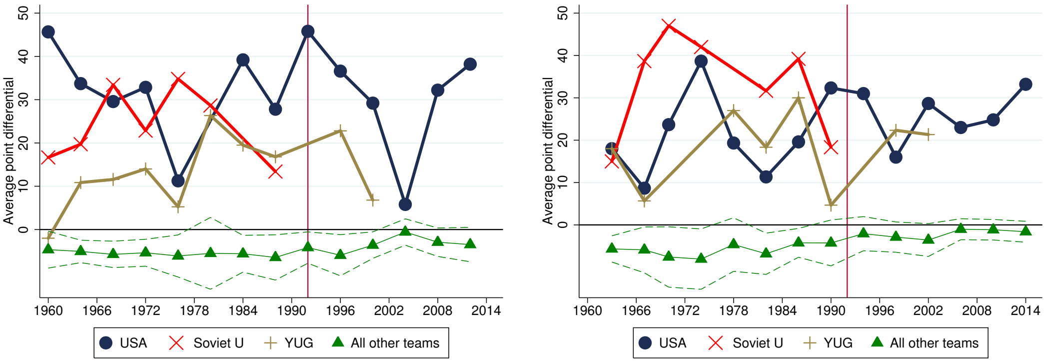
Notes: Left: 1960–1992. Right: 1996–2012. All first-round round robin games from 1960–2014.

Figure 2: Cumulative point differentials and number of games: Women 1960–2012.



Notes: Left: 1960–1991. Right: 1992–2014. All first-round round robin games from 1960–2014.

Figure 3: Average point differentials: US and main competitors (male teams)



Notes: Left: Olympics. Right: FIBA World Cups. $N = 2666$

4 Empirical Approach and Results

The empirical literature on the influence of incentives in competitive settings on effort has proposed several proxies for effort in sports competitions. Berger and Nieken (2014) analyze effort provision in round-robin tournaments and use the number of two-minute penalties in handball (a direct consequence of fouls or rule infractions) as a proxy for effort. A similar approach is chosen by Nieken and Stegh (2010), who use two-minute penalties in hockey to proxy effort provision. Deutscher et al. (2013) make the distinction between positive and destructive efforts by analyzing fouls and fair tackles in football separately. An increase of positive as well as negative effort (sabotage) indicates an increase in competition intensity as well as effort. Consequently, fouls should be a valid proxy for individual and team effort in sports contests. In order to measure effort provision of basketball teams, I follow the approach of previous studies on efforts in basketball contests who identify personal fouls (or penalties) as a suitable proxy for effort. In a closely related paper, Lackner, Stracke, Sunde and Winter-Ebmer (2015) analyze the effect of heterogeneity multi-round pairwise elimination tournaments in professional basketball. They use the number of fouls as a proxy for effort, arguing that a higher number of fouls should approximate a higher intensity of the game, which should be correlated with higher effort. In order to account for different styles of play as well as ability of basketball teams, they use the deviation of long-term foul behavior. Data on Olympic and World Cup basketball tournaments, however, do not provide information on long-term behavior of teams before the observed tournaments. Consequently, I will use a fixed-effects approach to account for unobserved ability and playing styles.

Previous studies on superstar effects on risk-taking use risky types of golf shots (Brown, 2011) or the probability of a false start in swimming legs (Jane, 2014) as identifiers for risky strategies. Risk-taking in the context of basketball, however, is commonly measured by the ratio of three point attempts of all attempts. This measure of risk taking is similar to the one employed in Grund et al. (2013), who analyze the effect of intermediate score differentials on risk taking behavior of NBA teams in round-robin and elimination tournaments. Figure 4 plots the long-time trend of fouls per player-minute[6] (left panel) for men and women in all round-robin games since 1960 as well as the ratio of three-point attempts over total shot attempts along with the success rate of three-point shots for both genders (right panel).

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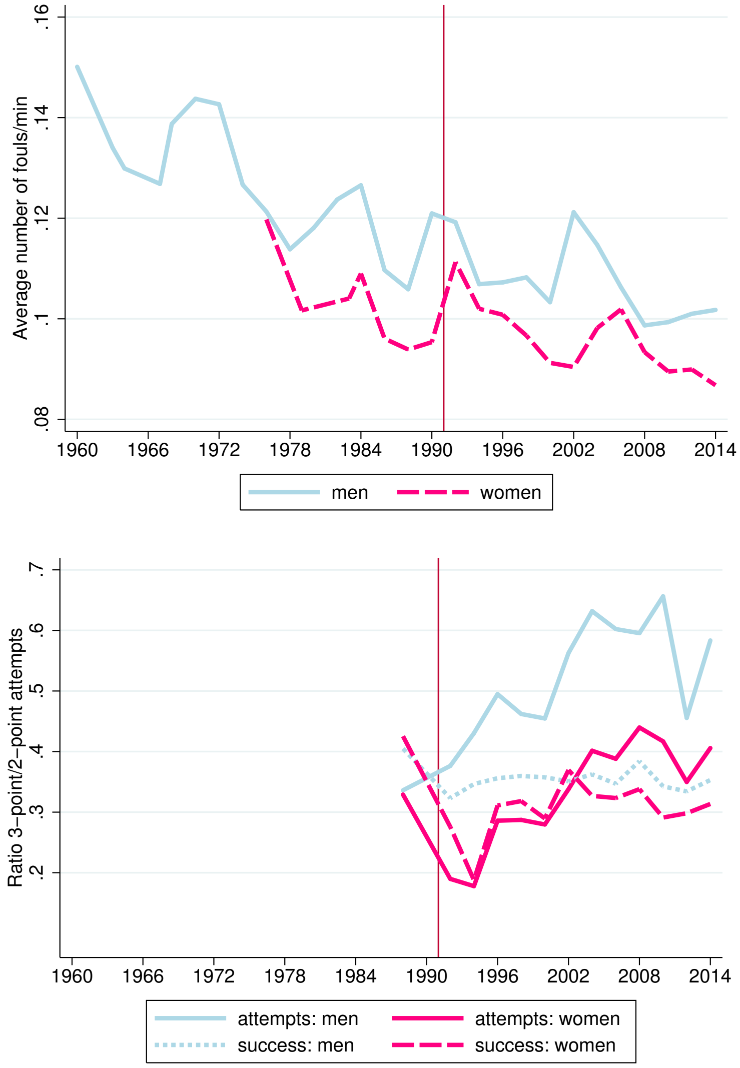
[6] I do normalize the overall number of fouls of a team in a game by dividing it by the maximum number of minutes played by all players on the court. For a standard game without overtime this amounts to 200 player-minutes.

Figure 4: Trend of fouls per minute and three-point attempts and success: men and women



Notes: Evolution of effort an risk-taking measure over time. Top: personal fouls per player-minute. Bottom: Percent three-point shots of all shots and success rate. Only first-round round-robin games of Olympic and FIBA World Cup basketball tournaments were included. Only games without US participation included, $N = 2262$

While the US national teams have won the majority of Olympic gold medals as well as World Cups in the last 60 years, the 1992 reform by FIBA marks a clear shift of power towards the men's team USA, which was henceforth frequently called "dream team". In the early 90s, the vast majority of NBA players were of US nationality with only few international players on NBA rosters (Yang and Lin, 2012). The US team superstar effect, however, might have been mediated somewhat over time, as the number of the number of international NBA players has steadily increased. At the same time, the quality of other leagues has improved as a consequence of the 'globalization' of basketball.

All Olympic and World Cup basketball tournaments were held in several stages including round-robin an stage-wise elimination contests. Since 1960, the tournament mode has changed only slightly. All tournaments consist of a first round-robin stage with parallel competition in two groups. The only exception were the 1960 (Rome) games with four parallel groups in the first stage. Men's World Cup tournaments are similar, with an initial round-robin stage of 3 groups until 1982 and later on 4 parallel groups. Out of these group stages, multiple teams advance into the following stages, which are mostly stage-wise elimination tournaments. Only some tournaments also featured a second round-robin stage.

In round-robin basketball competitions, it is obvious that all teams who are seeded into the same group as the US team will be strongly affected by a possible superstar effect.[7] The probability of each team–seeded into the same group as the US team–to qualify for the next round (regardless if elimination mode or second round-robin phase) is lower compared to teams in the other group(s). In addition to this current heterogeneity effect, there is also a dynamic forward-looking effect. The next opponent(s) for such a team will be stronger, as the final ranking–which is influencing the seeding for the next round–will be lower due to the presence of team USA. Consequently, the first prize (i.e. winning the group) and second prize (qualifying for the next tournament stage behind the US team) are deflated through superstar presence. As a result, FIBA's 1991 decision to allow NBA players to participate in international competitions will affect teams competing in the same group as the US team from 1992 onwards.

Comparing success of the US national team at Olympic Games and FIFA World Cups, one can conclude that the US dominance was greater in the Olympics. This is surprising, as the level of competition at the Olympics typically is higher as fewer (and on average better) teams are competing. One potential reason for the less dominant US team is the

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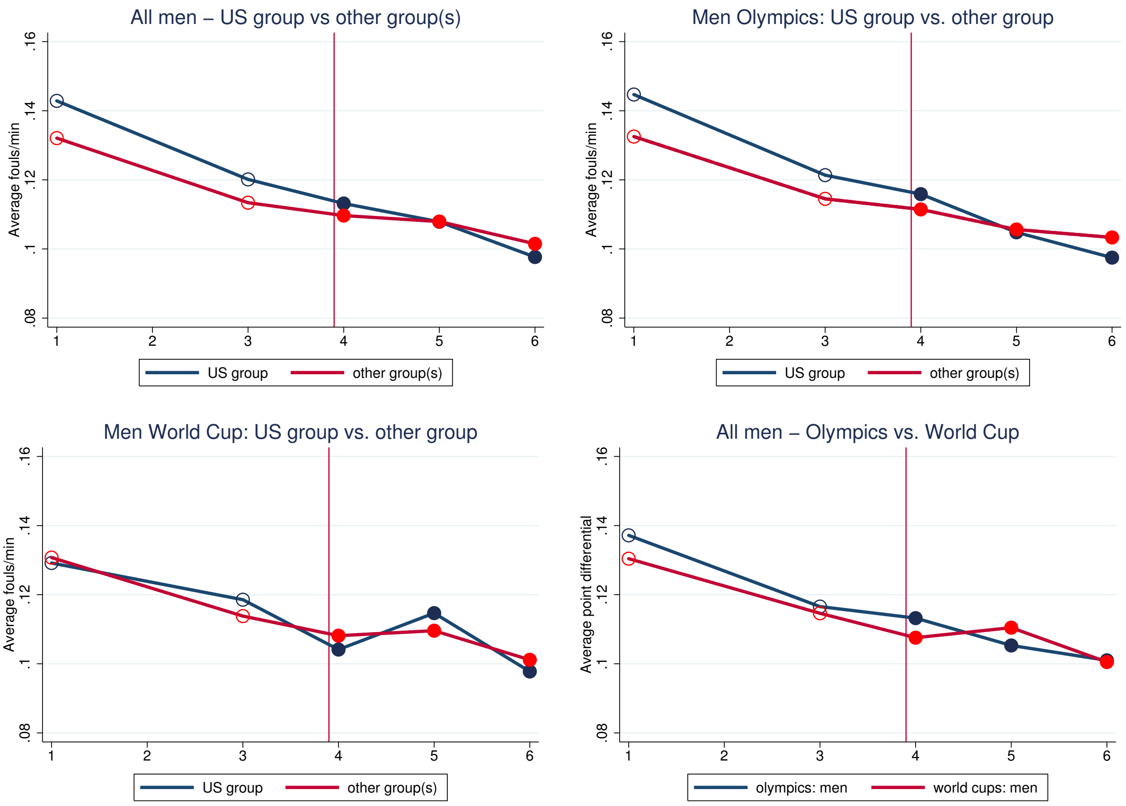
[7] Unfortunately there was no available information on seeding in both Olympics and World Cup competitions. However, the few tournaments where seeding information was available confirmed that the main objective of the seeding procedure was to distribute teams equally over all groups regarding their overall team ability. This ensures that–on average–all groups are equally talented, except that there is the US team seeded into one of them.

lower reputation of winning the World Cup compared to winning Olympic gold. Brown (2011) shows that the negative superstar effect is less pronounced when the superstar is expected to be less dominant, i.e. when his probability to win the tournament is smaller. This is reflected in the lower two panels of Figure 1: USA teams were the dominant teams before and after 1991 in men's FIBA World Cups. However, in contrast to the development at the Olympics, there was at least one strong competitor after 1992 to be found in the Spanish national team. Consequently, the reform of 1991 should have different effects on Olympics and World Cups, which can be exploited in a difference-in-difference framework.

Women's basketball competitions have not been subject to similar reforms. There was no professional US league similar to the NBA for most of the observed FIBA competitions. The most prolific women's league was founded in 1996 and named Women's National Basketball Association. The inaugural season was staged in 1997.

Table 5 plots the evolution of the average number of personal fouls per player-minute over three time intervals (decades), before and after the reform in 1992. When comparing games in the same group as team USA with all other games (top left panel), we see an accelerating downward trend after the 1992 reform, which was more pronounced compared to all other games. Looking at Olympic games (top right panel) and World Cups (lower left panel) separately, we see that this seems to be coming mostly from Olympic games. In addition, it is obvious that the common trend assumption is not violated.

Figure 5: Average number of fouls per player-minute for treatment and control groups



Notes: Average number of fouls per player-minute for treatment and control groups over decade from 1960 through 2014. Decade 1: 1960–1969, decade 2: 1970–1979, decade 3: 1980–1991, decade 4: 1992–1999, decade 5: 2000–2009 and decade 6: 2010–2014. $N = 1{,}286$

4.1 Causal Effect of Enforcement of Superstar Status on Effort

In order to estimate the causal effect of the 1991 reform on effort provision in round-robin stages of international basketball competition, the following difference-in-differences model is estimated:

$$Y_{ig} = \beta_0 + \beta_1 T + \gamma d + \delta(T \cdot d) + \beta_3 X_{ig} + \epsilon_{ig}, \tag{1}$$

where Y_{ig} measures effort as personal fouls per player-minute of team i in game g. T is a binary variable indicating if the observed team is belonging to one of multiple treatment groups analyzed. d is a binary variable which takes the value 1 for all decades after the reform taking effect in 1991 and 0 otherwise. X_{ig} is a continuous variable controlling for the cumulative number of games a team has played in the competition.

In order to further analyze the dynamics of the change in effort for treatment and control groups, the following dynamic version of the model is estimated:

$$Y_{ig} = \beta_0 + \beta_1 T + \sum_{t=1}^{3} \gamma_t d_t + \sum_{t=1}^{3} \delta_t (T \cdot d_t) + \beta_3 X_{ig} + \epsilon_{ig}, \tag{2}$$

where d_t includes three dummies for all decades after the reform taking effect in 1991. The parameter of interest are δ_1, δ_2 and δ_3. These coefficients measure the causal effect of the reform on effort provision of treated teams relative to the control group. It is important to note that only games without participation by team USA were included into the estimation sample.

In the first specification of models 1 and 2, the treatment group consists of all teams which are competing in the same round-robin group as team USA versus all other groups. An alternative specification will compare Olympic competitions as the treatment group to teams competing at World Cups.[8]

Table 1 tabulates the results for estimating model 1 and 2 separately for multiple treatment and control groups. The first two columns present the effect of the reform in 1991 on effort of all teams in men's Olympic and World Cups round-robin games. I measure a relatively moderate post-treatment effect of -0.008 fouls per player-minute in the static model.

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[8] In order to keep a sufficiently large sample, all observations from the 1980 Olympics in Moscow–which were boycotted by the USA–were included in this analysis. All results presented are robust to the exclusion of these observations.

This amounts to an increase of 10% on the sample mean or roughly 1.6 fouls less for a standard game duration of 40 minutes.

The dynamic specification measures no significant decline in effort provision for teams competing in the same group as team USA in the first decade after the reform (1992-1999). However, in the period from 2000-2009, an effort decrease of -0.013 (2.6 fouls per 40 minutes) is estimated, while for the years 2010-2014 the estimated negative superstar effect on effort is -0.017 (3.4 fouls per 40 minutes). From these dynamic diff-in-diff results one can conclude that the increase in superstar status needed one decade to manifest itself and was not weakened by the increased number of international players competing in the NBA.

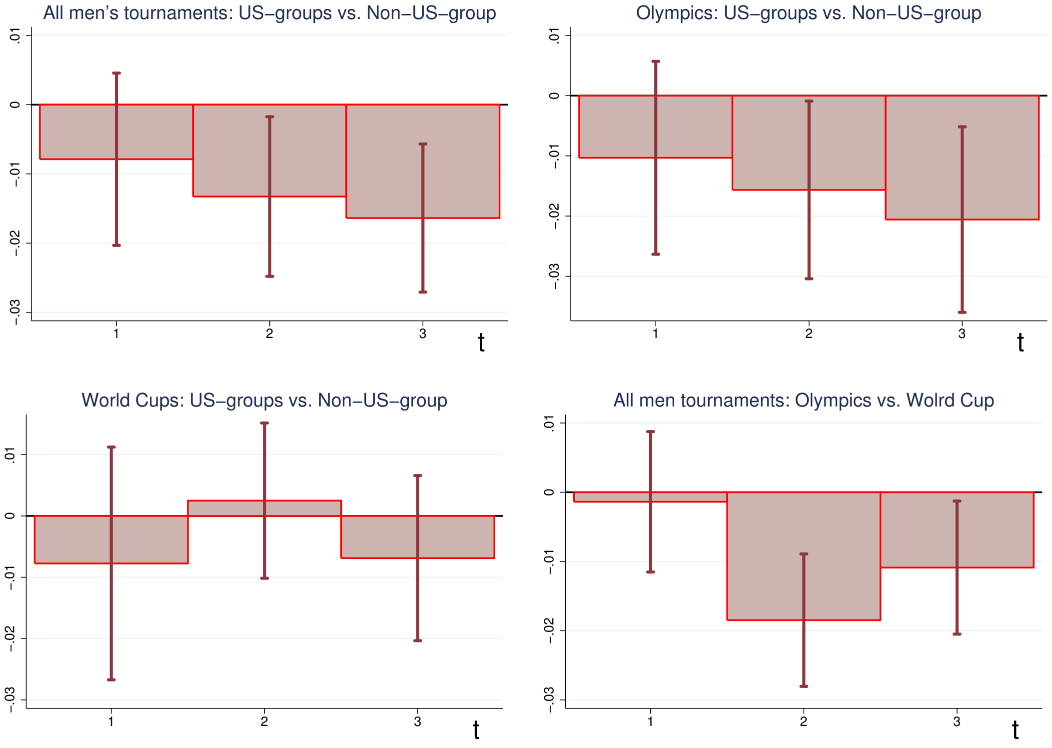
In a further step, Olympic and World Cup tournaments are analyzed separately. The estimated coefficients indicate that the overall negative effect of superstar presence is predominantly coming from Olympic tournaments. I estimate significant and sizeable effects of the 1991 reform on effort of teams competing in the US round-round group. This is not the case for the World Cup sample, where all estimated coefficients (static and dynamic) are insignificant and close to 0. This result is not surprising, as the dominance of the men's team USA was much stronger in the Olympics (consult section 3). Columns (7) and (8) confirm this notion, as we estimate the causal effect of the 1991 reform on the treatment group Olympics Games compared to the "placebo" control group of games at World Cups. Indeed I do estimate a negative effect of the reform on effort for the Olympic Games. Thus, the reform was affecting mostly Olympic tournaments. Figure 6 plots the estimated coefficients of the dynamic diff-in-diff model over time.

Table 1: Effect of 1991 reform on effort - Difference-in-difference model

	US vs. other groups:						*Men: Olympics vs. WC*	
	all men		Olympics		WC			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$T * d$	-0.012**		-0.015**		-0.004		-0.009**	
	(0.005)		(0.006)		(0.006)		(0.004)	
$T * d_1$		-0.008		-0.010		-0.008		-0.001
		(0.006)		(0.008)		(0.010)		(0.005)
$T * d_2$		-0.013**		-0.016**		0.002		-0.018***
		(0.006)		(0.007)		(0.006)		(0.005)
$T * d_3$		-0.016***		-0.021***		-0.007		-0.011**
		(0.005)		(0.008)		(0.007)		(0.005)
Mean of dep. var.	0.114		0.119		0.110		0.114	
Effect on the mean	-0.105		-0.126		-0.019		0.079	
N	1286		611		675		1286	
R^2	0.142	0.152	0.236	0.248	0.131	0.141	0.144	0.159

The Dependent variable is the average number of fouls per player-minute for treatment and control groups over decade from 1960 through 2014. $d_1 = 1$ if year $\in$ [1992, 1999], $d_2 = 1$ if year $\in$ [2000, 2009] and $d_2 = 1$ if year $\in$ [2010, 2014]. Observations from 1980 Olympics in Moscow were NOT excluded. Coefficients for additional variables are not reported due to space limitations. All specifications include the number of the current game of all games the team played in the observed tournament. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors in round parentheses.

Figure 6: Estimated effect of 1992 reform on treatment group over time



Notes: Estimated evolution of effort change over time as tabulated in table 1. t=0: 1992–1999, t=1: 2000–2009 and t=2: 2010–2014. t ∈ [0,2] indicate post reform period.

4.2 Superstar Effect on Effort - Fixed-effect Models

From the Diff-in-Diff results presented in section 4.1, I conclude that the 1991 reform of international basketball had a causal effect on the overall level of men's competition in Olympic and Wold Cup basketball tournaments: I do find that teams, who–after the reform–are seeded into the same group of first-round round-robin stages as team USA, reduced their effort compared to all teams competing in parallel groups. Olympic competitions are estimated to having been affected in a stronger way than World Cups, which is likely be due to the fact that the team USA was (perceived) as far less dominant by their competitors in these tournaments.

Due to data limitations before the 1991 reform, it is not possible to analyze the causal effect of the reform on alternative measures for effort or risk taking. Detailed statistics on three-point throwing attempts, which provide an often used opportunity for risk-taking (Grund et al., 2013; Böheim et al., 2016), are mostly unavailable before 1991[9]. Additionally, the results presented in Table 1 might suffer from the fact that there is no information on initial seeding available.[10] Consequently, it cannot totally be ruled out that the selection into treatment and control group is not correlated with unobserved team characteristics. In addition, there is no comparable reform for women's competitions.

In order to further investigate superstar in rank-order contests, the following fixed effects model is estimated:

$$Y_{ig} = \beta_0 + \beta_1 \times USgroup + \beta_2 X_{ig} + \tau_q + \pi_t + \nu_{ig}, \tag{3}$$

where *US group* is a binary variable equal to 1 if the observed team i in game g of tournament t in the same round-robin group as team USA. X_{ig} is a continuous variable controlling for the cumulative number of games a team has played before game g in the tournament. In order to capture unobserved team- or tournament-specific characteristics, team-decade (τ_q)[11] as well as tournament fixed-effects (π_t) are estimated. The same data are used as in section 4.1. However, as tournament fixed-effects are taken into account, it is not necessary to drop observations from the period from 1970 through 1979.[12] All decades are defined as in section 4.1.

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[9] The three-point attempt was introduced by FIBA in 1984.

[10] While it is reasonable to assume that seeding was done according to some indicator of team strength, I was unable to get detailed information on the seeding procedure for each competition.

[11] Team-year/tournament fixed-effects are not possible, as they would correlate with the *US group* variable.

[12] Omitting all observations from this time period does not change the results presented in section 4.2. These results are available on request.

The coefficient β_1 measures the change of effort due to the the presence of team USA as a superstar in the same round-robin group. As the 1991 reform of international basketball has shown to have an effect on effort in groups with team USA representing the superstar, I split the overall sample in pre- and post 1991. Following Brown (2011), I also split the sample into US-weak and US strong samples.[13] It follows from theory that the superstar effect should be present only when the superstar. i.e. the US mens' basketball team, was perceived as the clearly dominant team by the opposing teams. If a superstar is present, the causal negative effect of this presence should increase with the strength of the superstar. The results for estimating model 3 for these sub-samples of men's competitions are presented in Table 2.

Table 2: Men: Effect on competing within the US group on effort

	Olympics		*World Cups*		*All men*	
	>1991	<1991	>1991	<1991	not weak	weak
US Group	-0.0091*** (0.0033)	0.0103*** (0.0031)	-0.0058 (0.0048)	0.0021 (0.0051)	-0.0092*** (0.0026)	0.0107*** (0.0021)
Team-decade FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Mean dep. variable	0.107	0.133	0.105	0.121	0.104	0.111
N	296	475	434	329	494	236
R^2	0.342	0.323	0.274	0.307	0.280	0.299

The Dependent variable is the number of personal fouls per player-minute. Coefficients for additional variables are not reported due to space limitations. All specifications include team-decade and event dummy variables. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

The results show that effort was lower in all games that were played by teams which were seeded into the same group as team USA. For Olympic tournaments after 1991, male teams seeded into the US group committed about 0.009 fouls per player-minute less than

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[13] The following mens' tournaments were defined as US weak events: 1998, where the original team was unable to perform due to the NBA lockout and was replaced by minor-league players. 2004, when team USA has lost in the preparation games before the Olympic Games in Athens and never played well during the actual tournament. 2002 FIBA World Cup, where team USA played poorly and finished disappointing 6th. 2006 FIBA World Cup, where the 2002 disaster along with the poor outing at the 2004 Olympics was still in the media.

all teams seeded into parallel groups. For competitions between 1960 and 1991 (before the reform), I find that effort for teams competing in the US group was actually higher, as teams commit about 0.010 fouls per player-minute more when seeded together with team USA. This indicates that there was a pro-competitive peer-effect rather than a detrimental superstar effect before the 1991 reform dramatically enforced the US superstar status. For FIBA World Cups, I find a similar pro-competitive effect before 1991, while there is no superstar effect to be found after the reform. This confirms the findings presented in Table 1.

From the fixed-effects results one can cautiously conclude that the degree of dominance of team USA–although yielding multiple Olympic and World Cup titles–was not big enough before 1991 to cause an effort reducing superstar effect. Indeed, I do find a positive effort enhancing effect of being seeded into the same group as the US team. When splitting all competitions into tournaments where team USA was dominant and events where it was performing below average, I find a negative but insignificant effect of the US team in being seeded into the same group. For all years with a weak US team there is a strong and significant pro-competitive effect.

The same analysis is conducted for all data from women's competitions. While not comparable to the 1991 reform which admitted NBA players to FIBA competitions, there was a similar structural change in Women's competitions as in men's competitions. In 1997, the women's National Basketball Association (WNBA) started operating. This was likely a boost for the superstar status of the Women's US basketball team after the installment of this professional league. Consequently, it is reasonable to analyze if a possible superstar effect was present before and after 1997.

Table 3 presents the results for estimating model 3 for the sample of women's competitions. For a pooled estimation on all competitions, I find a positive but insignificant point estimate for the effect of the team USA presence in the group on effort. Splitting the sample in pre-WNBA and WNBA sub-samples does not change the results, as there is no significant effect of superstar presence on effort estimated for either period. The alternative specification of the fixed-effects model presented in the appendix yields positive and significant effects of superstar presence for the overall and post-WNBA installment year. However, I cannot conclude that there is an effort-decreasing superstar effect for women's competitions after the WNBA started to operate. Indeed there is some evidence for a positive effect over that time period. Consult section 4.4 and Table 9 in the appendix for more details.

Table 3: Women: Effect on competing within the US group on effort

	All	no WNBA	WNBA
US Group	0.0013 (0.0026)	0.0027 (0.0046)	-0.0005 (0.0037)
Team-decade FE	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*
Mean dep. variable	0.097	0.102	0.093
N	726	324	402
R^2	0.270	0.242	0.291

The Dependent variable is the number of personal fouls per player-minute. Coefficients for additional variables are not reported due to space limitations. All specifications include team-decade and event dummy variables. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

4.3 Risk Taking Behavior

There is little empirical evidence from the field on the effect of competitors' heterogeneity or superstar presence in competitions on agents' or teams risk taking behavior. In a theoretical article, Cabral (2003) analyzes how two agents decide between a safe and a risky technology depending on whether they are trailing or leading in a R&D contest. Heterogeneity in abilities can also be interpreted as a (score) deficit in a competition. The weaker contestant is initially behind, as her/his probability to win the competition is lower. Consequently, a deficit in abilities should increase a contestant's willingness to incur risks.

Brown (2011) identifies risk taking in professional golf contest, but her analysis fails to identify any effect of superstar presence on risk taking of all other professional golf players in top-tier tournaments. Another analysis is provided by Hill (2014), who uses false starts as indicators for risk taking. The results indicate no (causal) effect of superstar presence on risk taking in top-level 100 meter sprint competitions.

Following a definition of risk taking in basketball contests introduced by Grund et al. (2013), I will examine if superstar presence has any effect on risk taking by professional basketball teams in round-robin tournaments. Risk taking will be measured by the ratio of three-point attempts over two-point attempts. The higher this ration, the higher the associated risk, as teams shift their scoring attempts from the relatively easy two-point shooting attempt towards more risky three-point attempts.[14] Due to the fact that the three-point attempt was introduced by FIBA in 1984 and few box scores provide detailed information before 1990, the diff-in-diff framework is not applicable. Therefore, I will analyze risk taking for teams after 1992 by estimating 3 using the three-point ratio to proxy risk taking as the dependent variable.

Table 4 tabulates the results for risk taking in Men's international basketball competitions. The estimated coefficients on the *US Group* variable indicate that there is a negative association between competing directly with the US and risk-taking: while the coefficient estimated for the FIBA Wold Cups is significant and negative (column 3) at -0.098, the coefficient for the Olympics is negative but insignificant (col. 1). When omitting all tournaments where team USA was perceived as weak [15], the estimated relation for the Olympics now turns out to be significant (col. 2) while the World Cups estimate turns insignificant (col. 4).

Table 5 extends the analysis on risk taking to Women's competitions. The results for the pooled sample indicate that there is no correlation of superstar presence and risk taking. Looking at the time spans before and after the formation of the WNBA, however, the result is different: after the installment of the league I estimate an increase in risk-taking for teams that are competing in the same group as team USA. I estimate a negative but insignificant coefficient for all tournaments before the WNBA started in 1997.

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[14] Böheim et al. (2016) provide a comprehensive discussion and descriptive analysis of this risk measure. The expected return of a three-point return is similar to the one of a two-point attempt. However, the variance of a three-point attempt is larger.

[15] Consult section 4.2 for the exact criteria to define weak.

Table 4: Men: Effect on competing within the US group on risk taking

	Olympics		*World Cups*	
	All	Without weak	All	Without weak
US Group	-0.0054 (0.0384)	-0.0731*** (0.0269)	-0.0971** (0.0394)	-0.0841* (0.0498)
Team-decade FE	*Yes*	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*	*Yes*
Mean of dep. variable	0.500	0.475	0.578	0.588
N	296	250	434	244
R^2	0.423	0.422	0.378	0.352

The Dependent variable is the absolute number over three-point attempts divided by the absolute number of two-point attempts. Coefficients for additional variables are not reported due to space limitations. All specifications include team-decade and event dummy variables. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

Table 5: Women: Effect on competing within the US group on risk taking

	All	no WNBA	WNBA
US Group	0.0241 (0.0217)	-0.0500* (0.0262)	0.0632** (0.0287)
Team-decade FE	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*
Mean of dep. variable	0.337	0.254	0.368
N	548	146	402
R^2	0.576	0.695	0.507

The Dependent variable is the absolute number over three-point attempts divided by the absolute number of two-point attempts. Coefficients for additional variables are not reported due to space limitations. All specifications include team-decade and event dummy variables. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

4.4 Robustness

In sections 4.1 and 4.2, I use personal fouls as a proxy for effort. Alternatively, fouls could be interpreted as sabotage. However, effort and sabotage–while being two distinct phenomena–are obviously related: a foul which aims at stopping the opponent from scoring as the only possible way also represents effort.

Linking the number of fouls to an increase in the probability to win a game is difficult and not feasible with the underlying data.[16] In order to add robustness to the analysis, the number of points scored is used as alternative proxy for effort. In contrast to personal fouls, however, the number of points scored per player-minute is measuring intermediate output rather than a true effort input in the production function of teams. In addition, points scored are measuring performance, which is not only affected by effort, but a multitude of factors, including pure luck. Consequently, this additional approach represents a second best strategy, as is is not measuring a strategic decision of teams but an (intermediate) outcome. Table 6 tabulates the results from estimating model 3 with the number of points scored per player-minute as the dependent variable.

The results confirm the earlier findings for the effect of superstar presence on effort: male teams tend to exert less offensive effort (i.e. they score less) when they are in the same group as team USA after the Olympics and Wold Cups allowed professional athletes to participate. The coefficient for the Olympics is borderline insignificant but negative. In year before the FIBA reform, we see a positive effect of superstar presence on (offensive) effort. As before, I split the overall post 1991-reform sample into years where the US team was anticipated to be weak or strong. When the US team was weak (strong), there is a negative (positive) effect of superstar presence on effort.

Table 7 tabulates the results for using the absolute number of shooting attempts per player-minute as a third effort proxy.[17] In the presence of a strong superstar I estimate a strong negative effect on this specific effort measure. The estimated effect for Olympic Games and World Cups are also negative, albeit not highly significant. In the years when the team USS was perceived weak, there is a small but insignificant positive effect of superstar presence on the number of shooting attempts per player-minute. Consequently, this results confirms the negative effect of superstar presence on (offensive) effort.

The empirical approach of section 4.2 controls for unobserved team heterogeneity by estimating team-decade fixed effects in analogy to the timing effects presented in Table 1. In order to test the robustness of these results, an alternative specification is estimated.

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[16] Consult Lackner et al. (2015) for a detailed discussion of this issue.

[17] As for the risk taking measure, the analysis of throwing attempts is restricted to the years after 1991. Official FIBA box score statistics before do not report throwing attempts.

Instead of team-decade and tournament fixed-effects, this specification includes team and tournament fixed-effects, as well as team-specific trends. While yielding slightly different results in terms of significance, all results presented in sections 4 and 4.3 are confirmed. The corresponding tables are presented in the appendix. In terms of the sample of games used, all results are robust to excluding all observations from the Soviet Union as the second strong team before the nation dissolved.

Table 6: Effect on competing within the US group on effort: Men, alternative measure I

	Olympics		*World Cups*		*All men*	
	>1991	<1991	>1991	<1991	not weak	weak
US Group	-0.0162	0.0202**	-0.0203**	0.0014	-0.0202***	0.0288**
	(0.0111)	(0.0092)	(0.0078)	(0.0108)	(0.0061)	(0.0133)
Team-decade FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Mean of dep. variable	0.107	0.133	0.105	0.121	0.104	0.111
N	296	475	434	329	494	236
R^2	0.397	0.518	0.382	0.510	0.366	0.429

The Dependent variable is the number of points scored on offense per player-minute. Coefficients for additional variables are not reported due to space limitations. All specifications include team-decade and event dummy variables. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

Table 7: Effect on competing within the US group on effort: Men, alternative measure II

	Olympics	World Cups	All not weak	All weak
US Group	-0.0113*	-0.0084	-0.0127***	0.0036
	(0.0067)	(0.0053)	(0.0045)	(0.0056)
N	296	434	494	236
R^2	0.391	0.287	0.325	0.317

Only observations from years post 1991 are used. The Dependent variable is the number of total shooting attempts (two- and three-point) on offense per player-minute. Coefficients for additional variables are not reported due to space limitations. All specifications include team-decade and event dummy variables. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

5 Conclusion

I use data from top-level international basketball contests to analyze superstar effects in the context of rank-order tournaments. A superstar in my context is a team which dominates competitions over a substantial period of time. The data identifies team USA in men's and women's national basketball competitions as superstars. A Descriptive analysis confirms that the US men's national basketball team was indeed the dominant team in international competitions. However, the degree of dominance fluctuated as a result of an exogenous institutional reform. In addition, I use the US women's basketball team as a second superstar in order to test for potential gender differences in superstar effects.

In the empirical analysis I find that there is a causal effect of superstar presence for men's Olympic tournaments. Results from a diff-in-diff model suggest that this causal effect is due to the enforcement of the dominance or status of the sole superstar through a reform in 1992. This confirms theoretical results that demonstrate an increase superstar effect if superstar status gets stronger (Brown, 2011). There is also evidence to conclude that not only performance dominance but also status (financial) dominance plays a significant role, as the 1992 reform did not only enforce performance related dominance of team USA. It did also push the team's status as a superstar with a vastly superior status in terms of income and popularity.

I find significant and sizeable negative superstar effects on effort if the superstar was indeed dominant. Before the reform of 1992 and in competitions where team USA was perceived as weak, competition within the same group of the superstar yields higher effort. This finding of a positive peer effect further extends Brown (2011) and confirms the findings of Hill (2012).

In a second step, I analyze the effect of superstar presence on risk-taking behavior of male and female teams. For male teams, I do find robust evidence for a reduction of risk-taking if team USA as the superstar is present. For women, however, I get mixed results. Before the initiation of the leading professional women's basketball league (WNBA) in the US, there is a similar negative relationship between risk-taking and superstar presence. After the WNBA was initiated in 1997, this relationship is positive.

The results presented in this article have strong implications in a multitude of different contexts. Superstar effects are highly relevant for the design of promotion- and other types of tournaments. A firm typically wants to maximize total effort of all contestants by designing a tournament for ultimately selecting the best candidate. If a sufficiently strong superstar is present, a rank-order tournament design is not an optimal solution:

As all participants will consider their chances to rank higher than the superstar to be very small, they will reduce effort. Consequently, superstar presence will reduce overall effort and work against the target of overall effort maximization. In addition R&D contests or patent races will also be affected by the presence of a superstar firm. Such a dominant firm will reduce effort of all competing firms, which will have a negative effect on overall effort. Considering the overall reduction in investment into research and development (ie.e effort), this will likely lead to a loss in total welfare.

My finding of a positive peer effect in the presence of a weak superstar (or multiple superstars) are of high relevance. However, more research is needed in order to understand when a superstar peer effect actually does turn into a detrimental effort reducing superstar effect.

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APPENDIX

Table 8: Men: Effect on competing within the US group on effort - Alternative specification

	Olympics		*World Cups*		*All men*	
	>1991	<1991	>1991	<1991	not weak	weak
US Group	-0.0084**	0.0066**	-0.0064*	0.0032	-0.0092***	0.0107***
	(0.0034)	(0.0032)	(0.0037)	(0.0039)	(0.0026)	(0.0021)
Team FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Team-specific trend	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Mean of dep. variable	0.107	0.133	0.105	0.121	0.104	0.111
N	296	475	434	329	494	236
R^2	0.335	0.304	0.265	0.328	0.280	0.299

The Dependent variable is the number of personal fouls per player-minute. Coefficients for additional variables are not reported due to space limitations. All specifications include event and year dummies, as well as a team-specific trend. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

Table 9: Effect on competing within the US group on effort: Women, alternative specification

	All	no WNBA	WNBA
US Group	0.0039**	0.0063	0.0035
	(0.0019)	(0.0051)	(0.0027)
Team FE	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*
Team-specific trend	*Yes*	*Yes*	*Yes*
Mean dep. variable	0.097	0.102	0.093
N	726	324	402
R^2	0.227	0.230	0.275

The Dependent variable is the number of personal fouls per player-minute. Coefficients for additional variables are not reported due to space limitations. All specifications include event and year dummies, as well as a team-specific trend. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

Table 10: Effect of Team US presence on risk-taking: Men, alternative specification

	Olympics		*World Cups*	
	All	Without weak	All	Without weak
US Group	0.0403	0.0186	-0.1188***	-0.1742*
	(0.0352)	(0.0328)	(0.0344)	(0.0931)
Team FE	*Yes*	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*	*Yes*
Team-specific trend	*Yes*	*Yes*	*Yes*	*Yes*
Mean of dep. variable	0.500	0.475	0.578	0.588
N	296	250	434	244
R^2	0.415	0.405	0.358	0.366

The Dependent variable is the absolute number over three-point attempts divided by the absolute number of two-point attempts. Coefficients for additional variables are not reported due to space limitations. All specifications include tournament and year dummies, as well as a team-specific trend. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.

Table 11: Effect of Team US presence on risk-taking: Women, alternative specification

	All	no WNBA	WNBA
US Group	0.0135	-0.0517	0.0493*
	(0.0185)	(0.0355)	(0.0246)
Team FE	*Yes*	*Yes*	*Yes*
Tournament FE	*Yes*	*Yes*	*Yes*
Team-specific trend	*Yes*	*Yes*	*Yes*
Mean of dep. variable	0.337	0.254	0.368
N	548	146	402
R^2	0.504	0.636	0.448

The Dependent variable is the absolute number over three-point attempts divided by the absolute number of two-point attempts. Coefficients for additional variables are not reported due to space limitations. All specifications include tournament and year dummies, as well as a team-specific trend. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Robust standard errors (clustered on country-gender-tournament level) in round parentheses.